TEST BOOK

Cross-curricular Approaches to

Mathematics and Sciences

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This paperwork has been made with the contribution of the teachers from the 7 schools involved in the Erasmus+ Strategic partnership for Schools Only "Cross-Curricular Approaches to Mathematics & Sciences in Formal and Informal Contexts", no. 2015-1-RO01-KA219-015034.

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Foreword

This book is part of the training kit conceived by the multinational team involved in the Erasmus Plus project "Cross-curricular Approaches to Mathematics and Sciences in Formal and Informal contexts". The project involves students and teachers from seven European schools and aims at offering new learning opportunities to students, in an effort to prepare them for life. Also, the project is an opportunity for the teachers involved to develop professionally, because it challenges them to come up with ideas and it requires them to combine their knowledge, experience and expertise in a methodological approach which, though not entirely new, has been less used as a method of teaching and learning within the educational systems of the countries involved in the project.

The reasons why the cross-curricular approaches can be chosen as better or complementary alternatives to traditional instruction based on the study of individual subjects are known and we, the authors, only want to mention what we could find from first-hand experience. While testing and putting different cross-curricular ideas into practice, we could see that the students were much more involved and curious about the subject matter than in traditional learning circumstances. Moreover, we also found that cross-curricular work is not only a very useful motivational tool, but it also develops the thinking skills of our students, such as problem solving and reasoning, since they do not only apply knowledge and skills learned in one subject to another, but also reinforce and synthesize information and ideas from a range of sources.

The training kit comprises:
1. The student's book of cross-curricular activities;
2. The methodological guide of cross-curricular activities (the teacher's book);
3. Two video guides which include examples of cross-curricular activities implemented in formal and informal contexts;
4. A test book;
5. A booklet with questionnaires for students and teachers.

The age group to whom the activities address is 15-17, since the connection between the topics tackled from multiple perspectives and the surrounding world and real life is quite obvious and accessible to all of our students. All the materials are elaborated in accordance with the contents of the compulsory curriculum of all the seven partner countries for this age group.

Many thanks to all the teachers and students who contributed to the design and the implementation of the activities presented in this book!

The project coordinators

TEST 1
Unit 1/Topic: Arts of proportions

Task 1 to 5 are connected

1. The air we inhale is roughly composed of (by volume):
   - ✓ 78.62% nitrogen
   - ✓ 20.84% oxygen
   - ✓ 0.04% carbon dioxide
   - ✓ 0.5% water vapors

Write chemical formulas for those air constituents.

2. Relative atomic mass proportion of elements in air is approximately:
m(H):m(C):m(N):m(O)=1:12:14:16
Write molecular mass proportion for molecules in the air.

3. Write air composition (by mass) using fact that number of different molecules is proportional to appropriate volume proportion.

4. Body A and B have mass proportion mA:mB=q and velocity proportion vA:vB=k. Find kinetic energy proportion EA:EB.

5. Find mean velocity of air constituents relative to nitrogen velocity using fact that mean kinetic energy is equal to every constituent.

6. The extensions of the legs $|AD|$ and $|BC|$ of a trapezoid ABCD intersect in point E. Calculate |DE| if AB || DE and:
   a) |AB|=21cm, |AC|=18cm, |AD|=6cm;
   b) |AB|=18cm, |AC|=15cm, |AD|=10cm.

7. Two parallel lines p and q intersect the legs of an angle with the top O. If |OC|+|AC|=21cm, and |OD|:|OB|=5:3, what is the length of |OA|?

8. Measure the distance between the eyes, then the size of the eye. How do we write down this kind of relationship?

9. What is the ratio of the size of the nose in relation to the size of the ear?

10. What are the relations of the side of a television or computer screen?

TEST 2
Unit 1/Topic: Arts of proportions

Task 1 to 5 are connected

1. Somebody is moving uniformly down the ramp with rise V=3m and run H=4m. Find the slant length L and the friction factor.

2. The same ramp is rotated (now V=4m and H=3m) and the same body is put on the top of the ramp. Find the proportion of the net force to the body to its weight.

3. Find the body acceleration.

4. Find time of body moving on the ramp.

5. Find the body velocity at the bottom of the ramp.

6. Young frog is of the same shape as old one, with their linear proportion k. Young frog is capable to jump up 40 cm. Find jump height of the old frog!

7. Two parallel lines p and q intersect the legs of an angle with the top O. If |OC|+|AC|=21cm, and |OD|:|OB|=5:3, what is the length of |OA|?

8. On a leg of an angle with the top O you can find the points A and B, and on the other C and D. |OA|=20cm, |AB|=8cm, |OC|=15cm, |CD|=6cm. Prove that AC || BD.

9. If we take as a length the size of the eye, and as a second length the space between extreme left and extreme right outer corner of the eye, in which proportion are they to one another?

10. What is the ratio of the size of the forehead, nose and chin to the length of the face?

TEST 3
Unit 2/Topic: Recursion

1. Write down the first 5 members of the series given with the general term $a_1 = 1$; $a_{n+1} = 2a_n - n$; $n \geq 2$

2. Find the general term for the next series 5, 9, 17, 33, 65…

3. Draw the graph of the first 6 members of the following series $a_n = \dfrac{3n}{n+1}$

4. Join the first letters in front of the terms in the left column which descriptions correspond to the right-hand column:

   a) external fertilization   _____development of male reproductive cells
   b) internal fertilization   _____have a halfway number of chromosomes
   c) gamete   _____development of the female reproductive cells
   d) spermatogenesis   _____ fertilization takes place outside of the body
   e) oogenesis   _____ male gametes are placed into the female reproductive system

5. a) Circle in the picture the haploid phase of the life cycle of man

   b) Write the words meiosis and fertilization on the provided places in the rectangles in the picture
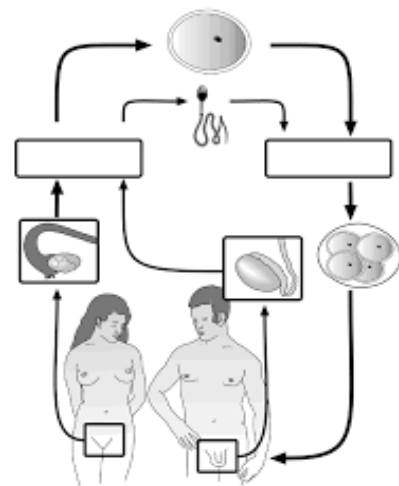
6. During organogenesis cells are _____ for certain functions and the process is called _____. From a germ layer can be differentiated more cell types for different _____ activation in cells.

7. Write down the successors of the natural numbers n, n−1, n+3, 2n, 2n−2!

8. What does a program memorize in a calling of function?

9. Write a recursive function which lists numbers from 1 to 100!

10. Which even number is successor to an even number?

TEST 4
Unit 2/Topic: Recursion

1. Write down the the predecessors of the naturel numbers n, n−1, n+3, 2n, 2n−2

2. Which odd number is predecessor to an odd number ?

3. Describe the operation of the instruction *return*!

4. Write a recursive function which lists numbers from 100 to 1.

5. Write down the first 5 members of the series given with the general term
$a_1 = 3; a_n = 2a_{n-1} + n^2; n \geq 2$

6. Find the general term for the next series 4, 7, 11, 16, 22…

7. Draw the graph of the first 6 members of the following series $a_n = \frac{2}{n+1}$

8. Explain the meaning of the concepts of differentiation and specialization of cells.

9. Select the correct arranged stages of embryonic development. Circle the correct answer.
    a) zygote-blastula- gastrula-morula
    b) zygote-morula-gastrula-blastula
    c) zygote-morula-blastula-gastrula
    d) zygote-blastula-gastrula –morula

10. Mark and name the parts of the sperm in the picture.

TEST 5
Unit 3/Topic: Nikola Tesla

1. Write the year and birth place of Nikola Tesla.

2. Name his most famous inventions.

3. In which cities did Tesla study?

4. Write some interesting facts from his life.

5. Choose one of his inventions and confirm how and for what purpose it is used today.

6. Where and how does the famous scientist die?

7. Outline his attitude towards society and money.

8. Explore his relationship with Edison

9. Find information about HARP project using ITC and explain your opinion about that, compare available information and connect them with Tesla "World-System" project. Argument your opinion!

10. Fill in the gaps with the given words:

Tesla in his childhood most loved ………………(1), which he fed all his life, then reading and playing cards. As a young man he played cards for money that once he would have won all shared with the poor off the streets. Five years after ………….(2)he entered Technical studies at Charles University in Prague. During this time he participated in the construction of new ………………….(3)switchboards and improved the device to amplify the telephone sound in Budapest. Afterwards, he moved to Paris where he worked in Edison's company Continental Edison Company. On assignment in Strasbourg (1883) he constructed during night-time the first powered AC ………………..(4)motor. He got the idea for this…………….(5) while walking through the park. Then he used a ……………(6)to draw a sketch in the sand and explained to a friend the principle on which the induction …………(7) would work. A year later, June 6 1894, he went to the …………………………..(8) and became an American citizen.In New York, he arrived with ……………..(9) cents in his pocket, a few own songs, calculations for a…………………………………..(10) and the recommendation of Edison's partner, Charles Batchelor which read: "Mr. Edison, I know two great men. One you are, and the other is the young man who stands before you."

TEST 6
Unit 3/Topic: Nikola Tesla

1. String long L=30 cm with electric current I=12 A is perpendicular to magnetic field with F=2.4 E - 4 N. Find Magnetic induction B!

2. Another string with L=20 cm and I=1.5 A is perpendicular to magnetic field with B=0.04 T. fin the Ampere force on string!

3. Find magnetic induction inside coil with 20 turn at every cm of length, with I=5A? Compare the answer with Earth field B=5 E-5 T

4. Coil with L=1.23 m is in air with five layers each with 850 turns and with I=5.57 A. Find magnetic induction inside coil!

5. Find how many times is the proportion of magnetic induction and magnetic field H in iron bigger than in air. Relative permeability of iron is 5000.

6. Some coil has surface S=0.08 m2 perpendicular to magnetic field and N=20. Find induced voltage if in 0.2 second magnetic induction change 0.125 T.

7. Find maximal voltage of ordinary AC (U=220V).

8. Find R for AC circuit with power P=75W and effective current of 5 A.

9. Proportion N2/N1=15. Find effective voltage (U2) on secondary coil with U1=120 V.

10. Explain why near thunder lighting can damage electric devices?

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TEST 7
Unit 4/Topic: Protein synthesis

Answer the following questions:

1. Which base bonds (pairs) with which base? Is this the same for RNA? If it is not, what bases change?

2. What is transcription? Where does it take place?

3. A DNA segment is changed from -AATTAG- to -AAATAG-. What kind of mutation is this?

4. What is mRNA?

Using genetic code answer the following questions:

5. How many different codes can be for amino acid sequence Ser-Ser-Leu-Arg?

6. Explain the importance of code redundancy.

7. How many different codes are for amino acid sequence Met-Glu-Cys-Trp?

8. Find the one letter Key amino acid sequence for this mRNA code:
GGGGAGAACGAG

9. In random nucleic acid sequences find the probability of STOP codon.

10. Using the answer from question 9 find the method for finding probably ORF (open reading frame) for some protein in long DNA sequence.

TEST 8
Unit 4/Topic: Protein synthesis

Answer the following questions:

1. Arrange the following terms from largest to smallest: nucleotide, nucleus, chromosome, specialized cell, gene, body.

2. What is translation? Where does it take place?

3. DNA segment is changed from -AATTAGAAATAG- to -ATTAGAAATAG-. What kind of mutation is this?

4. What is tRNA?

Using genetic code answer the following questions:

5. Some species have similar proteins but different AT/CG ratios. Explain this fact using code redundancy.

6. Find Ser-Leu-Arg-Ala possible code with maximal U nucleotide number.

7. Find Ser-Leu-Arg-Ala possible code with maximal C nucleotide number.

8. Find the one letter Key amino acid sequence for this mRNA repeating code:
   CUGAUAUUUGAGCUGAUAUUUGAGCUGAUAUUUGAG…

9. Find the one letter Key amino acid sequence for other two reading frame.

10. Explain using questions 8 and 9 why one base insertion/deletion mutation is probably more dangerous than one base point mutation.

TEST 9
Unit 5/Topic: Plitvice Lakes

Read the following text in order to solve tasks 1-4:

The area of Plitvice Lakes National Park extends across 296.85 square kilometres. The overall water body area is about 2 km^2. Here are presented altitude, area and depth for the first eight Upper lakes.

Lake	Altitude (m)	Area (ha)	Depth (m)	Group
Prošćansko jezero	636	69.0	37	Upper Lakes
Ciginovac	625	7.5	11	Upper Lakes
Okrugljak	613	4.1	15	Upper Lakes
Batinovac	610	1.5	6	Upper Lakes
Veliko jezero	607	1.5	8	Upper Lakes
Malo jezero	605	2.0	10	Upper Lakes
Vir	599	0.6	5	Upper Lakes
Galovac	585	12.5	25	Upper Lakes

Assuming that the mean depth of lake is half of maximal depth and that water flow is 1 m^3/s calculate:

1. Volume of water in every lake

2. Mean water delay in every lake

3. Power of waterfalls from one to the next lake

4. Total gravitational water energy with respect to the next lake

5. Chemical compound of the White and Black River (Croatian Bijela and Crna River) springs are typical karst water. Partial pressure of carbon dioxide is about 20 times bigger than in atmosphere (*Srdoč et al.*, 1985), probably due to surrounding forests. Why?

6. Down the springs concentration of dissolved CO2 falls rapidly, and pH is growing up. After 2 km Crna River (Black River) loses 3/4 of CO2, and Plitvice River from spring to end about 97 %. What you can conclude about tufa formation using these facts?

7. Organic compound are the strongest inhibitors for calcium carbonate precipitation in natural waters. According to chemical analysis, the upper concentration of organic

compounds that permits precipitations is about 10 mg/L of organic carbon with saturation>3.0 and pH>8,0. Natural values of organic carbon in lakes water is about 2.5 mg/L. Using that facts explain why is it important to protect area of National Park of any human activity, eg. Building of many hotels in the area?

8. Although some waters around Plitvice area are oversaturated from springs on, there are no precipitation of calcium carbonate at springs and some part after (Crna and Bijela River, Plitvice, Krka, Pliva, Lika, Una, Soča...). It is found that index of oversaturation must be bigger than 3.0 together with pH > 8.0 for precipitation to occur. Sartuk River is oversaturated 15 times and pH is 8.5, but precipitation doesn't occur. Inhabitants around Sartuk River use their water for clothes washing. Explain why there isn't precipitation in that river?

9. For testing biological impact on tufa formation and rapidity of precipitation, scientists used substratum of artificial fiber, steel and cooper. It is found no precipitation of copper. What can you conclude from these experiments?

10. Here are examples of some animals that exist in the national park. Connect names of that species with their latin name

      1. Wolf   ( ) *Cinclus cinclus*
      2. White-throated dipper   ( ) *Bubo bubo*
      3. Brown bear   ( ) *Canis lupus*
      4. Eurasian eagle-owl   ( ) *Ursus arctos*

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TEST 10
Unit 5/Topic: Plitvice Lakes

Read the following text in order to solve tasks 1-4:
The area of Plitvice Lakes National Park extends across 296.85 square kilometres. The overall water body area is about 2 km2. Here are presented altitude, area and depth for last four Upper lakes and the four Lower Lakes.

Lake	Altitude (m)	Area (ha)	Depth (m)	Group
Milinovo jezero	576	1.0	1	Upper Lakes
Gradinsko jezero	553	8.1	10	Upper Lakes
Buk	545	0.1	2	Upper Lakes
Kozjak	535	81.5	47	Upper Lakes
Milanovac	523	3.2	19	Lower Lakes
Gavanovac	519	1.0	10	Lower Lakes
Kaluđerovac	505	2.1	13	Lower Lakes
Novakovića brod	503	0.4	5	Lower Lakes

Assuming that the mean depth of lake is half of maximal depth and that water flow is 1 m^3/s calculate:

1. Volume of water in every lake

2. Mean water delay in every lake

3. Power of waterfalls from one to the next lake

4. Total gravitational water energy with respect to the next lake

5. First scientific experiments about tufa formation comes from the middle of last century. It is measured that water loses a total of 40 g/m3 (*Iveković*, 1960) from spring to the last lakes. The mean annual outflow is from 600 to 1200 L/s. Calculate range of mean diurnal and annual amount of new sedra barriers mass at the 16 Plitvice lakes.

6. Calcium carbonate very weakly dissolve in pure water, about 14mg/L. Compare that results with question 5 and explain why dissolved CO2 is important for Plitvice Lakes?

7. Big part of Croatia, similar to other part of Europe, is under karst, witl lot of lakes and rivers with high concentration of dissolved calcium carbonate, but only Plitvice lakes are example of cascade system with sedra barriers. What you can conclude from these facts?

8. Atmospheric partial pressure of CO2 is about 32 Pa (at 25 °C). With this partial pressure in water equilibrium concentration of dissolved calcium carbonate grows from 14 to 55 mg/L. From calculation it is estimated that dissolved $CaCO_3$ in spring water can be up to 300 mg/L. what you can conclude from this facts using your knowledge of (chemical) equilibrium?

9. Sedra barriers grows at different rate. About at the middle of Kozjak Lake, there is underwater barrier about 5 meter below surface. There are other examples of underwater barriers. Using your knowledge about barriers formation explain what factors determine barriers grow rates and describe Plitvice Lakes formation after last glacial period and evolution of Plitvice Lakes in remote future assuming that this dynamical system will be in similar near steady state equilibrium.

10. Here are examples of some animals that exist in the national park. Connect names of that species with their latin name

       1. Alpine newt   ( ) *Aquila chrysaetos*
       2. European polecat   ( ) *Emys orbicularis*
       3. Lynx   ( ) *Mustela putorius*
       4. Golden eagle   ( ) *Lynx lynx*
       5. European pond turtle   ( ) *Triturus alpestris*

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TEST 11
Unit 6/Topic: Graph of Functions

1.   Draw the graph of the function $f(x)=x^2-1$ on the coordinate grid.

2.   Draw the graph of the function $g(x)=-x+1$ on the same coordinate grid.

3.   Complete the equalities:
   $f(-2)=\ldots$, $f(-1)=\ldots$, $f(0)=\ldots$, $f(1)=\ldots$, $g(-2)=\ldots$, $g(-1)=\ldots$, $g(0)=\ldots$, $g(1)=\ldots$

4.   Put the right symbol $(=, <, >)$ looking at the graph:
   $f(-\pi) \ldots g(-\pi)$
   $f(-2) \ldots g(-2)$
   $f(2\pi) \ldots g(2\pi)$

5.   Can you find the domain and the range of the functions **f,g** from their graphs?

6.   Solve the equations $f(x)=0$, $g(x)=0$, $f(x)=g(x)$ looking at the graph.

7.   Solve the inequality $f(x) < g(x)$.

8.   Does the shape of the "basket" represent a graph of a function? Why?

9.   Describe shortly the interior of the cave.

10.   Explain the platonic symbols: *chains, freed prisoner, light of fire.*

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TEST 12
Unit 6/Topic: Graph of Functions

Task 1 to 7 are connected
The graph of the function $f(x)=x^3-2x^2-5x+6$ is given below. [also $f(x)=(x+2)(x-1)(x-3)$]

$f(x) = x^3 - 2x^2 - 5x + 6$
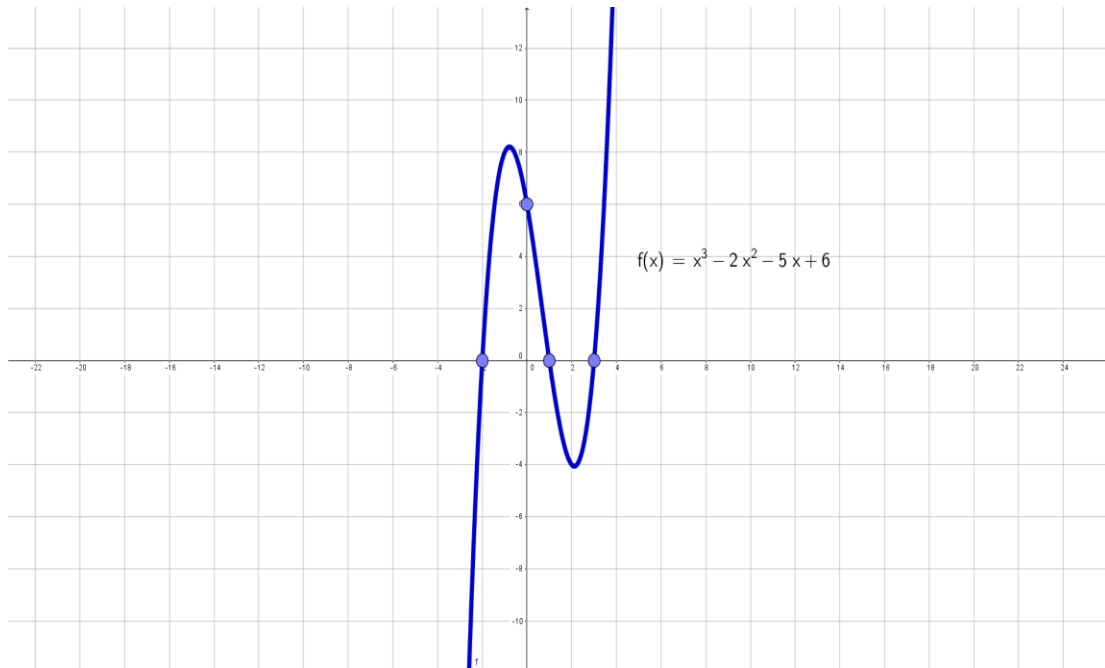
1.   Complete the equalities: $f(-2)=\ldots$, $f(1)=\ldots$, $f(0)=\ldots$, $f(3)=\ldots$

2.   Identify the x-intercepts and the y-intercepts.

3.   Put the right symbol $(=, <, >)$ looking at the graph:
        $f(3) \ldots f(10)$
        $f(2) \ldots f(\pi)$
        $f(0) \ldots f(2)$

4.   Identify the domain and the range of the function **f** from its graph?

5.   Solve the equation $f(x)=0$.

6.   Solve the inequality $f(x)>0$ looking at the graph.

7.   For $g(x)=-5x+6$, identify the common points of the graphs of **f** and **g**.

8.   In which photos the "arms" of the girl represent a graph of a function? Why?

| I. | II. | III. |

(photos by the students: Marina Kaneli, Georgia Sinioraki, Katerina Nasopoulou)

9)   What is the possible response of the prisoners to the news of the freed prisoner about the world outside?

10)   Explain the platonic symbols: *chained prisoners, voices and shadows, light of sun.*

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TEST 13
Unit 7/Topic: Ratios, proportions and applications

Task 1 to 7 are connected. The royal diamond is missing!!

Four thieves got into the Royal Palace last night and stole the Royal Purple diamond! A few minutes later, the alarm sounded and electrified rails stood up in a circle shape of radius R=30 meters (with the Palace P to be the center of the circle). At that moment, the thieves where hidden at points O, L, F and A. So, if the thieves where in distance less than 30 meters from the palace P, they got captured, otherwise they escaped!! The question is: how many of the thieves managed to escape?
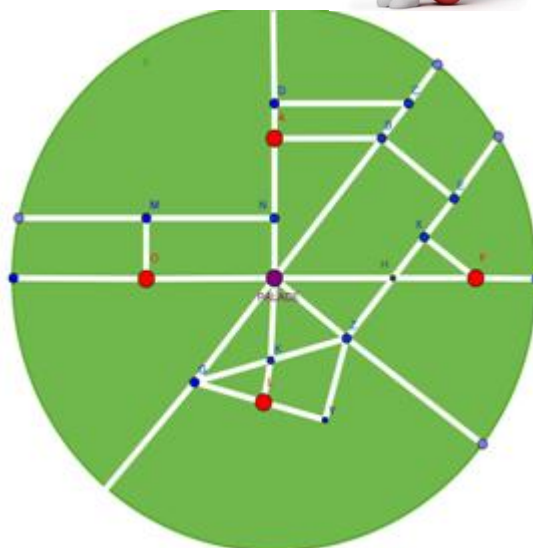
These are the information you can use:

1. PC= 55 meters, AD = 8 meters, BC = 11 meters. Did theft hidden at point A manage to escape?

2. Rectangles PNMO and PBEZ are similar, with corresponding sides ZE, MN and ratio of their areas to be $\dfrac{(PBEZ)}{(PNMO)} = 2$. Did theft hidden at point O manage to escape?

3. Angle (ZYG) is right. K is the middle of ZG. L is the middle of GY. ZY is 40 meters. GZ is 30 meters. Did theft hidden at point L manage to escape?

4. Angles FXZ and PZX are right. XF=10m, $ZH = 2\sqrt{21}$ m, ZP=20m. Did theft hidden at point F manage to escape?

Application on the golden rectangles
(This exercise can be done either in the computer lab using Geogebra, or in the classroom using rule and diabetes)

☑ 1st rectangle	☐ 1st arc
☐ 2nd rectangle	☐ 2nd arc
☐ 3rd rectangle	☐ 3rd arc
☐ 4th rectangle	☐ 4th arc
☐ 5th rectangle	☐ 5th arc
☐ 6th rectangle	☐ 6th arc
☐ 7th rectangle	☐ 7th arc
☐ 8th rectangle	

5. Let ABCD a golden rectangle ($\dfrac{AB}{AD} = \Phi(phi)$). Inside ABCD we draw square ADEF. Show that EFBC is a golden rectangle too.

6. Continue this procedure of drawing a square inside every new rectangle, having as side the smallest side of the rectangle.
    Repeat until you have made 8 squares.
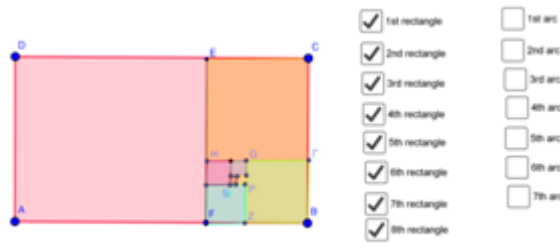
Inside each square, draw quadrants with radius equal to each square's side and centers F, H, G, P, S. What is the name of the curve you made?

7. Let ABCD trapezoid, with AB//CD. The non-parallel sides AD and CD intersect on O. We draw diagonal AC of ABCD. From B, we bring parallel to AC which intersects AD on point E. Show that OA2=OD.OE

8. Let ABCD a parallelogram. From vertex A we draw line Ax which intersects BC on F and DC on H. If E is the section of Ax and BD, show that

i) $\dfrac{AF}{AH} = \dfrac{AB}{DH}$,   ii) $AE^2 = EF \cdot EH$

9. What is the difference between "linear" and "aerial" perspective?

10. In the ancient *Theater of Dionysus* the first tier has 13 rows of seats and the second one 21. Examine how these numbers are connected with the *Fibonacci sequence* and the *Golden number Φ*.

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TEST 14
Unit 7/Topic: Ratios, proportions and applications

The ...golden star!!!

ADCDE is a regular pentagon (drawn with red colour). Its diagonals form a star, known as pentacle or pentagonal star.

There are plenty of triangles inside this scheme.
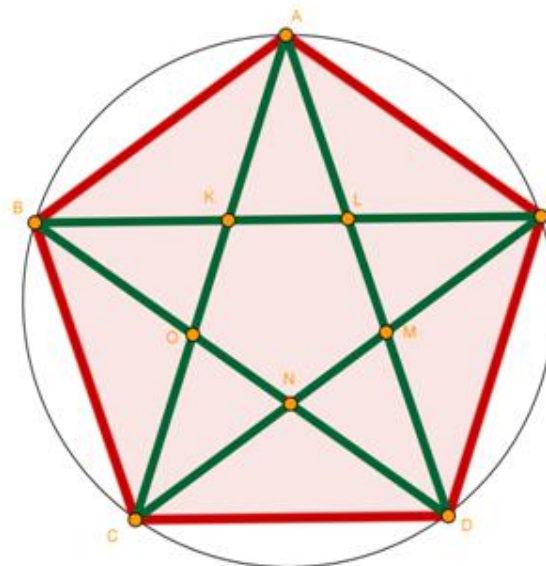
1. Calculate the measures of the angles of the regular pentagon.

2. Calculate the measures of the angles of all triangles inside the regular pentagon.

3. Are there any triangles which are **not** isosceles?

4. a. Which linear segments are equal to AK?
    b. Which linear segments are equal to KL?
    c. Which linear segments are equal to BL?

5. a. Which triangles are similar to AKL?
    b. Which triangles are similar to BKA?

6. Let AL=1 and AB=x. Then BK=? KL=? AK=? By proportion of sides of triangles AKL, BLA, we have? Solve the above equation. Which is the positive solution x?

7. Calculate the ratios:
$$\frac{BL}{BK}=\ldots\ldots\ldots,\frac{EK}{EL}=\ldots\ldots\ldots,\frac{BE}{BL}=\ldots\ldots\ldots,\frac{BE}{EK}=\ldots\ldots\ldots$$

8. Let ABC a triangle, D point on AB, E point on AC such that DE//BC and F point on BC such that EF//AB. If AD=8, AE=6, AC=9, FC=4,
    i) Calculate EF ; ii) Calculate DE.

9. Try to describe the "one point linear perspective" used by Leonardo da Vinci for the *Last Supper.*

10. In the ancient *Theater of Epidaurus* the first tier has **34** rows of seats and the second one **21.** Examine how these numbers are connected with the *Fibonacci sequence* and the *Golden number Φ*.

TEST 15
Unit 8/Topic: Acids, Bases and Salts in our Lives

1. Choose the right word to complete the text below

An ....(acid/base) is a compound that contains hydrogen and releases hydrogen ....(ions/atoms) in water . A........................(sour/sweet) taste is a characteristic property of all acids in aqueous solutions. Acids react with some ....(salts/metals) to produce hydrogen gas. There are many different kinds of acids. Lemon juice and ....(vinegar/sulfuric acid) are acids that found in nature. A very strong acid in our stomach is called ....(hydrochloric acid/ nitric acid). (Sodium hydroxide / potassium hydroxide) ....is known as caustic soda and it is used to make soap . When acid and base react, they form ....(amine/salt).   This process is known as ....(neutralization/ estereopsis). Salts are compounds of positive and negative ....(ions/charge). In the absence of water, ions can form ....(molars/ crystalls) which conduct electricity. Bases are compounds that form ....(hydrogen/hydroxide) ions when they are dissolved in water. Bases feel ....(soapy, hard) and taste....................(sour/bitter).   Bases   react   with   acids   to   produce   salt and..................(acid/water).

2. Which chemical substances are called bases, according to Arrhenius ?

3. Aspirine contains acetylsalicylic acid.
a. If we put some drops of aspirin solution into a beakery that contains blue bromothymol what color will the solution obtain?
b. What will the students observe if we insert Zn into a aspirin solution?

4. We have 3 solutions:

Solution	A	B	C
pH	7	2	10

Which solution would you use to neutralize:
a. bee's sting (contains acid)?
b. wasp's sting (contains base)?

5. We analyze the pH of our garden soil and it was found pH=6,6. Can we grow orange trees and lemons trees (they grow at soil pH=7) in our garden? What can we do so the soil becomes more basic?

6. Match the pH numbers in column A to the solutions in column B.

A	B
pH	Solution
1	Diluted solution of citric acid
5	Distilled water
7	Sodium hydroxide
9	Solution of sulfuric acid
14	Diluted solution of ammonia

7. A factory which produces electricity, releases acid gases of SO2 and NO2 . It has been mentioned that snails don't survive at that area, why this happens? Their cells contain sodium carbonate.

8. Your body needs food for energy and strenght. The digestive system breaks down food into energy. Write down the organs that consists the digestive system

9. What is called "mummification"?

10. Explain how the embalmers dried out the body and the reason they did it.
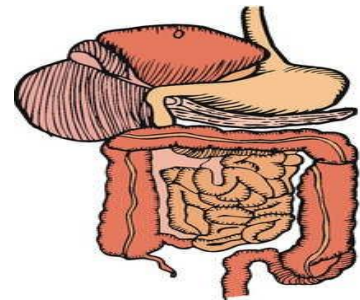
TEST 16
Unit 8/Topic: Acids, Bases and Salts in our Lives

1. Which chemical substances are called acids, according to Arrhenius ?

2. Can we keep acid solutions into a container made of iron or aluminium? Why?

3. What will be produced in the follow case?
a. magnesium reacts with sulfuric acid
b. baking soda reacts with sulfuric acid.

4. We have a bottle of solution without a label. How can you understand if we have acid or base?

5. Write the name and the formula of:
a. 3   acids (1 monoprotic……………., 1 diprotic ………………, 1 triprotic………………)
b. 3 bases (2 binary…………   …...…….., 1 tribinary………………… …..……………)

6. Using the Arrhenius definition, classify the following reagents, as acids, bases or salts.

HBr ……………………………   KCl…………………………………………
Ba(OH)2………………………   HCl…………………………………………
NaCl…………………………   Al(OH)3…………………………………
HClO………………………...   NaOH………………………………..
Al2(SO4)3…………………   HNO3………………………………..

7. Use the words in the box to fill in the blanks.

esophagus	small intenstine	nutrients	digestion	rectum mouth
chewed	digestive system	food	energy	enzymes
swallow	stomach	saliva	liver large intenstine	pancreas
hydrochloric acid				

All the living organisms need............... to get .... to live. But in order to use food,
they must break into basic..............by a process called ....is
a group of organs working together to convert food into energy .
In humans, the process of digestion begins in the .... where food is ....
into small pieces that are more easily digested. The pieces are covered by ....
The saliva makes the food slippery so that it is easier to .... The food travels to
the .... which is like a gate that sends food into the ....

 Once in the stomach, the food is mixed with .... and crushed more. In the stomach.................. help and speed the process of breaking down food. After food is sent into ...., where the small intestine continues the process of breaking down food by using enzymes released by the .... and bile from the .... The remaining food goes into the .... where the nutrients are absorbed.   The remaining food is pushed into the .... where it waits before leaving the body.

8. Which two liquids are mostly involved in chemical digestion?
Liquids:(1)…………………..,(2)……………………….
What is the role of each liquid?
Role of liquids: (1)…………………………………………………
                                (2)…………………………………………………

9. Present the religious beliefs connected with the mummification in ancient Egypt.

10. What was the purpose of a canopic jar?

TEST 17
Unit 9/Topic: Conic Sections-Circle, Parabola, Ellipse, Hyperbola

1. Archimedes, the fire bug!!

Fill in the blanks:
Archimedes may have used _____ acting collectively as a _____ reflector to burn ships attacking Syracuse. The ship caught fire in a few seconds after it arrived at the imaginary_____ of the _____.
Picture taken from
https://en.wikipedia.org/wiki/Archimedes

2. Follow the light!!
   Using a ruler, continue the routes of the rays
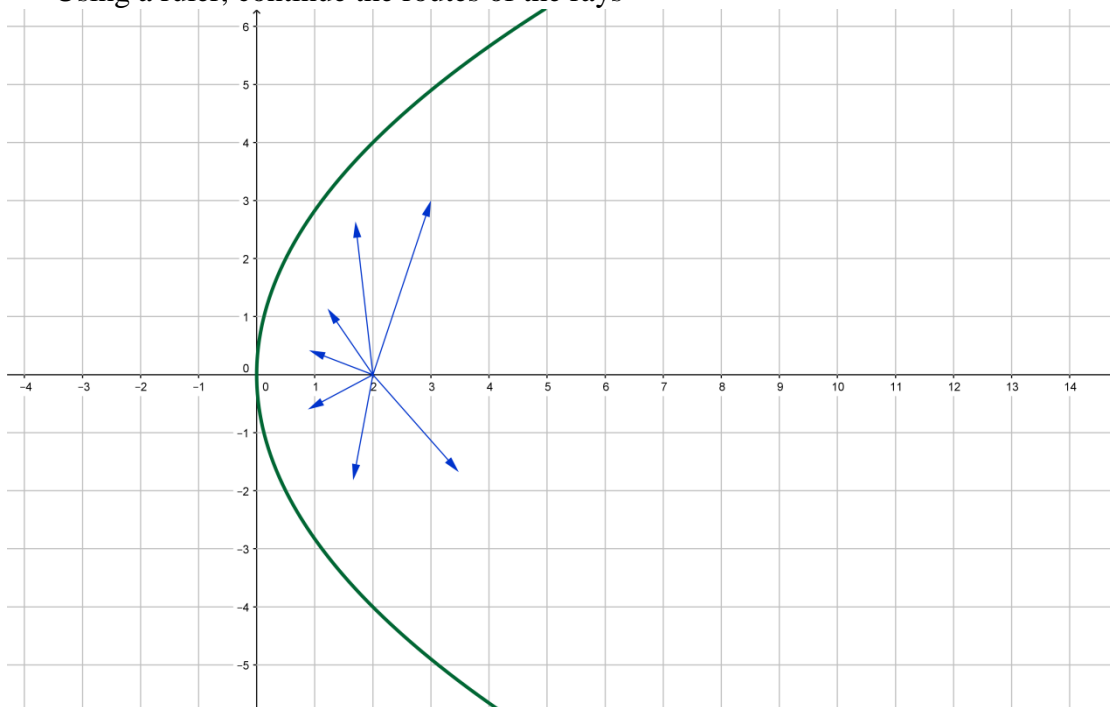
3. The circle below passes through the focus of the parabola. Find the equations of the circle and of the parabola .
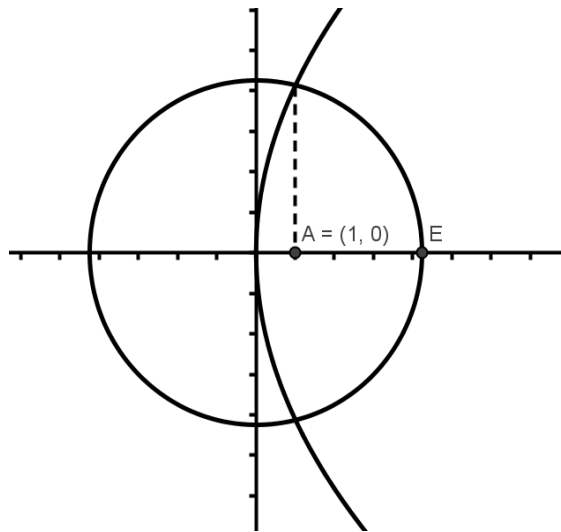
4. Prove that every isosceles hyperbola has eccentricity equal to $\sqrt{2}$

5. Show that the tangent lines of the ellipse x2+4y2=100 at points $K(4\sqrt{5}, \sqrt{5})$, $L(-4\sqrt{5}, \sqrt{5})$, $M(4\sqrt{5}, -\sqrt{5})$, and $N(-4\sqrt{5}, -\sqrt{5})$, form a square with diagonals x-axis and y-axis.

6. Which is the equation of the circle which has the origin of the axes as center and line x-y=2 as tangent line?

7. Make a short presentation of the biography and the work of Hypatia, one of the first women mathematicians.

8. Open a new Geogebra window (in the computer lab)
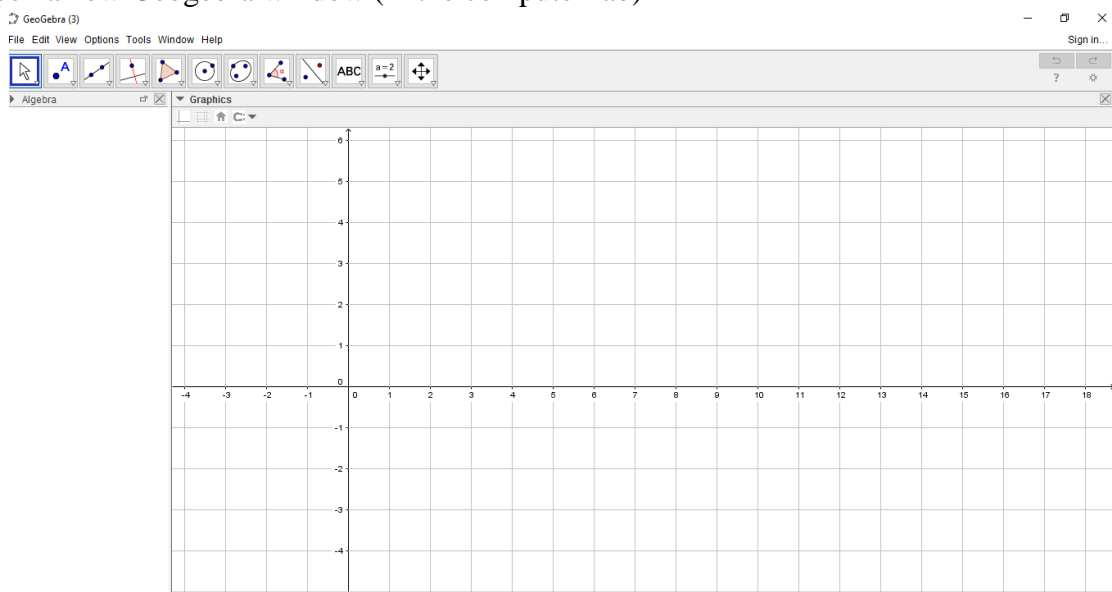
Define one Slider e with positive values.

Define a new slider a.

Then in the window of orders below give the order $x^2 / a^2 + y^2 / (e^2 a^2 + a^2) = 1$. What do you get?

Now move slider e and make conclusions. Then move slider a and make conclusions again

9.   What is a dome and which is its religious function?

10. a. What type of conic section has been used at the following domes?

  b. Can you name the buildings where they belong? Mention the era and the city – country, too.

TEST 18
Unit 9/Topic: Conic Sections-Circle, Parabola, Ellipse, Hyperbola

Task 1 to 6 are connected

The death of Archimedes depicted on a Roman floor mosaic, picture from *http://www-history.mcs.st-and.ac.uk/PictDisplay/Archimedes.html*

1. Find elements for the life and work of Archimedes, the place and the time he lived .

2. When Archimedes said the historic phrase : "Do not disturb my circles "to who m and why?

3. How did Archimedes manage to calculate the length of a cycle? What did he observe that applies to every cycle?

4. What price gave constant ratio π ?

5. Was that number known in other ancient cultures?

6. What progress had over the centuries to calculate decimal number π ?

7. The following poem is written in ancient Greek:

Αεί ο Θεός ο μέγας γεωμετρεί
το κύκλου μήκος ίνα ορίση διαμέτρω
παρήγαγεν αριθμόν απέραντον
και ον φευ! ουδέποτε όλον θνητοί θα εύρωσι
Trying to translate it in English, we read:
Great God forever geometrizes
the cycle's length, to define the diameter
he created number vast being
and alas ! no mortal will ever find it

The meaning is simple, nevertheless there is a small "secret" in the poem –written in Greek. Count every word's letters and you will find it!!

8. Mr Richman, a famous businessman and owner of hotels all over the world, intends to build a new hotel in Crete, in south count of Chania. He is interested in some tourist attractions such as:

- The Samaria gorge, and more specifically, village Omalos, where is the entrance of the gorge.
- The castle of Fragokastello, where the phenomenon of "Drosoulites" occurs every summer
- The coast of Lybian sea, where are some of the most beautiful beaches with clean, green and blue sea.

Mr Richman visited his group of architects and engineers holding a sketch of the map and gave them the following scenarios to receive their answers.
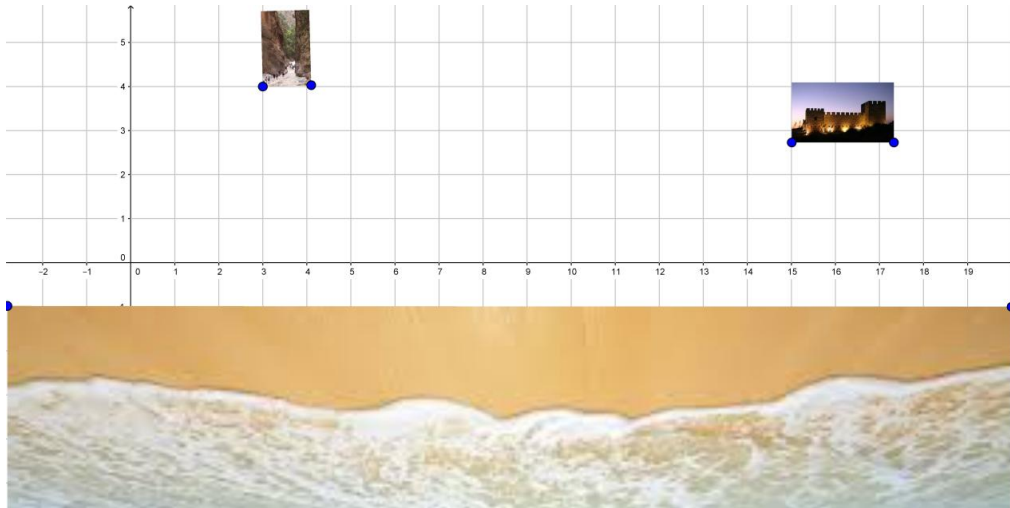
"I have four different scenarios in my mind. I want you to show me on the map all the possible positions if I want to have my new hotel :

a) to be in distance of 2 kilometers from Omalos village
b) to have the same distance both from Omalos village and from the coast of Lybian sea.
c) to be in such a position that the sum of the distances from the hotel to Omalos and from the hotel to Fragokastello to be 18 kilometers, since the distance from Fragokastello directly to Omalos is 13 kilometers (that means if a customer wants to go from one village to the other via the hotel, then he wouldn't have to travel more than 5 extra kilometers comparing to the direct moving).
d) to be closer to Fragokastello than to Omalos, but only for 2 kilometers. That is, if a customer wants to go to Fragokastello, he will cover 2 kilometers les than if he goes to Omalos.

Mr Bob, the head-engineer, made the following scheme and said:

" Mr Richman, it's all about math!!! Give coordinates to all the points that matter to you and let me show you the solutions for every case you asked"

Which solutions did Mr Bob give to Mr Richman?

9. How are domes built?

10. a. What type of conic section has been used at the following domes?
    b. Can you name the buildings where they belong? Mention the era and the city – country, too.

TEST 19
Unit 10/Topic: Equation of Lines

1. Find the slope of a line passing through the following pairs of points:
    a) (2,4) and (3,-7)
    b) (1, 0) and (3,1)
    c) (7, 4) and (-3, 4)
    d) (7, 4) and (7, -4)

2. Sketch the graph of the following linear equations:
    a) $y = 3$ c) $4y = -2x + 5$
    b) $x = 2$ d) $y = 3x+1$

3. Two airplanes leave airport at the same time. Airplane A travels west at 400 km per hour. Airplane B travels north at 500 km per hour. How far apart are they after 2 hours?

4. Using graph paper, draw a triangle with vertices A(0, 6) , B(6, 2) , C(2, -2). Find the midpoint of each side of the triangle

5. Write the equation of a line through the point (1, 1) and parallel to the line $y = 3x+7$.

6. Write the equation of a line through the point (-2, 1) and perpendicular to the line $x - y = 3$.

7. Determine whether the 3 points are vertices of a right triangle: A(1, 1), B(0, 2), and C(2, 4).

8. Maria and Konstantinos start working in a hotel. Maria gets 35€ per day. Konstantinos gets 30€ per day plus a starting bonus of 200€. When will they have the same amount of money?

9. Write down the titles of the most famous philosophical and mathematical book of Rene Descartes. Give a short explanation for their significance in the human thinking.

10 What kinds of choices an artist might make when creating a painting? Explain Mondrian's choice to vertical and horizontal elements.
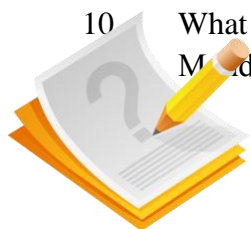
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TEST 20
Unit 10/Topic: Equation of Lines

1.   Find the distance between the points
   A(3, -3) and B(0, 1)   ;   C(1, -1) and D(-2, 1)

2.   Let A(1,1) , B(0,4) , C(x,2). Find x so that A,B,C are vertices of a right triangle with C=90°.

3.   Find the midpoint for each of the following pairs of points and plot the points:
   A(1,3) , B(2,-1), C(-1, 4) , D(1/2, 2)

4.   Find which of the following lines is parallel and which perpendicular to the line 2x-y=3.
   i) y=2x-2   ii) y=1/2 x-2   iii) y= x+2   iv) 2y+x=7   v) 2x+2y=1

5.   Find the equation of each line
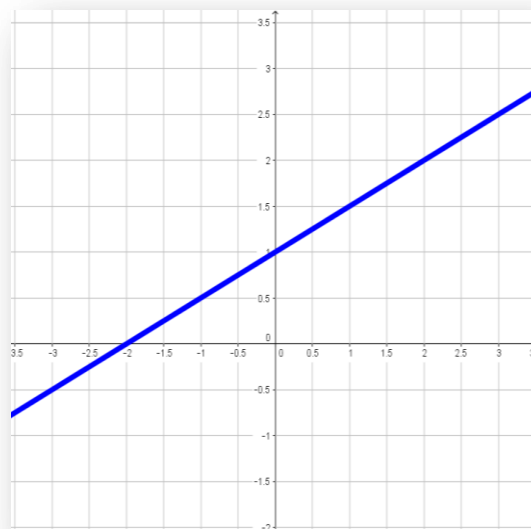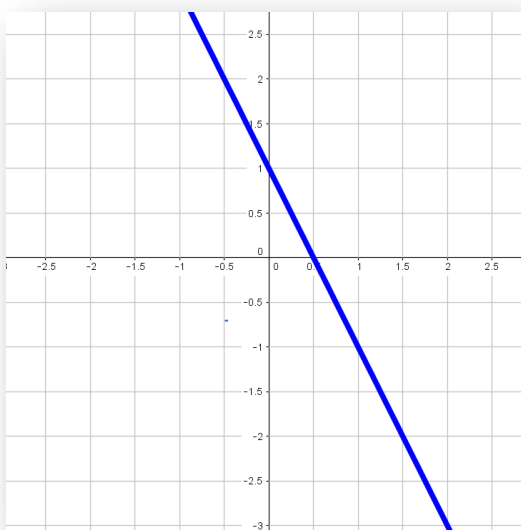
6.   Sketch the graph of the following linear equations:
   i) y=3   ii) x=2   iii) y=2x   iv) x=2y

7.   Write the equation of a line through the point (1, 2) and perpendicular to the line x + y+1 = 0

8. Two sailboats leave the island of Gavdos at the same time. Sailboat A travels west at a speed 4 knots. Sailboat B travels south at a speed 5 knots. How far apart (in nautical miles) are they after 3 hours?

    (1 knot = 1 nautical mile per hour)

9. *Rene Descartes, La Geometrie:* explain why this book is very important for the evaluation of mathematics. What about x?

10. What kinds of choices an artist might make when creating a painting? Explain Mondrian's choice to radically simplify the elements of his paintings.

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TEST 21
Unit 11/Topic: Science and Sport

Choose the correct answer

1. In the position-time diagram of the uniform motion the slope of the straight line represents :
    a) The increase of the run space.
    c) The increase of the velocity
    b) The velocity of the body
    d) The acceleration of the body

2. The following graph refers to the rectilinear motion of a point mass. The value of the velocity in the different lines is :
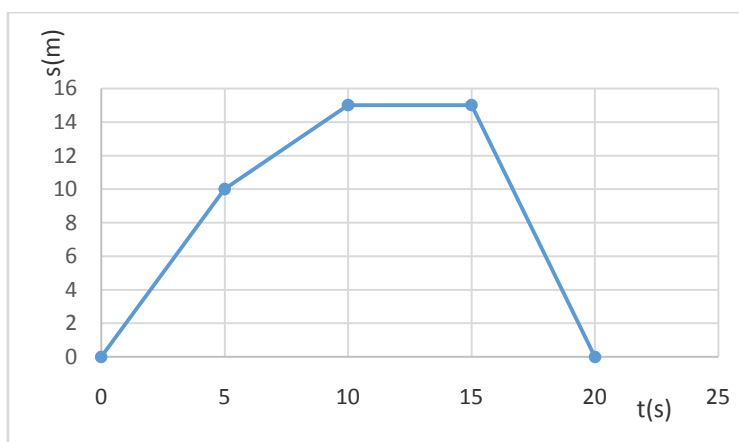
a) 0.5 m/s; 1m/s; 0; 0.33m/s
b) -0.5 m/s; -1m/s; 0; -0.33m/s
c) -2m/s; -1m/s; 0; +3m/s
d) 2m/s; 1m/s; 0; -3m/s

3. Among the following quantities only two are directly proportional. Which ones?
    a) the perimeter and a side of a squared table
    b) the radius and the surface area of a circle
    c) the volume of a cylinder and the base radius
    d) the number of the students of a school and the number of its teachers

4. Which of the following boards corresponds to the direct proportionality of the quantities?

    A.

t (s)	1	2	3	4
s (cm)	1	4	9	16

    B.

t (s)	1	2	3	4
s (cm)	3	6	9	12

C.

t (s)	2,0	2,5	3,0	3,5
s (cm)	20	30	40	50

D.

t (s)	1	4	8	10
s (cm)	20	5	2,5	2

5. Which of the following is the correct definition for food?
   a) matter to be ingested in small doses
   b) matter made up of different nutrients mixed together
   c) matter which is unnecessary for the human body
   d) matter needing cooking

6. Which of the following should be added in a balanced diet for a teenager?
   a) starch   c) dietary fibers
   b) iron   d) water

7. Which of the following provides a source of energy?
   a) water and minerals   c) carbohydrates and lipids
   b) vitamins   d) proteins

8. Which of the following units is used to measure the energy we get from digesting food?
   a) calorie or joule   c) metre
   b) kilogram   d) kelvin

9. In a correct diet:
   a) meals must be evenly distributed during the course of the day
   b) the evening meal must be the main one
   c) there shouldn't be more than two meals a day
   d) there must be fruit and vegetables

10. In order to guarantee the correct intake of proteins,
    a) it is sufficient to eat one type of pulses because it contains the necessary proteins
    b) it is sufficient to eat meat because it contains the necessary proteins
    c) it is necessary to reduce the intake of water to avoid diluting proteins too much
    d) it is necessary to increase the intake of cereal and cereal based products

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TEST 22
Unit 11/Topic: Science and Sport

Choose the correct answer

1. A car runs a rectilinear path at the constant speed of 90 km/h in 30 minutes. The covered distance is:
   a) 25 km
   b) 50 km
   c) 45 km
   d) 30 km

2. The following graph refers to the rectilinear motion of a point mass. Which of the following statements is wrong?
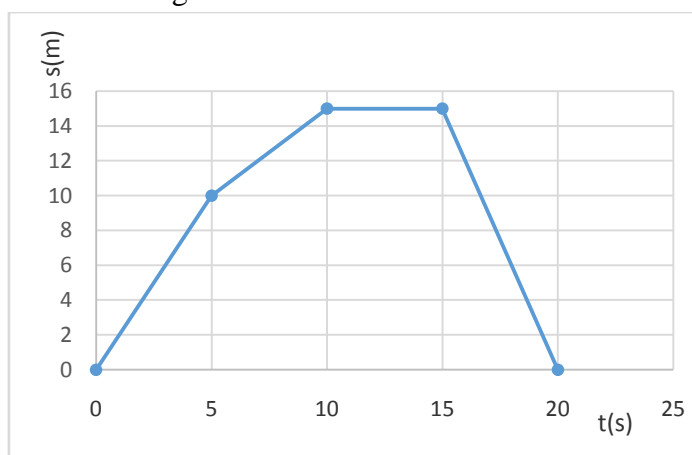
   a) From t=10s to t=15s the body stood still
   b) From t=15s to t=20s the body goes backwards towards the origin of the system of reference
   c) From t=5s to t=10s the body moved and its velocity was inferior in relation to the line from 0 to 5s
   d) At t=20s the body has reached a position equal to 20m compared with the origin.

3. When are two quantities directly proportional?
   a) their product is constant
   b) their sum is constant
   c) their difference is constant
   d) their ratio is constant

4. In the picture we have two directly proportional quantities: time (min) and quantity of water (l)
   Which of the following formulae describes the relationship?
   a) y = 4x
   b) y = x
   c) y = 2x
   d) y = 2x+1
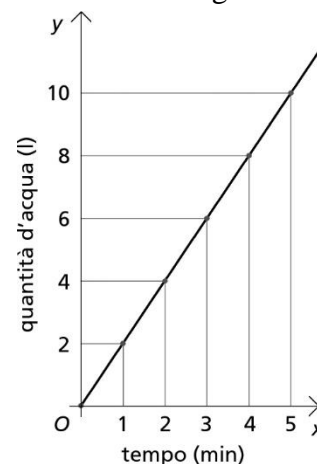
5. Which of the following is the main component of living organisms?
   a) vitamins
   b) water
   c) minerals
   d) proteins

6. How do we classify vitamins?
   a) as water and fat soluble
   b) as long and short
   c) as numerous and scarce
   d) as simple and compound

7. To achieve a balanced diet it is necessary
   a) to eat your meals quickly
   b) for every nutrient to be included in the right proportion
   c) to have a limited choice of food
   d) for daily nutrients to be mainly concentrated at lunch time

8. Which food contains the largest quantity of proteins with a high biological value?
   a) fresh fruit and vegetables
   b) meat, fish, eggs, dried pulses
   c) bread and pasta
   d) fizzy drinks

9. Which food should you eat to guarantee an adequate intake of fibres?
   a) milk and cheese
   b) bread and pasta
   c) fresh fruit and vegetables
   d) meat

10. In order to guarantee the intake of soluble vitamins,
    a) it is sufficient to take them occasionally because they accumulate in the organism.
    b) it is sufficient to drink water because they are contained in it together with minerals.
    c) it is necessary to include fat and dressing oil in your daily diet.
    d) it is necessary to introduce as much variety as possible in your food.

TEST 23
Unit 12/Topic: Kinematics and Road Safety

1. Use the equation for acceleration to determine the acceleration for the following two motions.

Time (s)	Velocity (m/s)
0	0
1	2
2	4
3	6
4	8

2. Consider the velocity-time graph below. Determine the acceleration:
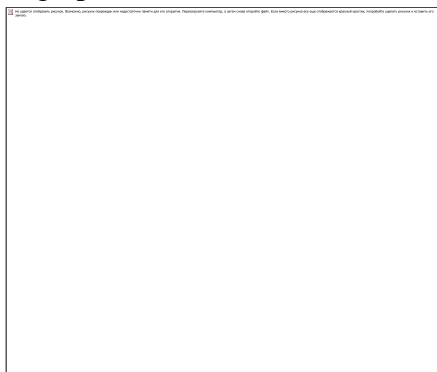
3. Giorgio is approaching a traffic light moving with a velocity of +30.0 m/s. The light turns yellow, and Giorgio applies the brakes and skids to a stop. If Giorgio's acceleration is 8.00 $\frac{m}{s^2}$, what is the braking distance of the car?

4. An airplane accelerates down a runway at 3.20 $\frac{m}{s^2}$ for 32.8 s until is finally lifts off the ground. Determine the distance traveled before takeoff.

5. A driver in a car on an icy highway is traveling at 100.0 *km/h*. He puts on the brakes and begins to slide. The coefficient of friction between the tires and the ice on the road is μ =0.15. What is the braking distance of the car?

6. Which kind of compound the ethanol is?
   a) a polar, inorganic compound
   b) a non polar, inorganic compound
   c) a polar, organic compound
   d) a non polar, organic compound

7. Which part of our body does the absorption of the alcohol begin in?
   a) liver   c) tongue
   b) stomach   d) bowel

8. Through blood, after 10-15 minutes from ingestion alcohol can reaches:
   a) inner bowel   c) muscles
   b) brain   d) fat tissues

9. The first enzyme involved into the alcohol metabolism is:
   a) lactase
   b) alcohol deydrogenase
   c) aldehyde deydrogenase
   d) amylase

10. Blood alcohol levels causing overestimation of driving abilities and longer reaction times
    are:
    a) 0.2-0.4 g/L
    b) 2.0-4.0 g/L
    c) 0.8-1.0 g/L
    d) 4.0-5.0 g/L

TEST 24
Unit 12/Topic: Kinematics and Road Safety

1. John is waiting at a traffic light. When it finally turns green, John accelerated from rest at a rate of a 6.00 m/s^2 for a time of 4.10 s. Determine the displacement of John's car during this time period.

2. A car starts from rest and accelerates uniformly over a time of 5.21 s for a distance of 110 m. Determine the acceleration of the car.

3. A car is initially travelling at a velocity of $36 \frac{km}{h}$. Suddenly the driver sees a cat crossing the road in front of the car. It takes 0.75 s for the driver to react and start braking the car. The car then decelerates at $4 \frac{m}{s^2}$ for 2 s, during which the cat has crossed the road. Find the total stopping distance d (reaction distance + braking distance).

4. A car is traveling at 80 km/h, and brakes with a reaction time of 0.5 s. Determine the reaction distance.

5. A driver in a car on a residential street is traveling at 50.0 *km/h*. She puts on the brakes when she sees a stop sign. The coefficient of friction between the tires and the road is $\mu = 0.60$. What is the braking distance of the car?

6. The factor that increases speed of alcohol absorption is:
   a) full stomach
   b) association with fatty foods
   c) empty stomach
   d) high room temperature

7. Most of the alcohol we ingest is absorbed in:
   a) upper bowel   c) esophagus
   b) kidneys   d) lungs

8. Following ingestion, alcohol reaches the greatest concentration in blood
   a) after 15 minutes in any condition
   b) after 30-45 minutes on an empty stomach
   c) after 60-90 minutes on an empty stomach
   d) after 30-45 minutes in any condition

9. The first step of the alcohol metabolism occurs
    a) in the mouth
    b) in the liver
    c) in the stomach
    d) in the esophagus

10. The final product of the alcohol metabolism is:
    a) Acetaldehyde
    b) Acetyl-CoA
    c) Acetate
    d) Acetic acid

TEST 25
Unit 13/Topic: Science and Orienteering

1. I am cycling when I see the following sign:
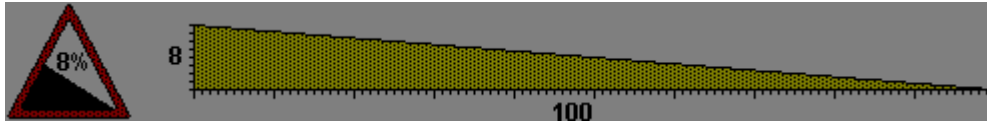
The angle α the road makes with the horizon equals:

a) $\alpha \cong 5°$ c) $\alpha = 13°$

b) $\alpha = 10°$ d) $\alpha \cong 2°$

2. On a geographical map the distance between two villages is 4 cm. If you know that the map scale is 1 : 150000, what is the actual distance between the two places?

a) 600 m   c) 60 km

b) 0,6 km   d) 6 km

3. What time does the sun reach its highest point above the horizon?

a) At 12.00   c) At 14.00

b) At 13.00   d) At 11.00

4. A plant whose trunk is covered in thorns is typical of:

a) dry climate   c) temperate forest

b) humid climate   d) tundra

5. Which of the following are photosynthetic organisms?

a) Frogs   c) Algae

b) Mushrooms/Fungi   d) Bees

6. Your city park is a small ecosystem containing biotic and abiotic components;identify the abiotic component in the list below:

a) gravel   c) ants

b) the lawn   d) the fir tree

7. In autumn the park is full of dry leaves, fern, mushrooms, insects and small mammals; where do mushrooms get their nourishment?

a) From the sun through   c) From small mammals'
    photosynthesis   excrements

b) Feeding on insects   d) From dead organisms

8.   How can you detect a control marker on an orienteering course?
   a) from a flag
   b) from a lantern
   c) from a notice

9.   An orienteering map uses symbols from:
   a) I.O.F.
   b) I.A.F.
   c) E.O.F.

10.   Which is the correct behaviour during an Orienteering exercise?
   a) Keep your map pointing North during the orienteering course
   b) Keep your map pointing South during the orienteering course
   c) Point your map as you feel like

TEST 26
Unit 13/Topic: Science and Orienteering

1. If on a road we have a 12% slope, then the angle between the road and the level ground is:
    a) 0,12°   b) 6,8°   c) 8,3°   d) 83°

2. We are on an orienteering competition. On our map the distance between two trees is 1,5cm. If the map scale is 1 : 2000, what is the actual distance between the two trees?
    a) 13,3 m   c) 300 m
    b) 3,0 km   d) 30 m

3. The geographical coordinates of point on Earth are:
    a) North, South, East, West
    b) Equator, the poles, Greenwich Meridian
    c) Latitude, longitude, altitude
    d) East and West

4. Which of these parts of a tree is not photosynthetic:
    a) leaves   c) leafy branches
    b) trunk   d) seed

5. Only one statement is correct. Which one?:
    a) All plants produce fruit
    b) All plants reproduce thanks to flowers
    c) All plants are autotrophic
    d) All plants have roots, trunk and leaves

6. In order to keep a well balanced ecosystem in the park every organism carries out a specific task; match each organism with its role.
    a. MUSHROOM   x. Producer
    b. MOSS   y. Primary consumer
    c. LIZARD   z. Decomposer
    d. ANT   k. Secondary consumer

7. Your city park is considered "the city lung". Why? (two correct answers)
    a) Because trees release CO_2
    b) Because trees absorb CO_2
    c) Because tress absorb O_2
    d) Because trees release O_2

8. Which of these instruments do you use with your map?
   a) A GPS (a satellite navigation system)
   b) a sextant
   c) a compass

9. What do you call the item that you use to show you went through a marker point?
   a) obliterator
   b) punching mechanism
   c) stapler

10. A good orienteer must first of all:
    a) be as fast as possible
    b) complete the entire route marked on the map
    c) ask for information

TEST 27
Unit 14/Topic: Arsenic and Drinking Water

1. Heat capacity
   a) and specific heat are the same physical quantity.
   b) is measured in J/K, while specific heat is measured in J/(kg · K).
   c) of a body is proportional to its mass, while specific heat is inversely proportional to its mass.
   d) of a body is inversely proportional to its mass, while specific heat is proportional to its mass.

2. In a calorimeter water has a temperature of Ta. We put a little marble block in the calorimeter with a temperature Tm, which is lower than Ta. Thermal equilibrium Te is such that:
   a) $Te < Tm < Ta$
   b) $Ta < Te < Tm$
   c) $Tm < Ta < Te$
   d) $Tm < Te < Ta$

3. If you administer a block of iron $3{,}45 \cdot 104$ J of heat, its temperature increases by $62{,}5$ K. Calculate the heat capacity of the block of iron.
   a) $5{,}52 \frac{J}{K}$
   b) $0{,}552 \frac{J}{K}$
   c) $552 \frac{J}{K}$
   d) $5520 \frac{J}{K}$

4. A mass of 200g of lead is heated at 363 K and placed in 500 g of water which initially has a temperature of 293 K. Ignoring the thermal capacity of the container and the heat loss of the system, calculate the equilibrium temperature of the whole set (water-lead). Take 130 J/(kg·K) as specific heat for lead and $4{,}19 \cdot 103$ J/(kg·K) as specific heat for water.
   a) 21°C
   b) 2,1°C
   c) 210°C
   d) 21K

5. In the water cycle, energy derives from:
   a) Oceans
   b) The atmosphere
   c) The sun
   d) The wind

6. Flowing through rocks, water increases its content of mineral salts and metal ions because:
    a) it is a good solvent and can dissolve compounds which make up minerals.
    b) it has a high density
    c) it is acidic and can therefore erode rocks
    d) it has a high surface tension

7. How do you define it when water passes below the surface?
    a) Infiltration   c) Irradiation
    b) Irrigation   d) Flooding

8. According to present regulations, the acceptable amount of arsenic in drinking water is $10\mu g/dm^3$; how much arsenic would you find in a glass containing $0,02\ dm^3$ of water?:
    a) 2 µg   c) 0,2 µg
    b) 20 µg   d) 0,1 µg

9. A change in the quality of water, which makes water unfit for certain uses is called:
    a) Sanitization   c) Pollution
    b) Condensation   d) Absorption

10. The water we drink is:
    a) A pure substance   c) A heterogeneous mixture
    b) A solution   d) A chemical compound

TEST 28
Unit 14/Topic: Arsenic and Drinking Water

1.   What unit can best measure specific heat?
      a) $1 / (J \cdot kg \cdot K)$
      b) $J / (K \cdot kg)$
      c) $J \cdot kg \cdot K$
      d) $(J \cdot kg) / K$

2.   Which of the following statements is true?
      a) Heat and work are measured by the same unit which is different from the one used for energy.
      b) Heat and work are ways to move energy between physical systems.
      c) Work and energy are measured by the same unit which is different from the one used for heat.
      d) Work and energy are ways to move heat between physical systems.

3.   When you administer a block of brass $2{,}66 \cdot 10^4$ J of heat, its temperature increases by 25,0 K. Calculate the heat capacity of the brass block.
      a) $1{,}064 \cdot 10^3$ J/K
      b) $1{,}064$ J/K
      c) $1{,}064 \cdot 10^4$ J/K
      d) $1{,}064 \cdot 10^2$ J/K

4.   A mass of 200g of copper is heated at 90°C and placed in 0,500 kg of water at 20°C initially. Ignoring the heat capacity of the container and the loss of heat of the system, calculate the equilibrium temperature of the water-copper set. Remember that specific heat for copper is 387 J/(kg·K) and specific heat for water is 4,19 ·103 J/(kg·K).
      a) 2,2K
      b) 22K
      c) 2,2°C
      d) 22°C

5.   On average, the percentage of water in the human body is :
      a) 36%
      b) 66%
      c) 30%
      d) 40%

6. In your world, drinking water comes from:
   a) surface water
   b) underground water
   c) disalination of sea water
   d) All options are correct

7. Chlorine is added to drinking water to kill microbes that cause illness. This process is known as:
   a) Chlorination
   b) Elimination
   c) Microbe Termination
   d) Vaporization

8. Which is the only substance that in nature you can found in liquid, solid and gaseous states:
   a) Oxygen
   b) Hydrogen
   c) Nitrogen
   d) Water

9. In a water molecule, how is the charge distributed?
   a) Negatively on the hydrogen side and positively on the oxygen side
   b) Positively on the hydrogen side and negatively on the oxygen side
   c) Neither of the above; water is non-polar and has an evenly distributed charge.
   d) Positively on the Hydrogen atom because it's more electronegative than Oxygen one.

10. According to present regulations, the acceptable quantity of Arsenic in drinking water is $10\mu g/dm^3$; how much Arsenic can you find in a glass containing $20\ cm^3$?:
    a) 2 µg
    b) 20 µg
    c) 0,2 µg
    d) 0,1 µg

TEST 29
Unit15/Topic: Action and Reaction:Examples from Animal Movement

1. A body of mass m=1kg increases its velocity by 10 m/s in 10 seconds. Another body of mass m=2 kg changes its velocity by 2 m/s in 1 second. Which of these two bodies receives the greater force?
   a) The first one.
   b) The second one
   c) It cannot be worked out.
   d) The forces exerted on both bodies are the same.

2. A force of 150 N is exerted on a body of mass m=100 kg, which moves in linear motion. Which of the following statements is correct?
   a) The resulting force exerted on the body is 150 N.
   b) Friction is irrelevant.
   c) Friction force equals 150 N.
   d) The resulting force is 980 N.

3. There are two skaters: the first one has double the mass of the second one. They push each other with a force of 20 N. Which acceleration will they have?
   a) The same acceleration.
   b) The first one will move with double the acceleration of the second one
   c) The second one will move with double the acceleration of the first one.
   d) It's impossible to give an answer because the masses of the two skaters are not given.

4. You are holding an object gripping it. Both gravity and the force of your hand are exerted on the object. Are these forces an action/reaction pair?
   a) No, they are not because they are exerted on the same object.
   b) Yes, they are because the object remains still.
   c) Yes, they are because the resulting force is null.
   d) Yes, they are because the two forces are equal and opposite

5. A car and a bus crash. Is the magnitude of the force exerted by the bus greater, smaller or equal to that exerted by the car?
   a) It is equal, because action and reaction forces are always equal in modulus.
   b) It is greater, because the bus has greater mass than the car and, therefore, can exert a greater force.
   c) It is smaller, because the car has a smaller mass.
   d) You cannot answer without knowing the two masses.

6. Movement of animals:
   a) occurs in response to a stimulus
   b) is a process which requires energy
   c) occurs thanks to the action of contractile cells
   d) all answers are correct

7. Movement of animals in water:
   a) is contrasted by the high density of water, therefore hydrodynamic shapes are facilitated
   b) is facilitated by the high density of water
   c) is facilitated by the complex shape of animals
   d) none of these answers is correct

8. Propulsion in bird flight:
   a) takes place in flapping flight
   b) takes place in gliding flight
   c) always results in the animal ascending
   d) none of these answers is correct

9. Which of the following is a propulsive organ?
   a) a man's arm when he's walking
   b) a kangaroo tail
   c) a shark dorsal fin
   d) none of these answers is correct

10. Given equal propulsive organs and equal weights, reaction is:
    a) greater if the animal moves in the air
    b) greater if the animal moves in water
    c) not related to where it takes place
    d) none of these answers is correct

TEST 30
Unit15/Topic: Action and Reaction: Examples from Animal Movement

1. "On a long jump, an athlete pushes the ground and the ground pushes, in turn, the athlete's feet exerting a force which is equal and opposite". This statement:
   a) Is not true, because in this case the athlete would remain still as the resulting force is null.
   b) It is not strictly true, because the force from the ground is slightly greater, thus allowing the athlete to defy gravity.
   c) It is true, because the third law of motion applies here.
   d) You cannot tell, because the weight of the athlete and the weight of the earth are not given.

2. A force of 300 N is exerted on a body of mass m=150 kg, travelling with uniform linear motion. Which of the following statements is correct?
   a) The resulting force exerted on the body equals 300 N.
   b) Friction is irrelevant.
   c) The friction force exerted on the body equals 300 N
   d) The resulting force equals 1470 N

3. We can walk on the ground thanks to:
   a) The reaction of the ground caused by the action of our feet.
   b) The very large mass of the Earth.
   c) The velocity of the action of our legs.
   d) A consequence of the law of inertia applied to the Earth.

4. If the resulting force of all the forces acting on a body is null, then that body:
   a) Is at rest for any reference system
   b) Is at rest, or moves according to uniform linear motion
   c) Moves in uniform linear motion for any reference system
   d) Is at rest only if its mass is large

5. A gun of mass m=7.5 Kg shoots a bullet of mass m=0.1 Kg. If during the explosion the bullet acceleration is 150 m/s2, the acceleration for the gun will be:
   a) 20 m/s^2 c) 0.02 m/s^2
   b) 0.2 m/s^2 d) 2 m/s^2

6. Given equal propulsive organs and equal weights, reaction is:
   a) greater if the animal moves in the air
   b) greater if the animal moves in water

c) not related to where it takes place

d) none of these answers is correct

7. Propulsion in bird flight:
    a) takes place in flapping flight
    b) takes place in gliding flight
    c) always results in the animal ascending
    d) none of these answers is correct

8. Movement of animals in water:
    a) is contrasted by the high density of water, therefore hydrodynamic shapes are facilitated
    b) is facilitated by the high density of water
    c) is facilitated by the complex shape of animals
    d) none of these answers is correct

9. Movement of animals:
    a) occurs in response to a stimulus
    b) is a process which requires energy
    c) occurs thanks to the action of contractile cells
    d) all answers are correct

10. Which of the following is a propulsive organ?
    a) a man's arm when he's walking
    b) a kangaroo tail
    c) a shark dorsal fin
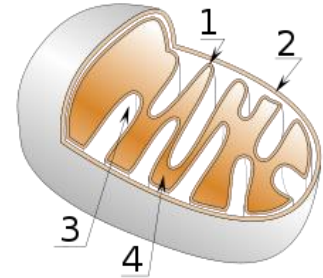   d) none of these answers is correct

TEST 31
Unit 16/Topic:Mitochondria as the place of production of the energy consumed by organisms

1. Complete the diagram of the mitochondrion by naming the highlighted elements

    1 – ……………………………………………………
    2 – ……………………………………………………
    3 – ……………………………………………………
    4 – ……………………………………………………
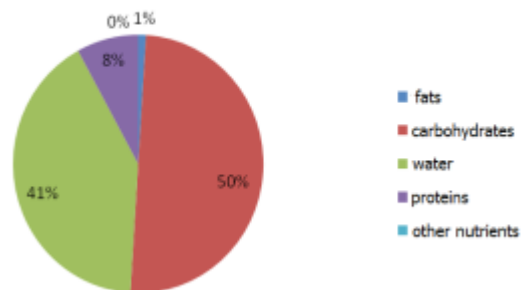
2. What is the role of mitochondria?

3. The energy value of $100g$ of cereals is $410kcal$, and $100g$ of
   3% milk is $125kcal$. Calculate the energy of one portion of cereal with milk, which consists of $200g$ of milk and $60g$ of cereal.

4. Calculate the energy value of wheat bread using the information presented in diagrams. Estimate how many calories does $100g$ of bread contain. It is established that the energy value of fat amounts to $900kcal/100g$, while proteins and fats $400kcal/100g$.

5. Translate words:
    numerous - ……………………………
    run on - …………………………….
    provide - ………………………………
    retina - ………………………………
    tongue - ………………………….…
    liver - ……………………………………
    muscles - ………………………………
    convert - ………………………………
    require facilitate -………………………
    free radicals ……………………………

Wheat bread

- fats
- carbohydrates
- water
- proteins
- other nutrients

0% 1%
8%
41%
50%

6. Decipher the names of substances and minerals:
    a. atinmiv -……………………………………………………………………
    b. crumomhi- …………………………………………………………………
    c. cinz- ………………………………………………………………………….
    d. uimslene- …………………………………………………………………….
    e. mzyoecne- …………………………………………………………………….

7. Use the words to finish the sentences below: vitamin D3, coenzyme Q10,vitamin B, chromium, zinc, selenium,

a) Fish (mackerel), shellfish and liver are high in ....
b) Brocoli, grape juice and barley are high in ....
c) Fish, cod liver oil, eggs, are high in ....
d) Pumpkin seeds, garlic are high in ....
e) Mushrooms, Brussels sprout, spinach and grains are high in ....
f) Sardines, broccoli, liver are rich in ....

8. The amount of energy supplied is important for health reasons. What is the amount of energy we get from individual nutrients?

9. Complete sentences:
    a. Mitochondria are called „energy centres of cells"
        …………………………………………………………
    b. The number of mitochondria in a cell depends on
        .…………………………………………………………

10. Draw the food pyramid and a sign its individual components.

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TEST 32
Unit 16/Topic:Mitochondria as the place of production of the energy consumed by organisms

Choose the correct answer 1-4:

1. Food Pyramid gives guidelines for eating balanced diet.
    a) true   b) false

2. The Food Pyramide recommends consuming a lot of fats, oils and sweets.
    a) true   b) false

3. The base of the Food Pyramid includes food we need to eat the most of.
    a) true   b) false

4. What food group serves as the base of the Food Pyramid?
    a) vegetables   c) bread
    b) fruit   d) oils, fats and sweats

5. Complete the sentences with the words in the box (<u>there are two extra words</u>).

PROTEIN, MATRIX, CRISTAE, OUTER, FOLDED, CRISTAE, OXYGEN, SURFACE

   a) The cristae, matrix, inner membrane and outer membrane are the main ....
       of the mitochondria.
   b) The .... is essentially the .... inner membrane of the mitochondria.
   c) The .... is the fluid inside the mitochondria.
   d) The covering of the cell is called .... membrane.
   e) The fluid contains water and ....

6.Match the words (1-5) with definitions (A-E).

I.__ FRESH	A. an aquatic animal having very hard outer layer
II. __ SHELLFISH	B. the process by which organisms take in and utilize food material
III.__ NUTRITION	C. not preserved by freezing, canning, pickling, salting, etc.:
IV. __ LIVER	D. a group of organic substances essential in small quantities to normal metabolism
V.__ VITAMINS	E. an organ located in the upper right side of the abdominal cavity

7. In the following picture, with numbers from 1 to 14 marked organelles. Scroll the number, which indicates mitochondria and specify the feature through which identification was possible.
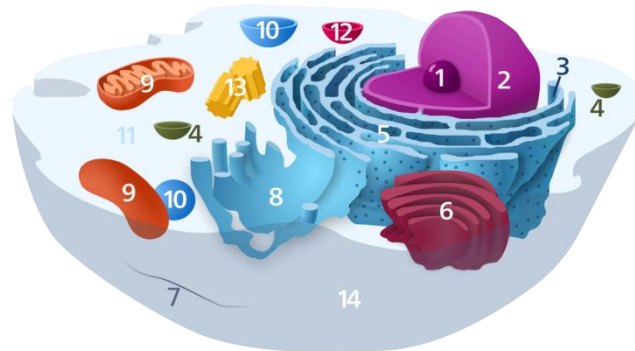
8. Mitochondria are the place where the energy used by the body is produced. Write the reaction showing a process of producing energy.

9. Write the definition of energy balance and specify when it will be positive for the body.

10. Specify:
The size of the mitochondrion: _____
The shape of the mitochondrion:_____

TEST 33
Unit 17/Topic: Percentages in everyday life

1. Complete the conversation with the words in the box.

| Altogether   Can   card   else   have   help   Here   How   It   much |
| Nothing   pound   Thank |

Shop assistant: Can I a) _____ you?
Eva: How b) _____ are these badges, please?
Shop assistant: They're 10p but from today they are 50% off.
Eva: c) _____ I have two, please?
Shop assistant: That's ten d) _____ . Anything e) _____? A poster perhaps?
Eva: No, thank you. f) _____ else. Here's my credit g) _____.
Adam: h) _____ much is this pen, please?
Shop assistant: i) _____'s 75p.
Adam: Can I j) _____ it, please? k) _____you are. One pound.
Shop assistant: Right. I can give you a small discount 10% off so that's 67.50p l) _____. Thank you.
Adam: m) _____ you.

2. Arrange the words in the right order to create correct sentences.

a. have/large/don't/the/any/We/ones/moment/at

_____

b. they/are/how/much?

_____

c. sell/you/do/shirts/rugby?

_____

d. size/are/what/they?

_____

3. Write the correct word in the box below the pictures

| cash   credit card   receipt   checkout   percent |

a   b   c

d   e

4. Cross odd one out

    a) discount   bargain   price   sale

    b) leaflet   flyer   commercial   brand

    c) price tag   designer label   trolley   bar code

    d) salesperson   cashier   shop assistant   customer

    e) changing room   discount   checkout   fitting room

5. Check your understanding: true or false Circle True or False for these sentences.

    a) The JR Sports sale starts in August.   True False

    b) The video console comes with five games.   True False

    c) The video console is in good condition.   True False

    d) You have to pay to use Jack and Jill's car park.   True False

    e) Jack and Jill's is open until late.   True False

6. Unscramble the words and write their definition:

    sutnidco -   elas -   gbinaar -

7. Take 35% off the prices, calculate the new cost.

a.   b.

8. A wholesale store offers a discount of 3% for payment on the day of purchase, while for each day of delay in payment it charges 0.5% interest from the bill. You are making a purchase worth of 1080 PLN. How much will you pay for the goods if paying on the day of purchase? How much would you have to pay after 3 days and after 10 days?

9. 1000 PLN was deposited into a bank, some of it to account A, the interest rate of which is 12% per annum, and some of it to account B, the interest rate of which is 15% per annum. After a year 132 PLN interest was obtained. How much money was deposited to the account A and how much to account B?

10. The prices of two cameras were lowered, one by 20% and the other by 30%. The new prices were 880 PLN and 840 PLN respectively. Which of the two cameras was more expensive before the reduction and how much?

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TEST 34
Unit 17/Topic: Percentages in everyday life

1. Give 5 examples of application of Percentages in everyday life.

2. The following table presents results of product sales in a bar. On the basis of these data, create a table and a graph as similar as possible to the sample presented in the picture below.

Product	Amount
Sandwiches	21%
Salads	9%
Soups	16%
Drinks	38%
Desserts	16%

Produkty

Desery 16%
Kanapki 21%
Sałatki 9%
Napoje 38%
Zupy 16%
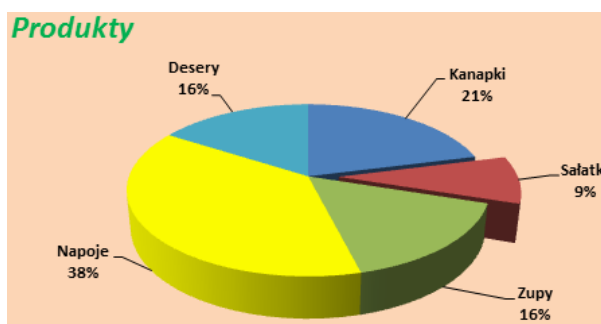
3. Copy table and create a pie chart based on the data provided.

Candidate	Number of votes
Janek Wiśniewski (1C)	45
Kasia Nowak (3B)	32
Dorota Kowalska (2A)	116
Marek Kowalski (2A)	201

4. Copy table and create a line graph based on the data provided in the spreadsheet. Format the chart area according to requirements.

Month	Attendance
September	93,6%
October	91,6%
November	88,6%
December	89,6%
January	88,6%
February	88,6%
March	85,6%
April	84,6%
May	82,6%
June	81,6%

5. Choose appropriate chart types for the following tasks:

    a) pie   I   to show increases and decreases

    b) column   II   to show the share of individual values in the total

    c) line   III   for comparing values

6. Give 4 examples of the usage of a column-line charts in everyday life, where one of the Y-axes is set to a percentage and the secondary axis to any other value.

7. The price of a certain product was increased firstly by 30% and then by 40% more. By how many percent is the price higher than the initial price? Justify your answer.

8. A swimsuit cost $80zł$ in July, in august there was a reduction of 12%, and in September another reduction of 10%.

    a. What was the price of the swimsuit after both reductions?

    b. How much would it cost if the price was reduced again by 22%?

9. The price of certain goods was reduced by 20% and then increased 20%.

    Is the price the same after these alterations? If not, how much higher or lower is the final price than the initial price? Justify your answer.

10. Calculate the tax for a person who deposited 1500 PLN for a one-year deposit if the interest rate is 5%?
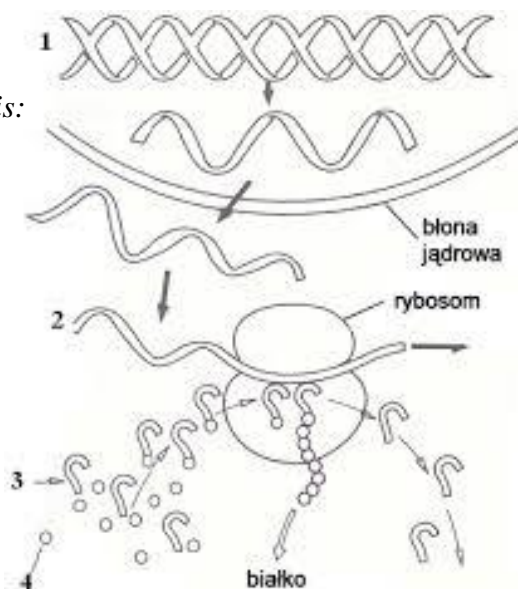
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TEST 35
Unit 18/Topic:Nucleic acids and their effects on the organism

1. Name at least 10 athletic disciplines.

2. Name 3 distances included in the short flat racing.

3. Name the types of nerve fibers.

4. What it is DNA?

5. What it is the genetic code?

The diagram shows the course of protein biosynthesis:

6. Assign each of the organic compounds shown in the illustration numbered 1 – 4 the correct name A – E.

1 – ....   A. amino acid
2 – ....   B. DNA
3 – ....   C. mRNA
4 – ....   D. rRNA
                                                    E. tRNA

7. Provide the name of the process resulting in the production of a compound with a specific number 4 on the diagram 2.

8. Present the role of tRNA in the synthesis of protein.

In humans, right-handedness is the dominant characteristic (A), while left-handedness is recessive (a). A family had a child. Both parents are heterozygous right-handed.

9. Determine the genotypes of both parents.

    Mother's genotype ....

    Father's genotype ....

10. Note down the genetic cross and based on that determine what is the probability that a child was born left-handed

TEST 36
Unit 18/Topic:Nucleic acids and their effects on the organism

1. Assign definitions 1, 2, 3 and 4 to the corresponding explanation from column A - F. Two definitions are unnecessary.

1. GENOME	A. RNA of the organism
2. GENOTYPE	B. chromosomes of the organism
3. PHENOTYPE	C. genes of the organism
4. KARYOTYPE	D. features of the organism
	E. variability of of the organism
	F. DNA of of the organism

2. Explain the meaning:
   a) Nucleotide   b) Gene

3. Explain the meaning: Chromosomes

4. Explain the meaning: Mutation

5. What it means RNA? Explain.

6. The following table presents the rules of expression (the disclosure) of the gene of baldness in men and women.

Genotype	Female phenotype	Male phenotype
BB	baldness	baldness
Bb	Normal hair growth	baldness
bb	Normal hair growth	Normal hair growth

Based on the data from the table formulate a conclusion for a baldness gene expression in humans.

7. Brown eye color (A) in a human dominates over blue (a). Brown-eyed man who is homozygous marries a blue-eyed woman. What is the probability that their children will have blue eyes?

8. Gregor Mendel, through his work on pea plants, discovered the fundamental laws of inheritance. Write what Mendel concluded.

9. Explain what the first and second law of Mendel: 1st - The Law of Segregation

10. Explain what the second law of Mendel: 2nd - The Law of Independent Assortment

TEST 37
Unit 19/Topic: Statistics for astronomy

A street poll was conducted. The question was „How many times were you at a cinema last month?" The survey results are presented in the diagram below.

the number of visits to the cinema
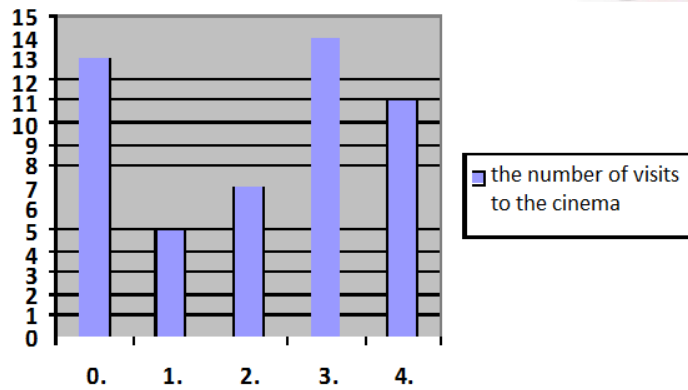
1. What percentage of the respondents visited a cinema more than once in the last month?

2. What is the median of visits to the cinema? Enter a dominant for visits to the cinema.

3. What is the average number visits to the cinema.

4. Calculate the standard deviation of the average number of visits to the cinema. Present the result with one decimal place.

5. 50 randomly selected blocks of butter, produced by some dairy plant, were weighted. The results are presented in the table below.

The mass of a block of butter [dag]	The number of blocks of butter
16	1
18	15
19	24
20	68
21	26
22	16

Based on the data presented in the table, calculate the arithmetic average and standard deviation of the mass of a block of butter.

6. The Milky Way contains about:
A. 50 billion stars   B. 300 billion stars   C. 300 million stars   D. 500 million stars

7. Antares is a star:

A. smaller than the Sun
B. about the size of the Sun

C. several times bigger than the Sun
D. several hundreds of times bigger than the Sun

8. In a radius of 15 light years from the Sun there are:

A. about 1000 stars
B. about 10 stars
C. about 50 stars
D. about 500 stars

9. The Andromeda Galaxy, as compared to the Milky Way, contains

A. about a thousand times more stars
B. about 100 times less stars

C. about half the number of stars
D. million times more stars

10. The universe contains

A. thousands of galaxies
B. milions of galaxies

C. bilions of galaxies
D. trilions of galaxies

TEST 38
Unit 19/Topic:Statistics for astronomy

1. In a radius of 15 light years from the Sun there are about 50 stars. Using the cosmological principle, estimate how many stars are there within twice the size radius from the Sun.

2. Sirius - the brightest star in the night sky

a)   is located in the immediate vicinity of the Sun and its mass is several hundred times greater than the mass of the Sun

b)   is located in the immediate vicinity of the Sun and its mass is several times smaller than the mass of the Sun.

c)   is located at a distance of more than 50 thousand light-years from the Sun

d)   is located approx. 8 years of light from the Sun

3. The density of the universe is

a)   very large, because the mass of the Universe is huge

b)   very small, because the Universe contains huge "empty" spaces

c)   comparable to the density of the Sun

d)   greater than the density of matter in the Milky Way

4. The table contains some results of a written test in mathematics in a senior year (assessed at six-grade scale). Present two conclusions based on the analysis of these values.
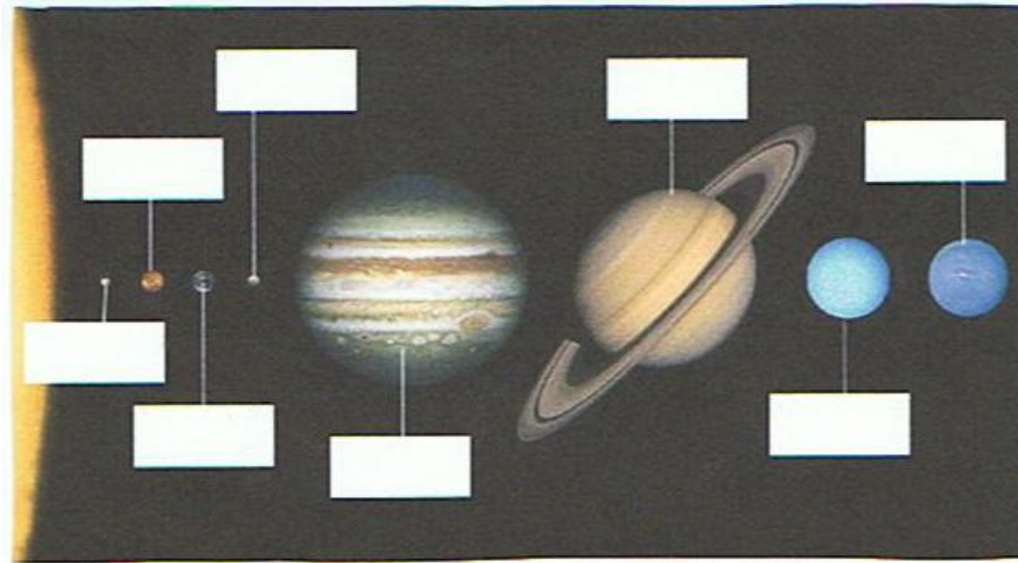
	Girls	Boys
Number of people	11	14
Average mark	4,0	3,8
Standard deviation	1,1	1,8

5. The table presents the results obtained during a quiz for students of 3rd class. Calculate the arithmetic average and standard deviation of the results, as well as present your conclusions.

Mark	6	5	4	3	2	1
Number of students	1	2	6	5	9	2

6. Name the planets.

7. Write the numbers

15,000,000	
89,078	
4.6 x 20	
56,000 x 2.6	
17,456,000	

8. Answer the questions about planets: Pluto   Mercury   Jupiter   Jupiter   Mercury
   a) Which is the biggest?   ……………………………………
   b) Which is the smallest?   ……………………………………
   c) Which is the hottest?   ……………………………………
   d) Which is the closest to the earth?   ……………………………………
   e) Which is the heaviest?   ……………………………………

9. Use the words to complete the sentences with correct forms:

> hot   long   short   cold   big   small

	Mercury	Venus	Earth	Mars
Diameter (km)	5,000	12,000	12,700	6,800
Number of hours in a day	4,200	2,800	24	25
Number of days in a year	88	224	365	687
Averege temperature	465°C	480°C	15°C	-65°C

   1. A year on mars is_____than a year on the Earth.
   2. A day on Venus is _____ than a day on Mercury.
   3. The temperature in Mercury is _____ than Venus.

4. The temperature on Venus is _____ than the Earth.

5. Venus is _____ than the Earth.

6. The Earth is _____ than Mars.

10. Find the words

MERCURY/ASTRONAUT/JUPITER/EARTH/ROCKET/GALAXY/NEPTUNE/URANUS/
SATURN/VENUS/MOON/MARS

Z	U	F	F	C	M	O	O	N	G	I	G	C	E	F	V
K	F	M	H	E	D	D	S	S	M	G	D	X	K	E	E
C	X	I	U	B	N	Q	C	M	P	H	Y	K	G	A	T
G	V	V	R	D	C	B	N	E	P	T	U	N	E	R	U
E	E	W	A	O	Y	C	Z	R	U	O	U	L	U	T	J
D	N	H	N	R	K	S	L	C	L	K	B	E	B	H	P
J	U	O	U	K	Q	H	A	U	Q	P	M	V	C	M	B
W	S	L	S	H	B	R	O	R	X	U	A	B	I	N	D
N	Z	Y	Q	Y	F	A	V	Y	B	B	E	U	Z	G	G
H	S	A	T	U	R	N	Q	V	W	X	J	M	A	R	S
Q	C	J	D	N	G	I	W	G	C	L	U	H	A	W	W
R	G	E	O	X	M	O	B	B	K	D	P	J	N	R	Z
V	G	A	L	A	X	Y	D	N	D	V	I	G	S	Q	K
U	N	D	M	U	P	R	O	C	K	E	T	T	Y	B	Q
P	D	P	C	V	X	P	T	Q	F	M	E	Y	M	Y	X
A	S	T	R	O	N	A	U	T	J	R	R	A	L	H	L

Now, write the names of the planets in order.

_____

_____

_____

_____

_____

_____

_____

TEST 39
Unit 20/Topic: Chemistry for people – cosmetics and detergents

1. Water is:
a)   active component   c) base component
b)   solvent   d) answers b/ and c/ are correct

2. Milk is an example of emulsion:
a) O/W   b) W/O   c)   W/W   d) it is not an emulsion

3. Loose powder consist of: 120 g talc, 7,5 g zinc oxide, 7,5 g zinc stearate, 15 g rice starch. Talc content (mass percentage) in the loose powder is:
 a) 10%   b) 65%   c) 70%   d) 80%

4. Substance facilitating the formation of emulsion is:
a) fixative   b) emulsifier   c) sactive component   d) stabilizer

5. The shaving foam function is:
a) cleaning   b) fragrance   c) embelishment   d) care and protection

6. The aqueous phase in the moisturizing cream should be 80% of the mass. Calculate how many grams of water is in 250 g of cream
a) 50g   b) 100   c) 200g   d) 150g

7. By analyzing the composition of the cream it be concluded that the ingredients:
a) are ordered according to their decreasing content
b) are ordered according to their increasing content
c) are given in any order
d) base components are given at the end

8. Greasing cream is the example of:
a) suspension   c) emulsion O/W
b) emulsion W/O   d) solution

9. On the basis of figures determine which gases contribute most to global warming and try to determine their origin.

10. Moisturizing cream contains of 5% emulsifier (mass percentage). Calculate how many grams of emulsifier contains 250 g of cream.
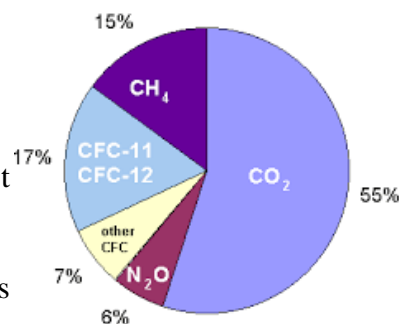
Erasmus+

TEST 40
Unit 20/Topic: Chemistry for people – cosmetics and detergents

1. Responsible for the greenhouse effect are:
a) greenhouse gases   b) contamination   c) industrial plants

2. If not for the greenhouse effect the earth's temperature was that:
a) 00   b) -19   c) 14

3. The greenhouse gases include:
a) CO_2 b) O_2 c) O_3

4. The result of the greenhouse effect is not:
a) raising the water level   b) warming   c) the UV radiation reaching the Sun.

5. The ozone hole is most commonly observed on:
a) Antarctica   b) Asia   c) Australia

6. What kind of gas was replaced Freon?
a) propane, butane,   b) nitrogen, butane   c) propane, helium

7. What are the harmful effects of UV rays?
a) melting of glaciers   b) skin cancer   c) the destruction of the facades of buildings

8. Which of the characters says that the cosmetic does not destroy the ozone layer?

a)   b)   c)

9. Which countries have the largest share of CO2 emissions from the burning of fossil fuels?
 a) Russia, Germany   b) USA, Brazil   c) USA and China

10. Microbeads (used In toothpaste or face scrub) are tiny plastic balls made of:
a) sand   b) polyethylene   c) salt

Erasmus+
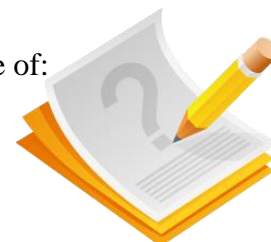
TEST 41
Unit 21/Topic: Motion. Applications.

The Danube is the second longest among Europe's rivers (after the Volga), the only river flowing from West to East, it flows from the Black Forest (Germany) and crosses 10 countries (Germany, Austria, Slovakia, Hungary, Croatia, Serbia, Romania, Bulgaria, Moldova and Ukraine) passing through four capitals: Vienna, Bratislava, Budapest and Belgrade.

Read the following situation in order to solve tasks 1-4:

The National Administration of the Romanian Waters recorded the speed of the currents of the Danube in the same point (kilometer 482, downstream Giurgiu) for a week, registering the following values:

1. How long does it take to a life buoy fallen into the water, to cover the distance of 1,296 kilometers?
a) 30 min   b) 1280s   c) 20 min   d) ¼ hour

No.	Day	Velocity (m/s)
1	Monday	1,16
2	Tuesday	1,12
3	Wednesday	0,98
4	Thurday	0,99
5	Friday	1,03
6	Saturday	1,10
7	Sunday	1,18

2. A motor boat travels on the Danube at constant speed in relation to the river bank. The boat covers a stretch of 6 km upstream in 16 minutes and downstream in 10 minutes. What is the velocity of the boat and the velocity of the water in relation to the river banks?

a) v_B=7,5m/s;   c) v_B=6,5m/s;   e) v_B=8,5m/s;   g) v_B=9m/s;

b) v_A=2,5m/s   d) v_A=2m/s   f) v_A=3m/s   h) v_A=3m/s

Read the following situation in order to solve tasks 3-4:
The rectilinear motion of two motorboats is described by the following laws of motion $(t_0 = 0)$ $x_1 = 4 + 2\,t^2$ (m) and $x_2 = 10\,t - 2\,t^2$ (m).

3. The time after which the speed of the two motorboats are equal is:
a) 2 s   b) 1,25   c) 3s   d) 1,5s

4. Draw the graph of the law of speed for Motorboat 2 relative to a reference system linked to Motorboat 1.

Read the following situation in order to solve tasks 5-6:
Two motorboats start from the same point A (the harbor of Galati) travelling in the same direction, moving uniformly straight, at the speeds v_1 and v_2 ($v_1 > v_2$). After time t_1, travelling in the same direction, a third motorboat starts from A. It reaches the first motorboat t_2 minutes later than it reaches the second motorboat.

5. Consider known v_1, v_2, t_1, t_2. Find out the speed v_3 of the third boat. The unit for speed is km / h, and for time, minutes.

6.Determine the algorithm and corresponding program.

Read the following situation in order to solve tasks 7-8:
A swimmer aims to cross the Danube in an area with a width of about 500 m.

7. Name at least 5 skeletal muscles involved in doing this feat.

8. Name at least 2 properties of the skeletal muscles involved in swimming.

9. *Fill in the gaps with one of the following words:*

punched, jumped, hit, crawled, bending, pulling, tumbled, pushed, crouched, kicked

1. *The soldiers .... forward on their bellies.*
2. *The circus lion .... through the hoop*
3. *She slipped and .... down the hill*
4. *He .... the winning field goal*
5. *She................. him on the chin.*
6. *The trees were .... in the wind.*
7. *We spent the morning in the garden .... weeds.*
8. *The bulldozer................. the rubble over the edge of the pit.*
9. *She................... down, trying to get a closer look at the spider.*
10. *The plate shattered when it .... the floor.*

10. Name 10 types of actions you can do with a ball.

TEST 42
Unit 21/Topic: Motion. Applications.

According to http://www.economica.net/cercetatorii-romani-care-au-facut-o-locomotiva-si-o-vand-nemtilor-vezi-cum-arata_38490.html#ixzz3wBmvlguW*, two types of locomotives are being currently produced in Craiova and they are called the Transmontana and the Phoenix. The Transmontana is the first locomotive with an asynchrone engine ever produced in Romania, while the Phoenix is the first electrical locomotive powered by low voltage and choppers for driving DC propulsion motors.*

Read the following situation in order to solve tasks 1-4:
A speedometer put on a wagon which was detached from the locomotive that was pulling it, allowed an observer to record its speed every two seconds.

t(s)	0	2	4	6	8	10	12	14	16
v(m/s)	16	14	12	10	8	6	4	2	0

By applying the brake shoes on the wheels and repeating the same experiment starting from the same speed, the observer recorded the following values:

t(s)	0	2	4	6	8	10
v(m/s)	16	12	8	4	0	0

1.The acceleration of the wagon without applying break shoes:
a) -1 m/s^2 b) -0,75m/s^2 c) -1,5m/s^2 d) -2,4 m/s^2

2. The acceleration of the wagon after applying break shoes:
a) -1,5m/s^2 b) -1,75m/s^2 c) -1 m/s^2 d) -2 m/s^2

3. Draw the graphs of the relation bewteen time and the in both cases (on the same graph)

4. Determine the distance covered by the wagon until it stopped (for both cases).

Read the following situation in order to solve tasks 5-6:
Let' s consider A and B as 2 railway stations, while d is the distance between them. One train leaves from point A going towards B at v1 speed. After the t_0 time, a second train leaves from B, having the same direction as the first train and travelling at the v_2 speed ($v_2>v_1$). Both trains move uniformly rectilinear and v_1,v_2 are t_0 known.

5. After how long do the two trains meet and at what distance from point A? The measurement unit for speed is km/h, for distance- km, for time- h.

6. Determine the algorithm and the corresponding programme.

Read the following situation in order to solve tasks 7-8:
To load a rail boxcar, an employee performs all sorts of moves, especially with his arms and torso.

7. Identify a bone lever and specify the type of class it belongs to.

8. Specify the active and resistance forces (for the levarage in item 7) and draw the lever.

9. Fill in the gaps with one of the following words:

rushed, sprawling, slouch, lifted, bowed, sprinted, trip, dashed, dodge, bounced

1) The paramedics................. the stretcher into the ambulance.
2) She..................... down the hallway to the bathroom.
3) Firefighters .... to the accident scene.
4) He deliberately tried to .... me.
5) Melinda was .... in her favorite chair watching TV.
6) They managed to .... the reporters by leaving through the back exit.
7) Sit up straight. Please don't ....**.**
8) The athlets.................... **.** for the finish line.
9) He.................. . with elaborate courteousy.
10) The ball .... a few times and then rolled to a stop.

10. Name ten different ways in which you can move by using your legs.

TEST 43
Unit 22/Topic: Magnets and the magnetic effect of the electric current

The Earth is a giant magnet with a magnetic field which is extremely strong. The intensity of this field decreases as we get higher into space, so that the force of the magnetic fields is 10,000 times lower at a distance of 8-14 terrestrials radiuses. In this way, the whole worlds, be it alive or inanimate, is enclosed in this field and the weakening of the force of the field would definitely have certain adverse effects, because without the magnetic field life could not exist in its current form on our planet.

1. It is known that magnetic poles *coincide / do not coincide* with the geographic poles (circle the correct version):

    a) *The magnetic South pole* is called *boreal / austral pole* and is in the northern hemisphere at the edge of the Antarctic continent and is located in Alaska.

    b) *The magnetic North pole* is called *boreal / austral pole* and is the oceanic region of southern Australia off the west coast of Bathurst Island, near the Canadian Northwest Territories approximately 1290 km of Hudson.

2. _____ _____ represents the angle between the Earth's magnetic field and the geographic north. It has a positive value if the magnetic north is located eastern of the geographic north and it also varies in time and space.

3. The magnetic field of the Earth is indispensable to the living world, just as _____, _____, food or sunlight.

4. In the environment there are many active bioenergy signals, one of the most important being the Schumann waves. Their first harmonic has a frequency of 7.8 Hz. Exactly the same frequency is present in _____, the main control center of the human brain (that brain region responsible for our ability to _____and _____)

5. The magnetic induction unit is:

a) N/A   b) N·A/m   c) T   d) Kg/(A^2·s^2)

6. A coil of radius r = 4 cm is traversed by a current with the intensity I = 8A. What is the magnetic induction coil in the center. We know that $\mu_0= 4\pi \cdot 10^{-7}$ H/m.

a) $4\pi \cdot 10^{-6}$ T   b) $2\pi \cdot 10^{-7}$ T   c) $0,25\pi \cdot 10^{-6}$ T   d) $0,5\pi \cdot 10^{-7}$ T

7. The transition from one slide to another in the computer presentation about magnets can be made:

a) Through a transition effect
b) Through an animation effect
c) With a click
d) Automatically after a certain time

8. What types of animation effects can we use in a computerized presentation about magnets?

9. Fill in the sentences with one of the following words:

cope, outright, siege, rise, supply, reminiscent, alternative, realm, needle, peculiar

a) A compass……………….. is a device that tells which direction is north, south, east and west.
b) The storm cut off our water…………………..
c) Inducing drowsiness is one of the …………………..properties of this drug.
d) There is no …………………………….. but to walk.
e) Tell me …………………………..what's bothering you.
f) His style of writing is ……………………………of Hardy's.
g) I will try to ……………………….. with his rudeness.
h) The decision to fire the redundant staff gave …………………………. to a wave of protests.
i) The army laid ……………………to the city for over a month.
j) Magic addresses problems outside the …………………………. of science.

10. Translate the following phrases into your mother tongue, then use them in sentences of your own:

a) to coin a new word/term/phrase
b) imbued with a peculiar ability
c) steeped in superstitions
d) to hail the properties
e) to pique curiosity

TEST 44

Unit 22/Topic: Magnets and the magnetic effect of the electric current

When Christopher Columbus crossed the Atlantic in 1492, he found that the North indicated by the compass was a little different from what he had calculated taking into account the position of the stars. Columbus also noted that the compass orientation changed as his ships departed from Europe, and got closer to the American continent. So, it was Columbus who, at the time, discovered the magnetic declination.

1. The magnetic declination for the city of Craiova according to www.magnetic-declination.com is $+50^0$ 4'. Choose the correct statement from the list below:
a) The declination is positive when the magnetic north is east of the geographical north.
b) The declination is positive when the geographic north is east of the magnetic north.
c) The declination is positive when the magnetic north is west of the geographic north.
d) The declination is always positive but its value varies in time and space.

2. The magnetic field lines come out of the Earth's surface over the entire southern hemisphere and enter into the Earth on the entire northern hemisphere so the force lines of the magnetic field come out of the............... pole and enter the ....pole.

3. The magnetic field of the Earth is a defender of life, protecting it from the harmful effect of the solar wind and the electric particle flow from the sun that would otherwise destroy the atmosphere and water on our planet. The fact that the magnetic field plays an essential role in maintaining our health was confirmed when the first astronauts returned ill from space. Once the problem was identified, it was solved immediately, NASA installing _____ in its stations and on spacecrafts.

4. The intensity of the magnetic field may be reduced or even be shielded by disruptive elements from the environment (the construction of reinforced concrete, metal construction, asphalt, etc.). List three possible symptoms that may occurr when the beneficial action of the geomagnetic field decreases.

5. What is the value of the magnetic induction produced by an electric current with the intensity of 10A running through a linear conductor, at the distance of 20cm from the conductor? It is known that $\mu_0 = 4\pi \cdot 10^{-7}$ H/m.
a) 10^{-6} T   b) $2 \cdot 10^{-6}$ T   c) 10^{-5} T   d) $0,5 \cdot 10^{-5}$ T

6. A coil with 100 turns, the length of 10π cm is traversed by an electric current with the intensity of 2A. Knowing $\mu_0 = 4\pi \cdot 10^{-7}$ H/m what is the value of the magnetic induction in the center of the coil?

a) $6 \cdot 10\text{-}4$ T   b) $5 \cdot 10\text{-}6$ T   c) $4,2 \cdot 10\text{-}5$ T   d) $8 \cdot 10\text{-}6$ T

7. The attraction and the repelling of the poles of two magnets can be shown by using an electronic presentation with:
a) transition effects
b) sound effects
c) animation effects
d) organizational diagrams

8. In order to draw a magnet in an electronic presentation we can use:
a) an image   c) WordArt
b) automated forms   d) a table

9. Fill in the sentences with one of the following words:
    field, polarity, to attract, repel, repulsion, field, current, reversal, magnetism
a) The magnetic ………………… means that the poles flip so that the North pole becomes the South pole and vice versa.
b) In physics ………………….. refers to the force tending to separate two objects, such as the force between two like electric charges or magnetic poles
c) Good and evil are an example of ……………………..
d) The scent will ………………..certain insects.
e) The electric ………………..can be either direct or alternating.
f) Electric charges of the same sign …………………… one another.
g) The Earth has a huge magnetic ………………...
h) Everyone succumbed to the ………………….. of his smile.

10. Translate the following phrases into your mother tongue, then use them in sentences of your own:
a) besieged city
b) to choose truth over the superstition
c) the bulk of the letter
d) to set apart from
e) to make your blood curdle

TEST 45
Unit 23/Topic: Structured data types. Bi-dimensional arrays

For each item, select the letter corresponding to the correct answer. There is only one correct choice.

1. The four personality type model: sanguine, choleric, phlegmatic and melancholic was created by:

   a)   C. G. Jung   b)   H. Eysenck   c)   Hippocrates and Galen   d)   S. Freud

2. The human personality contains traits which are:

   a)   Cardinal   b)   Secondary

   c)   Central   d)   Cardinal, central and secondary

3. The matrix (the two-dimensional picture) encoding the relationships of friendship in a class has elements equal to:

   a)   0   b)   1   c)   0 si 1   d)   -1, 0 and 1

4. The main diagonal of a square matrix (two-dimensional array coded elements) has items coded through:

   a)   A[i][i]   b)   A[i][j]   c)   A[j][i]   d)   A[n][n]

5. Consider the array $A = \begin{pmatrix} 3 & -1 \\ 2 & 4 \end{pmatrix}$, $B = \begin{pmatrix} -2 & 3 \\ 5 & 6 \end{pmatrix}$. If C=(cij)=A+B, then choose which of the following statements is not true:

   a) $c_{12}=2$ b) $c_{11}=5$ c) $c_{22}=10$ d) $c_{21}=7$

6. Consider the array $A = \begin{pmatrix} 3 & -1 \\ 2 & 4 \end{pmatrix}$. If C=(cij)=tA, then choose which of the following statements is true:

   a)   The trace of A=1   b) $c_{12}=3$ c) $c_{22}=3$ d)   the trace of C=7

7. Determine the real numbers x and y, so that we have A = B, where

$$A = \begin{pmatrix} 9 & 8 \\ y+x+2 & x^2 \end{pmatrix} , \ B = \begin{pmatrix} y^2 & x-3y \\ -2 & 1 \end{pmatrix}$$

   a)   x=-1, y=3   b)   x=1, y=3   c)   x=-1, y=-3   d)   x=1, y=-3

8. Say whether the statements below are true or false:
   a) Being prying means being inquisitive in an annoying, officious, or meddlesome way.
   b) If you are persistent, you will continue to do something even though it is difficult or other people want you to stop.
   c) Gregarious people have difficulties in relating to a social group.
   d) Obstinate people will easily give up their opinion and do whatever is reasonable.

e) To be sly means to be clever in a dishonest way.
f) Proud, arrogant, haughty, insolent, overbearing and disdainful are synonyms.
g) Being dissembling means never hiding your true feelings
h) Haughty people have an insulting attitude, thinking that they are better, smarter, or more important than others.
i) Contemptuous and contemptible mean almost the same thing.
j) Down-to-earth people will always be practical and sensible.

9. Group the following traits of character into positive and negative ones:

Moody, clinging, affectionate, ruthless, unassuming, foolhardy, self-confident, stubborn, gregarious, gullible, fair-minded, reliable, agreeable, cunning, foolish, grumpy, quick-tempered, boastful, sensitive, meddlesome

10. For each sentence, choose the best word or phrase to complete the gap from the choices below.
    1. She says the most terrible things about other people. She can be so _____ sometimes.
    A demanding   B pushy   C bossy   D bitchy
    2. Mike's very _____. Sometimes I just wish he could be quiet and listen for a change.
    A impertinent   B talkative   C easy-going D rude
    3. You're always impossible to please. You're so _____.
    A demanding   B vain   C aggressive D out-going
    4. Billy is young, yet he loves meeting new people. He's very_____.
    A vain   B out-going   C shy D pushy
    5. My wife is never late for anything. I wish I could be as _____ as she is.
    A timid   B punctual   C time-wasting   D early
    6. His girlfriend often shouts at people when they don't do what she wants. She can be very _____.
    A timid   B talkative   C vain   D aggressive

TEST 46
Unit 23/Topic: Structured data types. Bi-dimensional arrays

For each item, select the letter corresponding to the correct answer. There is only one correct choice.

1. Imagination gives…………………..to the human personality:
   a) Originality   b) Correctness   c) Accuracy   d) Receptiveness

2. The simplest informational human connection with the world and with oneself is done through:
   a) Memory   b) Sensations   c) Language   d) Representations

3. The secondary diagonal of a square matrix (two-dimensional array coded elements) has items coded through:
   a) A[n-j][i]   b) A[i][n+1-i]   c) A[i][n-j]   d) A[n-j][j]

4. An element located on the line i and column j of a matrix, whose value is the average of the indices is defined by the expression:
   a) A[j][i]=(i+j)/2   b) A[j][j]=(i+j)/2   c) A[i][i]=(i+j)/2   d)   A[i][j]=(i+j)/2

5. Consider the arrays $A = \begin{pmatrix} 3 & -1 \\ 2 & 4 \end{pmatrix}$, $B = \begin{pmatrix} -2 & 3 \\ 5 & 6 \end{pmatrix}$. If C=(cij)=A-B, then choose which of the following statements is true:

   a) c12=-4   b) c11=5   c) c22=3   d) d. c21=-3

6. Consider the array $A = \begin{pmatrix} -2 & 3 \\ 5 & 6 \end{pmatrix}$. If C=(cij)=tA , then choose which of the following statements is true:
   a) The trace of A=8   b) c12=5   c) c22=-2   d) the trace of C=3

7. Determine the real numbers x and y, where A=B,

$$A = \begin{pmatrix} 0 & x^2 + 2x \\ y - x & 3 \end{pmatrix}, \; B = \begin{pmatrix} y^2 + 12x & 15 \\ 9 & 3x + 2y \end{pmatrix}$$

   a) x=3 și y=6   b) x=-5 și y=14   c) x=-3 și y=6   d) x=-5 și y=9

8. Say whether the statements below are true or false:

a) Being flippant means lacking proper respect or seriousness
b) Quarrelsome people will do anything to avoid arguments.
c) Reliable people can be counted on to do what they say they'll do.
d) Being sensible means having or showing good sense or judgment.
e) A rambunctious person is always reserved and quiet.
f) A pedant is a person who annoys other people by correcting small errors and giving too much attention to minor details
g) Discourteous people have good manners
h) One can easily deceive a gullible person
i) Conscientious people are never very careful about doing what you are supposed to do.

9. Being Group the following traits of character into positive and negative ones:
   sensible, bitchy, tough, fussy, naughty, secretive, stingy, versatile, neat, quick-witted, witty, easygoing, thoughtful, considerate, boastful, harsh, deceitful, lazy, brave

10. For each sentence, choose the best word or phrase to complete the gap from the choices below.
   1. She's so _____, she always gets people to do what she wants.
      A shy   B vain   C manipulative   D punctual
   2. Don't be so _____. You shouldn't tell people what to do all the time.
      A bossing   B punctual   C bossy   D timid
   3. When I was younger, I was very ___, but now often speak to groups of 100 people and it doesn't worry me at all.
      A demanding B shy C bitchy   D vain
   4. He's incredibly ____. He spends hours looking at himself in the mirror.
      A punctual   B shy C bitchy   D vain
   5. My father's quite _____. He often forgets where he has put things.
      A absent-minded   B open-minded   C like-minded   D mindful
   6. The important thing is to be _____. Don't give up. Keep on trying.
      A out-going   B persistent   C shy D push

TEST 47
Unit 24/ Topic: Power in our homes

1. The voltage across a resistor with the resistance R = 25Ω, powered by two sources connected in series having the parameters E_1=24V; r_1=3Ω, respectively E_2=36V; r_2=2Ω is of:
a) 120V   b) 100V   c) 60V   d) 50V

2. Draw the diagram of an electric circuit containing a resistor with the resistance R and three identical sources, each of them characterized by E and r, of which two are mounted in parallel and then in series with the third one.

3. If for the circuit from item 2 above, we know that E = 20V, r = 2Ω and the consumer resistance is R = 27Ω, then the current through the resistor has the value of:
a) 1,33A   b) 2A   c) 1A   d) 1,5A

4. If 10 sources are connected in series, each of them with t.e.m of 2V and the internal resistance of 1Ω, one of the sources being connected with reversed polarity, which are the parameters of the equivalent generator?
a) E_e=18V; r_e=9Ω b) E_e=16V; r_e=10Ω c) E_e=18V; r_e=10Ω d) E_e=20V; r_e=10Ω

5. Having the sequence below given in order to calculate the equivalent resistance and equivalent electromotive voltage, how should generators be connected and how many generators are there?
```
for(i=0;i<5;i++)
    {rep=rep+1/r[i];
    Eep=Eep+ E[i]/r[i];}
    rep=1/rep;
    Eep=rep*Eep;
```
a) in parallel; 6   b) in series; 5   c) in series; 6   d) in parallel; 5

6. If n generators are connected in parallel, each of them being characterized by E and r, which of the sequences below shows the equivalent resistance and the equivalent electromotive voltage, on the same line, separated by a space?

a) cout<< r*n<< "   b) cout<< r/n ;   c) cout<< r/n<< "   d) cout<< r*n ;
"<< E*n ;   cout<<" "<< E ;   "<< E/n ;   cout<<" "<< E ;

7. Which of the statements below is false?
a) Built-in items usually require more disk space than linked items.

b) A linked item is not updated if the source file changes.

c) We can paste a spreadsheet, an equation, a chart, a drawing object into a presentation.

d) We cannot insert into a presentation a linked item which will be shown as an icon.

8. Match each icon in the left column with the type of item from the right column:

1.	A. SmartArt
2.	B. ClipArt
3.	C. WordArt
4.	D. Chart
5.	E. Picture
6.	F. Shapes

9.   Fill in the blanks with one of the following words:

electricity, shells, supply, outlet, negative, plant, cord, power cuts, transformer

a. Electrons spin around the nucleus in shells and have a ………………charge.
b. Moving electrons are called ....
c. Parts of the country have had ....because of the storm.
d. The power .... is the place where electricity is produced.
e. The...................... changes electricity from one voltage to another.
f. Magnets can pull electrons outside their ....
g. We need an extension............... to connect the equipment to the ....of electricity.
h. The British call this a socket, while the Americans call it a(n).................

10. Answer 2 out of the 3 questions:

Q1. Who was the first scientist who conducted an electric current by passing a magnet through a copper wiring?

Q2. Who invented the light bulb?

Q3. Who is the famous scientist about who many people believed he discovered electricity with his famous lightning experiment?

TEST 48
Unit 24/ Topic: Power in our homes

1. The intensity of the current that crosses a resistor with resistance R = 6,8Ω, powered by two power supplies connected in parallel with the parameters E_1=24V; r_1=3Ω, respectively E_2=24V; r_2=2Ω is of:

a) 2A   b) 6A   c) 3A   d) 12A

2. Draw the diagram of a circuit containing a resistor of resistance R and four identical sources each of them characterized by E and r, two of which are mounted in parallel and then in series with the other two which are mounted in series with each other.

3. If for the circuit from item 2 above, we know that E = 15V, r = 4Ω and the consumer resistance is R = 35Ω, then the terminal voltage in the resistor has the value of:

a) 60V   b) 70V   c) 45V   d) 35V

4. If 8 sources are connected in series, each of them with t.e.m of 4V and the internal resistance of 2Ω, two of the sources being connected with reversed polarity, which are the parameters of the equivalent generator?

a) E_e=28V; r_e=16Ω   b) E_e=16V; r_e=16Ω   c) E_e=32V; r_e=12Ω   d) E_e=24V; r_e=14Ω

5. Having the sequence below given in order to calculate the equivalent resistance and electromotive voltage, how should generators be connected and how many generators are there?

```
for(i=1;i<=5;i++)
    {rep=rep+1/r[i];
    Eep=Eep+ E[i]/r[i];}
    rep=1/rep;
    Eep=rep*Eep;
```

a) in parallel; 5   b) in series; 4   c) in series; 5   d) in parallel; 4

6. If n generators are connected in series, each of them being characterized by E and r, which of the sequences below shows the equivalent resistance and the equivalent electromotive voltage, on different lines?

a)cout<<E/n<<endl<<r/n;   b)cout<<E<<endl;   c) cout<<E*n<<endl;   d) cout<<E<<endl;
                         cout<<r/n;   cout<<r*n;   cout<<r*n;

7. Which of the statements below is true?
   a) We can paste a spreadsheet, an equation, a chart, a drawing object into a presentation
   b) We cannot insert into a presentation a linked item which will be shown as an icon.
   c) Built-in items usually require more disk space than linked items.
   d) A linked item is not updated if the source file changes.
.

8. What does the option selected permit?

a) Creating a new chart;

b) Inserting an existing equation

c) Creating a new picture

d) Creating a new equation
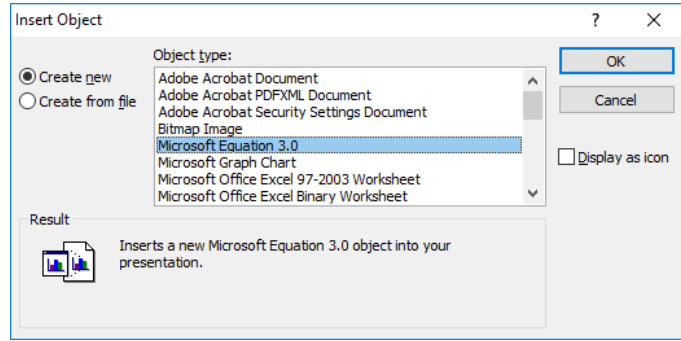
9. Fill in the blanks with one of the following words:

magnets, supply, socket, electricity, extension, power, voltage, moving, electrons

   a) ……………………. spin around the nucleus and have a negative charge.
   b) ……………… electrons are called electricity.
   c) Parts of the country have had .... cuts .because of the storm.
   d) The power plant is the place where ……………. is produced.
   e) The transformer changes electricity from one ……………. to another.
   f) ……………………. can pull electrons outside their shells.
   g) We need an ………………cord to connect the equipment to the ………………..of electricity.
   h) The British call this place in the wall a(n)...................., while the Americans call it an outlet.

10. Answer 2 out of the 3 questions:

Q1. Who is the famous scientist about who many people believed he discovered electricity with his famous lightning experiment?

Q2. Who is the scientist who supported the production of AC power?

Q3. Who invented the battery?

TEST 49
Unit 25/Topic: Energy for the long run

1. It is common knowledge that, when kept in the stand-by mode, the different devices and keep consuming electricity. Read the information in the table below and fill in the last two columns by answering the question: *How much energy can we save monthly if we eliminate the "hidden" power consumption caused by maintaining appliances on stand-by?*

No.	The kind of appliance let on stand-by	Estimated Consumption* (Wh)	No. of appliances	No. of hours in the stand-by mode (in 30 days)	Electricity Consumption in a Month (Wh)	Electricity Consumption in a Month (KWh)
1	TV+PC Screen	8,3	3	600		
2	DVD	10	1	720		

*according to:http://www.sotaventogalicia.com/area_divulgativa/zona_interactiva.php

2. The average consumption of a household is of 240kwh per month. If the hidden consumption due to keeping devices in the stand-by mode increases the average consumption with 20%, how many kwh can we save monthly if we become more responsible as far as electricity consumption is concerned?

    a) 48kWh   b) 192kWh   c) 24kWh   d) 72KWh

3. Knowing that a small hydroelectric power plant can produce enough energy for two households and the average consumption of a household per year is of 3300kWh, calculate the energy produced by the power plant per day if its efficiency is 86%.

    a) 23kWh   b) 32 kWh   c) 20,93kWh   d) 21,86 KWh

4. Find two advantages and two disadvantages of installing a small hydroelectric power plant.

5. What does the Dark Web consist of?

6. Name the types of alternative forms of energy.

7. Explain how an address found by using a search engine is copied into a Word document.

8. Circle the correct item:

A. Over the past month officers have been stopping vehicles to test exhaust _____

 a. smoke   b. fumes

B. The _____ of litter is very important.

 a. conserve   b. prevention

C. This is a form of precipitation that contains pollution.

 a. acid rain   b. smog

D. David conserves water by not letting it _____ when he's not using it.

 a. run   b. ruin

E. Many unethical companies _____ their waste into rivers.

 a. dump   b. give

9. Select the words listed below to match the statements that follow. Write the letter of the term in the blank.

a)	smog	e)	fossil
b)	natural resources	f)	recycling
c)	pesticides	g)	ozone
d)	biodegradable	h)	ecology

…………………The process by which wastes are converted into new products and materials.

…………………..The earth's materials that are used by the living things for such needs as food, shelter and manufacturing.

………………….Term applied to wastes that break down into harmless substances when exposed to the environment.

…………...The layer of the atmosphere thought to be breaking down because of air pollution

10. Read this fragment from the poem "Warned", written by Sylvia Stults in 2015, and write down the main idea of each stanza:

I.   The sands of time have rendered fear
         Blue skies on high no longer clear
         Stars were bright whence they came
         Now dimmed, obscured, pollution's haze

II.   Crystal clear our waters gleamed
         Fish abundant, rivers streamed
         Ocean floors sandy white
         Now littered, brown, pollution's plight
         ………………………………………………..

V.   Protect what has been given for free
         Our waters, skies, wildlife and trees
         For once they're gone, don't you say
         Consider yourself warned of that fatal day!

Source: http://www.familyfriendpoems.com/poem/warned

TEST 50
Unit 25/Topic: Energy for the long run

1. It is common knowledge that, when kept in the stand-by mode, the different devices and keep consuming electricity. Read the information in the table below and fill in the last two columns by answering the question: *How much energy can we save monthly if we eliminate the "hidden" power consumption caused by maintaining appliances on stand-by?*

No.	The kind of appliance let on stand-by	Estimated Consumption* (Wh)	No of appliances	No of hours in the stand-by mode (in 30 days)	Electricity Consumption in a Month (Wh)	Electricity Consumption in a Month (KWh)
1	Computer (without the screen)	3	1	600		
2	Router	6,8	1	720		

*according to:http://www.sotaventogalicia.com/area_divulgativa/zona_interactiva.php

2. The hidden consumption due to keeping devices in the stand-by mode in a household is of 50kwh.If the hidden consumption increases the average consumption of the household by 20%, how many kwh are monthly consumed?

    a)220kWh   b) 150kWh   c) 200kWh   d) 250KWh

3. Knowing that a wind turbine can produce enough energy for three households and the average consumption of a household per year is of 3285kWh, calculate the energy produced by the wind turbine per day if its efficiency is 35%.

a) 23kWh   b) 32 kWh   c) 20,93kWh   d) 21,86 KWh

4. Name two advantages and two disadvantages of installing a wind turbine.

5. Name three search engines.

6. Name four Internet browsers.

7. Explain how to search for an image by using a search engine.

8. Circle the correct item:

 A. _____, which is partly caused by exhaust fumes from cars, is a very big problem in many big cities across the world.

a. Smog   b. Smoke

B. A _____ energy system converts the energy found in sunlight, wind, falling water, waves, geothermal heat, or biomass.

    a. renewable   b. generable

C. Oil _____ pollute sea water and kill marine life.

    a. soil   b. spills

D. Forests, farmland, and oceans are known as "natural _____".

 a. research   b. resources

E. _____ are the worst cause of pollution in the home.

 a. aerosol sprays   b. exhaust fumes

9. Select the words listed below to match the statements that follow. Write the letter of the term in the blank.

    a) smog   e) fossil
    b) natural resources   f) recycling
    c) pesticides   g) ozone
    d) biodegradable   h) ecology

…………………….Chemicals used to kill unwanted insects.

………………….Fog-like pollution caused by automobile emissions.

………………….Types of fuel, such as coal, that cause air pollution when burnt.

………………….The study of the interaction of living organisms with their environment.

10. Read this fragment from the poem "Warned", written by Sylvia Stults in 2015 and write down the main idea of each stanza:

    I.   The sands of time have rendered fear
            Blue skies on high no longer clear
            Stars were bright whence they came
            Now dimmed, obscured, pollution's haze

            …………………………………..
    III.   Trees towered high above
            Trunks baring professed love
            Birds chirping from sites unseen
            Gone, paper joined pollution's team

    IV.   One can't blame pollution alone
            As they say, you reap what you've sown
            So let us plant a better seed
            Tear out old roots, cultivate, weed!

            …………………………………………………
            Sources: http://www.familyfriendpoems.com/poem/warned

TEST 51
Unit 26/Topic: Guadalquivir river

1.What is water? What is its importance for life?

2.Where does river water come from?

3. Write a definition in English for the next words: Reservoir, Ocean, Swamp

4. Explain the mechanisms of osmoregulation in freshwater fish and in marine fish.

5. Passive gain of water across body surface and through gills occurs in :
a)Marine fishes   b) Freshwater fishes

6. Difference between : hypertonic, isotonic and hypotonic.

7. Explain briefly the parts you can distinguish in a water bill.

8. What do the fixed expenses belong to?

9. In which concepts the 10% of taxes is applied in the water bill?

10. Convert these quantities into cubic metres.
a) 3000 litres   b) 250000 litres

TEST 52
Unit 26/Topic: Guadalquivir river

1.Why does solid water float on liquid water? Is it important? Is solid water a heat insulating? Give some examples.

2.Water (pure substance) has some specific properties such as: melting point, boiling point and density. Explain each of them and show the different values for pure water.

3.What is water specific heat? Why is the temperature change not big in the coast as in the inner lands?

4. Write a definition in English for the next words: Valley; Gulf; River

5.What is osmoregulation?

6.Cartilaginous fishes produce :
a)Large amount of hypotonic urine.
b) Large amount of hypertonic urine.
c) Large amount of isotonic urine.

7.High concentration of urea is typical in :
a)Freshwater fishes   b) Bony fishes   c) Cartilaginous fishes

8.What's the name of the chart in the water bill? What does it stand for?

9. The amount of a water bill is 115 euros (taxes included). Calculate how many cubic meters have been consumed. Take into account that the price of each cubic meter is 2,1 euro and that you have paid 24 euros for other concepts. Don't forget to include taxes.

10. Imagine we don't know how many cubic metres have been consumed or the cost of the rest of the concepts. However, we know the price of the cubic metre (0,25 €). We also know that the price of the consumption has doubled the rest of the concepts and that the final cost without taxes is 7 euros. How can we know how many cubic metres have been consumed and the cost of the other concepts?

Erasmus+

TEST 53
Unit 27/Topic: Light and Life

1. Explain the "light bulbs challenge".

2. Explain some of the arguments in favour of the use of low energy bulbs.

3. Which percentage belongs to lighting in an electricity bill?

4. How much can you save with a low energy bulb ?

5. Write a definition in English for: SUNSET

6. Fill in the chart with the eye's anatomy.

1.	7.
2.	8.
3.	9.
4.	10.
5.	11.
6.	12.
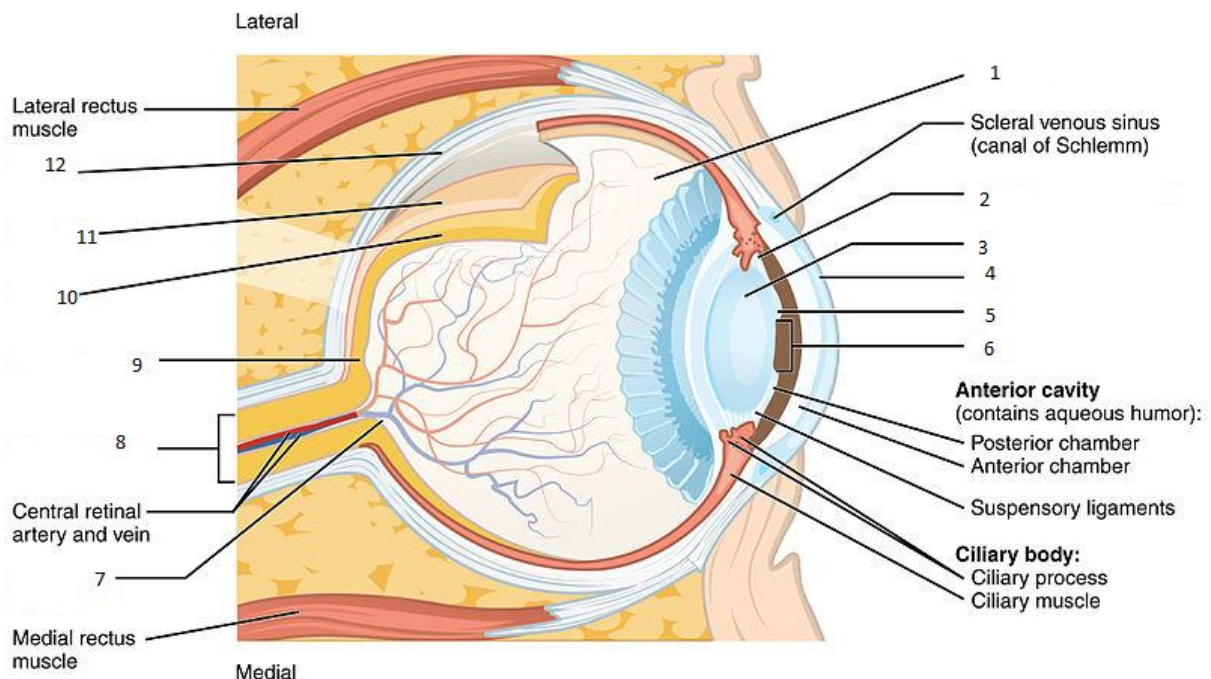
7. Define reflection and refraction.

8. Explain how a convergent lense work.

9. There are 10 daylight hours in Spain on 22nd June. Are there the same daylight hours in Spain on the same day?

10. Write a definition in English for: DAWN

TEST 54
Unit 27/Topic: Light and Life

1.If we have a bill of 200 euros, how much belongs to lighting? How much would we save if we replaced them with low energy light bulbs?

2.How many kg of CO_2 the atmosphere will save if we use a 9W low energy bulb. Moreover, this bulb saves 248 kwh during its lifetime.

3.Imagine a town hall has saved 200 euros in lighting this year because it has replaced all the bulbs with low energy light bulbs. How much would it have paid if it had used traditional light bulbs?

4. Write a definition in English for: NOON

5. Inside the eye occurs:
   a) Refraction   b) Reflection   c) Dispersion

6. Tell and give a reason why light is important for plants.

7. Why a 3D image is created when you use a holographic pyramid?

8. What does the crystalline do to focus objects?

9.Write a definition in English for: AFTERNOON

10. Write a definition in English for: EVENING

TEST 55
Unit 28/Topic: Great Discoveries

1. Who invented the radio?

2. Who invented the aeroplane?
   a) Marconi   b) The Wright brothers   c) Levi Strauss

3. When was the scissors invented?
   a) 20th century   b) 19th century   c) 1500 BC

4. Find out the probability in fraction, decimal numbers and percentage in the next situation-
When you roll a dice, you get:
   a) an even number?   b) a multiple of two or three?   c) or six?

5. Find out the probability in fraction, decimal numbers and percentage in the next situation-
   A bag has five yellow, three blue and two red balls:
   a) blue   b) not blue   c) yellow or red

6. Find out the probability in fraction, decimal numbers and percentage in the next situation.
   -In the next wheel :
   a) blue
   b) red
   c) light yellow or green

7. Find out the probability in fraction, decimal numbers and percentage in the next situations
   -In a bag, there are 5 two-euro coins, 3 one-euro coins, 4 fifty-cent coins, 2 twenty-cent coins and   6 ten-cent coins. What's the probability of taking one coin .
   a) equal or higher than 1 euro?
   b) equal or higher than 50 cents?
   c) lower than 2 euros?

8. List and draw the three types of fingerprints.

9. Why fingerprints are used for confirming or disproving a person's identity ?

10. Difference between qualitative and quantitative analysis.

TEST 56
Unit 28/Topic: Great Discoveries

1. When was basketball invented?
   a) 500 BC   b) 2000 BC   c) 19th century

2. When was the gas mask invented?
   a) 20th century   b) 14th century   c) 8th century

3. What is a chemical reaction? What is the difference between endothermic and exothermic reaction?

4.Which factors does the reaction speed depend on?

5. Which uses has the gunpowder had?

6. Benedict's solution (Fehling's solution) is used to test:
   a) Glucose   b) Starch   c) Sacarose

7. Lugol's Iodine is used to test :
Lipids   b) Starch   c) Glucose

8. A forensic report said " *The rectal temperature of the corpse was 32ºC at 12.10 a.m. of February 24, 2016."* How many hours have passed since the dead?

9. True or false? *You can add salt of different chemical elements to the powder*. When you burn the gunpowder, its colour changes.

10. True or false? Originally gunpowder was invented in China.

TEST 57
Unit 29/Topic: Rocks and monuments

1. Draw the rock cycle.

2. The Roman bridge of Córdoba is made of:
   a) Marble   b) Limestone

3. Taj Mahal is made of:
   a) White marble   b) Pink marble

4. Juan and Pedro can see a tower from the door of their house. The angles are 45° and 60°. They have measured the distance between their houses (126 m) and the tower is located between the two houses. Calculate the height of the tower.

5. A carpenter wants to build a stepladder. Its arms must do an angle of 60ª when they are open. If the height of the ladder is 2 m when it is open, how long does each arm have to be?

6. To calculate the height of a tree, Manuel has put a stick of 1 m long in the ground and has measured its shade (1,78 m). Then, he has measured the height of the shade of the tree (21,36 m). Can he find out the height of the tree? How? In this case, how tall is the tree?

7. If the shade of a stick is half its height, which angle do the sun rays form with the horizon?

8. Write the next words in the correct categories.
   a) marble   b)granite

ROCKS AND MINERALS	LANDSCAPE	MONUMENTS

9.Write the next words in the correct categories.
   a) cathedral   b) pyramid

ROCKS AND MINERALS	LANDSCAPE	MONUMENTS

10. Write the next words in the correct categories.
a) rainforest   b)coral reef

ROCKS AND MINERALS	LANDSCAPE	MONUMENTS

TEST 58
Unit 29/Topic: Rocks and monuments

1. Write the next words in the correct categories.
   a) castle   b)temple

ROCKS AND MINERALS	LANDSCAPE	MONUMENTS

2. Read the sentences and fill in the gaps with the next words

                    Temple   -   opera house   -   lighthouse

a) In Sydney you can visit an _____
b) The Parthenon is an ancient Greek _____
c) A _____ is located in the coast to help the ships at night.

3. Read the sentences and fill in the gaps with the next words

                    rainforest -   ruins   -   reef

a) The most famous _____ in the world is near the coast of Australia.
b)You can find the most important _____in Brazil. It's called the Amazon.
c) The city of Pompeii has some Roman _____

4. Read the sentences and complete with the appropriate word.
a) It says "Here lies Patrick Stevens who died March 14th 1945" _____
b) This _____ was built in the past on that high mountain so that enemies could not attack it.

5. What's "mal de la piedra" ("rock disease")?

6. Which are the main sources of pollution for the formation of acid rain?

7. What is the chemical reaction that takes place in acid rain?

8. Write all the different ways to measure the height of a building.

9. Explain what you have to do to measure the height of a tower using a mirror and a metre.

10. What's the name of the theorem we use to calculate long heights using the shade.

TEST 59
Unit 30/Topic: Amusements Park

1. Your heart rate increases because of the action of the :
   a) Sympathetic nervous system   b) Parasympathetic nervous system

2. The whiplash is :
   a) Knee sprains and strains.   b) Neck sprains and strains.

3. Dizziness is one whiplash symptoms:
   a) True   b) False

4. Write the correct definition for this word : *Dizziness*

5. Write the correct definition for this word: *Headache*

6. Write the correct definition for this word: *Stiffness*

7. Write the correct definition for this word: *Vertigo*

8. Write the correct definition for this word: *Painkiller*

9. Write the correct definition for this word: *Physiotherapy*

10. Write the correct definition for this word: *Anxiety*

TEST 60
Unit 30/Topic: Amusements Park

1. Which category does "physiotherapy" belong to?
    a) symptom   b)treatment

2. Which category does "headache" belong to?
    a) symptom   b)treatment

3. Which category does "painkiller" belong to?
    a) symptom   b)treatment

4. Which category does "dizziness" belong to?
    a) symptom   b)treatment

5. Explain how you calculated the price of the tickets.

6. If a park has 3000 m2 and uses 65% of it in attractions and the rest in streets, toilets, shops, etc., what is the surface of the park?

7. If the number of visitors per year is 80.000 and an advertisement makes an increase of 26%, how many visitors will be in a year after the advertisement?

8. True or false?
If there is a decrease of 10% in the number of visitors and in the next year the decrease is 20%, the final decrease after two years is 30%.

9. Complete:
a) To increase an amount by 40%, you have to multiply by _____
b) To decrease an amount by 15%, you have to multiply by_____
c) To calculate the 156% of a quantity, you have to multiply by_____

10. Choose the correct answer: El 29 ‰ of 350 is:
    a) 101,5   b) 1015   c) 205   d) 10,15
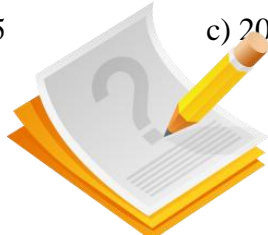
TEST 61
Unit 31/Topic: Vectors

1. A man first walks 6 kms due east and then 8 kms due North. How far and in what direction is he from his starting point?

2. Consider a motorboat that heads due to east at a velocity of 8 m/s across a river flowing due south at 6 m/s. Find the resultant velocity of the motorboat.

3. Suppose that an airplane is flying due west at 120 km/h in a wind that is blowing due north at 50 km/h. In what direction and at what speed is the airplane actually flying?

4. A 20N force and a 40N force are exerted due east on the same point of an object.
   a) What is their resultant force?
   b) If the 40N force was exerted due west, what would the resultant force be?

5. A book is moved once around the perimeter of a rectangular tabletop of dimensions 2.0m x 3.0m. If the book ends up at its initial position, what is the distance travelled?

6. The magnitudes of two vectors A and B are respectively 5 units and 4 units. Find the largest and smallest values possible fort he resultant vector.

7. Which of the following are vectors and which are not:
   Force ……………………..   Temperature …………………….
   Volume ……………………   Time …………………….
   Velocity ………………….   Length …………………………

8. Is it possible to add a vector quantity to a scalar quantity?

9. A pedestrian moves 5 km east and then 12 km north. Find the magnitude and direction of the resultant displacement vector.

10. A jet airliner moving initially at 400 km/h to the east moves into a region where the wind is blowing at 100 km/h to the west. What is the new speed?

TEST 62
Unit 31/Topic: Vectors

Task 1 to 4 are connected. Look at the figure below:
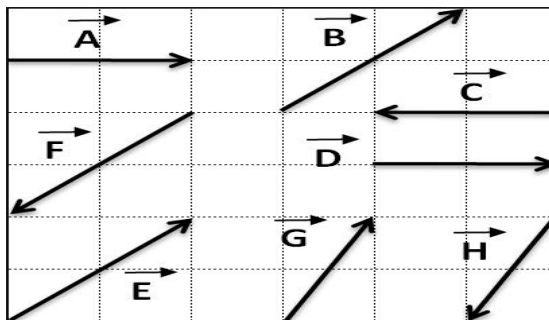
1. Which vectors are in the same direction?

2. Which vectors are in the opposite direction?

3. Which vectors have the same magnitude?

4. Which vectors are equal?

5. Decide whether the quantities below are vector or scalar:

Energy …………………..	Pressure …………………….
Heat ………………………	Momentum ………………….
Gravity …………………………	Mass ………………………….

Task 6 to 7 are connected. Look at the figure and fill in the chart below:

$\vec{V}_K = 40$ km/h

6.

Vehicle	Velocity
L	
M	
N	

7.

Vehicle	Direction
L	
M	
N	

Task 8 to 9 are connected. Your ship can make 20 km/h but the river flows at 5 km/h.

8. What is your speed relative to the shore going upstream?

9. What is your speed relative to the shore going downstream?

10. Your airplane flies north at 80 km/h while a wind blows at 60 km/h. What is your ground speed relative to the land below?

TEST 63
Unit 32/Topic: Vertical and horizontal motion
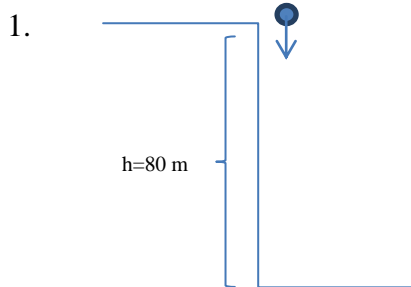
1. A ball is dropped from a 80 m high cliff.
   a) How long does it take the ball to hit the ground?
   b) Find the velocity of the ball as it hits the ground?
   (g=10m/s^2); ($v_0 = 0$); (air friction is neglected.)

   h=80 m
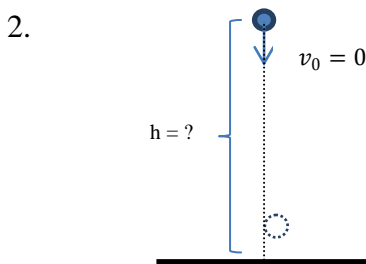
2. An object is released from the rest. It strikes the ground with a velocity 25 m/s. From what height was it released? (g=10 m/s^2; $v_0 = 0$; air friction is neglected.)

   $v_0 = 0$
   h = ?
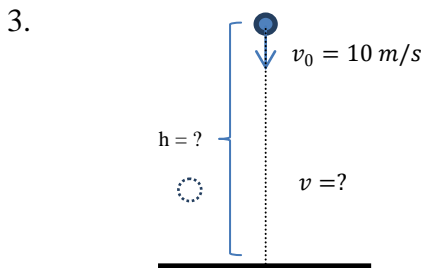
3. A ball is thrown downwards with an initial velocity of 10 m/s. It hits the ground after 3s.
   a) What is the velocity of the ball as it hits the ground?
   b) From what height above the ground is the ball thrown?
   (g=10 m/s^2; $v_0 = 0$; air friction is neglected.)

   $v_0 = 10\ m/s$
   h = ?
   v =?
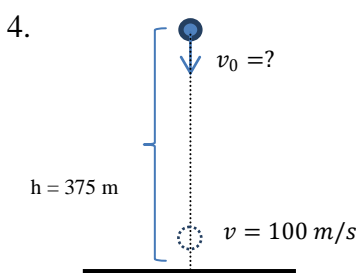
4. An object is thrown downwards from a height 375 m. It hits the ground with a velocity 100 m/s.
   a) What is the initial velocity of the object?
   b) What are the distance dropped by the object during the first second and during the last second?
   (g=10 m/s^2; $v_0 = 0$; air friction is neglected.)

   $v_0 =?$
   h = 375 m
   $v = 100\ m/s$
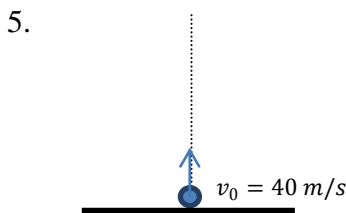
5. A ball is thrown upward with an initial velocity of 40m/s. Find:
   a) The velocity after 2 s,
   b) The maximum hight that it rises,
   c) The total time to return to the original position,
   d) The velocity as it returns to the original position.
   (g=10 m/s^2; $v_0 = 0$; air friction is neglected.)

   $v_0 = 40\ m/s$

6.

$v_0 = 30 \, m/s$

$h = 35 \, m$
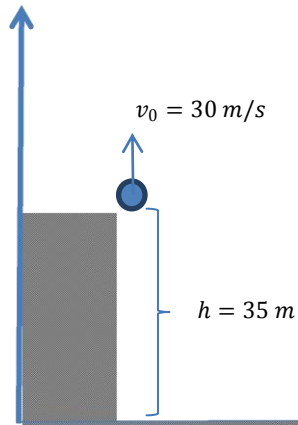
A ball is thrown vertically up from the edge of a roof 35 m above the ground with an initial velocity 30 m/s. Find:
   a) The maximum height it rises,
   b) With what velocity does it strikes the ground?
      (g=10 m/s^2; $v_0 = 0$; air friction is neglected.)

7.

$v_0 = 5 \, m/s$

$v = 55 \, m/s$

A package is realesed from a helicopter rising with a velocity 5m/s. The package hits the ground with a velocity 55 m/s.
   a) How long does it take the package to hit the ground?
   b) At what height was the package dropped?
      (g=10 m/s^2; $v_0 = 0$; air friction is neglected.)

8.

$v_0 = 30 \, m/s$

$h = 125 \, m$
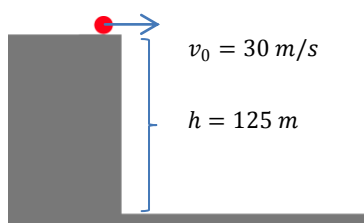
A stone is thrown horizontally at 30 m/s from the top of a cliff 125 m high.
   a) How long does it take the stone to reach the bottom of the cliff?
   b) How far from the base of the cliff does the stone strike the ground?
      (g=10 m/s^2; $v_0 = 0$; air friction is neglected.)

9.

$v_0 = 100 \, m/s$
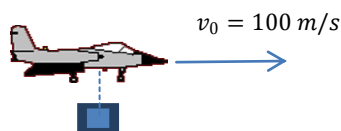
A package is released from a plane flying horizontally with a velocity 100m/s . the package hits the ground 10s later.
   a) At what height was the package released?
   b) How far from the initial point the package strikes the ground?
      (g=10 m/s^2; $v_0 = 0$; air friction is neglected.)

10. Fill in the blanks with the correct form of the verbs below. Two of them are extra:

march/ crawl/ tiptoe/ drag/ stretch/ pick up/ kick/ lean/ throw/ lift

a) She **………………** forward and whispered something in my ear.

b) The ants **…………..** up my leg while I was sitting in the garden.

c) **……………** your arms above your head.

d) When they attacked me, I **……………**at them and screamed for help.

e) Just **……………** the phone and call him.

f) The table was too heavy to lift so we had to **……………..**it across the room.

g) Could you help me **…………………..**this table please?

h) He told the sergeant to **…………………..** us for another five minutes.

TEST 64
Unit 32/Topic: Vertical and horizontal motion

1.Translate the words below:

a)gravity ………………… d)horizontal motion …………………

b)free falling ………………… e)velocity …………………

c)vertical motion ………………… f)maximum height …………………

2.What is the formula for:

a) distance equation c) rate equation regardless of time

b) rate equation

3. Decipher the words below:

a) locivety ………………… d) ghtieh …………………

b) itmono ………………… e) lfaingl …………………

c) vigrtya …………………

4. If we don't neglect air resistance how will velocity-time graphics of a body which is realesed from a constatnt hight be like?

a) b) c)

d) e)
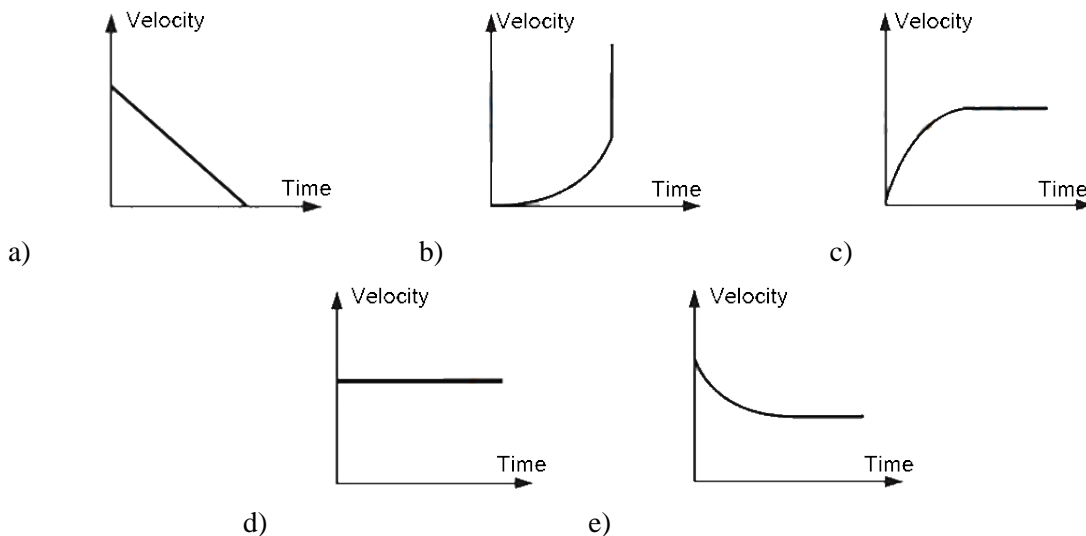
5. 3 balls are realesed from hights as it seen in the figure. If the mass of the balls are 2m, 4m and 2m, what is the relations between the velocities of the balls when they strike on the ground. (air friction is neglected.)

a) $v_1=v_2=v_3$ b) $v_1<v_2=v_3$ c) $v_1>v_2=v_3$ d) $v_1=v_2>v_3$ e) $v_1=v_2<v_3$

6.

The object thrown from point A, as in the figure, hits point K. How many meters is the length of the MK? $\sin 37^0 = 0,6$, $\cos 37^0 = 0,8$

a) 250   b) 225   c) 150   d) 125   e) 100

7. Write the definitions of the verbs related to motion in English:
   a) to march: ……………
   b) to throw: ……………
   c) to stretch: …………..
   d) to tiptoe: ……………
   e) to lift: ………………

8. Fill in the blanks with the correct form of the verbs below. Two of them are extra:
   march/ crawl/ tiptoe/ drag/ stretch/ pick up/ kick/ lean/ throw/ lift
   1)   She ………………. forward and whispered something in my ear.
   2)   The ants ………….. up my leg while I was sitting in the garden.
   3)   ……………. your arms above your head.
   4)   When they attacked me, I ……………at them and screamed for help.
   5)   Just ……………. the phone and call him.
   6)   The table was too heavy to lift so we had to ……………..it across the room.
   7)   Could you help me ……………………..this table please?
   8)   He told the sergeant to ………………….. us for another five minutes.

9. Find the words related to motion hidden in the puzzle below
   march/ crawl/ tiptoe/ drag/ stretch/ pick up/ kick/ lean/ throw/ lift

T	İ	P	T	O	E	W	E	L
H	O	S	T	R	E	T	C	H
R	V	E	P	O	U	R	E	N
O	G	L	K	I	C	K	I	S
W	H	M	A	R	C	H	T	E
A	C	H	E	R	R	K	S	H
D	R	A	G	E	A	I	V	S
U	E	R	Y	G	W	O	O	P
D	L	E	A	N	L	I	F	T

10. An object has a mass m is thrown with an initial velocity v_0 toward point L. But it hits point M. (air friction is neglected.)

I.   mass of the object
II.   initial velocity v_0
III. hight of the K from the ground
IV.   distance between K and L
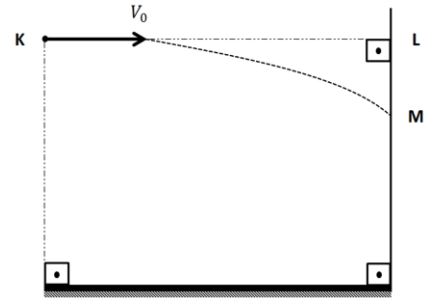
Which of the things above you don't need to know in order to find the length of LM?
a) I and IV   b) I and III   c) II and III   d) II and IV   e) I and II

TEST 65
Unit 33/Topic: Exponents and root numbers

1. If it takes bacteria 20 minutes to divide once, how long would it take for 15 divisions? How many bacteria would you get if you started out with two and waited 400 minutes?

2. Calculate the perimeter and area of rhombus whose diagonals are 24 cm and 32 cm long.

3. Is a triangle with sides 24, 51 and 45 a right triangle?

4. A ladder 5 meter long is leaning against the Wall. Its foot is 0,9 m away from the wall. In which height can the ladder touch the wall?

5. Determine the length of the cube diagonal with edge.

6. What is the length of the chord circle of a diameter 50 mm if the distance from the circle is 24 mm?

7. Fill 4 numbers between 5 and 295245 to form a geometric progression:
a1 : --------------------------
a2 : ------------------------
a3 : -----------------------
a4 : ------------------------

8. Once upon a time Tsar owned a money printer and printed and printed. As a result of printing money , prices went up, in the first year 5,9 % ; in the second year 2,4% ;in the third year 5,9 % ; in the fourth year 5,7%. Then Tsar failed in election. Calcuate the avarage annual inflation rate (percantage of price increase) during these four years.

9. Surface of the first cube wall is 360 cm2 . Second cube area is 30% of the surface of the first cube. Determine the length of the edge of the second cube.

10. The oil drilling rig is 24 meters height. Fix the ropes whose ends are 7 meters away from the foot of the tower. How long are these ropes?

TEST 66
Unit 33/Topic: Exponents and root numbers

1. Match the vocabulary terms in coloumn A with the definitions in coloumn B.

A	B
I.exponential multiplication	A.microorganisms that can be either helpful or harmful in foods.
II.preservatives	B.a type of shorthand used by scientists to express very large numbers.
III.bacteria	C.a measure of the water in foods that is not bound to food molecules and can support the growth of bacteria, yeasts and molds.
IV.water activity	D.a term describing bacterial growth and doubling of numbers at each generation.
V.scientific notation	E.chemicals that keep bacteria and other microorganisms from growing.

I…………   II. …………...   III. ………….   IV. ………..   V. ………….

2. How is bacterial growth controlled in foods?
   a. ………………………………………………………………………………………
   b. ………………………………………………………………………………………
   c. ………………………………………………………………………………………

3. List three methods of food preservation. For each method give an example of food that is preserved that way.

4. How would you express the following using scientific notation?
   a) 456   b) 17,000,000   c) 1

5. Decipher the words related to multiplying microbes below:
   a) ctareiba…………………………   c) nisganromicsm ……………
   b) tivesvapreser ………………   d) sivinsdio   ………………

6. If it takes bacteria 20 minutes to divide once, how long would it take for 15 divisions? How many bacteria would you get if you started out with two and waited 400 minutes?

7. Fill in the blanks with the correct words:
a) ………………………is the square of a whole number.

b)………………………. of a number is the length of the side of a square with an area equal to the number.

8. What is the order for evaluating a given expression?

9. The electron and proton of a hydrogen atom are separated by a distance of about $5{,}3 \cdot 10^{-11}$ m. Find the magnitude of the electric force and the gravitational force that each particle exerts on the other. $k = 9{\cdot}10^9$ N.m^2/C^2 ; $q_1 = 1{,}6 \cdot 10^{-19}$ C (electron charge); $q_2 = 1{,}6 \cdot 10^{-19}$ C (proton charge) ; $r = 5{,}3 \cdot 10^{-11}$ m

10. Three charged particles are located as shown in Figure below. If the resultant electric force on q_3 is zero, How are q_1 and q_2 related?
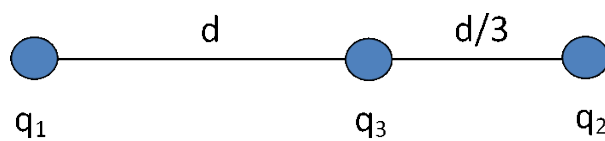
TEST 67
Unit 34/ Topic: Frequency and sound waves

Task 1 to 4 are connected.

Eda collected 30 leaves and wrote down their lengths in centimeters. Here are her results:

2	5	3	8	5	4	5	2	3	7
5	4	2	5	6	8	6	3	4	5
3	5	8	2	6	4	7	6	8	3

1. Complete the frequency table to show Eda's results.

Length in centimeters	Tally	Frequency

2. Find the mean value of the given data.

3. Find the median.

4. Find the mode value.

Task 5 to 8 are connected.

Kadir rolled a die a number of times and recorded his results in a bar graph as above.
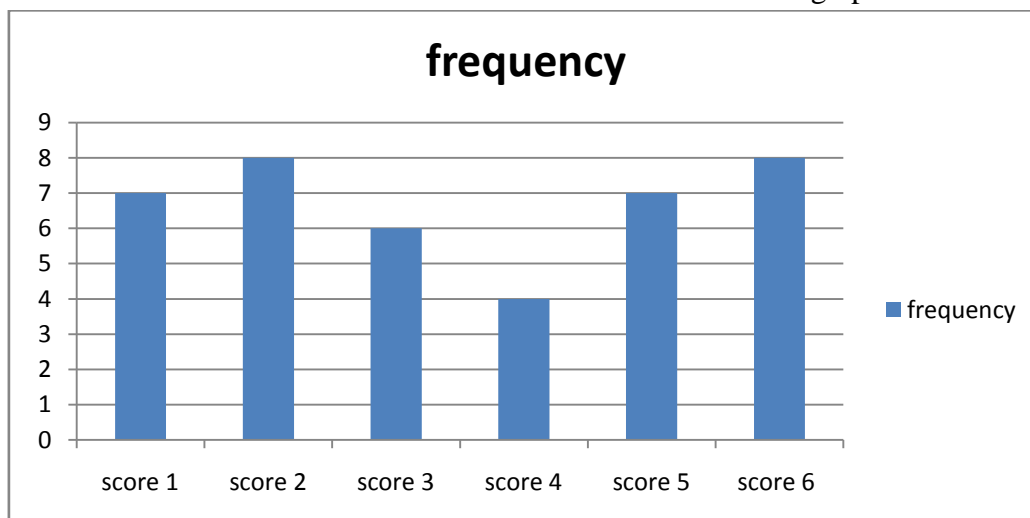
5. According to the given bar graph, prepare a frequency table.

6. Find the median value.

7. Find the mode value.

8. Find the mean value.

Task 9 to 10 are connected.

20 students scored goals for the school football team last month. The table below gives information about the number of goals they scored:

Goals scored	Number of students
1	9
2	3
3	5
4	3

9. Write down the mode number of the goals scored and find the median number.

10. Work out the mean number of the goals scored.

TEST 68
Unit 34/ Topic: Frequency and sound waves

Task 1 to 2 are connected.

Read the following statements:
   a) A sound wave is a mechanical wave.
   b) A sound wave is a means of transporting energy without transporting matter.
   c) Sound can travel through a vacuum.
   d) A sound wave is a pressure wave; they can be thought of as fluctuations in pressure with respect to time.
   e) A sound wave is a transverse wave.
   f) To hear the sound of a tuning fork, the tines of the fork must move air from the fork to one's ear.
   g) Most (but not all) sound waves are created by a vibrating object of some type.
   h) To be heard, a sound wave must cause a relatively large displacement of air (for instance, at least a cm or more) around an observer's ear.

1.Which of the statements are TRUE of sound waves? Identify all that apply.

2. Which of the statements are FALSE of sound waves? Identify all that apply.

Task 3 to 4 are connected.

Read the following statements:
   a) The intensity of a sound wave has units of Watts/meter.
   b) When a sound wave is said to be intense, it means that the particles are vibrating back and forth at a high frequency.
   c) Intense sounds are characterized by particles of the medium vibrating back and forth with a relatively large amplitude.
   d) Intense sounds are usually perceived as loud sounds.
   e) The ability of an observer to hear a sound wave depends solely upon the intensity of the sound wave.

3. Which of the following statements are TRUE of sound intensity and decibel levels? Identify all that apply.

4. Which of the following statements are FALSE of sound intensity and decibel levels? Identify all that apply.

Task 5 to 6 are connected.

Read the following statements:

f) From the least intense to the most intense, humans have a rather narrow range of intensity over which sound waves can be heard.

g) The intensity of sound which corresponds to the threshold of pain is one trillion times more intense than the sound which corresponds to the threshold of hearing.

h) Two sounds which have a ratio of decibel ratings equal to 2.0. This means that the second sound is twice as intense as the first sound.

i) Sound A is 20 times more intense than sound B. So if Sound B is rated at 30 dB, then sound A is rated at 50 dB.

j) Sound C is 1000 times more intense than sound D. So if sound D is rated at 80 dB, sound C is rated at 110 dB.

k) A machine produces a sound which is rated at 60 dB. If two of the machines were used at the same time, the decibel rating would be 120 dB.

l) Intensity of a sound at a given location varies directly with the distance from that location to the source of the sound.

m) If the distance from the source of sound is doubled then the intensity of the sound will be quadrupled.

n) If the distance from the source of sound tripled, then the intensity of the sound will be increased by a factor of 6.

5. Which of the following statements are TRUE of sound intensity and decibel levels? Identify all that apply.

6. Which of the following statements are FALSE of sound intensity and decibel levels? Identify all that apply.

Task 7 to 8 are connected.

Read the following statements:

a) The speed of a sound wave depends upon its frequency and its wavelength.

b) In general, sound waves travel fastest in solids and slowest in gases.

c) Sound waves travel fastest in solids (compared to liquids and gases) because solids are more dense.

d) The fastest which sound can move is when it is moving through a vacuum.

e) If all other factors are equal, a sound wave will travel fastest in the most dense materials.

f) A highly elastic material has a strong tendency to return to its original shape if stressed, stretched, plucked or somehow disturbed.

7. Which of the following statements are TRUE of the speed of sound? Identify all that apply.

8. Which of the following statements are FALSE of the speed of sound? Identify all that apply.

Task 9 to 10 are connected.

Read the following statements:

    g) A more rigid material such as steel has a higher elasticity and therefore sound tends to move through it at high speeds.

    h) The speed of sound moving through air is largely dependent upon the frequency and intensity of the sound wave.

    i) A loud shout will move faster through air than a faint whisper.

    j) Sound waves would travel faster on a warm day than a cool day.

    k) The speed of a sound wave would be dependent solely upon the properties of the medium through which it moves.

    l) A shout in a canyon produces an echo off a cliff located 127 m away. If the echo is heard 0.720 seconds after the shout, then the speed of sound through the canyon is 176 m/s.

    m) The speed of a wave within a guitar string varies inversely with the tension in the string.

    n) The speed of a wave within a guitar string varies inversely with the mass per unit length of the string.

    o) The speed of a wave within a guitar string will be doubled if the tension of the string is doubled.

    p) An increase in the tension of a guitar string by a factor of four will increase the speed of a wave in the string by a factor of two.

    q) An increase in the linear mass density of a guitar string by a factor of four will increase the speed of a wave in the string by a factor of two.

9. Which of the following statements are TRUE of the speed of sound? Identify all that apply.

10. Which of the following statements are FALSE of the speed of sound? Identify all that apply.

TEST 69
Unit 35/ Topic: First and second degree equations

1. Write the linear equation according to the given knowledge:
a) Rate=-20meters per second   b) y-intercept= $200
   x-intercept=5 second   x-intercept=8 months

2. The given graph shows the height y(in meters)
of a flag x seconds after you start raising it up
a flagpole.
a) Find the slope.
b) Write an equation of the line.
c) What is the height of the flag after 9 seconds?
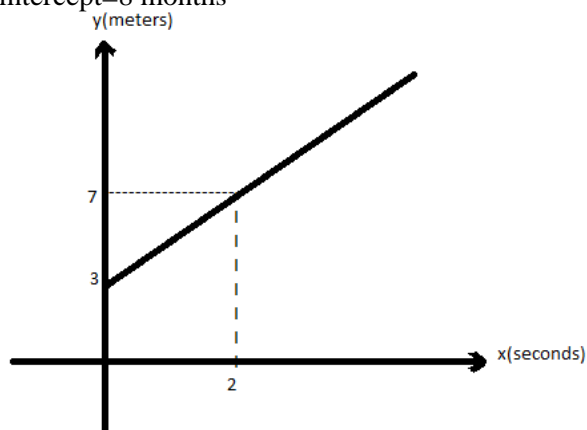
3. Find the area of a right angled triangle whose sides are X+1 ,X+3 and X+5.

4. You are downloading a song. The percent y (in decimal form) of megabytes remaining to download after x seconds is $Y= -0,1X+1$. After how many seconds is the download completed?

5. Tell the given systems have one solution , no solution or infinity solutions:
a)$Y=-X+6$ b)$Y=3X-2$ c)$-9X+3Y=12$
  $-4(X+Y)=-24$ $-X+2Y=11$ $Y=3X-2$

6. Solve for Y: $2Y^2+4=9Y$

7. Find two consequtive integers whose product is 132.

8. Solve for X:

$$\frac{X-2}{X-1} = \frac{X+4}{2X+2}$$

9. The height of the ball Messi shot at a height of 40 m. roof top from the basket level changes according to $Y=-X^2+10X+100$ function and the ball goes into the basket through the curved line. According to this, how high at most is the ball from the level of the building?

10. The square of a number is decreased by 15. This value is twice the original number.Find the smaller one.

TEST 70
Unit 35/ Topic: First and second degree equation

1. What are the solution methods of quadratic equations?

2. Translate the special terms about parabola below:
    a) Focus   c) Vertex
    b) Directrix   d) Axis of symmetry

3. Give three examples of the parabolas that you can see in your real life.

4. Fill in the blanks with the words below.
     u-shaped curve   parabola(x^2)   focus   quadratic equations   axis of symmetry
    a)If the light comes from the ……………………. of ……………………, it will be reflected
    as a parallel beam which is parallel to the ………..……… . This principle works for the light.
    b)The graphs of …………………………. are called ……………………….. which are a set
    of points in one planet that form a ………………………………………………… .

5. Decipher the given words related to equations.
    a) lprealal   …………………………   d) arabploa   …………………………
    b) nitecgnertsi   ……………………   e) terxve   ……………………………
    c) dciontnice   ……………………….

6. Find an example of two first degree equations in one variable with no solution and tell the reason.

7. Find an example of two first degree equations in one variable with infinite solution and tell the reason.

8. Find an example of two first degree equations in one variable with unique solution and tell the reason.

9. The profit function telling Mehmet how much money he will net for producing and selling exspeciality umbrellas is given by P(x) = –0.004x^2+ 8,048.x – 96. What is Mehmet's loss if he doesn't sell any of the umbrellas he produces, how many umbrellas does he have to sell to break even ?

10. A highway underpass is parabolic in shape. If the curve of the underpass can be modeled by h(x) = 72 – 0.02x^2, where x and h(x) are in meters, then how high is the highest point of the underpass, and how wide is it?

SOLUTION TEST 1
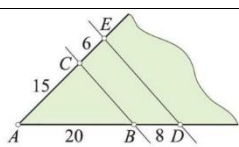
Item	Answer/ Clue	Marks
1	Nitrogen N_2, Oxygen O_2, Carbon dioxide CO_2, Water H_2O.	1p
2	M(N2):M(O2):M(CO2):M(H2O)=28:32:44:18	1p
3	Relative molecular mass must be multiplied by volume proportion because number of molecules of some sort is proportional to relative volume. 2201.36 : 666.88 : 1.76 : 9 In order to find percentage, all the result are added to 2879 and every proportion must be divided by that sum and multiplied by 100 or directly divided by 28.79. The result is: 76.47% nitrogen ; 23.16% oxygen; 0.06% carbon dioxide; 0.31% water vapors	1p
4	EA=mAvA2/2, but mA=qmB and vA=kvB, so EA=qmB(kvB)2/2=qk2EB, so EA:EB=qk2.	1p
5	If energy is equal, then qk2=1 and k=sqr(q), so: v(N_2):v(O_2):v(CO_2):v(H_2O)= 1 : 0.94 : 0.80 : 1.25	1p
6	1) [Proportion] $\|AB\| : \|AC\| = \|DE\| : \|DC\| \implies \|AB\| : \|AC\| = \|DE\| : (\|AC\| - \|AD\|) \implies 21 : 18 = \|DE\| : 12 \implies \|DE\| = \frac{21 \cdot 12}{18} = 14$ cm; 2) [Proportion] $\|AB\| : \|AC\| = \|DE\| : \|DC\| \implies \|AB\| : \|AC\| = \|DE\| : (\|AC\| - \|AD\|) \implies 18 : 15 = \|DE\| : 5 \implies \|DE\| = \frac{18 \cdot 5}{15} = 6$ cm.	1p
7	[From] $\|OC\| = \|OA\| + \|AC\| = \|OA\| + 21 - \|OC\|$, [follows] $2\|OC\| = \|OA\| + 21$. [Now from] $5\|OA\| = 3 \cdot \frac{1}{2}(\|OA\| + 21)$, jer je $\|OC\| : \|OA\| = 5 : 3$, [we calculate] $\|OA\| = 9$ cm.	1p
8	1:1	1p
9	1:1	1p
10	4:3 and 16:10 to 16:9	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 2
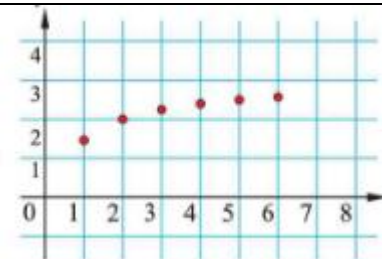
Item	Answer /Clue	Marks
1	Using Pythagoras theorem L=SQR(V2+H2)=5m. Total force on body is zero, assuming uniform motion. So, µFn=Fp. Using similar triangle: Fn=HG/L=4G/5, Fp=VG/L=3G/5, assuming that: µ4G/5=3G/5, so: µ=3/4=0.75.	1p
2	Similar as 1, but with substitution 3m to 4m: Fn=3G/5, Fp=4G/5, F(friction)= µFn=9G/20=0.45G. Total force on body is difference Fp- µFn=(0.8-0.45)G=0.35G, F:G=0.35=35:100=7:20.	1p

3	F=ma, but from task 2. F=0.35G=0.35mg, so 0.35mg=ma, a=0.35g. assuming $g=10 m/s^2$, a=3.5 m/s^2.	1p
4	$$L=at^2/2, \text{ so } t = \sqrt{\frac{2L}{a}} \Rightarrow t = \sqrt{\frac{10}{3.5}} = 1,69\,s$$	1p
5	v=at=5.91m/s	1p
6	If the old frog is isometric scaling of young frog, then cross area of old frog is k2 bigger, so is the leg force. Old frog legs are k times longer so the leg work of old frog is k2k=k3 bigger than young frog leg work. As mass of old frog is k3 time bigger, and potential gravity energy is mgh it follows that old frog jumps the same height, 40 cm.	1p
7	From $|OC| = |OA| + |AC| = |OA| + 21 - |OC|$, follows $2|OC| = |OA| + 21$. Now from $5|OA| = 3 \cdot \frac{1}{2}(|OA| + 21)$, jer je $|OC| : |OA| = 5 : 3$, we calculate $|OA| = 9$ cm.	1p
8	$|AC| : |AB| = 3 : 4 = |AE| : |AD|$.	1p
9	1:3	1p
10	1:3	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 3

Item	Answer/ Clue	Marks
1	1, 1, 0, -3, -10	1p
2	$a_n = 2a_{n-1} - 1$	1p
3		1p
4	a) d b) c c) e d) a e) b	1p
5	a) Circle the sperm and egg cell- top image. b) Left rectangle - meiosis, right rectangle-fertilization	1p

6	specialized, differentation, gene	1p
7	n+1, n, n+4, 2n+1, 2n-1	1p
8	It memorizes the place in the program (memory) where it was called upon (in order to be able to return after **return**) and memorizes the value of the arguments sent to the function.	1p
9	```<script>function count(n){//document.write(n," ");if(n>1) {count(n - 1);document.write(n," ");return n;}document.write(n," ");return n;}x = count(100);</script>```	1p
10	If the even number is **n** , its even number successor is **n+2**	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 4

Item	Answer/ Clue	Marks
1	n-1; n-2; n+2; 2n-1; 2n-3	1p
2	If the odd number is written as 2n+1, then his predecessor is 2n-1	1p
3	*Return* quits the execution of a function and returns the control of the program to the place from where the function was called.	1p
4	```<script>function count(n){document.write(n," ");if(n>1) {count(n - 1);return n;}return n;}x = count(100);</script>```	1p
5	3, 10, 29, 74, 173	1p
6	$a_n = \frac{1}{2}(n^2 + 3n + 4)$	1p

7		1p
8	Differentiation is the process of selective gene activity (different genes are active in different cells during the development the organism) and leads to specialization of cells for specific functions.	1p
9	zigota-morula-blastula-gastrula	1p
10		1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 5

Item	Answer/ Clue	Marks
1	Nikola Tesla was born around midnight, between July 9 and July 10, 1856 during a fierce lightning storm in a small village Smiljan, near Gospic, Croatia.	1p
2	Alternating current generators, induction electro-motors, high frequency transformers, remote control. Tesla developed the idea for smartphone and wireless internet technology in 1901. and radio astronomy.	1p
3	Gospić, Karlovac, Graz, Prague.	1p
4	According to family legend, midway through the birth, the midwife wrung her hands and declared the lightning a bad omen. This child will be a child of darkness, she said, to which his mother replied: "No. He will be a child of light." Tesla **could not stand the sight of pearls**, to the extent that he refused to speak to women wearing them. **He wore white gloves** to dinner every night and prided himself on being a "dapper dresser." Tesla **had** what's known as a **photographic memory**. He was known to **memorize books and images and stockpile visions for inventions in his head**. He also had a **powerful imagination** and **the ability to visualize in three dimensions**, which he used to control the terrifying vivid nightmares that he suffered from as a child. Most people don't know that Tesla **had** a **terrific sense of humor,** too.	1p
5	Tesla inventions, for example, remote control we used today for TV, cars etc. He was the first to be thinking about the information revolution in the sense of delivering information for each individual user. He also conceived of, but never	1p

	developed technology for radar, X-rays, a particle beam "death ray".	
6	6. Tesla died alone in room 3327 of the New Yorker Hotel on 7 January 1943, at the age of 86 in New York. His body was later found by maid Alice Monaghan after she had entered Tesla's room, ignoring the "do not disturb" sign that Tesla had placed on his door two days earlier. Assistant medical examiner H.W. Wembly examined the body and ruled that the cause of death had been coronary thrombosis.	1p
7	Tesla was not interested in money at all, he only need money for his experiments, he died alone and poor.	1p
8	Many have characterized Tesla and inventor Thomas Edison as enemies but this relationship has been misrepresented. Early in his career, Tesla worked for Edison, designing direct current generators, but famously quit to pursue his own project: the alternating current induction motor. Sure, they were on different sides of the so-called "Current Wars," with Edison pushing for direct current and Tesla for alternating current. But Carlson considers them the Steve Jobs and Bill Gates of their time: one the brilliant marketer and businessman and the other a visionary and "tech guy."	1p
9	The High Frequency Active Auroral Research Program (HAARP) was an ionospheric research program jointly funded by the U.S. Air Force, the U.S. Navy, the University of Alaska, and the Defense Advanced Research Projects Agency (DARPA), designed and built by BAE Advanced Technologies (BAEAT).Its purpose was to analyze the ionosphere and investigate the potential for developing ionospheric enhancement technology for radio communications and surveillance.[2] The HAARP program operated a major sub-arctic facility, named the HAARP Research Station, on an Air Force-owned site near Gakona, Alaska. This project is scientific and military investigations that use some Tesla idea about earth energy control, but Tesla had the dream for free wireless energy use for everybody, not for military use. Second question is about dangers from that geo-energy use. Probably Tesla was aware of those dangers.	1p
10	Tesla in his childhood most loved **birds**, which he fed all his life, then reading and playing cards. As a young man he played cards for money that once he would have won all shared with the poor off the streets. Five years after **Graz** he entered Technical studies at Charles University in Prague. During this time he participated in the construction of new **telephone** switchboards and improved the device to amplify the telephone sound in Budapest. Afterwards, he moved to Paris where he worked in Edison's company Continental Edison Company. On assignment in Strasbourg (1883) he constructed during night-time the first powered AC **induction** motor. He got the idea for this **invention** while walking through the park. Then he used a **stick** to draw a sketch in the sand and explained to a friend the principle on which the induction **motor** would work. A year later, June 6 1894, he went to the **United States** and became an American citizen. In New York, he arrived with **four** cents in his pocket, a few own songs,	1p

calculations for a **flying machine** and the recommendation of Edison's partner, Charles Batchelor which read: "Mr. Edison, I know two great men. One you are, and the other is the young man who stands before you."

United States (8); Graz (2); telephone (3); four (9); invention (5); motor (7); stick (6); induction (4); flying machine (10); birds (1).

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 6

Item	Answer/ Clue	Marks
1	B=6.7 E-5 T	1p
2	F=1.2 E-2 N	1p
3	B=1.3 E-2 T, 260 times stronger	1p
4	B=2.42 E-2 T	1p
5	5000	1p
6	U=1 V	1p
7	Umax=311.1 V	1p
8	R=3 Ω	1p
9	U2=1800 V	1p
10	Thunder produce strong induced currents that can damage devices.	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 7

Item	Answer/ Clue	Marks
1	Adenine bonds with thymine; guanine bonds with cytosine. This is not the same for RNA. In RNA, adenine bonds with uracil.	1p
2	Transcription is the process by which RNA is made. Part of the nucleotide sequence of DNA is copied into RNA. This process takes place in the nucleus.	1p
3	Point mutation- substitution	1p
4	RNA is a long strand of RNA nucleotides that are formed complementary to one strand of DNA. mRNA is responsible for carrying DNA's instructions out of the nucleus.	1p

5	There are 6 codes for Ser and Leu aminoacid and 4 codes for Arginine. So, there are a total of 6*6*6*4= 864 different codes for the same sequence.	1p
6	The code redundancy, especially for third base is often neutral, coding the same amino acid. Mutation on first or second base is more dangerous but if this is not essential amino acid for protein function that points mutation will be small for protein functioning but among lot of neutral or dangerous mutations that are eliminated in the life game, there will be small part of useful mutation that improves the possibility for survival of that mutation.	1p
7	Similar to question 5 but here are amino acid with only one code (Met and Trp) or two code (Glu and Cys), so there are 1*2*2*1=4 different codes for that sequence.	1p
8	Using genetic code: GGG GAG AAC GAG Gly – Glu – Asn – Glu = GENE	1p
9	In random nucleic acid sequences find the probability of STOP codon. In totally random nucleotide sequence all of the codes are of the same probability of 1/64. Because there are three Stop codes this is probability of 3/64 or on average, every 21 triplet will be STOP codon.	1p
10	If in some reading frame long more than for example 300 base (100 triplets) there isn't Stop code (expected number will be 5) that reading frame is probably frame that code some proteins. For eukaryotes thing are more complicated because of introns inside exons.	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 8

Item	Answer/ Clue	Marks
1	Body, specialized cell, nucleus, chromosomes, genes, nucleotide.	1p
2	During translation, nucleotides in mRNA are decoded into a sequence of amino acids in a protein. It occurs after transcription in the cytoplasm and involves the	1p

	ribosomes.	
3	Frame shift- deletion	1p
4	tRNA is a smaller segments of RNA nucleotides that transport amino acids to the ribosome.	1p
5	Code redundancy means that different nucleotide triplets code for some amino acids. So, different species can mutate large number of base without changing the proteins they code.	1p
6	Ser Arg and Leu had 6 different codes, while Ala has 4 different codes. One possible code with maximal U nucleotide number is UCUUUGCGUGCU with 6 U and 3 C and 3 G.	1p
7	7. Some as, for 6, but now one possible sequence is UCCCUCCGCGCC with 8 C, 2 U and 8. Find one letter Key amino acid sequence for this mRNA repeating code.	1p
8	CUG AUA UUU GAG CUG AUA UUU GAG CUG AUA UUU GAG… Leu Ile Phe Glu Leu Ile Phe Glu Leu Ile Phe Glu =LIFELIFELIFE	1p
9	UGA UAU UUG AGC UGA UAU UUG AGC UGA UAU UUG AG… Stop Tyr Leu Ser Stop Tyr Leu Ser Stop Tyr Leu … = nonsense GAU AUU UGA GCU GAU AUU UGA GCU GAU AUU UGA G… Asp Ile Stop Ala Asp Ile Stop Ala Asp Ile Stop … = nonsense	1p
10	One base insertion/deletion mutation is probably more dangerous than one base point mutation because it causes (as one base insertion) frame shift that code totally different amino acid and probably Stop code so after this type of mutation inside protein that mutated protein will be short and different and its function will probably be lost.	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 9

Item	Answer/ Clue	Marks
1		1p
2		1p
3		1p
4		1p

Lake	Volume/ $1000m^3$	T/days	Power/KW	Energy/GJ
Prošćansko	12765	147.7	107.91	1377
Ciginovac	412.5	4.8	117.72	48
Okrugljak	307.5	3.6	29.43	9
Batinovac	45	0.5	29.43	1
Veliko	60	0.7	19.62	1.1
Malo	100	1.2	58.86	6
Vir	15	0.2	137.34	2
Galovac	1562.5	18	-	-

Item	Answer/ Clue	Marks
5	Rainwater that falls on the area pass through ground rich of organic (leafs) compounds bacterial decompositions and flora respirations that cause low concentration of oxygen in forest ground and high concentration of carbon dioxide that dissolve in water.	1p
6	Solubility of calcium carbonate depend on dissolved CO2. Less dissolved CO2 means more oversaturated dissolved calcium carbonate and consequently formation of sedra, mainly at waterfalls. Part of CO2 lost is due to biological activity in lakes and barriers (photosynthesis).	1p
7	The answer is obvious. Polluted waters caused by human activity with many dissolved organic compound can inhibit new tufa formtion with results of erosion of tufa barriers that will destroy Plitvice Lakes.	1p
8	Because of human activity (clothes washing) organic carbon concentration is over 10 mg/L and forbid tufa formation. Only one kg of organic carbon dissolved in 100,000 L or 100 cubic meters forbid tufa formation in that water.	1p
9	Biological impact are important for tufa formation, so we can conclude that tufa formation at Plitvice Lakes is not only physical and chemical process because cooper is poison for species that participate in tufa formation.	1p
10	1. Wolf (2) Cinclus cinclus 2. White-throated dipper (4) Bubo bubo 3. Brown bear (1) Canis lupus 4. Eurasian eagle-owl (3) Ursus arctos	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 10

Item	Answer/ Clue	Marks
1		1p
2		1p
3		1p
4		1p

Lake	Volume/ $1000m^3$	T/days	Power/KW	Energy/GJ
Milinovo	5	0.06	225.63	1
Gradinsko	405	4.7	78.48	32
Buk	1	0.01	98.1	0.1
Kozjak	19152.5	221.7	117.72	2255
Milanovac	304	3.5	39.24	12
Gavranovac	50	0.6	137.34	7
Kaluđerovac	136.5	1.6	19.62	2.7
Novakovića	10	0.1	-	-

Item	Answer/ Clue	Marks
5	Diurnal from 2 to 4 tons, anual from 750 to 1500 tons of calcium carbonates.	1p
6	Without dissolved CO_2 the amount of dissolved calcium carbonate will be less than 14 g/m^3 and this is about 1/3 part of it precipitation in Plitvice Lakes. The conclusion is that there will be no sedra barriers, nor lakes without high concentration of dissolved CO_2.	1p
7	Because there are not similar natural dynamical system as Plitvice Lakes are, this is the reason why this, one of the oldest national parks in Southeast Europe and the largest national park in Croatia, in 1979, was added to the UNESCO World Heritage register. It is obvious that in this national park are specific climatic, geographic and other coincidence like high oversaturation of dissolved calcium carbonate caused by high dissolved CO2, low concentration of organic carbon and other physical and chemical factors together with known and unknown interplay of biological influence to this system in such delicate near steady state equilibrium.	1p
8	In equilibrium with the air, concentration of dissolved CO2 must have the same partial pressure in air and water. Fact that dissolved CaCO3 is about 6 times bigger than expected suggest that dissolved CO2 in spring water has at least 6 times bigger partial pressure than in air. The conclusion must be that rainwater from air to underground and finally to springs must somehow be in environment where the concentration of CO_2 is more than 6 times bigger than in air (it can be more than 100 times bigger). This situation is in forest ground due to biological activity of flora and bacterial decomposition of organic compounds with low concentration of oxygen and high concentration of	1p
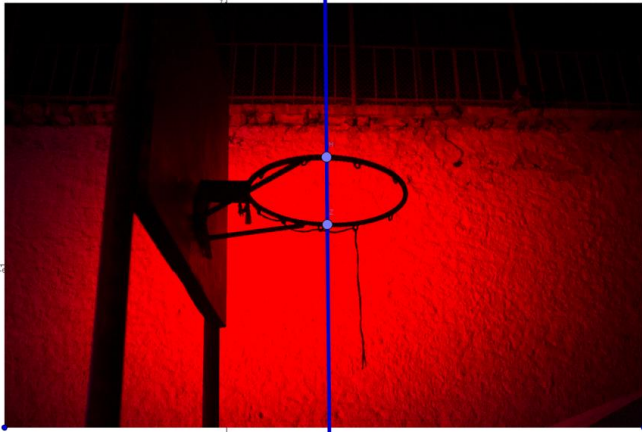
	carbon dioxide. So, biological component (forests) around Plitvice Lakes are very important part of this complex dynamical system.	
9	Barriers grow rates depend on chemical (pH and oversaturation of dissolved calcium carbonate, CO2 lost), physical (water velocity and surface area at waterfalls, water temperature) and biological (species at the barriers and biological activity like photosynthesis). At different waterfalls (barriers) all of these factors determine velocity of barrier growth but probably the growth rate is proportional to waterfall height because bigger height gives bigger surface for all processes to occur. Assuming this, after last glacial period there was river without lakes with many small waterfall with different heights and different growth rate causing fusing of two or more small lakes to one bigger when upper height of downwater barriers reach some water barrier height, so the number of lakes decreased with time as happen to two lakes before about 400 years with two lakes now forming Kozjak Lake. In remote future, assuming unchanged processes, there will probably be only two big lakes, Upper Lake and Down Lake with only two high waterfalls.	1p
10	1. Alpine newt *(4) Aquila chrysaetos* 2. European polecat *(5) Emys orbicularis* 3. Lynx *(2) Mustela putorius* 4. Golden eagle *(3) Lynx lynx* 5. European pond turtle *(1) Triturus alpestris*	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 11

Item	Answer Clue	Marks
1		1p
2		1p
3	f(-2)=3 , f(-1)=0 , f(0)=-1 , f(1)=0 ,	1p

$g(x) = -x + 1$ $f(x) = x^2 - 1$

	g(-2)=3 , g(-1)=2 , g(0)=1, g(1)=0	
4	f(-π) > g(-π) ; f(-2) = g(-2) ; f(2π) > g(2π)	1p
5	The domain of the function **f** is **ℝ.** The domain of the function **g** is **ℝ.** The range of the function **f** is **[-1, +∞).** The range of the function **g** is **ℝ.**	1p
6	f(x)=0, x=1, x=-1 g(x)=0, x=1 f(x)=g(x), x=-2, x=1	1p
7	f(x) < g(x) x∈(-2,1)	1p
8	The shape of the "basket" does not represent a graph of a function because more than one intersection points exists with a vertical line.	1p
9	In a deep cave are human beings with their necks and legs chained so that they cannot move. Behind the prisoners a fire burns, and between them and the fire there is a raised way on which a low wall has been built. Along the raised way people walk carrying all sorts of things which they hold so that they project above the wall-statues of men, animals, etc. The prisoners, facing the inside wall, cannot see one another, or the wall behind them on which the objects are being carried. All they can see are the shadows these objects cast on the wall of the cave. The prisoners live all their lives seeing only shadows of reality, and the voices they hear are only echoes from the wall.	1p
10	**-***Chains* represent the senses and generally the material world. -*Freed prisoner* represents the Philosopher, who seeks knowledge outside of the cave and outside of the senses. -*The light of the fire* represents the restricted human knowledge.	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 12

Item	Answer Clue	Marks
1	f(-2)=0 , f(1)=0 , f(0)=6 , f(3)=0	1p
2	x-intercepts: A(-2,0) , B(1,0) , C(3,0) y-intercepts: D(0,6).	1p
3	f(3) < f(10) ; f(2) < f(π) ; f(0) > f(2)	1p
4	The domain of the function **f** is **R**; The range of the function **f** is **R.**	1p
5	f(x)=0 ; x=-2 , x=1 , x=3	1p
6	f(x)>0 ; x $\in$ (-2, 1) $\cup$ (3, +∞).	1p
7	f(x)=g(x) $x^3-2x^2-5x+6 = -5x+6$; $x^2(x-2)=0$; x=0, x=2 The intersection points of the graphs of **f** and **g** are: D(0,6) and E(2,-4).	1p
8		1p

	Image (II) does not represent a graph of a function because more than one intersection points exist with a vertical line. Images (I), (III) represent graphs of functions.	
9	They would at first find this situation very amusing and would taunt him by saying that his sight was perfectly all right before he went up out of the cave and that now he has returned with his sight ruined. Their conclusion would be that it is not worth trying to go up out of the cave. Indeed, says Plato "if they could lay hands on the man who was trying to set them free and lead them up they would kill him."	1p
10	-*The chained prisoners* represent people that are slaves of their senses and who believe that knowledge comes from what they see and hear in the world (empirical evidence). - *The voices and shadows* represent the false perceptions that people have for world and superior Ideas (such as truth and justice) -*The light of Sun* represents philosophical truth and knowledge.	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 13
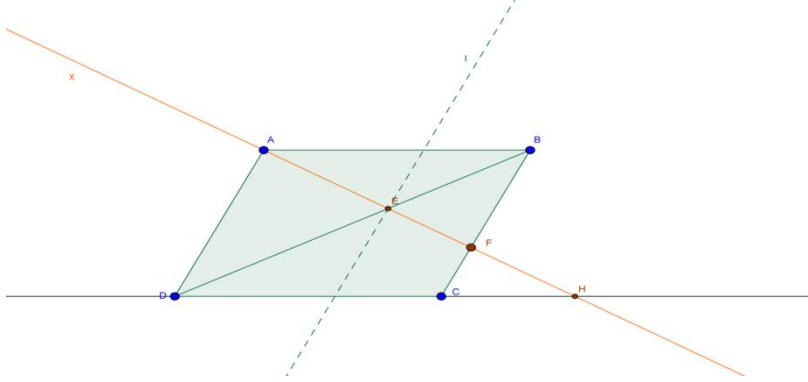
Item	Answer Clue	Marks
1	Since PC= 55 meters and BC = 11 meters, then PB=PC-BC=55-11=44 meters. Applying Thales's intersection theorem to lines PD, PC which are intersected by parallel AB//CD, we have $\frac{PA}{AD} = \frac{PB}{BC} \Leftrightarrow \frac{PA}{8} = \frac{44}{11} = 4 \Leftrightarrow PA = 8 \cdot 4 = 32$ meters > 30 meters, so theft A managed to escape!!	1p
2	Since rectangles PNMO and PBEZ are similar, if x is the ratio of similarity (i.e. the ratio of their corresponding sides), then the ratio of their areas will be x2. So, since $\frac{(PBEZ)}{(PNMO)} = 2 \Leftrightarrow \frac{PB}{PO} = \sqrt{2} \Leftrightarrow \frac{44}{PO} = \sqrt{2} \Leftrightarrow PO = \frac{44}{\sqrt{2}} = \frac{44\sqrt{2}}{2} = 22\sqrt{2}$ So $\cong 22 \cdot 1.41 = 31.11$ *meters* PO>30 meters, which means that theft O managed to escape.	1p
3	Since PZG is right-angled triangle and PK is the median corresponding to the hypotenuse, $PK = \frac{GZ}{2} = \frac{30}{2} = 15$ meters. In triangle ZYG, K is the middle of ZG, L is the middle of GY, so KL//ZY and $KL = \frac{ZY}{2} = \frac{40}{2} = 20$ meters. So PL=PK+KL=15+20=35 meters>30 meters :	1p

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	theft at L managed to escape!!	
4	Right-angled triangles FXZ and PZX are similar (they have angles PHZ=XHF). By the proportion of their sides we have $$\frac{PZ}{XF} = \frac{ZH}{HX} \Leftrightarrow \frac{20}{10} = \frac{2\sqrt{21}}{XH} \Leftrightarrow XH = \sqrt{21}$$ Applying Pythagoras' theorem on triangle FXZ we get: $$FH^2 = FX^2 + XH^2 = 10^2 + \sqrt{21}^2 = 100 + 21 = 121 \Leftrightarrow FH = \sqrt{121} \Leftrightarrow FH = 11$$ meters. Applying Pythagoras' theorem on triangle PZH we get: $$PH^2 = PZ^2 + ZH^2 = 20^2 + (2\sqrt{21})^2 = 400 + 4 \cdot 21 = 400 + 84 = 484$$ $$\Leftrightarrow PH = \sqrt{484} \Leftrightarrow PH = 22 \, meters$$ So PF = PH+HF = 11+22 = 33 meters : theft at F managed to escape!!!	1p
5	ABCD is golden rectangle, that means $$\frac{AB}{AD} = \Phi \Leftrightarrow \frac{AF+FB}{AD} = \Phi \Leftrightarrow \frac{AF}{AD} + \frac{FB}{AD} = \Phi \overset{AF=AD}{\Leftrightarrow} 1 + \frac{FB}{AF} = \Phi \overset{AF=EF}{\Leftrightarrow}$$ $$\frac{FB}{EF} = \Phi - 1 \Leftrightarrow \frac{EF}{FB} = \frac{1}{\Phi - 1} \overset{\Phi=\frac{1+\sqrt5}{2}}{=} \frac{1}{\frac{1+\sqrt5}{2} - 1} = \frac{1}{\frac{1+\sqrt5-2}{2}} = \frac{2}{\sqrt5 - 1} =$$ $$\frac{2 \cdot (\sqrt5 + 1)}{(\sqrt5 - 1)(\sqrt5 + 1)} = \frac{2 \cdot (\sqrt5 + 1)}{\sqrt5^2 - 1} = \frac{2 \cdot (\sqrt5 + 1)}{4} = \frac{\sqrt5 + 1}{2} = \Phi$$ which means that EFBC is golden too!!!	1p
6	The (purple) curve made by these instruction is the logarithmic spiral.	1p

7	Applying Thales' s intersection theorem to lines OD, OC which are intersected by parallel AB//CD, we have $$\frac{OA}{OD} = \frac{OB}{OC} \ (1)$$ Applying Thales' s intersection theorem to lines OD, OC which are intersected by parallel EB//AC, we have $$\frac{OE}{OA} = \frac{OB}{OC} \ (2)$$ Relationships (1), (2) have the second parts the same, so $$\frac{OA}{OD} = \frac{OE}{OA} \Leftrightarrow OA^2 = OD \cdot OE$$	1p
8	Applying Thales's intersection theorem to lines HA, HΔ which are intersected by parallel AΔ//CB, we have $$\frac{AF}{AH} = \frac{CD}{DH} \stackrel{CD=AB}{\Longleftrightarrow} \frac{AF}{AH} = \frac{AB}{DH}$$	1p
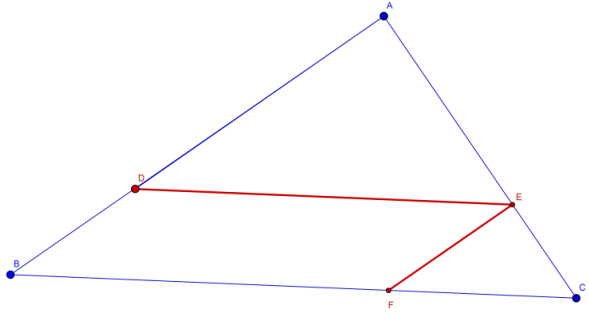
Let l line parallel to AD//BC

Applying Thales's intersection theorem to lines AH, BD which are intersected by parallel BC//AD//l, we have

$$\frac{AE}{EF} = \frac{ED}{EB} \ (1)$$

Applying Thales's intersection theorem to lines AH, BD which are intersected by parallel DH//AB, we have

$$\frac{EH}{AE} = \frac{ED}{EB} \ (2)$$

Relationships (1), (2) have the second parts the same, so

$$\frac{AE}{EF} = \frac{EH}{AE} \Leftrightarrow AE^2 = EF \cdot EH$$

9	*Linear perspective* is a mathematical system for creating the illusion of space and distance on a flat surface such as a canvas or wall. *Aerial (or atmospheric) perspective* is to create a sense of depth in painting by imitating the way the atmosphere makes distant objects appear less distinct and more bluish than they would be if nearby.	1p
10	• The numbers **13** and **21** are *Fibonacci numbers*. • The whole **13+21=34** is a *Fibonacci number*, too. • The ratio of the rows of the tiers is: 21 / 13 = 1,615… ~ Φ (the larger part to the shorter part) 34 / 21 = 1,618…= Φ (the whole to the larger part)	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 14

Item	Answer/ Clue	Marks
1	Regular pentagon consists of 3 triangles (for example ABC, ACD, ADE), so the sum of all angles of ABCDE are $3.180^o = 540^o$. Thus, every angle of the regular pentagon is $540^o : 5 = 108^o$	1p
2	Every acute-angled isosceles triangle has angles of 72°, 72° (angles of basis), 36°. Every obtuse-angled isosceles triangle has angles of 36°, 36° (angles of basis), 108°.	1p

3	**All** triangles are isosceles.	1p
4	Which linear segments are equal to AK? AK, AL, EL, EM, DM, DN, CN, CO, BO, BK Which linear segments are equal to KL? KL, LM, MN, NO, OK Which linear segments are equal to BL? BL, KE, AM, DL, EN, CM, BN, DO, CK, AO	1p
5	Which triangles are similar to AKL? AKL, ACD, ELM, EBC, DMN, DBA, CNO, CEA, BKO, BED, BLA, EAK, DEL, CMD, BCN, EDN, BOA Which triangles are similar to BKA? BKA, ALE, EMD, CND, COB, AOD, BNE, AOD, CKE, LBD	1p
6	Let AL=1 and AB=x. Then $\qquad$ BK=1, $\qquad$ KL=x-1, $\qquad$ AK=1 By proportion of sides of triangles AKL, BLA , we have $$\frac{x}{1}=\frac{1}{x-1}\Leftrightarrow x(x-1)=1\Leftrightarrow x^2-x-1=0,$$ which gives as (positive) solution $x=\dfrac{1+\sqrt{5}}{2}\cong 1.618=\Phi(phi)$	1p
7	Notice that $$\frac{1}{x}=\frac{1}{\frac{1+\sqrt{5}}{2}}=\frac{2}{1+\sqrt{5}}=\frac{2(1-\sqrt{5})}{1-5}=\frac{2(1-\sqrt{5})}{-4}=\frac{\sqrt{5}-1}{2}\Rightarrow$$ $$\frac{\sqrt{5}+1-2}{2}=\frac{\sqrt{5}+1}{2}-1=x-1$$ $$\frac{BL}{BK}=\Phi\ldots\ldots,\frac{EK}{EL}=\Phi\ldots\ldots,\frac{BE}{BL}=\frac{x+1}{x}=1+\frac{1}{x}\Rightarrow$$ $$1+x-1=x.=\Phi\ldots\ldots,\frac{BE}{EK}=\Phi.$$	1p
8	 is a I) DEFB parallelogram, so EF=DB and DE=BF. Applying Thales's theorem to CA, CB intersected by parallel EF//AB we get $$\frac{CE}{AC}=\frac{EF}{AB}\Leftrightarrow\frac{AC-AE}{9}=\frac{EF}{AD+EF}\Leftrightarrow\frac{9-6}{9}=\frac{EF}{8+EF}\Leftrightarrow\frac{1}{3}=\frac{EF}{8+EF}\Leftrightarrow$$ $$8+EF=3EF\Leftrightarrow 8=2EF\Leftrightarrow EF=4$$	1p

	II) Applying Thales's theorem to AC, AB intersected by parallel DE//BC we get $$\frac{AD}{AB} = \frac{DE}{BC} \Leftrightarrow \frac{8}{8+4} = \frac{DE}{BF+FC} \Leftrightarrow \frac{8}{12} = \frac{DE}{DE+4} \Leftrightarrow \frac{2}{3} = \frac{DE}{DE+4} \Leftrightarrow$$ $$8 + 2DE = 3DE \Leftrightarrow DE = 8$$	
9	Christ is in centre among the apostles. We can easily see Leonardo's use of *one-point linear perspective*, in which the vanishing point is at Christ's right eye (the orthogonals can be seen by following the tops of the wall tapestries or the coffers to where they intersect at Christ), which is also framed by the pediment above and back-lit by the open window behind.	1p
10	• The numbers **21** and **34** are *Fibonacci numbers*. • The whole **21+34=55** is a *Fibonacci number*, too. • The ratio of the rows is: 34 / 21 = 1,618… = Φ (the larger part to the shorter part) 55 / 34 = 1,618… = Φ (the whole to the larger part)	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 15

Item	Answer/ Clue	Marks
1	Acid, ions, sour, metals, vinegar, hydrochloric acid, Sodium hydroxide, salt, neutralization, crystalls, hydroxide, soapy, bitter, water .	1p
2	According to Arrhenius bases called the chemical substances which produces hydroxyl ions OH- in water. A base increases the concentration of OH- ions in an aqueous solution.	1p
3	a.The solution in the beakery will become acid and the it will turn into yellow. b. If the students insert Zn into a aspirin solution they will observe the production of gas because Zn reacts with HCl and produces H_2?	1p
4	a. At the first case we will use the solution C, the acid will react with the basic solution. b. The base of the wasp's sting will be neutralize with the solution	1p
5	The orange trees and lemons trees grow at soil pH=7, our garden soil was found pH=6,6 so it is difficult to grow orange trees and lemons trees at the specific soil. The soil becomes more basic if we add an amount of ash.	1p
6	Match the pH numbers in column A to the solutions in column B. 1- Solution of sulfuric acid 5- Diluted solution of citric acid 7 -Distilled water 9- Diluted solution of ammonia 14- Sodium hydroxide	1p
7	A factory which produces electricity, releases acid gases of SO2 and NO_2.	1p

	Gauses of SO_2 and NO_2 react with rain water and produces acid solutions of H_2SO_4 and HNO_3. Snails don't survive at that area because their cells contain sodium carbonate. Sodium carbonate reacts with the acid solution of H_2SO_4 and HNO_3 and their cell are destroyed.	
8	**Use the words in the box to fill in the blanks.**	1p
	esophagus small intenstine nutrients digestion rectum mouth chewed digestive system food energy enzymes swallow stomach saliva liver large intenstine pancreas hydrochloric acid	
	All the living organisms need <u>food</u> to get <u>energy</u> to live. But in order to use food, they must break into basic <u>nutrients</u> by a process called <u>digestion</u> . <u>Digestive system</u> is a group of organs working together to convert food into energy . In humans, the process of digestion begins in the <u>mouth</u> where food is <u>chewed</u> into small pieces that are more easily digested. These pieces are covered by <u>saliva.</u> The saliva makes the food slippery so that it is easier to <u>swallow</u>. The food travels to the <u>esophagus</u> which is like a gate that sends food into the <u>stomach</u>. Once in the stomach, the food is mixed with <u>hydrochloric acid</u> and crushed more. In the stomach <u>enzymes</u> help and speed the process of breaking down food. After food is sent into <u>small intenstine</u> , where the process of breaking down food is continued by using enzymes released by the <u>pancreas</u> and bile from the <u>liver</u>. The remaining food goes into the <u>large intenstine</u> where the nutrients are absorbed. The remaining food is pushed into the <u>rectum</u> where it waits before leaving the body.	
9	Over many centuries, the ancient Egyptians developed a method of preserving bodies so they would remain lifelike. The process included embalming the bodies and wrapping them in strips of linen. Today we call this process "mummification".	1p
10	The body was laid in a bed of "natron", a combination of salt and baking soda that naturally occurs in Egypt, to dry out the flesh. The embalmers placed additional "natron" packets inside the body. The internal organs were washed and packed in "natron", too. After forty days the body was washed again and covered with oils. The dehydrated internal organs were wrapped in linen and returned to the body. Normally when a person dies, the skin and other soft tissues decay, or break down, leaving only the bones behind. The process of mummification includes drying the body very quickly, so decay-causing bacteria can't grow, and soft tissue and hair remain.	1p
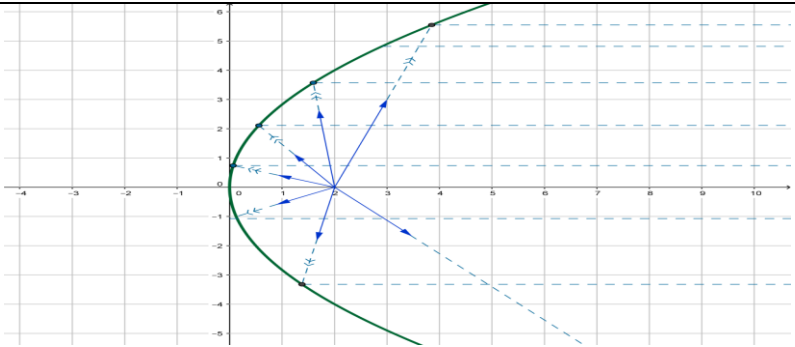
SOLUTION TEST 16

Item	Answer/ Clue	Marks
1	According to Arrhenius acids called the chemical substances which produces hydrogen ions H+ in water. An acid increases the concentration of H+ ions in an aqueous solution	1p
2	We can not keep acid solutions into a container made of iron or aluminium because iron and aluminium reacts with acid solutions.	1p
3	a. Magnesium reacts with sulfuric acid and it is produced salt and hydrogen gas. b. baking soda reacts with sulfuric acid and it is produced carbon dioxide.	1p
4	We can understand if we have a bottle with acid or base using universal paper. Also we can distinguish the acid or basic solution with indicator.	1p
5	a.3 acids (1 monoprotic HCl, 1 diprotic H_2SO_4, 1triprotic H_3PO_4) b. 3 bases (2 binary $Ca(OH)_2$, $Ba(OH)_2$, 1 tribinary $Al(OH)_3$)	1p
6	Using the Arrhenius definition, classify the following reagents, as acids, bases or salts. HBr acid; KCl salt; $Ba(OH)_2$ base; HCl acid; NaCl salt Al $(OH)_3$ base; HClO acid; NaOH base; $Al_2(SO_4)_3$ salt; HNO_3 acid	1p
7	esophagus　　small intenstine　　nutrients　　digestion　　rectum mouth　　chewed　　digestive system　　food　　energy enzymes　　swallow　　stomach　　saliva　　liver large intenstine pancreas　　hydrochloric acid All the living organisms need <u>food</u> to get <u>energy</u> to live. But in order to use food, they must break into basic <u>nutrients</u> by a process called <u>digestion</u> . <u>Digestive system</u> is a group of organs working together to convert food into energy . In humans, the process of digestion begins in the <u>mouth</u> where food is <u>chewed</u> into small pieces that are more easily digested. These pieces are covered by <u>saliva.</u> The saliva makes the food slippery so that it is easier to <u>swallow</u>. The food travels to the <u>esophagus</u> which is like a gate that sends food into the <u>stomach</u>. Once in the stomach, the food is mixed with <u>hydrochloric acid</u> and crushed more. In the stomach <u>enzymes</u> help and speed the process of breaking down food. After food is sent into <u>small intenstine</u> , where the process of breaking down food is continued by using enzymes released by the <u>pancreas</u> and bile from the <u>liver</u>. The remaining food goes into the <u>large intenstine</u> where the nutrients are absorbed. The remaining food is pushed into the <u>rectum</u> where it waits before leaving the body.	1p

8	The human digestive system consists of the below organs: Mouth, esophagus, stomach, small intestine, liver, pancreas and large intestine. Liquids:(1) gastric acid, (2) bile Role of liquids: (1) The gastric acid plays a key role in digestion of proteins by activating digestive enzymes that break down the long chains of amino acids. (2) Bile contains bile acids, which are critical for digestion and absorption of fats in the small intestine.	1p
9	The Egyptians believed that after death they would have a new kind of life called the afterlife. As well as needing all their everyday possessions for the next life, they also needed their bodies and so they were preserved or mummified after their death. They considered the mummified body as the home for the soul or spirit. If the body was destroyed, the spirit might be lost. The idea of "spirit" was complex involving really three spirits: the ka, ba, and akh. The ka, a "double" of the person, would remain in the tomb and needed the offerings and objects there. The ba, or "soul", was free to fly out of the tomb and return to it. And it was the akh, perhaps translated as "spirit", which had to travel through the Underworld to the Final Judgment and entrance to the Afterlife. To the Egyptian, all three were essential.	1p
10	During the mummification process one of the embalmer's men made a cut in the left side of the body and removed many of the internal organs. It was important to remove these organs because they are the first part of the body to decompose. The stomach, liver, lungs and intestines were carefully dried in salts, anointed with oils, and then wrapped. Finally, they were placed in special boxes or jars - today called "canopic jars".	1p
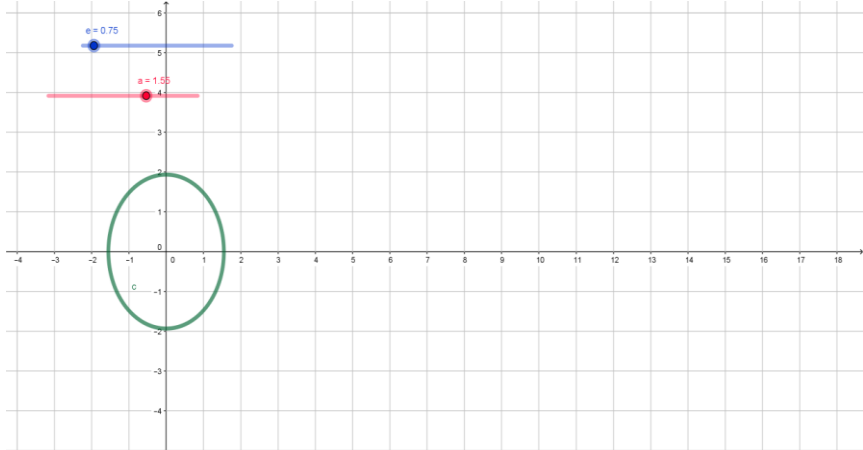
Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 17

Item	Answer/ Clue	Marks
1	Mirrors; parabolic; Syracuse; focus; parabola	1p
2		1p
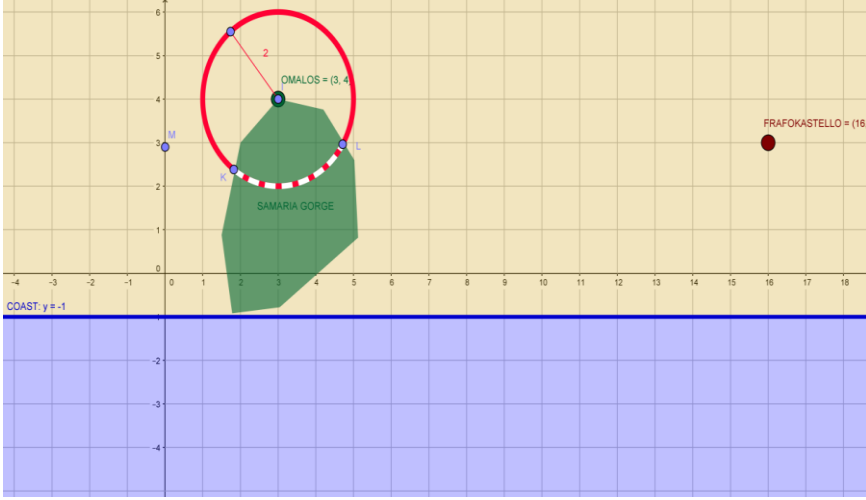
3	Let E(p,0) be the focus of the parabola y²=4px and x²+y²=r² the equation of the circle with center O(0,0) and radius r. Since the circle passes through the focus of the parabola, the coordinates of the focus must verify the equation of the circle, that is $p^2+0=r^2$, or r=p (both of them are positive). So the equation of the circle is x₂+y²=r².	1p

The common point of the circle and the parabola is the solution of the system

$$\left. \begin{array}{c} x^2 + y^2 = p^2 \\ y^2 = 4px \end{array} \right\} \Leftrightarrow \left. \begin{array}{c} x^2 + 4px - p^2 = 0 \\ y^2 = 4px \end{array} \right\}$$

But the common point has x=1 (as we see from point A), so

$$\left. \begin{array}{c} 1^2 + 4p1 - p^2 = 0 \\ y^2 = 4px \end{array} \right\} \Leftrightarrow \text{(since p>0) }, \ p = 2 + \frac{\sqrt{20}}{2} \quad \text{so the equation of the}$$

parabola is $y^2 = (8 + 4\sqrt{20})x$.

4	Let $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ be the equation of a hyperbola. Since it is isosceles, a=b. But then eccentricity equals to	1p

$$\varepsilon = \frac{c}{a} = \frac{\sqrt{a^2 + b^2}}{a} = \frac{\sqrt{a^2 + a^2}}{a} = \frac{\sqrt{2a^2}}{a} = \frac{a\sqrt{2}}{a} = \sqrt{2} \ (\alpha{>}0)$$

5	The equation of the ellipse x2+4y2=100 becomes $\dfrac{x^2}{100} + \dfrac{y^2}{25} = 1$	1p

The equation of the tangent line at $K(4\sqrt{5}, \sqrt{5})$, $\quad \dfrac{x4\sqrt{5}}{100} + \dfrac{y\sqrt{5}}{25} = 1 (1)$

The equation of the tangent line at $L(-4\sqrt{5}, \sqrt{5})$, $\quad \dfrac{-x4\sqrt{5}}{100} + \dfrac{y\sqrt{5}}{25} = 1 (2)$

The equation of the tangent line at $M(4\sqrt{5}, -\sqrt{5})$, $\quad \dfrac{x4\sqrt{5}}{100} - \dfrac{y\sqrt{5}}{25} = 1 (3)$

The equation of the tangent line at $N(-4\sqrt{5}, -\sqrt{5})$, $\quad -\dfrac{x4\sqrt{5}}{100} - \dfrac{y\sqrt{5}}{25} = 1 (4)$

Their common points-in pairs- will be found solving the corresponding

	systems: Adding by parts at (1), (3) we get $2\dfrac{x\sqrt{5}}{25}=2 \Leftrightarrow x=5\sqrt{5}$ and y=0, that is the section point is A($5\sqrt{5}$,0). Adding by parts at (1), (2) we get $2\dfrac{y\sqrt{5}}{25}=1 \Leftrightarrow y=5\sqrt{5}$ and x=0, that is the section point is B(0, $5\sqrt{5}$). Similarly we get is C($-5\sqrt{5}$,0).and D(0,- $5\sqrt{5}$) the other two section points . Then| AC|=|BD|=$10\sqrt{5}$, that is for ABCD, its diagonals are equal and vertical (since they are segment on the two axes), so ABCD is a square.	
6	1. We know that the radius of the circle will be the distance from the origin to the point of tangency , so we need the distance from O(0,0) to line x-y=2. So r=$\dfrac{\|0x-0y-2\|}{\sqrt{1^2+1^2}}=\sqrt{2}$, thus the equation of the circle is x^2+y^2=2.	1p
7	Use sources like Wikipedia … 	1p
8	E is the eccentricity of the ellipse we ordered. If e=0, then we have a circle. If e gets very big, we (almost) get a line.	1p

9	The dome is simply a three-dimensional arch, which distributes the load of the entire dome to its edges. In regards to proportion, a more conical dome allows it to be higher than one of an equal width. A triangular or planar roof would likely collapse. Domes in religious architecture have two aspects: aesthetic and functional. The need for an uplifting experience is combined with the need to create a huge space for a huge number of worshippers. The form of the dome recalls the dome of the sky, or that it is in the direction of heaven.	1p
10	**a.** ellipse, hyperbola **b.** San Carlo alle Quattro Fontane, Rome, Italy, 1640 (middle ages) Metropolitan Cathedral of Our Lady of Aparecida, Brasília, Brazil, 1960 (modern era)	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 18

Item	Answer/ Clue	Marks
1	Use sources like https://en.wikipedia.org/wiki/Archimedes	1p
2		1p
3		1p
4		1p
5		1p
6		1p
7	3,1415926535897932384626 are the first digits of π!!!!	1p
8	The locus of points that have distance 2 kilometers from Omalos village form a circle with center Omalos and radius 2 kilometers. All the possible positions to build the hotel are the points of that circle – without the arc KL which passes through Samaria gorge of course!! b.The locus of points that have the same distance both from Omalos village and from the coast of Lybian sea form a parabola with focus Omalos and diretrix the coast of the sea (line y=1). All the possible positions to build the hotel are the points of that parabola – without the part MN which passes through Samaria gorge of course!!	1p
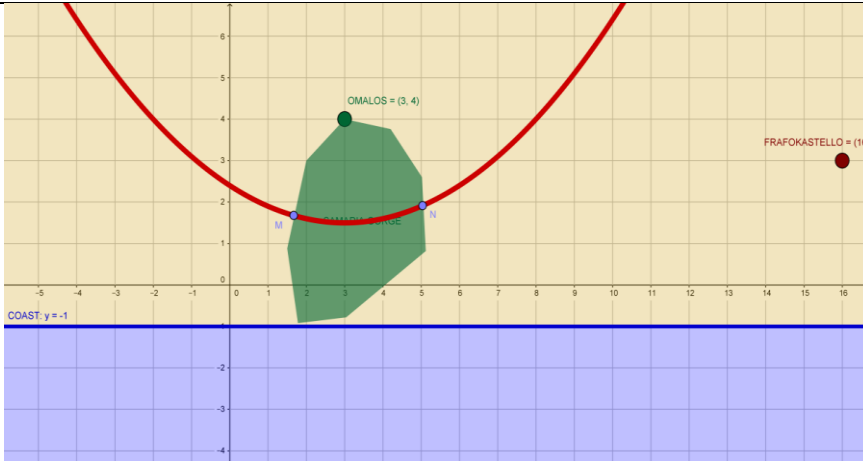
c. The locus of points that the sum of the distances from the hotel to Omalos and from the hotel to Fragokastello to be 18 kilometers, since the distance from Fragokastello directly to Omalos is 13 kilometers form an ellipse with foci Omalos and Fragokastello. All the possible positions to build the hotel are the points of that ellipse – without the part MN which passes through Samaria gorge of course!!
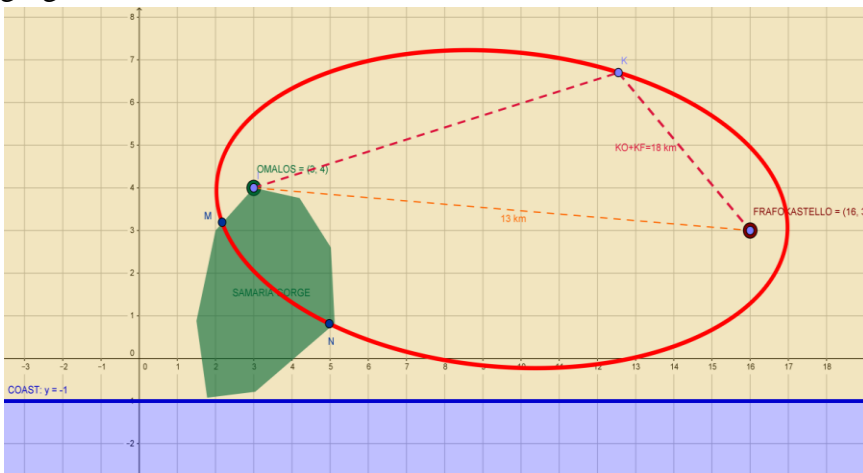
d.The locus of points that would be closer to Fragokastello than to Omalos, but only for 2 kilometers. form a (branch of) hyperbola with foci Omalos and Fragokastello. All the possible positions to build the hotel are the points of that branch of hyperbola

9	Domes, although self-supporting and structural, are built on some form of temporary support (centring). Like an arch, the intermediate forms are not structurally sound until the keystone, the central uppermost piece, is put into place. However, depending on whether they sit on the ground or on walls, domes may need reinforcing to deal with lateral loads - loads that push outward.	1p
10	**a.** circle, parabola **b.** Pantheon, Rome, Italy, 125 AD (antiquity) Saint Anselm Church, Creve Coeur, Missouri, 1962	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 19

Item	Answer/ Clue	Marks
1	The slope of a line passing through the following pairs of points is: a) (2,4) and (3,-7) a1= -13 b) (1, 0) and (3,1) a2= 1/2 c) (7, 4) and (-3, 4) a3= 0 d) (7, 4) and (7, -4) the slope is undefined.	1p
2		1p
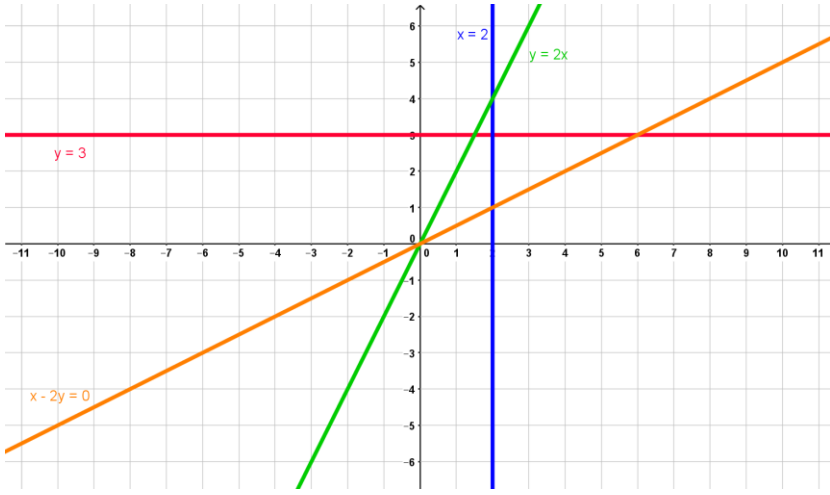
3	The distance between the airplane A and the airport (G), after 2 hours, is 800km and the distance between the airplane B and the airport is 1000km. After 2 hours the points A,B,G are vertices of a right triangle. Therefore $AB = \sqrt{800^2 + 1000^2} \approx 1280$ km.	1p
4	The midpoint of AB is M(3,4) ; The midpoint of BC is N(4,0) The midpoint of AC is L(1,2)	1p
5	The slope of the line y= 3x+7 is a1= 3. So the slope of the requested line is a2=3. Therefore the equation of the line is: y-1=3(x-1) ⇔ y=3x-2.	1p
6	The slope of the line x - y = 3 is a1= 1. So the slope of the requested line is a2= -1. Therefore the equation of the line is: y-1= -1(x+2) ⇔ y= -x-1.	1p
7	$AB = \sqrt{(0-1)^2 + (2-1)^2} = \sqrt{2}$; $BC = \sqrt{(2-0)^2 + (4-2)^2} = \sqrt{8}$ $AC = \sqrt{(2-1)^2 + (4-1)^2} = \sqrt{10}$; $AB^2 + BC^2 = AC^2$ Therefore the 3 points are vertices of a right triangle	1p
8	After x days they will have the same amount of money. Maria will have 35x€ and Konstantinos (200+30x)€. 35x=200+30x ; 5x=200 ⇒ x=40	1p
9	*Meditationes de Prima Philosophia (Meditations on First Philosophy)*: he determined "doubt" as the origin of wisdom and encourage the men of his era to meditate in the nature of the human mind and the essence of things. *La Geometrie:* he united the previous separate fields of algebra and geometry by using algebraic equations in geometry.	1p
10	Choices such as colour, line, composition, subject matter, and scale. It seems that from Ancient art through Renaissance to Modern Times one of the basic pursuits of art has been the "balance". Mondrian chose to distil his representations of the world to their basic vertical and horizontal elements, which represented the two essential opposing forces: the positive and the negative, the dynamic and the static, the masculine and the feminine. The dynamic balance of his compositions reflect what he saw as the universal balance of these forces.	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 20

Item	Answer/ Clue	Marks
1	$AB = \sqrt{(3-0)^2 + (-3-1)^2} = 5$ $CD = \sqrt{(1+2)^2 + (-1-1)^2} = \sqrt{13}$	1p
2	A(1,1) , B(0,4) , C(x,2). If A,B,C are vertices of a right triangle (C=90°), then: $AB^2=BC^2+AC^2$ $(1-0)^2+(1-4)^2= (x-1)^2+(1-2)^2+(0-x)^2+(4-2)^2$ $x^2-x^{-2}=0$; x= 2 or x= -1.	1p
3	The midpoint for AB is $M(\frac{1+2}{2},\frac{3-1}{2})$ therefore $M(\frac{3}{2},1)$. The midpoint for CD is $N\left(\frac{-1+\frac{1}{2}}{2},\frac{4+2}{2}\right)$ therefore $N(-\frac{1}{4},3)$.	1p
4	The line **(i)** is parallel to the line 2x-y=3. The line **(iv)** is perpendicular to the line 2x-y=3.	1p
5	The equation of the first line is **y= -2x+1** The equation of the second line is **x-2y= -2.**	1p
6		1p
7	The slope of the line x+y+1=0 is a1= -1. So the slope of the requested line is a2=1. Therefore the equation of the line is: y-2=1(x-1) ⇔ y=x+1.	1p
8	After 3 hours the sailboat A is 12 nautical miles (west), and the sailboat B is 15 nautical miles (south) faraway from Gavdos (G). ABG is a right triangle. Therefore the distance between A and B is $AB = \sqrt{12^2 +15^2} \approx 19.5$ nautical miles	1p
9	Descartes' new geometry was able to unite the previous separate fields of	1p

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	algebra and geometry. Before the end of the European Renaissance, math was clearly divided into these two separate subjects. You didn't use algebraic equations in geometry, and you didn't draw any pictures in algebra. Then, around 1637 René Descartes came up with a way to put these two subjects together. Many modern algebraic conventions come from this book: for example, Descartes used letters from the beginning of the alphabet for constants and known quantities, and letters from the end of the algebra for variables. So Descartes is the reason we solve for x, and not some other symbol.	
10	Choices such as colour, line, composition, subject matter, and scale. It seems that from Ancient art through Renaissance to Modern Times one of the basic pursuits of art has been the "balance". He needed to reflect what he saw as the spiritual order underlying the visible world, creating a clear, universal aesthetic language within his canvases.	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 21

Item	Answer	Clue	Marks
1	b	In general the average velocity of a certain interval of time equals the slope of the straight line which connects the two points on the position-time graph corresponding to the two end points of that interval	1p
2	d	$$v_m = \frac{displacement}{elapsed\ time} = \frac{\Delta s}{\Delta t} = \frac{s_2 - s_1}{t_2 - t_1}$$ • From t = 0 s to t = 5 s $v_m = \frac{\Delta s}{\Delta t} = \frac{s_2 - s_1}{t_2 - t_1} = \frac{10}{5} = 2$ m/s • From t = 5 s to t = 10 s $v_m = \frac{\Delta s}{\Delta t} = \frac{s_2 - s_1}{t_2 - t_1} = \frac{15 - 10}{10 - 5} = 1$ m/s • From t = 10 s to t = 15 s $v_m = \frac{\Delta s}{\Delta t} = \frac{s_2 - s_1}{t_2 - t_1} = \frac{15 - 15}{15 - 10} = 0$ m/s • From t = 15 s to t = 20 s $v_m = \frac{\Delta s}{\Delta t} = \frac{s_2 - s_1}{t_2 - t_1} = \frac{0 - 15}{20 - 15} = -3$ m/s	1p
3	a	2p = 4L → $\frac{2p}{L} = 4$ The ratio is constant; 2p and L are directly proportional and the coefficient of proportionality is 4	1p
4	b	The ratio of two quantities (s and t) is constant and the coefficient of proportionality is 3	1p
5	b	-	1p
6	b	-	1p
7	c	-	1p
8	a	-	1p
9	a	-	1p
10	b	-	1p

SOLUTION TEST 22

Item	Answer	Clue	Marks
1	c	$\Delta s = v_m\ \Delta t = (90\text{ km/h})(0,5\text{h}) = 45\text{ km}$	1p
2	d	At t=20s the body is returned to the origin of the reference system	
3	d	When the ratio of two quantities is constant, those quantities are defined as directly proportional.	1p
4	c	The ratio of two quantities (Δ quantity of water (l) and Δ time (*min*) is constant and the coefficient of proportionality is 2	1p
5	b	-	1p
6	a	-	1p
7	b	-	1p
8	b	-	1p
9	c	-	1p
10	d	-	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 23

Item	Answer	Clue	Marks
1	$2\ \frac{m}{s^2}$	$a = (v_f - v_i) / t$ Pick any two points: $a = (8\text{ m/s} - 0\text{ m/s}) / (4\text{ s})$; $a = (8\text{ m/s}) / (4\text{ s})$; $a = 2\text{ m/s}^2$	1p
2	4 m/s^2	$a = \frac{v_f - v_i}{t_f - t_i} = \frac{25-5}{5} = 4\text{ m/s}^2$	1p
3	56,3 m	$v_f^2 - v_i^2 = 2a\ \Delta s_f$ $\Delta s_f = (v_f^2 - v_i^2)/ (2a)$ $\Delta s_f = (0 - 302)/(-16) = 56,3\text{ m}$	1p
4	1721 m	$\Delta x = \frac{1}{2}a\ t^2 = \frac{1}{2}\ 3.20 \cdot (32.8)2 = 1721\text{ m}$	1p
5	262.5 *m*	The speed of the car must be converted to meters per second: $v_0 = 100$ km/h $= 27,78$ m/s . The braking distance can be found using the formula: $d = \Delta s_f = \frac{1}{2}\ \frac{v_0^2}{\mu g}$ $d = \frac{(27.78\,m/s)^2}{2(0.15)(9.80\,m/s^2)}$ $d = \frac{771.6 m^2/s^2}{2.94 m/s^2}$ $d = 262.5\ m$	1p
6	c	-	1p
7	c	-	1p
8	b	-	1p
9	b	-	1p
10	c	-	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 24

Item	Answer	Clue	Marks
1	50.4 m	$\Delta x = v_0 t + \frac{1}{2} a t^2$ $\Delta x = (0 \text{ m/s}) \cdot (4.1 \text{ s}) + \frac{1}{2} \cdot (6.00 \text{ m/s}^2) \cdot (4.10 \text{ s})^2$; $\Delta x = 50.4$ m	1p
2	8.10m/s^2	$\Delta x = \frac{1}{2} a t^2$; $a = \frac{2\,\Delta x}{t^2} = \frac{2 \cdot 110}{5.21^2} = 8.10 \text{ m/s}^2$	1p
3	19.5 m	$v_0 = 36$ km/h = 10 m/s, $a = -4$ m/s$_2$ (negative value means deceleration), $t = 2$ s; $v = ?$ $s = ?$ The velocity after applying the brake for 2s is given by $v = v_0 + at = 10 - 4 \cdot 2 = 2$ m/s Since the car is initially travelling at a constant velocity, the reaction distance is given by $\Delta sr = v_0\, tr = 10 \cdot 0.75 = 7.5$m while the braking distance is $\Delta sf = v_0 t + \frac{1}{2} a t^2 = 12$m The stopping distance is therefore $d = \Delta sr + \Delta sf = 7.5 + 12 = 19.5$m	1p
4	11.1m	80km/h = 22.22m/s $\Delta sr = v_0\, tr = 22.22$m/s $\cdot$ 0.5s = 11.11 m	1p
5	16.40 m	The speed of the car must be converted to meters per second: $v_0 = 50$ km/h = 13.89 m/s The braking distance can be found using the formula: $d = \Delta sf = v_0{}^2 / (2\,\mu\, g)$ $d = \dfrac{(13.89\ m/s)^2}{2(0.60)(9.80\ m/s^2)}$ $\qquad$ $d = \dfrac{192.9\ m^2/s^2}{11.76\ m/s^2}$	1p
6	c	-	1p
7	a	-	1p
8	b	-	1p
9	c	-	1p
10	b	-	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 25

Item	Answer	Clue	Marks
1	a	tan-1(0.08) $\cong$ 5°	1p
2	d	x = 1 : 150000 ; x = 4 ·150000 cm = 600000 cm x=6000 m = 6 km	1p
3	a	-	1p
4	a	-	1p
5	c	-	1p

6	a	-	1p
7	d	-	1p
8	b	-	1p
9	a	-	1p
10	a	-	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 26

Item	Answer	Clue	Marks
1	b	tan-1(0.12) = 6.8°	1p
2	d	1,5 : x = 1 : 2000 x = 1,5 ·2000 cm = 3000 cm = 30 m	1p
3	c	-	1p
4	d	-	1p
5	c	-	1p
6	-	a-z; b-x; c-k; d-y	1p
7	b, d	-	1p
8	c	-	1p
9	b	-	1p
10	b	-	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 27

Item	Answer	Clue	Marks
1	b	-	1p
2	d	-	1p
3	c	-	1p
4	a	-	1p
5	c	-	1p
6	a	-	1p
7	a	-	1p
8	c	-	1p
9	c	-	1p
10	b	-	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 28

Item	Answer	Clue	Marks
1	b	-	1p
2	b	-	1p

3	a	-	1p
4	d	-	1p
5	b	-	1p
6	d	-	1p
7	a	-	1p
8	d	-	1p
9	b	-	1p
10	c	-	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 29

Item	Answer	Clue	Marks
1	b	-	1p
2	c	-	1p
3	c	-	1p
4	a	-	1p
5	a	-	1p
6	d	-	1p
7	a	-	1p
8	a	-	1p
9	b	-	1p
10	b	-	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 30
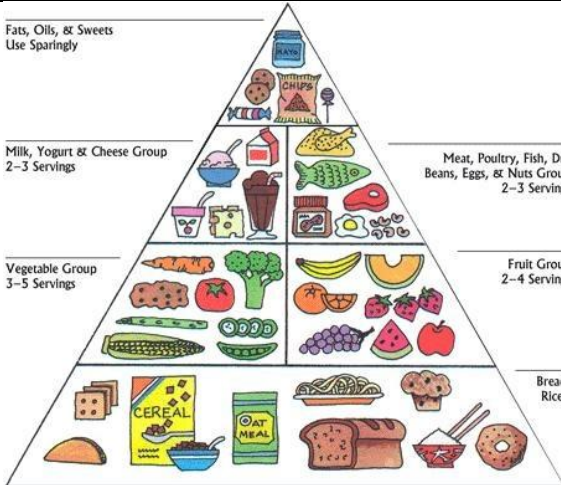
Item	Answer	Clue	Marks
1	c	-	1p
2	c	-	1p
3	a	-	1p
4	b	-	1p
5	d	-	1p
6	b	-	1p
7	a	-	1p
8	a	-	1p
9	d	-	1p
10	b	-	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 31

Item	Answer/Clue	Marks
1	1 – The inner mitochondrial membrane	1p

	2 – The outside mitochondrial membrane 3 – The mitochondrial crests 4 – The mitochondrial matrix	
2	The most important function of the mitochondria is to produce energy.	1p
3	2.125+0,6.410=250+246=496 kcal	1p
4	$0,5 \cdot 900 + 0,41 \cdot 0 + 0,08 \cdot 400 + 0,01 \cdot 400 = 486$	1p
5	translations dependent on the mother tongue	1p
6	a) atinmiv - vitamn d) uimslene- selenium b) crumomhi- e) mzyoecne- coeznyme chromium c) cinz- zinc	1p
7	a) vitamin B d) zinc b) chromium e) selenium c) vitamin D3 f) coenzyme Q10	1p
8	<u>Energy balance</u> - a form of presentation of the metabolism of living organisms; it compares the amount of energy supplied from food with the energy expenditure of the specific organism.	1p
9	a. Mitochondria are called „energy centres of cells" because the process of cellular respiration and ATP production takes place in mitochondria b. The number of mitochondria in a cell depends on the metabolic activity of cells (the more active, the more mitochondria it has)	1p
10	*http://cbisby.global2.vic.edu.au/2014/03/11/healthy-food-pyramid/*	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 32

Item	Answer	Marks
1	A – TRUE	1p
2	B – FALSE	1p
3	A – TRUE	1p
4	C - BREAD	1p

5	a. surface d. outer b. cristae, folded e. protein c. matrix	1p
6	I. C II. A III. B IV. E V. D	1p
7	9 – the inner mitochondrial crests / mitochondrial crests	1p
8	$C_6H_{12}O_6 + 6O_2 \ \rightarrow \ 6CO_2 + 6H_2O + ATP$ (energy)	1p
9	This is a comparison of the amount of energy supplied in the diet of the body's energy requirements. If the energy value of food is higher than the body's needs then the energy balance will be positive for the organism.	1p
10	The size of the mitochondrion - usually 2 to 8 microns The shape of the mitochondrion - round, oval or less commonly slender and branched	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 33

Item	Answer	Marks
1	a help e else i that b much f nothing j have c can g card k here d pound h how l altogether m thank	1p
2	a We don't have any large ones at the moment. b How much are they? c Do you sell rugby shirts? d What size are they?	1p
3	a – credit card, b – per cent, c – receipt, d – cash, e – checkout,	1p
4	a) Price, b) brand, c) trolley, d) customer, e) discount	1p
5	a) False, b) True, c) True, d) False, e) True	1p
6	discount - to offer for sale or sell at a reduced price bargain - an advantageous purchase, especially one acquired at less than the usual cost sale - able to be bought at reduced prices	1p
7	a – 2.49, b – 3.79	1p
8	Payment 1080 PLN is 100% . Payment on the day of purchase: $100\% - 3\% = 97\%$ $$\frac{97}{100} \cdot 1080 = 1047{,}6 \ zl$$ Payment after 3 days: $$1080 + 3 \cdot \frac{0{,}5}{100} \cdot 1080 = 1080 + 16{,}2 = 1096{,}2 \ zl$$ Payment after 10 days:	1p

	$$1080 + 10 \cdot \frac{0,5}{100} \cdot 1080 = 1080 + 54 = 1134 \; zl$$	
9	Amount deposited on account A: x Amount deposited on account B: $100 - x$ Annual interest on account A: $0,12 \cdot x$ Annual interest on account B: $0,15(1000 - x)$ Equation based on the interest rate: $0,12x + 0,15(1000 - x) = 132$ $$0,12x + 150 - 0,15x = 132$$ $$-0,03x = 18 \; ; \quad x = 600$$ Answer: 600 PLN was deposited on account A and 400 PLN on account B.	1p
10	Initial price of the first camera: $x - 100\%$ After reduction: $0,8 \cdot x$ Calculating the price of the first camera: $0,8x = 880$ $$x = \frac{880}{0,8} = 1100 \; zl$$ Initial price of the second camera: y-100% After reduction: $0,7 \cdot x$ Calculating the price of the second camera: $0,7x = 840$ $$x = \frac{840}{0,7} = 1200 \; zl$$	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 34

Item	Answer	Marks
1.	f.eg.: body mass index, tax and interest rates, percent of fibers in materials, exam results, sale prices, discount vouchers, cooking scales and more…	1p
2.	Insert a pie chart Highlighting data labels and lines leading Formatting background color and key text	1 p
3.	Insert a pie chart Highlighting data labels and lines leading Formatting background color and key text	1 p
4.	Insert a pie chart Highlighting data labels and lines leading Formatting background color and key text	1 p
5.	a) - II b) - III c) - I	1p
6.	a) at a bank – the number of loans and the average interest rate b) in trade – percentage of sales of the product in individual quarters and total sales for the whole year c) meteorology – percentage of the rainfall in individual months and the	1 p

	average monthly temperature during the year d) marketing – percentage of expenditures on advertising and the number of visits	
7.	Initial price - 100% : x Increased by 30% so now it is 130% of the initial price: $1,3 \cdot x$ Another increase in price, so 140% of the initial price of $1,3 \cdot x$: $1,4 \cdot 1,3 \cdot x$ The result of multiplication: $1,4 \cdot 1,3 \cdot x = 1,82x$ Initially it was x, that is 100%, while finally it is $1,82x$, that is 182% of x. Answer: The current price is 82% higher than the initial price.	1p
8.	First reduction of the price: $0,88 \cdot 80zł = 70,4zł$ Second reduction: $0,9 \cdot 70,4zł = 63,36zł$ Discount of 22% **:** $0,78 \cdot 80zł = 62,40zł$	1p
9.	$0,8 \cdot x$ $1,2 \cdot 0,8x = 0,96x$ $x - 0,96x = 0,04x$ The final price is lower than the initial price by 4%.	1p
10.	Calculating interest: $\dfrac{5}{100} \cdot 1500 = 75zł$ Calculating the tax: $\dfrac{19}{100} \cdot 75 = 14,25zł$	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 35

Item	Answer	Marks
1.	Jumps: long jump, high jump, pole vault, triple jump, Runs: 60m,100m,200, 400m,800m,1500m,5000m,10000m, marathon. Steeplechase 110 i 400m with barriers, 3 km with barriers Throws: javelin, hammer, ball, discus.	1p
2.	60m,100m,200m,400m,	1 p
3.	Fibers: White fiber (FT -type II) called fast-twitch and red fiber (ST-type I) called slow-twitch	1 p
4.	a long linear polymer found in the nucleus of a cell and formed from nucleotides and shaped like a double helixdeoxyribonucleic acid, the material that contains the information that determines inherited characteristics	1 pt.
5.	the rule that describes how a sequence of nucleotides, read in groups of three consecutive nucleotides (triplets) that correspond to specific amino acids, specifies the amino acid sequence of a protein	1p
6.	1-DNA, 2-mRNA, 3- rRNA, 4-amino acid	1p

7.	transcription	1p
8.	tRNA transports amino acids from the cytoplasm to the ribosomes	1 p
9.	Mother's genotype - Aa Father's genotype - Aa	1 p
10.	The probability is 25%	1p

Gametes of the father Gametes of the mother	A	a
A	AA	Aa
a	Aa	aa

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 36

Item	Answer	Marks
1.	1. F 2. C 3. D 4. B	1p
2.	Nucleotide - Monomer of nucleic acid; consists of a 5-carbon sugar, phosphate group, and a nitrogen base b) Gene - Sequence that codes for a protein and this determines trait	1 p
3.	Chromosomes - thread like structures that have genetic info that is passed down from one generation to the next	1p
4	Mutation - Change in DNA sequence that affects genetic information	1p
5.	RNA - (biochemistry) a long linear polymer of nucleotides found in the nucleus but mainly in the cytoplasm of a cell where it is associated with microsomes	1p
6.	The expression of this gene depends on the sex.	1 p
7.	Alleles: A - allele conditioning brown eyes a - allele conditioning blue eyes Thus, all possible genotypes and phenotypes are the following: AA – brown eyes ; Aa – brown eyes ; aa - blue eyes We note down the cross using the following symbols: P - the genotypes of the parents ; F1 - the genotypes of the children gametes - it is good to note them down in a circle P: AA x aa	1 p
8.	He deduced that genes come in pairs and are inherited as distinct units, one from each parent. Mendel tracked the segregation of parental genes and their appearance in the offspring as dominant or recessive traits. He recognized the mathematical patterns of inheritance from one generation to the next.	1 p
9.	The Law of Segregation: Each inherited trait is defined by a gene pair. Parental genes are randomly separated to the sex cells so that sex cells contain only one gene of the pair. Offspring therefore inherit one genetic allele from each parent when sex cells unite in fertilization.	1p

| 10. | The Law of Independent Assortment: Genes for different traits are sorted separately from one another so that the inheritance of one trait is not dependent on the inheritance of another. | 1p |

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 37

Item	Answer	Clue	Marks
1.	64%	The number of all respondents: 13+5+7+14+11=50 The number of respondents who went to cinema more than once: 7+14+11=32 The percentage is: $\dfrac{32}{50} \cdot 100\% = 64\%$	1p
2.	2,5	Dominant is the most commonly given answer, so it is equal to 3. Median is the middle value of the set of data put in order. In the set of 50 data there is no middle number, so we have to calculate the arithmetic average of the values of 25 and 26. That is: $\dfrac{2+3}{2}=2,5$	1p
3.	2,1	We need to divide the number of all cinema visits by the number of all respondents: $$\frac{0\cdot13+1\cdot5+2\cdot7+3\cdot14+4\cdot11}{50}=\frac{105}{50}=2,1$$	1p
4.	1,5	Puting the data into the formula for standard deviation: $$\sigma=\sqrt{\frac{13(0-2,1)^2+5(1-2,1)^2+7(2-2,1)^2+14(3-2,1)^2+11(4-2,1)^2}{50}}$$ Calculating standard deviation: $$\sigma\cong1,5$$	1p
5.	1,13	Calculating arithmetic average: $$\frac{1\cdot16+15\cdot18+24\cdot19+68\cdot20+26\cdot21+16\cdot22}{150}=\frac{3000}{150}=20$$ $$\sigma=\sqrt{\frac{190}{150}} \Rightarrow \sigma\approx1,13$$	1p
6.	b	-	1 pt
7.	d	-	1 pt
8.	c	-	1 pt
9.	a	-	1 pt
10.	c	-	1 pt

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 38

Item	Answer	Marks
1.	Calculate how many times is the volume of a sphere greater if the radius is twice bigger: 23=8 times bigger, therefore if the radius is twice the size, that is 30 light years, there are 8 times more stars, that is $8 \cdot 50 = 400$ stars. Conclusion: The distances between stars are huge (as well as the "empty" spaces between them are very large)	1 p
2.	D	1 p
3.	B	1 p
4.	Presenting conclusion from the data in the task. Examples: • average results of girls and boys are similar, • results among girls are similar, while among boys they are varied, • boys are a group of varied level of skills, • all girls have a similar level of skills.	1p
5.	Calculating arithmetic average: $$\frac{1\cdot6+2\cdot5+6\cdot4+5\cdot3+9\cdot2+2\cdot1}{1+2+6+5+9+2}=\frac{75}{25}=3$$ Calculating standard deviation: $$\sigma=\sqrt{\frac{1(6-3)^2+2(5-3)^2+6(4-3)^2+5(3-3)^2+9(2-3)^2+2(1-3)^2}{25}}\cong1,26$$ Presenting conclusion from the obtained value of arithmetic average and standard deviation.	1p
6.	Mercury – Venus – Earth – Mars – Jupiter – Saturn – Uranus – Neptune - Pluto	1 p
7.	Fifteen milion Eighty-nine thousand, seventy-eight Four point six times twenty Fifty-six thousand times two point six Seventeen milion, four hundred fifty six thousand	1 p
8.	a) Jupiter; b) Mercury; c) Mercury; d) Pluto; e) Jupiter	1 p
9.	1. longer 4. hotter 2. shorter 5. smaller 3. colder 6.bigger	1 p

10.		1 p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 39

Item	Answers	Clue	Marks
1	c	-	1 p
2	a	-	1 p
3	d	-	1 p
4	b	-	1 p
5	d	-	1 p
6	c	-	1 p
7	a	-	1 p
8	b	-	1 p
9	CO_2	CO_2- industry development, deforestation methane - coal mining and oil (the main component of natural gas), distribution of debris and animal waste; CFCs-deodorants,air conditioners, refrigerators	1 p
10	12,5g	% calculating of the number of grams of cream: 5% x 250g = 12,5g or ratio placement ; 250g- 100% x - 5% answer:250g cream consist of 12,5g emulsifier	1p
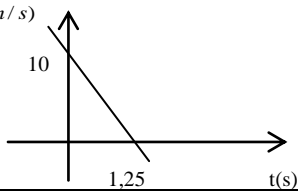
Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 40

Item	Answer	Clue	Marks
1	a	-	1p
2	b	-	1p
3	c	-	1p
4	b	-	1p
5	a	-	1p
6	a	-	1p
7	b	-	1p
8	b	-	1p
9	c	-	1p
10	b	-	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 41
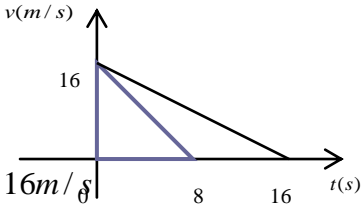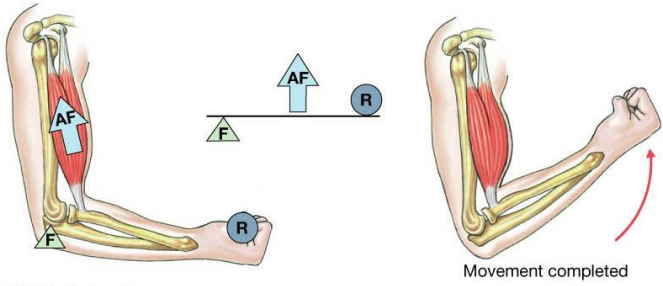
Item	Answer	Clue	Marks
1	c)	The average speed (the arithmetic mean of the registered values of the speed) is going to be calculated: $t=d/v_{med}$	1p
2	a)	$(v_B+v_A)t_{min}=d$; $(v_B-v_A)t_{max}=d$	1p
3	b)	$v_1 = 4t$; $v_2 = 10 - 4t$ $\Rightarrow$ $v_1 = v_2$ $\Rightarrow$ $t = 1,25s$	1p
4	-	$v_r = v_2 - v_1$ $\Rightarrow$ $v_r = 10 - 8t$	1p
5	-	If A is the meeting point of boats 2 and 3 and C is the meeting point of boats 1 and 3, $OA=v_2 \cdot t=v_3 \cdot (t-t_1)$; $OB=v_3(t-t_1+t_2)=v_1(t+t_2)$ t is the time in which boat 2 covers OA (until it meets boat 3). A second degree equation in v_3 is obtained: $t = \dfrac{v_3 \cdot t_1}{v_2 - v_3}$ $(v_3 - v_1) \cdot \dfrac{v_3 \cdot t_1}{v_2 - v_3} = v_3(t_1 - t_2) + v_1 \cdot t_2$ $v_3{}^2(2t_1 - t_2) - v_3(v_1t_1 - v_2t_1 + v_2t_2 + v_1t_2) + v_1v_2t_2 = 0$	1p
6	-	A possible programme is: #include <iostream> #include <math.h> using namespace std;	1p

```
int main()
{
    float a,b,c,d, v1,v2,v31,v32,t1,t2;
    cin>>v1>>v2>>t1>>t2;
    t1=t1/60;
    t2=t2/60;
    a=2*t1-t2;
    b=v1*t1-v2*t1+v2*t2+v1*t2;
    c=v1*v2*t2;
    if (a==0){
        if(b==0){
            if (c==0)cout << "any value can be v3" << endl;
                else cout << "no solution is possible";
        }
        else v31=-c/b; if (v31>0)cout<<"v3 este"<<v31;else cout
<< "no solution is possible";
    }
      else
        d=b*b-4*a*c;
        if (d>0)
        {
            v31=(-b+sqrt(d))/(2*a);
            v32=(-b-sqrt(d))/(2*a);
            if ((v31>0)&&(v32>0))cout<<"v3 is" <<v31<<"sau "
<<v32;
                        else if (v31>0) cout<<"v3 is " <<v31;
                          else if(v32>0) cout<<"v3 is" <<v32;
                            else cout << \"no solution is possible"
        }
        else if (d==0){v31=-b/(2*a);if (v31>0) cout<<"v3 este "
<<v31;
                    else cout << "nu poate avea solutie";
                    }
        else cout << "nu poate avea solutie";
    return 0;
}
```

7	-	Examples of the muscles involved : biceps brahial, triceps brahial, deltoid, pectorals, biceps femural,calf muscles etc	1p
8	-	extensibility, elasticity	1p
9	-	1.crawled. 2.jumped 3.tumbled 4. kicked 5.punched 6.bending 7.pulling 8. pushed 9.crouched 10.hit	1p
10	-	Kick, roll, hit, throw, catch, dribble, bounce, punt, shoot, serve (overhand/underhand), pass, juggle	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 42

Item	Answer	Clue	Marks
1	a)	$$a_1 = \frac{\Delta v}{\Delta t} = \frac{12-14}{4-2} = -1m/s^2$$	1p
2	d)	$$a_2 = \frac{\Delta v'}{\Delta t} = \frac{8-12}{4-2} = -2m/s^2$$	1p
3	-	$$v_1 = 16 - t \Rightarrow \begin{cases} t = 0s \Rightarrow v_1 = 16m/s \\ v_1 = 0m/s \Rightarrow t = 16s \end{cases}$$ $$v_2 = 16 - 2t \Rightarrow \begin{cases} t = 0s \Rightarrow v_2 = 16m/s \\ v_2 = 0m/s \Rightarrow t = 8s \end{cases}$$	1p
4	-	The graph shows that the areas of the triangles signify the distance: $\Rightarrow$ $d_1 = A_1 = 128m$; $d_2 = A_2 = 64m$	1p
5	-	If t represents the number of hours following the departure of the first vehicle from point A, then x=v₁•t ; x-d=v₂•(t-t₀) $\Rightarrow$ t= (v₂·t₀ –d)/(v₂-v₁) ; x= v₁.(v₂·t₀ –d)/(v₂-v₁)	1p
6	-	Input data: d, v1,v2, t0 Output data: t real v1,v2,d, t0, t begin read v1,v2, d, t0 t← (v2*t0-d)/(v2-v1) write t end	1p
7	-	IIIrd class lever at the joint of the the elbow or any other correct version	1p
8	-		1p
9	-	1) lifted 2)dashed 3) rushed 4) trip 5) sprawling	1p

		6) dodge 7)slouch 8)sprinted 9) bowed 10)bounced	
10	-	jog, sprint, walk, saunter, jump, run, stride, tiptoe, jump, leap, skip, limp	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 43

Item	Answer	Clue	Marks
1	-	Do not coincide a) boreal pole b) austral pole	1p
2	-	Magnetic declination	1p
3	-	Apa, aerul/atmosfera/oxigenul	1p
4	-	Hypothalamus Concentration, attention	1p
5	c)	Tesla	1p
6	a)	$B=\mu \cdot I/(2r)$ $B=4\pi \cdot 10^{-6}$ T	1p
7	a)c)d)	Users can click, can achieve a transition effect or can set the presentation to automatical transition from one slide to another.	1p
8	-	Entrance – the effect on appearance Emphasis - the effect when highlighting; Exit- the effect at the end; Motion Paths - the application direction of the effect	1p
9		a) A compass *needle* is a device that tells which direction is north, south, east and west b) The storm cut off our water *supply*. c) Inducing drowsiness is one of the *peculiar* properties of this drug. d) There is no *alternative* but to walk. e) Tell me *outright* what's bothering you. f) His style of writing is *reminiscent* of Hardy's. g) I will try to *cope* with his rudeness. h) The decision to fire the redundant staff gave *rise* to a wave of protests. i) The army laid *siege* to the city for over a month. j) Magic addresses problems outside the *realm* of science.	1p
10		to coin a term/word/phrase – a crea un nou termen e.g.The scientist coined a term for the new process. Imbued with a peculiar ability- inzestrat cu/dotat o anumita capacitate e.g. She was imbued with this peculiar ability of making the others feel miserable. Steeped in superstition- afundat in superstitii e.g.The whole community seemed to be steeped in pre-Christian superstitions.	1p

		To hail the properties- a lauda proprietatile medicinale
		e.g.The spokesman of the company hailed the medicinal properties of the herbs.
		To pique curiosity- a starni curiozitatea
		e.g. His mysterious disappearance piqued everyone's curiosity.

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 44

Item	Answer	Clue	Marks
1	a)	The declination is positive when the magnetic north is east of the geographical north.	1p
2	-	The lines of the magnetic field come out of the austral pole (the magnetic North Pole) and enter the boreal pole (the magnetic south pole).	1p
3	-	Magnets	1p
4	-	Headaches Fatigue Blood circulation disorders Digestive problems Insomnia *(Any 3 correct answers)*	1p
5	c)	$B=\mu \cdot I/(2\pi r)$; $B=10^{-5}$ T	1p
6	d)	$B=\mu \cdot N \cdot I/l$; $B=8 \cdot 10^{-6}$ T	1p
7	c)	Animation effects	1p
8	b) d)	We can use any of the two methods-b), d).	1p
9		a) The magnetic reversal means that the poles flip so that the North pole becomes the South pole and vice versa. b) In physics repulsion refers to the force tending to separate two objects, such as the force between two like electric charges or magnetic poles c) Good and evil are an example of polarity. d) The scent will attract certain insects. e) The electric current can be either direct or alternating. f) Electric charges of the same sign repel one another. g) The Earth has a huge magnetic field. h) Everyone succumbed to the magnetism of his smile.	1p
10		besieged city- oras aflat sub asediu e.g. The bisieged city surrendered after two years of ordeal. to choose truth over the superstition- a face distinctia intre adevar si superstitie e.g. Choosing the truth over the superstition can be extremely difficult sometimes. the bulk of the letter- cea mai mare parte din scrisoare e.g. Although the bulk of the letter was about unimportant matters, its conclusion contained some interesting remarks. to set apart from- a se distinge de	1p

| | | e.g. Nadia Comaneci's natural talent set her apart from other gymnasts.
to make your blood curdle- a „ingheta" sangele
e.g. He told stories about life in the army that would make your blood curdle. | |

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 45

Item	Answer	Clue	Marks
1	c)	Hippocrates and Galen	1p
2	d)	Cardinal, central and secondary	1p
3	c)	0 and 1	1p
4	a)	A[i][i]	1p
5	b)	c11=5	1p
6	d)	urma lui C=7	1p
7	c)	x=-1, y=-3	1p
8	-	1-True, 2-True, 3- False, 4- False, 5-True, 6-True, 7- False, 8-False, 9- False, 10-True	1p
9		*Positive traits:* moody, affectionate , unassuming, self-confident, gregarious, fair-minded, reliable, agreeable, sensitive *Negative traits:* clinging, ruthless, foolhardy, stubborn, gullible, cunning, foolish, grumpy, quick-tempered, boastful, meddlesome	1p
10		1-D, 2-B, 3-A, 4-B, 5-B, 6-D	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 46

Item	Answer	Clue	Marks
1	a)	Originality	1p
2	b)	Sensentions	1p
3	b)	A[i][n+1-i]	1p
4	d)	A[i][j]=(i+j)/2	1p
5	c)	c22=3	1p
6	b)	c12=5	1p
7	c)	x=-3 and y=6	1p
8	-	1-true, 2-false, 3-true, 4-true, 5-false, 6-true, 7-false, 8-true, 9-false, 10-true	1p
9	-	*Positive traits*: sensible, tough, versatile, neat, quick-witted, witty, easygoing, thoughtful, considerate, brave *Negative traits:* bitchy, fussy, naughty, secretive, stingy, boastful, harsh, deceitful, lazy	1p
10		1-C, 2-C, 3-B, 4-D, 5-A, 6-B	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 47

Item	Answer	Clue	Marks
1	d)	$E_e = 24+36 = 60V$; $r_e = 5\Omega$ $I = \dfrac{E_e}{R+r_e} \Rightarrow I = 2A$; $I = \dfrac{U}{R} \Rightarrow U = 50V$	1p
2	-		1p
3	a)	$E_p = 20V$; $E_e = E+E_p = 40V$; $r_p = r/2 = 1\Omega$; $r_e = r_p + r = 3\Omega$ $I = \dfrac{E_e}{R+r_e} \Rightarrow I = \dfrac{4}{3}A = 1{,}33A$	1p
4	b)	$E_e = 8E$; $r_e = 10r$; $E_e = 16V$; $r_e = 10\Omega$	1p
5	d)	4-0+1=5	1p
6	b)	-	1p
7	b) d)	-	1p
8	-	1B, 2E, 3F, 4A, 5C, 6D	1p
9	-	a. negative; b. electricity; c. power cuts; d. plant; e. transformer; f. shells; g. cord; supply; h. socket; outlet	1p
10	-	A1. Michael Faraday A2. Thomas Alva Edison A3. Benjamin Franklin	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 48

Item	Answer	Clue	Marks
1	c)	$E_e = 24V$ $\dfrac{1}{r_e} = \dfrac{1}{r_1} + \dfrac{1}{r_2} \Rightarrow r_e = 1{,}2\Omega$; $I = \dfrac{E_e}{R+r_e} \Rightarrow I = 3A$	1p
2	-		1p

3	d)	$E_p=15V$; $E_s=E+E=2E$ $E_e=2E+E_p=45V$ $r_p=r/2=2\Omega$; $r_s=r+r=8\Omega$ $I = \dfrac{E_e}{R+r_e} \Rightarrow I=1A$; $I=\dfrac{U}{R} \Rightarrow U=35V$	1p
4	b)	$E_e=4E$; $r_e=8r$ $E_e=16V$; $r_e=16\Omega$	1p
5	d)	$E_p=15V$; $E_s=E+E=2E$; $E_e=2E+E_p=45V$; $r_p=r/2=2\Omega$; $r_s=r+r=8\Omega$ $I = \dfrac{E_e}{R+r_e} \Rightarrow I=1A$; $I=\dfrac{U}{R} \Rightarrow U=35V$	1p
6	b)	$E_e=4E$; $r_e=8r$ $E_e=16V$; $r_e=16\Omega$	1p
7	a)	5-1+1=5	1p
8	c)		1p
9	-	a. electrons; b. moving; c. power; d.electricity; e. voltage; f. magnets; g. extension; supply; h. socket	1p
10	-	A1. Benjamin Franklin; A2. Nikola Tesla; A3. Alessandro Volta	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 49

Item	Answer	Clue		Marks
1		Electricity Consumption in a Month (Wh)	Electricity Consumption in a Month (KWh)	1p
		14940	14,94	
		7200	7,2	
2	a)	E=20% 240=48kWh		1p
3	c)	E=3300·2=6600kwh (for 2 households) E=6600:365 zile $\cong$18kwh (in a day) $\eta = \dfrac{Pusable}{Pconsumed} \Rightarrow Pconsumed = \dfrac{Pusable}{\eta} = \dfrac{18}{0,86} = 20,93kwh$ (intr-o zi)		1p
4	-	Possible advantages: • It uses the energy of the water, which is renewable; • It is an environmentally-friendly way of producing electricity; • It is in accordance with the EU Directive, which requires that, by 2020, the Romanian state should	Possible disadvantages: • Once destroyed, the natural environment can be restored ecologically, but can never get back to its original state. • Any transformation is irreversible and has consequences, often unknown, on the ecosystem • The fauna suffers. Vibrations	1p

		produce over 20% of the total amount of energy, by using renewable sources of energy.	and noise drive the animals away and the aquatic fauna, under the given conditions, suffers severely. • Some fish species are endangered, being nearly impossible to migrate over the newly created dams.	
5	-	The Dark Web consists of: academic, governmental, large libraries, international companies and organizations databases, private intranets which are password-protected, private pages managed by different companies which limiting access to information, documents in formats that can not be indexed, encyclopedias, dictionaries, etc.		1p
6	-	The hydraulic energy, the solar energy, the wind energy, the geothermal energy, the biomass energy.		1p
7	-	Open an Internet browser and enter the address www.google.ro, enter the keyword or phrase in the search box, then type *Enter*. We choose the desired result and click in the address bar and then press *Ctrl + A*, right-click the selection, then we choose the *Copy* option. In the Word document where we wantt to insert the address, we put the cursor and then, by right-clicking the page, we choose *Paste*.		1p
8	-	A-b; B-b; C-a; D-a; E-a		1p
9	-	1-f; 2-b; 3-d; 4-g		1p
10	-	*Suggested answer:* Stanza I: S1 begins with a warning: people have reasons to fear because of the damage brought to the environment: Contrary to how it used to be, the air is nowadays so polluted that we can no longer see the blue skies. Stanza II: speaks about the pollution of the waters. If in the past the waters teemed with life, being clean and clear, now the plight of pollution has spread all the waters of the earth. Stanza V urges to action: humans must start protecting the environment, otherwise the fatal day is bound to come		1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 50

Item	Answer	Clue		Marks
1.		Electricity Consumption in a Month (Wh)	Electricity Consumption in a Month (KWh)	1p
		1800	1,8	
		4980	4,98	

2.	a)	E=250 kWh	1p
3.	c)	E=3285·3=9855kwh (for 3 households) E=9855:365 zile =27kwh (in a day) $$\eta = \frac{Pusable}{P_{consumed}} \quad \Rightarrow \quad P_{consumed} = \frac{P_{usable}}{\eta} = 77,14 kwh$$ (in a day)	1p
4.	-	**Possible advantages:** • The main advantage of producing wind energy is zero emission of pollutants and greenhouse gases, thanks to the fact that no fuel is burnt. • Wind energy production does not involve the production of any kind of waste. • Reduced costs per unit of energy produced. It is in accordance with the EU Directive, which requires that, by 2020, the Romanian state should produce over 20% of the total amount of energy, by using renewable sources of energy **Possible disadvantages:** • One disadvantage is the variation of the wind speed. • Sound pollution- wind turbine produce noise which is comparable to a vehicle travelling at a speed of 70 km/h, which creates discomfort for the people living in the area and can scare the animals. • The rotating turbine blades are a potential threat to some birds; High costs. For a 1MW power plant about $ 1 million is needed	1p
5.	-	Search engines: Google, Yahoo, Excite, Alta Vista, WebCrawler	1p
6.	-	Internet Browsers: Google Chrome, Internet Explorer, Opera, Safari, Mozilla Firefox	1p
7.	-	We open an Internet browser and type de address www.google.ro, then we type the search word or phrase into the search box, press Enter and click on Pictures. We then choose the result and click on See the picture, then by right-clicking we choose Save, type the name for the picture and choose the location, then click on Save.	1p
8		A-a; B-a; C-b; D-b; E-a	1p
9.		1-c; 2-a; 3-e; 4-h	1p
10.	-	**Suggested answer:** Stanza I: S1 begins with a warning: people have reasons to fear because of the damage brought to the environment: Contrary to how it used to be, the air is nowadays so polluted that we can no longer see the blue skies.	1p

| | | Stanza III draws a parallel between the past grandeur of the forests and the consequences and roots of deforestation
Stanza IV gives a warning: you reap what you sow and urges to immediate change in the human behavior towards the environment. | |

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 51

Item	Answer /Clue	Marks
1	It's a liquid substance without smell, colour or taste. It's found in its purest form in nature and it forms rivers, lakes and seas. It occupies three quarters of Earth and it is a component of human beings. It is made of hydrogen, oxygen and influences on the climate.	1p
2	It comes from the rainwater, spring water and the melt snow.	1p
3	Reservoir- a natural or artificial place where water is collected for use, supplying a community or region. Ocean- the vast body of salt water that covers almost three-fourths of the earth's surface Swamp- an area of wet, spongy land	1p
4	FRESHWATER FISHES / MARINE FISHES / BONY FISHES **Freshwater fishes:** Their bodies are hypertonic and freshwater is hypotonic. Passive gain of water across body surface and through gills. Kidneys absorb salts and little water. Large amounts of hypotonic urine contain little salts. **Marine fishes:** Seawater is hypertonic. Passive loss of water through gills. They drink seawater almost constantly. Absorb water in the kidneys. Scanty amount of isotonic urine contains some salts. Salts actively excreted by gills.	1p
5	Freshwater fishes	1p
6	*Hypertonic :* noting a solution of higher osmotic pressure than another solution with which it is compared. *Hypotonic:* noting a solution of lower osmotic pressure than another solution with which it is compared. *Isotonic:* noting or pertaining to solutions characterized by equal osmotic pressure.	1p
7	Open question. It's different in each country. In Spain: ✓ Information about the user, the contract, the company and the bill. ✓ Data about the water consumption and information about the evolution of the annual consumption. ✓ Cost of the bill including the fixed expenses, the variables and the taxes.	1p
8	Open question. It's different in each country.	1p

| 9 | It's about the sum of the fixed expenses and the variables. | 1p |
| 10 | A) 3   B) 250 | 1p |

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 52

Item	Answer /Clue	Marks
1	Because ice has less density than the liquid water. Life on Earth wouldn't be possible if this didn't take place. Examples: igloos.	1p
2	The **melting point** of a solid is the temperature at which it changes state from solid to liquid at atmospheric pressure. The **boiling point** of a substance is the temperature at which the liquid changes into a vapor. The **density** of a substance is its mass per unit volume. Mathematically, density is defined as mass divided by volume. Values for pure water at atmospheric pressure Melting point 0 ℃ Boiling point 100 ° C Density 1 Kg/L (4 ℃)	1p
3	The specific heat is the amount of heat per unit mass required to raise the temperature by one degree Celsius. The specific heat of water is 1 calorie/gram °C = 4.186 joule/gram °C which is higher than any other common substance. As a result, water plays a very important role in temperature regulation.	1p
4	*Valley*- a wide, more or less flat, and relatively low region drained by a river system *Gulf*- a portion of an ocean or sea partly enclosed by land *River*- a natural stream of water flowing in a definite course	1p
5	Osmoregulation is the active regulation of the osmotic pressure of an organism's body fluids to maintain the homeostasis of the organism's water content.	1p
6	a) Large amount of hypotonic urine.	1p
7	Cartilaginous fishes	1p
8	It's a bar chart representing the evolution of the water consumption in the last year.	1p
9	Students have to do a linear equation like this one: 115 = 1,1 (24 + 2,1 x) x represents the cubic metres which have been consumed and 10% is taxes.	1p
10	Students have to do a linear equation like this one: x represents the fixed expenses and 2x stands for the cost of the consumption. 2x must be divided betwwen the cost of one cubic metre.	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 53

Item	Answer /Clue	Marks
1	It is an action taken by some communities in Spain. It consists in giving 100.000 low energy light bulbs to encourage its progressive use at home.	1p
2	They last eight times more and provide the same light. They save up to 80 % of the energy used by the incandescent light bulbs. Because of the savings in electricity. They are "cold": most of the energy they consume is transformed into light.	1p
3	15%	1p
4	80%	1p
5	*Sunset:* the setting or descent of the sun below the horizon in the evening.	1p
6	1. Vitreous chamber 7.Blind spot / 2. Suspensory ligaments 8.Optic nerve / 3. Lens 9.Fovea centralis / 4.Cornea 10.Retina / 5.Iris 11.Choroid / 6.Pupila 12.Sclera	1p
7	It's in the introduction.	1p
8	A convergent lense is thicker in the centre. Because of this, there are more rays of light in a point, which is called focus.	1p
9	No, there aren't.	1p
10	Dawn:the first appearance of daylight in the morning	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 54

Item	Answer /Clue	Marks
1	Lighting: 30 euros. Savings: 24 euros	1p
2	248 kg of CO_2	1p
3	250 euros	1p
4	*Noon*: midday	1p
5	a) Refraction	1p
6	Photosynthesis is the process in which light energy is converted into chemical energy. Using the energy of light, carbohydrates such as sugars are synthesised from carbon dioxide and water.	1p
7	The 3D image is created from 4 two-dimensional images located in the vertices of a square. If we can these images join in one point using the refraction, we will get the hologram.	1p
8	To increase its curvature and thickness.	1p

9	*Afternoon*: the time from noon until evening;	1p
10	*Evening:* the latter part of the day and early part of the night	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 55

Item	Answer /Clue					Marks
1	Marconi					1p
2	b)					1p
3	c)					1p
4			Fraction	Decimal	Porcentaje		1p
		a)		0,5	50 %		
		b)		0,67	67 %		
		c)		0,17	17%		
5			Fraction	Decimal	Porcentaje		1p
		a)		0,3	30%		
		b)		0,7	70%		
		c)		0,7	70%		
6			Fraction	Decimal	Porcentaje		1p
		a)		0,33	33%		
		b)	0	0	0%		
		c)		0,67	67%		
7			Fraction	Decimal	Porcentaje		1p
		a)		0,4	40%		
		b)		0,6	60%		
		c)		0,75	75%		
8		ARCHES		LOOP	WHORLS		1p
9	Suggested solution: A fingerprint is an individual characteristic; no two people have been found with the exact same fingerprint pattern. A fingerprint pattern will remain unchanged for the life of an individual; however, the print itself may change due to permanent scars and diseases.						1p
10	Suggested solution:In qualitative analysis we want to know which elements or characteristic chemical species are present. In quantitative analysis we are interested in the relative amounts of the components present.						1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 56

Item	Answer /Clue	Marks
1	c)	1p
2	a)	1p
3	The answer depends on the teacher's explanation.	1p
4	The answer depends on the teacher's explanation	1p
5	Open asnwer. Example, explosives to make tunnels	1p
6	Glucose	1p
7	Starch	1p
8	10 (37 – rectal temperature) / 8 = Hours 10 (37 –35) / 8 = Hours ; 10 (2) / 8 = 2.5 hours ; 2 hours and 30 minutes.	1p
9	True	1p
10	True	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 57

Item	Answer /Clue	Marks
1		1p
2	b)	1p
3	a)	1p
4	79,88 m	1p
5	2,31 m	1p
6	12 m	1p
7	63,43º	1p
8	minerals	1p
9	monuments	1p
10	landscape	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 58

Item	Answer /Clue	Marks
1	Monuments	1p
2	a) opera house b) temple c) lighthouse	1p
3	a) reef b) rainforest c) ruins	1p
4	a) tomb b) castle	1p
5	The calcium carbonate of all these rocks is attacked by acids, and it turns into a plaster called sulfin, which is not only more soluble and therefore more easily washed away, but also has more volume. Because of this, it acts as a wedge on the stone, increasing its destruction by mechanical erosion. This produces a surface decomposition of the stone in the form of peels, grit and detachment of the outer layers. As a result, this produces wear and sculptural relief forms and polychrome loss and even detachment parts, which can cause mechanical instability and serious damage to such buildings.	1p
6	Nitrogen oxide, sulfur dioxide and sulfur trioxide produced by factories, power plants and vehicles that burn coal or petroleum products containing sulfur	1p
7	$$CO_2 + H_2O_{(g)} \rightarrow H_2CO_{3(ac)}$$ $$SO_{2(g)} + O_{2(g)} \rightarrow SO_{3(g)}$$ $$SO_{3(g)} + H_2O_{(g)} \rightarrow H_2SO_{4(ac)}$$ $$NO_{(g)} + O_{2(g)} \rightarrow NO_{2(g)}$$ $$NO_{2(g)} + H_2O_{(g)} \rightarrow HNO_{3(ac)} + NO_{(g)}$$	1p
8	With the shade, with a mirror, using trigonometry	1p
9	Free answer	1p
10	Thales' theorem.	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 59

Item	Answer /Clue	Marks
1	a) Sympathetic nervous system	1p
2	b) Neck sprains and strains.	1p
3	a) True	1p
4	Having a sensation of things going round and round	1p
5	A pain located in the head	1p
6	Rigid or firm	1p
7	A disordered condition in which one feels oneself or one's surroundings	1p

	whirling about	
8	something, as a drug or treatment, that relieves pain	1p
9	therapy performed on a person's body to restore its natural ability, as exercises to strengthen an injured limb.	1p
10	A sense of overwhelming fear or dread often with acute physical symptoms, as palpitations and sweating	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 60

Item	Answer	Clue	Marks
1	b)	treatment	1p
2	a)	symptom	1p
3	b)	treatment	1p
4	a)	symptom	1p
5	-	Open answer	1p
6		$0{,}65x = 3000$ $x = 4615{,}38$ m^2	1p
7		$80.000 \times 1{,}26 = 100.800$ visitors	1p
8	False	The final decrease is calculated in this way. $0{,}90 \times 0{,}80 = 0{,}72$ $100\% - 72\% = 28\%$	1p
9	-	a) 1,4 b) 0,85 c) 1,56	1p
10	d)	$0{,}029 \times 350 = 10{,}15$	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 61

Item	Answer /Clue	Marks
1	10 km – north-east	1p
2	10 m/s – south-east	1p
3	130 km/h – north-west	1p
4	a)60N b)20N	1p
5	10 m	1p
6	largest- 9 units smallest- 1 unit	1p
7	Force VECTOR Temperature NOT VECTOR Volume NOT VECTOR Time NOT VECTOR Velocity VECTOR Length VECTOR	1p
8	No	1p
9	13 km – south-east.	1p

10	300 km/h	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 62

Item	Answer /Clue	Marks
1	A-D, F-H, E-B	1p
2	A-C, F-B, G-H, F-E	1p
3	F-B-E, G-H, A-C-D	1p
4	A-D, E-B	1p
5	Energy SCALAR Pressure SCALAR Heat SCALAR Momentum VECTOR Gravity VECTOR Mass SCALAR	1p
6		1p
7		1p
8	25 km/h	1p
9	15 km/h	1p
10	100 km/h	1p

For items 6 and 7:

Vehicle	Velocity	Direction
L	20	East
M	30	West
N	10	North

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 63

Item	Answer /Clue	Marks
1	a) $h = \frac{1}{2}g.t^2$ $80 = \frac{1}{2}10.t^2$; $t^2 = 16$ $t = 4\,s$ b) $v = g.t$ $v = 10.4$ $v = 40\,m/s$	1p
2	$v^2 = 2.g.h$ $25^2 = 2.10.h$ $625 = 20.h$ $h = 31,25\,m$	1p
3	a) $v = v_0 + g.t$ $v = 10 + 10.3$ $v = 40\,m/s$ b) $v^2 = v_0^2 + 2.g.h$ $40^2 = 10^2 + 2.10.h$ $1600 = 100 + 20.h$ $1500 = 20.h$ $h = 75\,m$	1p
4	a) $v^2 = v_0^2 + 2.g.h$ $100^2 = v_0^2 + 2.10.375$ $10000 = v_0^2 + 7500$ $v_0^2 = 2500$ $v_0 = 50\,m/s$ b) $v = v_0 + g.t$ $100 = 50 + 10.t$ $t = 5\,s$ $t_1 = 1s$ => $h_1 =?$ $t_2 = 4s$ => $h_2 =?$ $h_2 = 50.4 + \frac{1}{2}10.4^2$ $h_2 = 200 + 80$ $h_2 = 280\,m$ $h_1 = v_0.t_1 + \frac{1}{2}g.t_1^2$ $h_1 = 50.1 + \frac{1}{2}10.1^2$ $h_1 = 55\,m$	1p
5	a) $v = v_0 - g.t$ $v = 40 - 10.2$ $v = 20\,m/s$	1p

	b)	$h_{max} = \frac{v_0^2}{2.g}$	$h_{max} = \frac{40^2}{2.10}$	$h_{max} = 80\ m$	
	c)	$t_{total} = 2.\frac{v_0}{g}$	$t_{total} = 2.\frac{40}{10}$	$t_{total} = 8\ s$	
	d)	$v = v_0 - g.t_{total}$	$v = 40 - 10.8$	$v = -40\ m/sn$	

Item		Answer			Marks
6	a)	$h_{max} = \frac{v_0^2}{2.g}$ $\quad$ $h_{max} = \frac{30^2}{2.10}$ $\quad$ $h_{max} = 45\ m$ $h_{max\,2} = 45 + 35$ $\quad$ $h_{max\,2} = 80\ m$ b) $\quad$ $v^2 = 2.g.h_{max\,2}$ $\quad$ $v^2 = 2.10.80$ $\quad$ $v = 40\ m/s$				1p
7	a) $\quad$ $v = v_0 + g.t$ $\quad$ $-55 = 5 + (-10).t$ $\quad$ $t = 6\ s$ b) $\quad$ $h = v_0.t + \frac{1}{2}g.t^2$ $\quad$ $h = 5.6 + \frac{1}{2}(-10).6^2$ $\quad$ $h = -150\ m$ (The minus sign indicates that the package has fallen 150 m below the point of release)					1p
8	a) $\quad$ $h = \frac{1}{2}g.t^2$ $\quad$ $125 = \frac{1}{2}10.t^2$ $\quad$ $t = 5\ s$ b) $\quad$ $x = v_0.t$ $\quad$ $x = 30.5$ $\quad$ $x = 150\ m$					1p
9	a) $\quad$ $h = \frac{1}{2}g.t^2$ $\quad$ $h = \frac{1}{2}10.10^2$ $\quad$ $h = 500\ m$ b) $\quad$ $x = v_0.t$ $\quad$ $x = 100.10$ $\quad$ $x = 1000\ m$					1p
10	a) She **leaned** forward and whispered something in my ear. b) The ants **were crawling** up my leg while I was sitting in the garden. c) **Stretch** your arms above your head. d) When they attacked me, I **kicked** at them and screamed for help. e) Just **pick up** the phone and call him. f) The table was too heavy to lift so we had to **drag** it across the room. g) Could you help me **lift** this table please? h) He told the sergeant to **march** us for another five minutes.					1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 64

Item	Answer /Clue	Marks
1	The translations of the words depend on the mother tongue.	1p
2	distance equation: $h = v_0.t \mp \frac{1}{2}.g.t^2$; $\quad$ rate equation: $v = v_{0 \mp} g.t$ rate equation regardless of time $v^2 = v_0^2 \mp 2.g.h$	1p
3	a) $\quad$ locivety $\quad$ **velocity** b) $\quad$ itmono $\quad$ **motion** c) $\quad$ vigrtya $\quad$ **gravity** d) $\quad$ ghtieh $\quad$ **height** e) $\quad$ lfaingl $\quad$ **falling**	1p
4	c)	1p
5	This kind of problem mass is not important. We just only look at the the hight. The velicity of the ball when it strikes the on the ground can be easly solved	1p

	by using the formulas (V^2=2gh). According to this equation the last velocity of the subject depends on the hight. So; v$_1$=v$_2$; because they realesed from the same hights, the last ball realesed from 2h, so v$_3$ is the biggest velocity. Correct answer is e) v$_1$=v$_2$<v$_3$	
6	$x = V_{0X} \cdot t$; 300=60t $\Rightarrow$ t=5s $V_{0X} = 75 \cdot cos37^0$=60m/s ; y=y$_0$+ v$_{oy}$t +at^2/2 $\Rightarrow$ y=100 m	1p
7	- *to march:* to walk steadily and rhythmically forward in step with other - *to throw*: to send something through the air with force - *to stretch*: to extend to full length - *to tiptoe*: to walk or move quietly on one's toes - *to lift*: to direct from a lower position to a higher one	1p
8	1) She **leaned** forward and whispered something in my ear. 2) The ants **were crawling** up my leg while I was sitting in the garden. 3) **Stretch** your arms above your head. 4) When they attacked me, I **kicked** at them and screamed for help. 5) Just **pick up** the phone and call him. 6) The table was too heavy to lift so we had to **drag** it across the room. 7) Could you help me **lift** this table please? 8) He told the sergeant to **march** us for another five minutes.	1p
9		1p
10	b)	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 65

Item	Answer /Clue	Marks
1	$456 = 4.56 \times 10^2$ $17,000,000 = 1.70 \times 10^7$ $1 = 1.0 \times 10^0$	1p
2	Perimeter: 80 cm; Area: 384 cm^2	1p
3	Yes. $c^2 = a^2 + b^2$ $c = \sqrt{24^2 + 25^2} = 51$	1p
4	$d = \sqrt{5^2 - 0.9^2}$ $d = 4.9$ m	1p
5	60 mm	1p
6	14 mm.	1p
7	$a_1 : 45 = 5.9$; $a_2 : 405 = 5.9.9$ $a_3 : 3645 = 5.9.9.9$; $a_4 : 32805 = 5.9.9.9.9$	1p
8	5%	1p
9	$6\sqrt{3}$ cm.	1p
10	25m	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 66

Item	Answer /Clue	Marks
1	I.D II.E III.A IV.C V.B	1p
2	a) Change the water activity of the food. Water activity decribes the amount of moisture that is available in food. Bacteria and other microorganisms need foods with high water activities in order to grow. b) Add preservatives to the food. They can act to improve appearance, moisture, and texture of the food. c) Control the temperature of the food. During processing, foods are heat treated (pasteurization, canning and boiling) to kill any microorganisms already present in the raw ingredients.	1p
3	a) decreasing the water activity. Ex:crackers b) adding preservatives. Ex.packaged snack cakes c) temperature control. Ex: ice cream	1p
4	a) $456 = 4.56 . 10^2$ b) $17,000,000 = 1.7 . 10^7$; c) $1 = 1.0 . 10^0$	1p
5	a. ctareiba **bacteria** b. tivesvapreser **preservatives** c. nisganromicsm **microorganism** d. sivinsdio **division**	1p
6	$20 \times 15 = 300 \Rightarrow 400/20 = 20$ divisions and $2^{20} = 2,097,152$ or 2.10×10^6	1p
7	a. Perfect square is the square of a whole number. b. Square root of a number is the length of the side of a square with an area equal to the number.	1p
8	First evaluate anything in parentheses. Next look for exponents followed by	1p

	multiplication and division (reading from left to right) and lastly, addition & subtraction (again reading from left to right.).	
9	The attractive electric force between proton and electron is given by: $$F = k\frac{q_1 q_2}{r^2} = k.\frac{e^2}{r^2} = \frac{9\ x\ 10^9\ x\ (1.6\ x\ 10^{-19})^2}{(5.3\ x\ 10^{-11})^2} = 8.2\ x\ 10^{-8}\ N$$ The gravitational force between these two particles is: $$F = G\frac{m_p\ m_e}{r^2} = 6.7\ x\ 10^{-11}\frac{9.1\ x\ 10^{-31}\ x\ 1.67\ x\ 10^{-27}}{(5.3\ x\ 10^{-11})^2} = 3.6\ x\ 10^{-47}\ N$$	1p
10	The forces $F_{31} = F_{32}$, because the net force is zero. $$F_{31} = k\frac{q_1 q_3}{d^2}\ \ ;\ \ F_{32} = k\frac{q_2 q_3}{(d/3)^2}\ \Rightarrow\ \frac{k\ q_1 q_3}{d^2} = k\frac{q_2 q_3}{(d/3)^2}\ \Rightarrow\ q_1 = 9q_3$$	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 67

Item	Answer /Clue	Marks
1	<table><tr><td>Length in centimeters</td><td>Tally</td><td>Frequency</td></tr><tr><td>2</td><td>llll</td><td>4</td></tr><tr><td>3</td><td>HHl</td><td>5</td></tr><tr><td>4</td><td>llll</td><td>4</td></tr><tr><td>5</td><td>HHl ll</td><td>7</td></tr><tr><td>6</td><td>llll</td><td>4</td></tr><tr><td>7</td><td>ll</td><td>2</td></tr><tr><td>8</td><td>llll</td><td>4</td></tr></table>	1p
2	Find the mean value of the given data. (4x2+ 3x5+4x4+5x7+6x4+7x2+8x4) / 30 = 4.8	1p
3	Find the median. 5	1p
4	Find the mode value. 5	1p
5	<table><tr><td>Score</td><td>Frequency</td></tr><tr><td>1</td><td>7</td></tr><tr><td>2</td><td>8</td></tr><tr><td>3</td><td>6</td></tr><tr><td>4</td><td>4</td></tr><tr><td>5</td><td>7</td></tr><tr><td>6</td><td>8</td></tr></table>	1p
6	Find the median value. 3	1p
7	Find the mode value. 2 and 6.	1p
8	Find the mean value. 3,5	1p
9	Write down the mode number of the goals scored.1; Find the median number.2	1p
10	Work out the mean number of the goals scored. 2,1	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 68

Item	Answer/ Clue	Marks
1	a. TRUE - A sound wave transports its energy by means of particle interaction. A sound wave cannot travel through a vacuum. This makes sound a mechanical wave. b. TRUE - Absolutely! Particles do not move from the source to the ear. Particles vibrate about a position; one particle impinges on its neighboring particle, setting it in vibrational motion about its own equilibrium position. d. TRUE - As particles move back and forth longitudinally, there are times when they are very close within a given region and other times that they are far apart within that same region. The close proximity of particles produces a high pressure region known as a compression; the distancing of particles within a region produces a low pressure region known as a rarefaction. Over time, a given region undergoes oscillations in pressure from a high to a low pressure and finally back to a high pressure.	1p
2	c. FALSE - Only electromagnetic waves can travel through a vacuum; mechanical waves such as sound waves require a particle-interaction to transport their energy. There are no particles in a vacuum. e. FALSE - Never! Waves are either longitudinal or transverse. Longitudinal waves are those in which particles of the medium move in a direction parallel to the energy transport. And that is exactly how particles of the medium move as sound passes through it. f. FALSE - It is the disturbance that moves from the tuning fork to one's ear. the particles of the medium merely vibrate back and forth about the same location, never really moving from that location to another location. This is true of all waves - they transport energy without actually transporting matter. g. FALSE - All sound waves are created by vibrating objects of some sort. h. FALSE - Quite surprisingly to many, most sounds which we are accustomed to hearing are characterized by particle motion with an amplitude on the order of 1 mm or less.	1p
3	c. TRUE - An intense sound is the result of a large vibration of the source of sound that sets particles of the medium in motion with a high amplitude of movement about their usual *rest* position. d. TRUE - Loudness is more of a subjective response to sound, dependent in part upon the *quality* of an observer's ears. Intensity is an objective characteristic of sound that can actually be measured in Watts/meter^2. However, intense sounds will always be observed to be louder by an observer than less intense sounds.	1p

4	a. FALSE - Intensity is a power/area relationship and as such the units are typically Watts/meter2. The Watt is a unit of power and the meter2 is a unit of area.	1p
	b. FALSE - Intense sounds are simply sounds which carry energy outward from the source at a high rate. They are most commonly sound waves characterized by a high amplitude of movement. While frequency does effect one's perception of the loudness of a sound, it does not effect the intensity of a sound wave.	
	e. FALSE - Not only must the sound be intense enough to cause an audible disturbance of the mechanisms of the ear, it also must fall within the human frequency range of 20 Hz to 20000 Hz.	
5	g. TRUE - The threshold of pain has an intensity of 1 W/m^2 and the threshold of hearing has an intensity of 1.0×10^{-12} W/m^2. That's a ratio of one trillion.	1p
	j. TRUE - Always remember that a decibel rating is based on the logarithmic function. A sound which is 1000 times (103 times) more intense than another sound is 3 bels or 30 dBels greater on the decibel scale.	
6	f. FALSE - Humans actually have a phenomenal range of intensities to which they are sensitive to. The intensity of the sound at the threshold of pain is one-trillion times more intense than the sound at the threshold of hearing. That's quite a range.	1p
	h. FALSE - No! Since the decibel scale is based on a logarithmic function, this is simply not the case.	
	i. FALSE - Two sounds separated by 20 dB on the decibel scale have intensity ratios of 100:1. If one sound is 20 times more intense than another sound, then it is 13 dB higher on the decibel scale [that comes from 10*log(20)].	
	k. FALSE - Two machines would produce twice the intensity; but when converted to the logarithmic scale of decibels, there decibel rating would differ by 3 dB.	
	l. FALSE - Intensity varies inversely with distance from the source. To be more specific, it varies inversely with the square of the distance.	
	m. FALSE - If the distance from the source is doubled, then the intensity is decreased by a factor of four.	
	n. FALSE - If the distance from the source is tripled, then the intensity is decreased by a factor of nine.	
7	b. TRUE - For the same material, speed is greatest in materials in which the elastic properties are greatest. Despite the greater density of solids, the speed is greatest in solids, followed by liquids, followed by gases.	1p

	f. TRUE - This is the definition of elasticity. Elasticity is related to the ability of the particles of a material to return to their original position if displaced from it.	
8	a. FALSE - The speed of a wave is calculated by the product of the frequency and wavelength. However, itdoes not depend upon the frequency and the wavelength. An alteration in the frequency or the wavelength will not alter the speed. c. FALSE - Sound waves travel faster in solids because the particles of a solid have a greater elastic modulus. That is to say that a disturbance of a particle from its rest position in a solid leads to a rapid return to its rest position and as such an ability to rapidly transmit the energy to the next particle. d. FALSE - Sound is a mechanical wave which moves due to particle interaction. There are no particles in a vacuum so sound can not move through a vacuum. e. FALSE - Sound waves (like all waves) will travel slower in more dense materials (assuming all other factors are equal).	1p
9	g. TRUE - A more rigid material is characterized by particles which quickly return to their original position if displaced from it. Sound moves fastest in such materials. j. TRUE - The speed of sound through air is dependent upon the temperature of the air. k. TRUE - This is a big principle. Know it. n. TRUE - For a guitar string, the equation for the speed of waves is $v = SQRT(F_{tens}/mu)$. From the equation, it is evident that an increase in mass per unit length (mu) will result in an decrease in the speed; they are inversely related. p. TRUE - The speed of a wave in a string is directly related to the square root of the tension in the string. So the speed will be changed by the square root of whatever factor the tension is changed.	1p
10	h. FALSE - The speed of sound through a material is dependent upon the properties of the material, not the characteristics of the wave. i. FALSE - A loud shout will move at the same speed as a whisper since the speed of sound is independent of the characteristics of the sound wave and dependent upon the properties of the material through it is moving. l. FALSE - Speed is distance traveled per time. For this case, the sound travels a distance of 254 m (to the cliff and back) in 0.720 seconds. That computes to 353 m/s.	1p

m. FALSE - For a guitar string, the equation for the speed of waves is v = SQRT (F$_{tens}$/mu). From the equation, it is evident that an increase in tension will result in an increase in the speed; they are directly related.

o. FALSE - The speed of a wave in a guitar string varies directly with the square root of the tension. If the tension is doubled, then the speed of sound will increase by a factor of the square root of two.

q. FALSE - An increase in the linear mass density by a factor of four will decrease the speed by a factor of 2. The speed is inversely related to the square root of the linear density.

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 69

Item	Answer /Clue	Marks
1	a) Y=-20X+100 b)Y= -25X+200	1p
2	a) the slope is 2 meters per second b) Y= 2X+3 c)21	1p
3	24 unit2	1p
4	10 seconds	1p
5	a) infinity solutions b) one solution c) no solution	1p
6	the solution set is {4,1/2}	1p
7	11 and 12	1p
8	The solution set is { 0 , 5 }	1p
9	85 m	1p
10	-3	1p

Observation: Partial scores may be granted. Working time: 2 hours

SOLUTION TEST 70

Item	Answer /Clue	Marks
1	The solution methods of quadratic equations are: - Completing square - Factoring - Graphing - The quadratic formula	1p
2	The translations of the words depend on the mother tongue.	1p
3	Three examples of the parabolas could be as below: Fountains, satellite dishes, the path of a ball in the air	1p
4	a)If the light comes from the *focus* of *parabola,* it will be reflected as a parallel beam which is parallel to *the axis of symmetry*. This principle works for the	1p

	light. b)The graphs of *quadratic equations* are called *parabolas* which are a set of points in one planet that form a *u-shaped curve*.	
5	a)lprealal **parallel** b)nitecgnertsi **intersecting** c)dciontnice **coincident** d)arabploa **parabola** e)terxve **vertex**	1p
6	No solution: x+y= 2 ; 3x+3y= -3 These equations represent two parallel lines on coordinate axis therefore there is no intersecting point. It means that there is no solution.	1p
7	Infinite solution: x-2y=1 ; -3x+6y=-3 These two equations represent the coincident lines therefore all the common points on these lines are the solutions for them. It means that there are infinite solutions.	1p
8	Unique solution:2x+3y=11 (Let's use the elimination method) x-y=3 (we enlarge each term by 3) : 2x+3y=11 3x-3y=9 (add these equations side by side) $\Rightarrow$ 5x+0=20 x=4 (put 4 instead of x to find the "y" value): 8+3y=11$\Rightarrow$3y=3 ; y=1 the solution has 1 element which is (4,1).	1p
9	If Mehmet sells no umbrellas, then x = 0, and he makes a negative profit (loss) of \$96. The break-even point comes when the profit changes from negative to positive, at an x-intercept. Using the quadratic formula, you get two intercepts: at x = 2,000 and x is approximately 12. The first (smaller) x-intercept is where the function changes from negative to positive. The second is where the profit becomes a loss again (too many umbrellas, too much overtime?). So, 13 umbrellas would yield a positive profit — he'd break even (have zero profit).	1p
10	The underpass is 72 m. high and 120 m. wide. The highest point occurs at the vertex: The x-coordinate of the vertex is 0, so the vertex is also the y-intercept, at (0, 60). The two x-intercepts represent the endpoints of the width of the overpass. Setting 72– $0.02x^2$ equal to 0, you solve for x and get x = 60, –60. These two points are 120 units apart — the width of the underpass.	1p
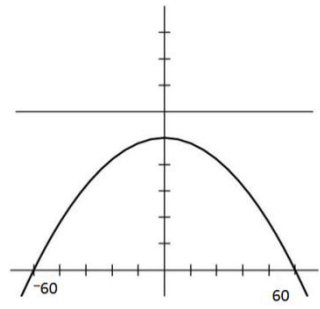
Observation: Partial scores may be granted. Working time: 2 hours

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SUMMARY