ÉRETTSÉGI VIZSGA ● 2008. május 14.

FIZIKA
ANGOL NYELVEN

KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA

2008. május 14. 8:00

Az írásbeli vizsga időtartama: 120 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

OKTATÁSI ÉS KULTURÁLIS
MINISZTÉRIUM

Név: .... osztály:......

Instructions to Candidates

Time allowed for this examination paper is 120 minutes.
Read the instructions of this question paper carefully, and make sure that you do not run out of time.
You may solve the problems in any order.
Materials allowed: calculator, data tables.
If there is not enough space provided for the solution of the problem you may use the blank sheets at the end of the examination paper. On the sheets attached please indicate the number of the problem.

Indicate here which of the problems 3/A and 3/B you have chosen. (That is which one you want to be assessed.)

3/ ☐

Név: .... osztály:......

PART ONE

Exactly one of the answers to each of the questions below is correct. Write the appropriate letter in the white square on the right. (If necessary check your answer by calculation.)

1. **An object starting from rest and undergoing uniformly accelerated motion covers a distance of 1 m during the first second of its motion. How much distance does it cover during the 2nd second of its motion?**

    A) 1 metre.
    B) 3 metres.
    C) 4 metres.

2 points	

2. **A stone is projected with a vertically upward speed of 20 m/s. What is the direction of its acceleration after 2 s elapsed?** $\left(g = 10 \frac{\text{m}}{\text{s}^2} \right)$

    A) It points vertically upward because the stone was projected up.
    B) Its acceleration is zero, because the stone is at rest at that moment.
    C) The acceleration is directed downward because the gravitational force points downward.

2 points	

3. **A closed bus initially travelling at a constant speed of 40 km/h suddenly breaks. What is the direction of the force that the passengers experience?**

    A) They do not feel any force because they slow down with the bus.
    B) They feel that a force pushes them forward.
    C) They feel that a force pulls them backward.

2 points	

4. **A rectangular block is at rest on the horizontal table. Which one of the following statements is *not true*?**
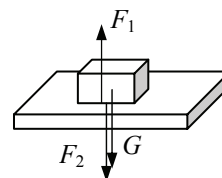

A) The gravitational force exerted on the block on the table is equal in magnitude to the normal force exerted by the table on the block.
B) The force exerted by the block on the table and the force exerted by the table on the block have the same magnitude.
C) Altogether the sum of the downward forces is greater than the sum of the upward forces.

2 points

5. **Three simple pendulums are started from the same small angular displacements. They are all displaced to the same direction, the masses of the bobs are *m* and *2m*, and they are all released at the same instant. Which two bobs will reach the furthest position on the other side at the same time if air resistance is negligible?**
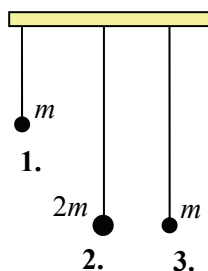

A) The first and the second.
B) The second and the third.
C) The first and the third.

2 points

6. **A narrow tube is attached to a container filled with water. The level of water is marked on the tube when the temperature of the water is 1 °C and when the temperature is 100 °C. Then 98 equidistant marks are painted to the tube. What is the temperature of the water when the level of water is at the 4ᵗʰ mark counted from the bottom?**
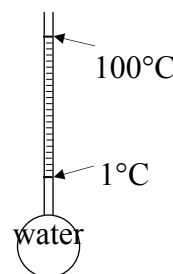
A) It is between 1 °C and 4 °C .
B) It is 4 °C.
C) It is above 4 °C.

2 points

7. **Which process needs more energy: 1 kg ice at a temperature of –1 ºC is heated to +1 ºC (case 1) or 1 kg water at a temperature of +1 ºC is heated to +3 ºC (case 2)?**

A)   More energy is needed in the first case.
B)   More energy is needed in the second case.
C)   The same energy is needed in both cases.

2 points

8. **Which physical quantity has the unit of J/kg?**

A)   Specific heat capacity.
B)   Specific latent heat of fusion.
C)   Heat capacity.

2 points

9. **When the atmospheric pressure on the coast of the Mediterranean Sea is 100 000 Pa, what might be the atmospheric pressure on the coast of the Dead Sea, which is 400 metres below the sea level?**

A)   Less than 100 000 Pa, because the atmospheric pressure increases as the height increases.
B)   It is exactly 100 000 Pa, because though the atmospheric pressure decreases as the height increases but below the sea level it remains constant.
C)   More than 100 000 Pa, because the atmospheric pressure increases as the height decreases.

2 points

10. **How does the root-mean-square (r.m.s.) value of the current in the electric system of the flat change if the vacuum-cleaner is turned off?**

A)   The r.m.s. value of the current increases because the net resistance of the circuit decreases.
B)   The r.m.s. value of the current decreases, because the net resistance of the circuit increases.
C)   The r.m.s. value of the current does not change, because the power delivered is constant.

2 points

11. An electroscope is placed inside of a metal net and connected to the net with a piece of wire. The net is charged. Will the pointer of the electroscope be displaced?

    A) Yes because charges will move from the net to the electroscope.
    B) No because the electroscope is in a "Faraday's cage".
    C) No because the glass body of the electroscope is an insulator.

2 points

12. By means of a magnet the colours of a TV screen in which there is a cathode ray tube (CRT) can be deformed. What is the explanation of the phenomenon?

    A) The colour of the points in the screen is determined by the internal magnetic field of the TV set and this is altered by the magnet.
    B) The moving electrons in the CRT are deflected by the external magnetic field.
    C) The magnetic field distorts the light (electromagnetic wave) that is emitted by the CRT thus we observe a distorted image.

2 points

13. Why high voltage is used for the transmission of electrical power?

    A) Because power stations generate high voltage current.
    B) Because the transmission of energy is quicker in this way.
    C) Because the power loss is smaller in this case.

2 points

14. In a mirror attached to the vertical wall we would like to see ourselves from top to toe. What is the least size of the mirror?

    A) The height of the mirror should be at least the half of our height.

    B) The height of the mirror should be the same as our height.

    C) It depends on the distance at which we observe ourselves.

2 points

15. Why does New Moon change to Full Moon?

A) Because the Moon rotates about its axis, so at nights we see different parts of it.

B) Because the Moon orbits about the Earth, and the shadow of the Earth will be different on it.

C) Because from the Earth we can see only that part of the Moon which is illuminated by the Sun, but from different directions.

2 points

16. Which of the following celestial objects exerts the greatest force on the Sun?

A) The Pluto.

B) The Moon

C) The Earth.

2 points

17. Which of the following statements can be explained with the wave-like behaviour of light?

A) Light might cause the electrons to be ejected from metals. (Photoelectric effect.)

B) Light consists of energy quanta (photons).

C) When light falls to a single slit it is diffracted.

2 points

18. In which process nuclear fusion do *not* occur?

A) Explosion of a Hydrogen bomb.

B) Explosion of an atom bomb.

C) Nuclear transformation in the core of the Sun.

2 points

19. Which quantity can be derived directly from the elementary charge and the Faraday constant (96500C)

    A)   Avogadro number.
    B)   The specific charge (charge-to-mass ratio).
    C)   The work function of a metal.

2 points

20. A sample containing radioactive Caesium is examined in a laboratory. The graph shows the mass of Caesium in the sample as a function of time. What is the half-life of Caesium?
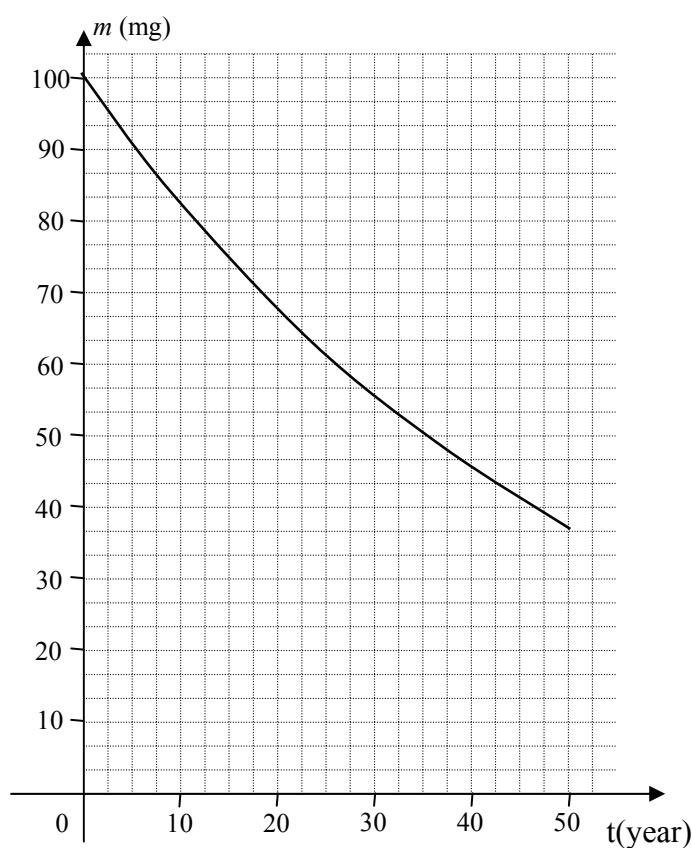
    A)   50 years
    B)   35 years
    C)   25 years

2 points

PART TWO

Solve the following problems. Justify your answers by means of explanations, diagrams or calculations, depending on the nature of the problem. Make sure that the meaning of all notations used is clear.

1. **You are about to replace your boiler. You can choose either electric boiler or a gas fired boiler. One aspect how to choose is to compare the prices of the unit energies. (Loss is considered to be the same in both cases.)**

   Compare the prices of the different energy sources if the following data are given by ELMÜ and Fővárosi Gázművek (2006. 03). Which type of boiler is more efficient?

Price of electric energy per kWh (Ft/kWh)	Calorific value of the gas (MJ/m^3)	Price of gas per m³ (Ft/m^3)
26.80	34.00	58.34

Total
14 points

Név: .... osztály:......

**2.** **A GPS (Global Positioning System) satellite undergoes uniform circular motion around the Earth above the Equator. The radius of the circle is 20180 km, and the satellite orbits in the direction similar to the rotation of the Earth. There is another satellite which has twice the mass of the former one and which is at a geostationary orbit at a height of 35786 km. (Geostationary or geosynchronous satellites orbit in the plane of the Equator and they are always above the same point of the Earth.)**

   a) Will the smaller satellite lag behind a chosen point on the Equator of the Earth?
   b) What is the distance covered by the smaller satellite in 1 hour? (The radius of the Earth is 6380 km and its time of revolution is 24 hours.)

a)	b)	Total
15 points	3 points	18 points

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Solve only one of the problems 3/A and 3/B. Indicate your selection on the inside of the front cover.

3/A   There is 1 kg water of temperature 20 °C in a well-insulated Thermos. Hot water is poured to it and while the mixture is continuously stirred, the temperature is measured. The graph shows the temperature of the mixture as a function of the mass of the mixture. (Specific heat capacity of water is considered constant.)
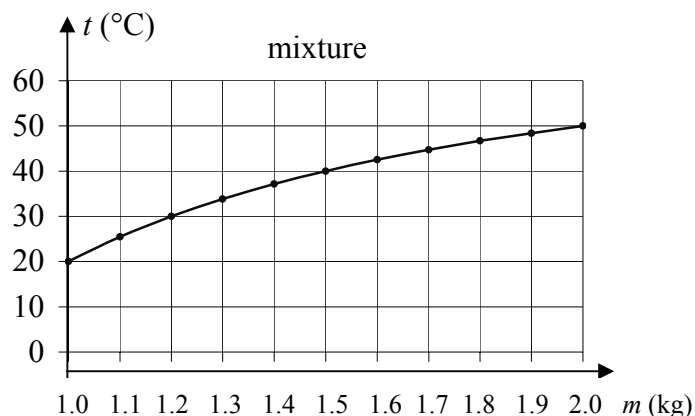
a) Fill in the first and the second column of the table according to the graph and calculate the values of the remaining part of the table.
b) Find the temperature of the hot water.
c) Explain why the graph is not a straight line.

$t_{mixture}$ (°C)	$m_{mixture}$ (kg)	m_{cold} (kg)	m_{hot} (kg)	Δt_{cold} (°C)	Δt_{hot} (°C)
30		1			
	1.5	1			
42.5		1			
	2	1			

a)	b)	c)	Total
12 points	2 points	4 points	18 points

Név: .... osztály:......

3/B **If a pedestrian steps in front of a car, he or she takes a tremendous risk. Using the table below we would like to examine how far the car should be when the driver notices the pedestrian such that the accident could be avoided.**
Let the "reaction distance" of the car be the distance covered by the car between the instant the driver spots the pedestrian and the instant he begins to brake. Let the "critical stopping distance" be the least distance in order to stop in time.

Speed (km/h)	Reaction distance (m)	Braking distance (m)	Critical stopping distance (m)
30	8	7	
50	14	19	
90	25	63	
110	31	93	

(Distances in the table are accurate to the nearest metre.)

a) Using the given data plot the reaction distance as a function of speed and the braking distance as a function of speed graphs in the same co-ordinate system.
b) Describe these distance-speed graphs referring to the type of motion. (Name these motions.) Find the relationship between the distance and the speed in both cases. Compare the distances covered during the reaction and during the braking processes. (Which is greater?)
c) What are the critical stopping distances to avoid the accident? Fill in the last column of the table.
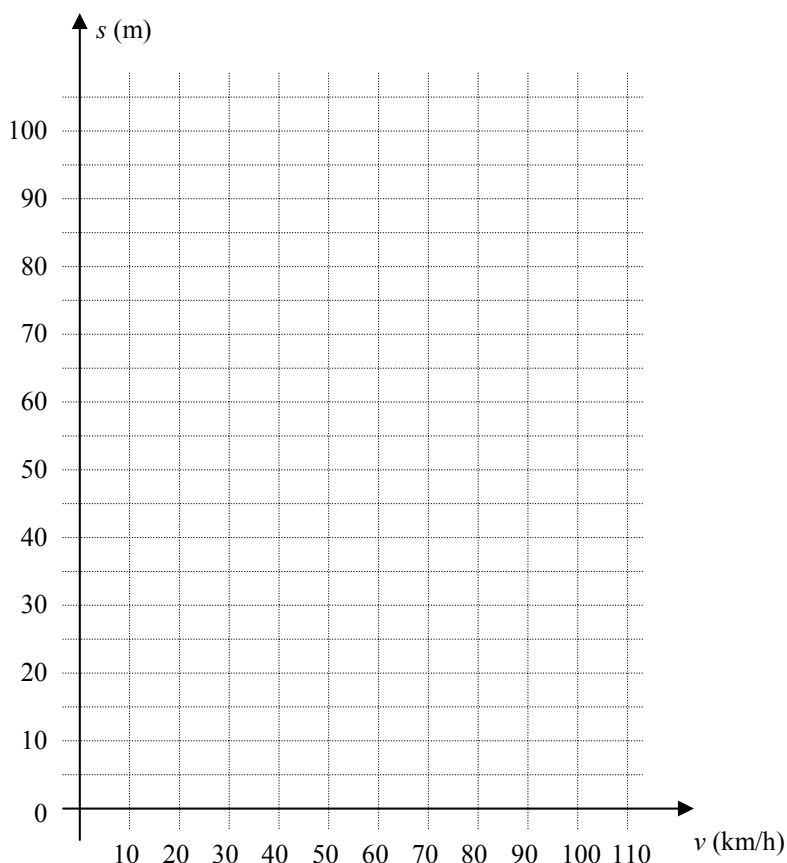
a)	b)	c)	Total
5 points	11 points	2 points	18 points

	Maximum score	Score attained
I. Multiple Choice Questions	40	
II. Extended response problems	50	
TOTAL	**90**	

examiner

Date: ………………………………….

	Score attained Elért pontszám	Score input for program Programba beírt pontszám
I. Multiple Choice Questions I. Feleletválasztós kérdéssor		
II. Extended response problems II. Összetett feladatok		

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Date / Dátum: ………………………………   Date / Dátum: ……………………………