ÉRETTSÉGI VIZSGA ● 2010. május 18.

FIZIKA
ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2010. május 18. 8:00

Az írásbeli vizsga időtartama: 120 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

OKTATÁSI ÉS KULTURÁLIS MINISZTÉRIUM

Instructions for the examinee

The time allowed for the examination is 120 minutes.
Read the instructions for the problems very carefully and use your time wisely.
You may solve the problems in arbitrary order.
Allowable materials: pocket calculator, data tables
Should the space provided for the solution of a problem be insufficient, you may continue the solution on one of the empty sheets at the end of the examination. Please indicate the number of the problem on the sheet.

Please indicate here which of the two problems 3/A and 3/B you have chosen (that is, which one you would like evaluated):

3/ ☐

PART ONE

Precisely one of the possible solutions for each of the following questions is correct. Write the corresponding letter in the white square on the right. (Check your answer with calculations if necessary.)

1. **In a thermodynamic process a gas expanded doing 740 J of work, while absorbing 800 J of heat. By what amount did its internal energy change?**

   A) +60 J
   **B)** +1540 J
   C) -1540 J

2 points	

2. **Imagine that we replace Earth with a small pebble! What would this pebble's period of orbit be as it moves around the Sun?**

   A) The period of orbit would be one year, just like for Earth.
   B) The period of orbit would be much longer, because the gravitational force acting on the pebble is much smaller.
   C) The pebble would in time be captured by the gravitational pull of the nearby Venus, so its period of orbit would be the same as that of Venus.

2 points	

3. **Three small carts are bound to one another as shown in the figure and we pull them with a force *F*. What is the relation between the forces arising in the ropes?**
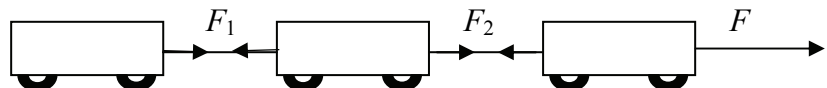
   A) $F_1 > F_2$
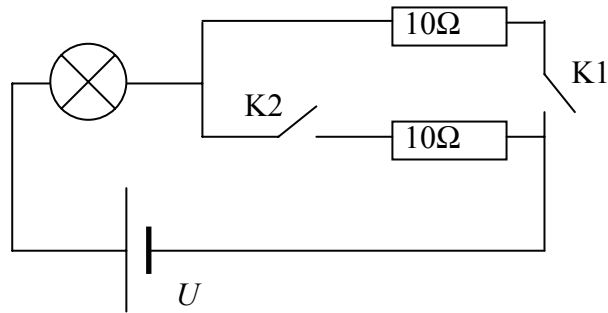   **B)** $F_1 = F_2$
   C) $F_1 < F_2$

2 points	

4.   Who is credited with discovering the atomic nucleus?

   A)   Planck
   B)   Rutherford
   C)   Bohr

2 points

5.   In which case does the light bulb shine the brightest?

   A)   If the K1 switch is closed.
   B)   If the K2 switch is closed.
   C)   If both of the switches are closed.

2 points

6.   Using a given voltage, which particle can be accelerated to greater speed: a proton or an alpha particle?

   A)   A proton.
   B)   An alpha particle.
   C)   Both particles accelerate to the same speed.

2 points

7.   A body at rest weighting $m = 6$ kg is attracted by Earth with a force of $m \cdot g = 60$ N. With what force does the body attract Earth?

   A)   With a force of $m \cdot g = 60$ N.
   B)   The body does not attract Earth.
   C)   With a force inversely proportional to the ratio of the two masses, i.e. with a force of $6 \cdot 10^{-23}$ N.

2 points

8. A body thrown vertically up into the air reaches a maximum height of *h*. What is the length of path covered by the body, when its kinetic energy is just half of its initial value?

A) $\dfrac{h}{4}$

B) $\dfrac{h}{2}$

C) $\dfrac{3}{4}h$
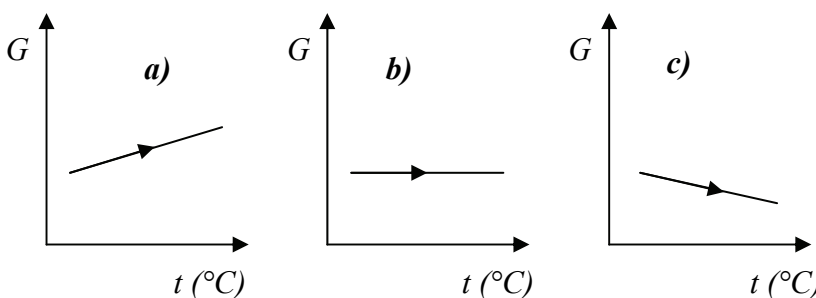
2 points

9. Which of the following optical instruments can be used to decompose white light into a spectrum of colours?

A) A diverging lens.
B) A prism.
C) A spherical mirror.

2 points

10. We place some water in a closed container on a scale and we begin to heat it. Which figure depicts correctly the weight shown by the scale as the heating proceeds?

A) Figure a).
B) Figure b).
C) Figure c).

2 points

11. **Which light source yields light with a greater wavelength: a 2 W power blue light source, or a 2 W power red light source?**

   A) The blue one.
   B) The red one.
   C) The wavelengths of the light emerging from the two sources are identical.
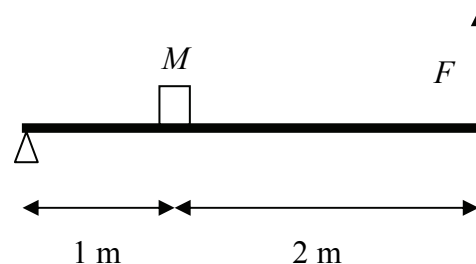
   2 points

12. **Two steel cubes with temperatures 30 °C and 20 °C respectively are placed beside each other in an isolating container. Which law of thermodynamics would be violated, if we saw the 30°C steel cube warm up and the 20°C cube cool down?**

   A) The first law of thermodynamics.
   B) The second law of thermodynamics.
   C) Both the first and the second laws of thermodynamics.

   2 points

13. **We would like to support a mass weighting 300 N using the lever depicted in the figure. What is the magnitude F of the force that we have to exert to achieve this?**

   A) 100 N
   B) 150 N
   C) 300 N

   2 points

14. **Which one of the following statements on electromagnetic waves is true?**

   A) Their frequency changes as they enter a different medium.
   B) Their velocity of propagation in vacuum is about 300 000 km/s.
   C) Their energy increases with increasing wavelength.

   2 points

15. A disc is sliding on ice. What can we say about the work done on the disc by the force of friction?

    A)   The force of friction impedes motion, so it does no work.
    B)   The work done by the force of friction is converted to heat, so the force of friction cannot do any mechanical work.
    C)   The force of friction does work on the disc, because it decreases its kinetic energy.

2 points

16. What kind of a field can be used to deflect alpha rays?

    A)   Only a magnetic field can be used to deflect alpha rays.
    B)   Only an electric field can be used to deflect alpha rays.
   **C)**   Both electric and magnetic fields can be used to deflect alpha rays.

2 points

17. We have two different isotopes of carbon. Which of their properties is the same?

    A)   The atomic numbers of the two isotopes are the same.
    B)   The mass numbers of the two isotopes are the same.
    C)   The difference between the atomic number and the mass number is the same for the two isotopes.

2 points

18. Two bodies of equal mass are tied together using a rope, and are hung vertically by holding the upper body as shown on the figure. The upper body is then released. What will the acceleration of the bodies be as they are falling?
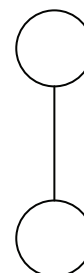
    A)   The upper body will fall with an acceleration of $2g$, the lower one with an acceleration of g.
    B)   Both bodies will fall with an acceleration of $g/2$.
    C)   Both bodies will fall with an acceleration of g.

2 points

Név: .... osztály:......

19. In which direction will the air flow through the holes of the sealings of a room, when we begin heating the room? (There was no air flow before the heating was turned on.)

   A) The air flows towards the outside.
   B) The air flows towards the inside.
   C) The direction of the airflow depends on the outside temperature.

2 points

20. Which of the following instruments can be used to generate an almost homogeneous magnetic field?

   A) A charged capacitor.
   B) A bar magnet.
   **C)** A solenoid with current flowing in it.

2 points

PART TWO

Solve the following problems. Justify your statements using calculations, diagrams or explanations, depending on the nature of the questions. Make sure that the notations you use are unambiguous.

1. **In the circuit shown in the figure, a battery with $U = 10$ V is connected to some resistors. A switch K is inserted into the circuit, which, depending on its state connects either to the circuit branch containing a resistor R, or to the other circuit branch containing a resistor $2R$. Initially, the switch is connected to the branch containing the resistor R. ($R_1 = R = 10$ Ω)**

   a) How much does the equivalent resistance of the circuit change when K is switched to the other state?

   b) Find the current flowing through R_1 for both the initial and the other state of the switch.

   c) How much does the power on R_1 change when K is switched to the other state?
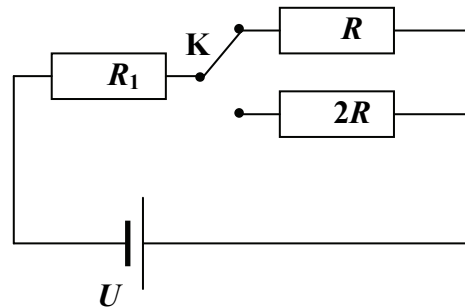
a)	b)	c)	Total
6 points	4 points	6 points	16 points

2. **A body of mass $m = 2$ kg is placed on a horizontal disc revolving around a vertical axis. Its distance from the axis is $R = 1$ m and it is at rest compared to the disc, revolving with it at a frequency of $f = 0,4$ Hz.**
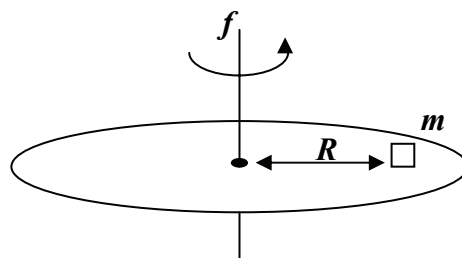
   a)   Calculate the force of static friction arising between the body and the disc.

   b)   At least how big is the coefficient of static friction between the disc and the body?

$(g = 10\dfrac{\text{m}}{\text{s}^2})$

a)	b)	Total
11 points	5 points	16 points

You need to solve only one of the two problems 3/A and 3/B. Indicate your choice on the inside of the front cover.

3/A   **The lens of a camera is movable; it can be moved in or out depending on the distance of the object to be photographed. Nowadays the lens is moved automatically by the camera. In the cases under consideration the object to be photographed is greater than the light-sensitive surface in the camera taking the picture. (The system of lenses that a real camera has is now assumed to be a single thin lens with constant focal length.)**

a)   What characteristic lengths are determined by the relative positions of the lens, the film (light-sensitive surface) and the object to be photographed?

b)   What kind of image is formed on the light-sensitive surface? Draw a diagram and explain.

c)   The camera is adjusted after photographing a nearby object to photograph a more distant object. How does the lens move, and how do the lengths characterizing image formation change? Justify your answer using the thin-lens equation.

d)   What is the smallest practical distance between the lens and the light-sensitive surface when taking a picture? When does this situation arise?

a)	b)	c)	d)	Összesen
2 points	6 points	8 points	2 points	18 points

3/B   **We have measured the volume and the pressure of a gas enclosed in a container with a piston during a thermodynamic process. The measured data is shown in the table bellow.**

V (cm^3)	50	45	40	35	30	25	20	15	10
p (10^5 Pa)	1	1,6	2,0	2,3	3,1	3,7	4,0	4,4	5

a) Plot the measured data on a *p(V)* graph. Fit a straight line onto the plot.
b) How much work has been done on the gas while it was compressed from 50 cm^3 to 10 cm^3?
c) Compare the initial and final temperatures of the gas.
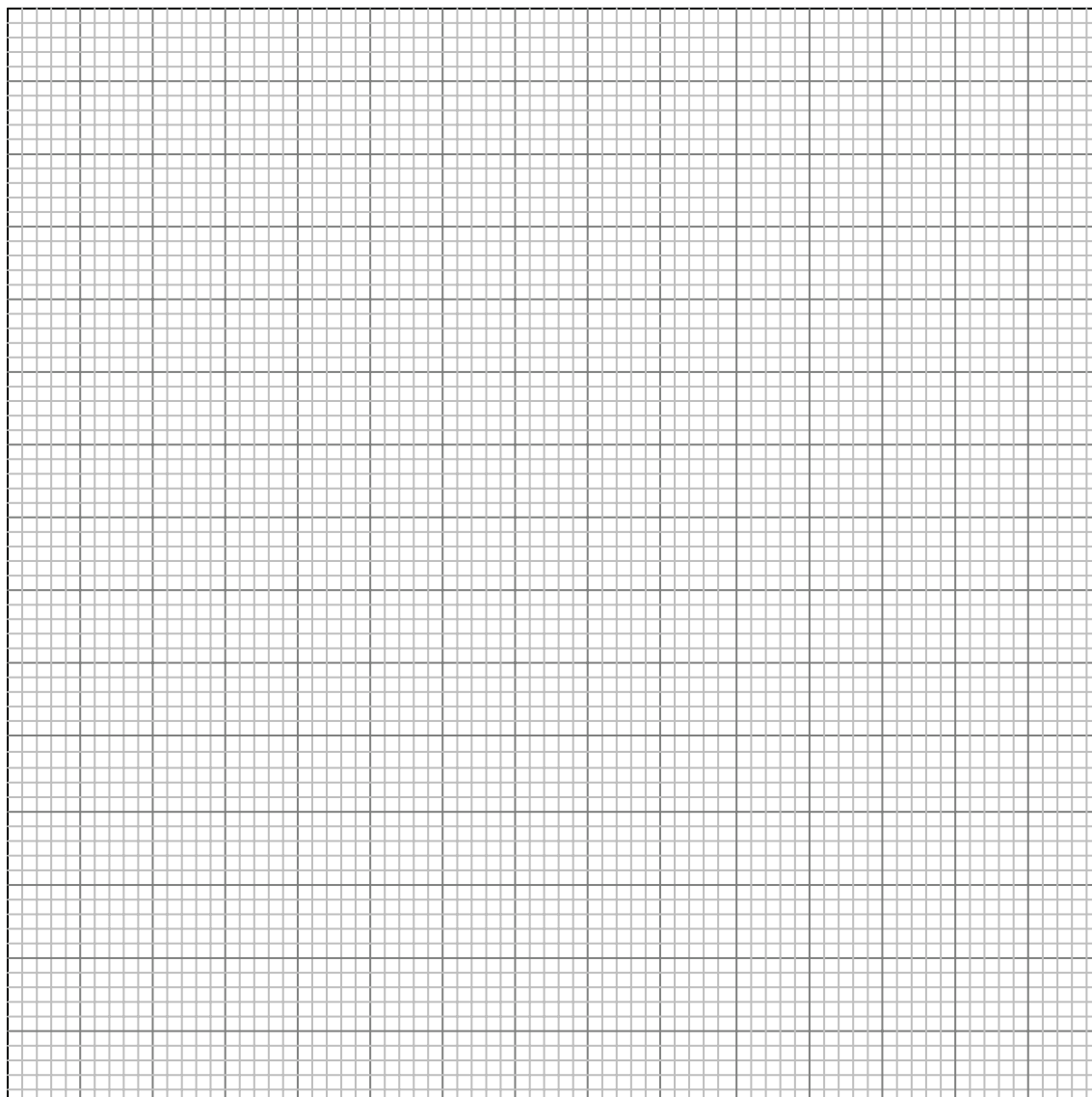
a)	b)	c)	Total
7 points	5 points	6 points	18 points

To be filled out by the examiner evaluating the paper!

	maximum score	score attained
I. Multiple choice questions	40	
II. Complex problems	50	
Total score of the written exam	**90**	

————————————
examiner

Date: ....

	score attained rounded to the **nearest integer** (elért pontszám **egész számra** kerekítve)	Integer score entered in the program (programba beírt **egész** pontszám)
I. Multiple choice questions (Feleletválasztós kérdéssor)		
II. Complex problems (Összetett feladatok)		

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examiner (javító tanár)   notary (jegyző)

Date/Dátum: .... Date/Dátum: ....