Név: ..... osztály:.....

ÉRETTSÉGI VIZSGA • 2007. május 14.

FIZIKA
ANGOL NYELVEN
PHYSICS

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA
STANDARD LEVEL
WRITTEN EXAMINATION

2007. május 14. 8:00

Az írásbeli vizsga időtartama: 120 perc
Time allowed for the examination: 120 minutes

Pótlapok száma / Number of extra sheets	
Tisztázati / Final version	
Piszkozati / Draft	

OKTATÁSI ÉS KULTURÁLIS MINISZTÉRIUM
MINISTRY OF EDUCATION AND CULTURE

Instructions to candidates

The time allowed for this examination paper is 120 minutes.
Read the instructions of the problems very carefully, and make sure that you do not run out of time.
You can solve the problems in any order.
Materials allowed: calculator, data tables.
If there is not enough space provided for the solution of a problem, ask for an extra sheet. On the sheet 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 ☐

PART ONE

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

1. **Which of the following speeds is the lowest?**

A) 7.2 km/h.
B) 1 m/s
C) 0.0036 km/s.

2 points	

2. **A car travelling on a straight road towards the east is braking. What is the direction of its acceleration?**

A) Towards the west.
B) Towards the east.
C) Towards the south.

2 points	

3. **The magnitude of the net force acting on a 2-kg object is 6 N. Which statement is true about its acceleration?**

A) The magnitude of the acceleration is 3 m/s^2.
B) The magnitude of the acceleration is 9.81 m/s^2.
C) The magnitude of the acceleration is 12 m/s^2.

2 points	

4. **Which physical quantity can be measured in units of kWh?**

A) Power.
B) Energy.
C) Efficiency.

2 points	

5. **Two railway carriages are travelling in the same direction. They collide, couple together and move on together. Which statement is true about their combined kinetic energy?**

A) The total kinetic energy of the coupled carriages is equal to the sum of the kinetic energies they had before the collision.
B) The total kinetic energy of the coupled carriages is greater than the sum of the kinetic energies they had before the collision.
C) The total kinetic energy of the coupled carriages is smaller than the sum of the kinetic energies they had before the collision. ☐

2 points	

6. **Helium gas is heated at constant pressure from an initial temperature of 20°C to 40°C. How will its volume change?**

A) It will increase by a factor of two.
B) It will decrease by a factor of one half.
C) It will change by a factor different from both of the above. ☐

2 points	

7. **A sample of gas absorbs 100 J of heat in a certain process, while it is expanding and doing a work of 20 J. What is the change in the internal energy of the gas in this process?**

A) The internal energy increases by 120 J.
B) The internal energy increases by 80 J.
C) The internal energy decreases by 80 J. ☐

2 points	

8. **A certain amount of water initially at 0 ^{o}C is slowly heated to a temperature of 8 ^{o}C. How will the volume of the water change during the heating?**

A) It will continuously increase.
B) It will decrease, then increase.
C) It will continuously decrease. ☐

2 points	

9. **During cooking, the safety valve of a pressure cooker opens at the appropriate temperature, and steam is released. Which statement is true about the temperature of the steam?**

A) The temperature of the steam released is higher than 100 °C.
B) The temperature of the steam released is 100 °C.
C) The temperature of the steam released is lower than 100 °C.

2 points	

10. **A positively charged metal body is grounded with a metal wire. What happens?**

A) Positively charged particles move from the body to the ground, and the body becomes neutral.
B) Electrons move from the ground to it, and the body becomes neutral.
C) The charge of the body will not change.

2 points	

11. **Electric current is flowing through two resistors of different resistances connected in series. Which of them dissipates more electric power?**

A) The resistor of lower resistance dissipates more electric power.
B) They both dissipate the same electric power.
C) The higher resistance dissipates more electric power.

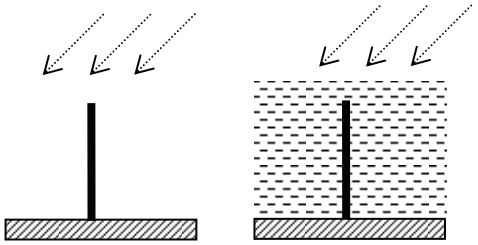
2 points	

12. **An alternating voltage of 24 V is connected to the primary coil of an ideal, 100% efficient unloaded transformer. The primary coil has 600 turns and the secondary coil has 1200 turns. What voltage will appear on the secondary coil?**

A) 0 V
B) 12 V
C) 48 V

2 points	

13. **At a certain position of the Sun, the shadow of a vertical pole on horizontal ground is 50 cm long. With all other conditions unchanged, how will the length of the shadow of the pole change if the pole is immersed in water?**



A) The length of the shadow will not change.
B) The length of the shadow will increase.
C) The length of the shadow will decrease.

2 points	

14. **A converging lens forms a magnified image of a candle flame on a screen. Which is closer to the lens, the candle flame or the screen?**

A) The candle flame is closer to the lens than the screen is.
B) The screen is closer to the lens than the candle flame is.
C) The given information is not enough to answer the question.

2 points	

15. **The cathode of a photocell is illuminated with red light, then it is illuminated with blue light. Is it possible that electrons are ejected in the case of the blue light but there are none ejected in the case of illumination by red light?**

A) Impossible because there is no photocell that operates with visible light.
B) Impossible because the energy of a photon of blue light is smaller than that of a photon of red light.
C) It is possible since the energy of a photon of blue light is greater than that of a photon of red light.

2 points	

16. **Which is greater, the sum of the masses of a free proton and a free neutron, or the mass of a deuterium ($^{2}_{1}\mathrm{H}$) nucleus?**

A) The two masses are exactly equal to each other.
B) The mass of the deuterium nucleus is smaller.
C) The mass of the deuterium nucleus is greater.

2 points	

17. **The $^{222}_{86}\mathrm{Rn}$ nucleus decays with α-decay. What nucleus is produced in the decay?**

A) $^{220}_{82}\mathrm{Pb}$

B) $^{218}_{84}\mathrm{Po}$

C) $^{222}_{87}\mathrm{Fr}$

2 points	

18. **The use of nuclear power plants raises several environmental problems. Which of the issues listed below represents the greatest environmental hazard?**

A) The strong radioactivity of fission product nuclei in the used uranium fuel rods removed from the reactor.

B) The strong radioactive radiation of the new uranium rods to be placed in the reactor.

C) The strong radioactive radiation originating in the building of the nuclear power plant in normal operation.

2 points	

19. **Which is the most abundant element in the Universe?**

A) Uranium.

B) Hydrogen.

C) Iron.

2 points	

20. **A gravitational attraction is acting between two astronomical objects. By what factor will the attractive force increase if their distance is halved?**

A) It will increase by a factor of $\sqrt{2}$.

B) It will increase by a factor of two.

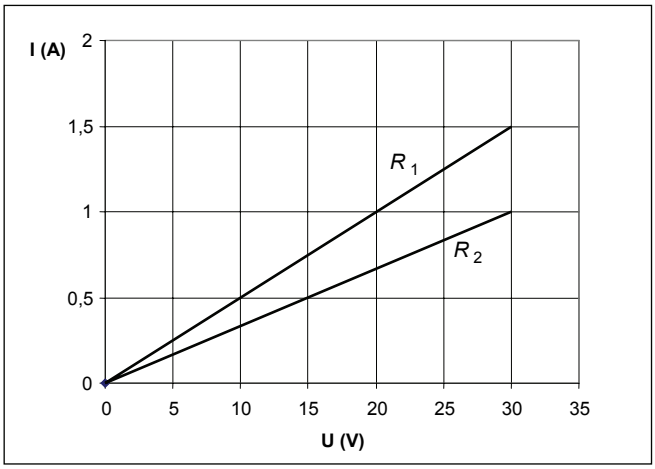
C) It will increase by a factor of four.

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.

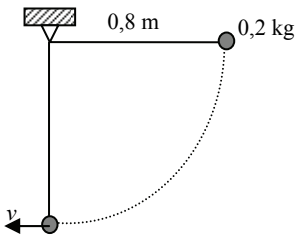
1. The diagram below shows the current vs. voltage graphs of two resistors (R_1 and R_2).



a) Determine the resistance of each resistor.
b) The two resistors are connected in series. What is the total voltage connected to them if the current flowing through the resistors is 0.5 A?
c) In the case of the series connection described in question b), what powers are dissipated by the individual resistors?

a)	b)	c)	Total
5 points	5 points	5 points	15 points

2. A 0.2-kg ball of negligible size is attached to the free end of a simple pendulum of length 0.8 m. The pendulum is deflected to a horizontal position and then released without pushing.



a) What is the speed of the ball in the vertical position of the pendulum?
b) Determine the centripetal acceleration of the ball in the vertical position of the pendulum.

(Let $g = 10$ m/s^2. Ignore the effects of air resistance. In the time instant in question, when the pendulum is vertical, the motion can be considered uniform circular motion.)

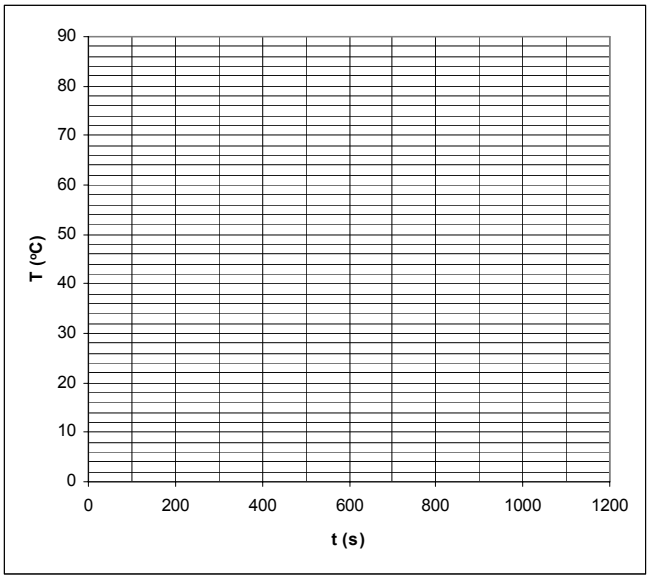
a)	b)	Total
12 points	5 points	17 points

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

3/A A hot metal object of mass 0.5 kg was left to cool on a cold balcony. While it was cooling, the temperature of the metal was measured at 200-second intervals. The data obtained are tabulated below. (The specific heat capacity of the metal is 400 J/kg·°C.)

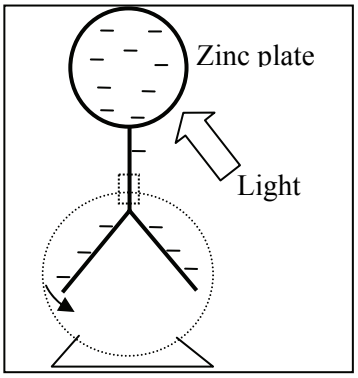
t (s)	0	200	400	600	800	1000
T (°C)	80.0	40.0	20.0	10.0	5.0	2.5

a) In the accompanying diagram, graph the temperature of the metal as a function of time and estimate what final temperature is reached by the cooling metal.
b) What may be the temperature of the balcony in °C?
c) What is the heat given off by the metal in the 400 to 600 s interval?
d) What is the average power of heat transfer in the interval investigated in question c)?



a)	b)	c)	d)	Total
6 points	2 points	5 points	5 points	18 points

3/B The following experiment is carried out: a zinc plate is connected to an electroscope, and the electroscope and zinc plate are given a surplus negative charge. (The experiment is done in a room of dry air, so there is very little loss of charge from the system, the charge indicated by the electroscope is practically constant.)
Then the zinc plate is illuminated with a powerful lamp that emits ultraviolet light, too. The deflection of the pointer of the electroscope starts to decrease, indicating that the system is losing its surplus charge. If the intensity of the illuminating light is increased, the rate of charge loss becomes faster.



a) What is the reason for the charge loss?
b) Why does the charge loss become faster if the intensity of illumination is increased?

a)	b)	Total
13 points	5 points	18 points

To be filled in by the teacher

	score attained	maximum score
I. Multiple Choice Questions		40
II. Extended Response Problems		50
TOTAL		**90**

teacher

Date: .....

	score attained (elért pontszám)	score input for program (programba beírt pontszám)
I. Multiple Choice Questions (Feleletválasztós kérdések)		
II. Extended Response Problems (Összetett feladatok)		

teacher
(javító tanár)

Date / Dátum: .....

registrar
(jegyző)

Date / Dátum: .....