Név:..... osztály: .....

ÉRETTSÉGI VIZSGA • 2006. május 15.

FIZIKA
ANGOL NYELVEN
PHYSICS

2006. május 15. 8:00

KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA
STANDARD LEVEL
WRITTEN EXAMINATION

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

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

OKTATÁSI MINISZTÉRIUM
MINISTRY OF EDUCATION

Instructions to candidates

Time allowed for this question 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 a problem ask for an extra sheet. On the sheets attached please indicate the number of the problem.

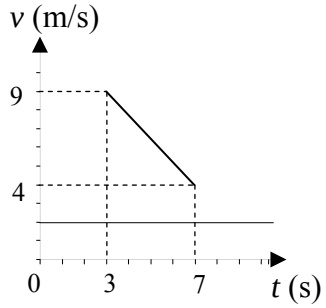
Indicate here which of the problems 3/A and 3/B you have chosen (That is which one you want to be assessed.)

3/ ☐

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.)

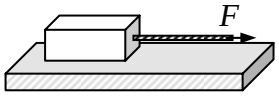
1. The figure shows the velocity versus time graph of the motion of a car. What can you state about the motion?



A) Its motion is uniform, and its acceleration is zero.
B) It slows down, its acceleration is –9/7 m/s^2.
C) It slows down, its acceleration is –5/4 m/s^2.

2 points	

2. A rectangular block is pulled horizontally along a horizontal surface, but it stays at rest. Determine the static frictional force.



A) Smaller than the force F with which it is pulled.
B) Same as the force F with which it is pulled.
C) Greater than the force F with which it is pulled.

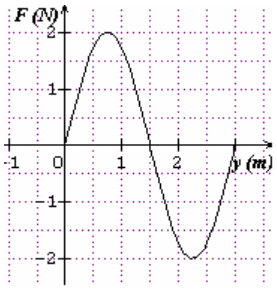
2 points	

3. If a 50 N force is exerted on a spring, then its elongation is 10 cm. What is the elongation of the spring if it is pulled apart by two forces, both a 100 N, at its 2 ends, one of them points to the right, the other to the left.

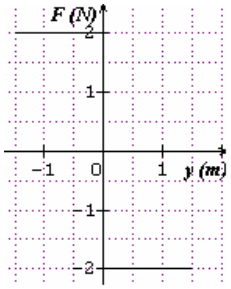
A) 10 cm.
B) 20 cm.
C) 40 cm.

2 points	

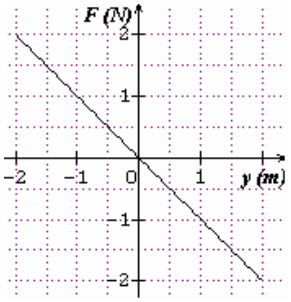
4. **The graphs below show the net forces exerted on different objects as a function of time. Which figure shows the graph of a force, which results in simple harmonic motion?**



(A)



(B)

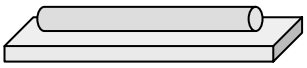


(C)

A) The graph in figure (A).
B) The graph in figure (B).
C) The graph in figure (C).

2 points	

5. **The horizontal stone column is to put in an upright position such that the least work is done. Where should it be grasped and raised?**



A) At the end of the column, because in this way the least force should be exerted.

B) At the centre of gravity, because in this way the torque is zero.

C) Anywhere, the work done is independent of the point at which it is grasped.

2 points	

6. **If someone has an earache, to relieve the pain usually a bag of hot salt is pressed against their ear. Why is it good to use salt?**

A) Salt is incompressible, therefore it can be pressed with any force against the ear.
B) The specific heat capacity of salt is high, therefore it remains hot for a long time.
C) The freezing point of salt is low, therefore this kind of treatment can be used in winter as well.

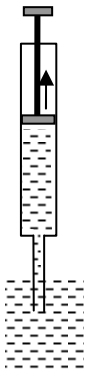
2 points	

7. A drop of pure alcohol dripped to your skin feels cold, why?

A) This is because alcohol must be kept in the refrigerator, otherwise it dissolves, thus it is cold.
B) Because alcohol vaporizes easily, and during the evaporation it absorbs heat.
C) Because alcohol is good heat conductor, thus it absorbs heat from your skin.

2 points	

8. What is the principle of sucking liquid into a syringe?



A) Vacuum sucks in the liquid under the piston.
B) The liquid sticks firmly to the piston and it cannot come off the piston.
C) The external pressure presses the liquid into the syringe.

2 points	

9. In the combustion chamber of the engine of a car the mixture of petrol vapour and air is compressed so fast that the heat transfer between the mixture of the gases and its environment is negligible. How does the internal energy of the mixture of petrol and air change during the process?

A) The internal energy decreases because the gas does positive work, though there is no heat transfer.
B) The internal energy remains the same because the mixture of the gases does not absorb heat from its environment.
C) The internal energy increases, because the environment does positive work on the gas , though there is no heat transfer.

2 points	

10. A small charged particle is placed near a neutral metal body. Is there an electric force exerted on the particle?

A) No
B) Yes, an attractive force.
C) Yes, a repulsive force.

2 points	

11. How does the current in the main branch of the electric circuit of a flat change if a new resistor is connected into the circuit?

A) The current decreases, since the equivalent resistance of the circuit increases.
B) The current increases, since the equivalent resistance of the circuit decreases.
C) The current does not change, since the power is constant.

2 points	

12. A ring carrying current is placed into uniform magnetic field such that the flux linkage through the ring is the greatest. What can be stated about the total torque of the magnetic forces exerted on the ring?

A) The torque is zero.
B) The torque is the least in this position but not zero.
C) The torque is maximum in this position.

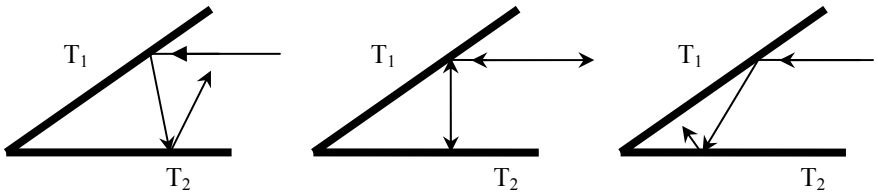
2 points	

13. What happens if a bar magnet is moved into the air core of a coil, which is connected to an ammeter?

A) The ammeter indicates current while the magnet is moving.
B) The ammeter does not indicate current, because there is no electric field generated.
C) The ammeter does not indicate the current because current is induced only in the bar magnet (eddy current) and the ammeter does not measure that.

2 points	

14. The angle between two plane mirrors (T1 and T2) is 30° An incident beam of light is parallel to mirror T2 as shown in the figure. Which figure shows the correct path of the reflected beam.



(A) **(B)** **(C)**

A) Figure (A)
B) Figure (B).
C) Figure(C).

2 points	

15. Which of the photons below has the greatest energy?

A) The photon of red light.
B) The photon of γ-ray.
C) The photon of ultraviolet light.

2 points	

16. Consider the two isotopes of carbon of atomic mass numbers 12 and 14. Which of the following characteristics are different in the two isotopes?

A) Number of neutrons.
B) Number of protons.
C) The atomic number.

2 points	

17. Which of the following is necessary to initiate fission?

A) High temperature.
B) The bombardment of the uranium isotope ^{235}U with α-particles.
C) The bombardment of the uranium isotope ^{235}U with slow neutrons.

2 points	

18. **The half life of the radioactive isotope of $^{24}_{11}\mathrm{Na}$ is 15 hours. How long does it take for ¾ of the original amount to decay?**

A) 7.5 hours.
B) 11.25 hours.
C) 30 hours.

2 points	

19. **Gravitation of the Moon is one-sixth of the gravitation of the Earth. Which of the following statements is false?**

A) It is easier to hold a weight on the Moon than on the Earth.
B) If two bodies collide elastically, under the same circumstances, their speeds after impact will be greater on the Moon than on the Earth.
C) If you jump down from a given height, the time of fall is greater on the Moon than on the Earth.

2 points	

20. **Which of the following elements is the most frequent in the Sun?**

A) Hydrogen.
B) Helium.
C) Iron.

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 are clear.

1. An electric kettle rated at 800 W heats up 1.5 l water from 20 °C to 90 °C in 13 minutes.

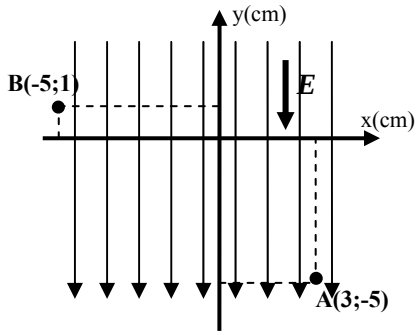
a) How much heat is absorbed by the water?

b) Find the efficiency of the heating.

(Specific heat capacity of water: $c = 4.2$ kJ/kg·K, density of water: $\rho = 1000$ kg/m^3.)

a)	b)	Total
5 points	7 points	12 points

2. An electron is moving in the E=2000N/C uniform electric field as shown in the figure. The particle moves from point A to point B, plotted in the figure. The coordinates of point A are A(3 cm; -5 cm) and point B are B(-5 cm; 1 cm).

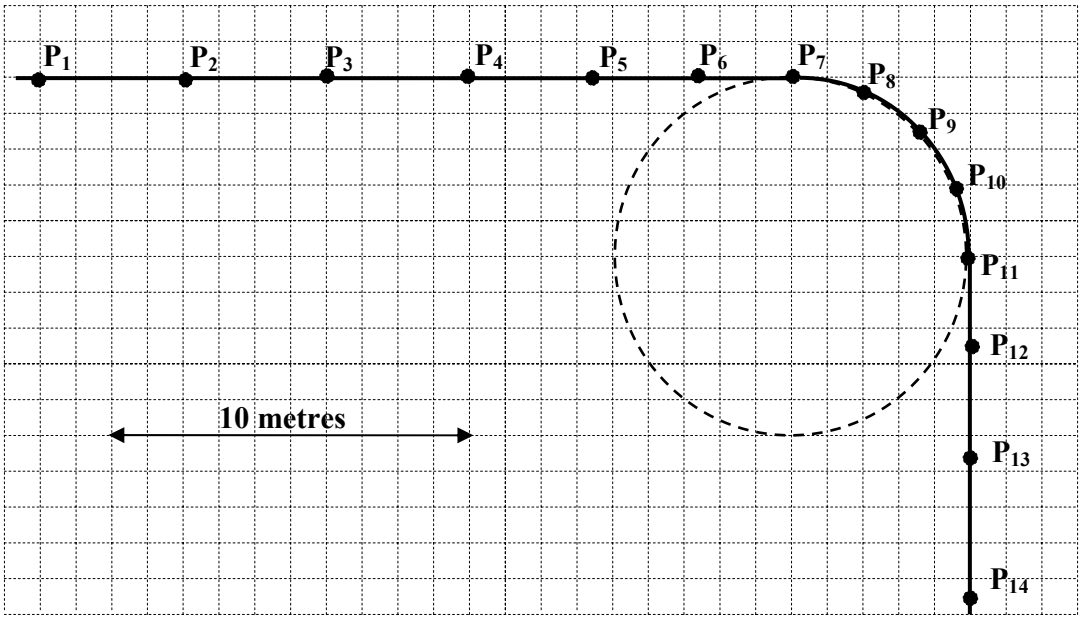


a) Determine the magnitude and the direction of the force exerted on the electron.
b) What is the work done by the electric field while the electron moves from (A) to (B)?
c) Find the voltage between points (A) and (B).
(Charge of an electron: $q = 1.6 \cdot 10^{-19}\,\mathrm{C}$.)

a)	b)	c)	Total
6 points	8 points	4 points	18 points

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

3/A The water-bottle of a cyclist is dripping. In every second one drop falls and leaves a mark on the horizontal ground. The figure shows the drops seen from above $(P_1 \ldots P_{14})$.



a) What is the speed of the cyclist between the points P_1–P_4?
b) What is the angle between the velocity and the acceleration of the cyclist, when he moves between the points P_{11}–P_{14}, and when he moves between the points P_4–P_7?
c) Find the acceleration and the velocity of the cyclist when he moves between the points P_7–P_{11}.

(Assume that the motion of the biker between two drops is the same as the motion that you can determine from the positions of the drops.)

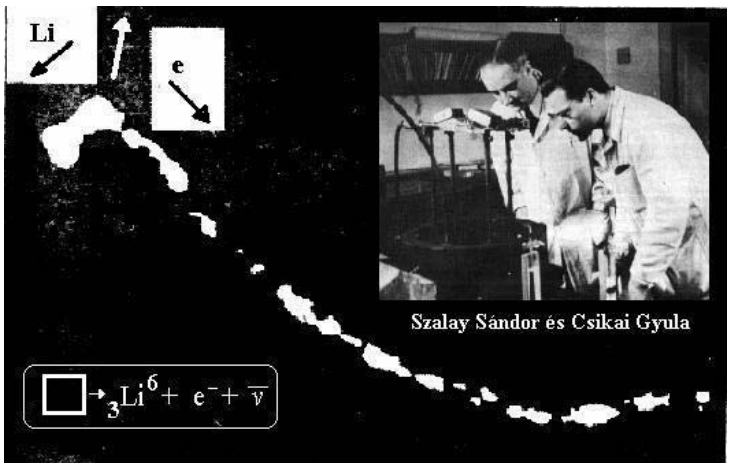
a)	b)	c)	Total
3 points	6 points	11 points	20 points

3/B

The photograph shown in the figure was taken by Szalay Sándor and Csikai Gyula. With this photo they proved experimentally the existence of the neutrino, which was predicted earlier by several theoretical physicists.

The photograph was taken in a cloud chamber and it shows the β^--decay of a nucleus initially at rest. The tracks of the nucleus of $^{6}_{3}\mathrm{Li}$ and the electron (e^-), both initiated at the position of the decay, can clearly be seen, but there is no other track indicating any other particle. In spite of this, the photograph proved for every physicist that during the decay process a third particle was emitted as well.

a) How did physicists deduce the existence of the third particle?
b) Determine the atomic number and the atomic mass number of the nucleus whose beta decay is shown in the photo.
c) In the figure it can also be seen that the track of the emitted electron is curved. This curved path is caused by the magnetic field which is perpendicular to the plane of the figure. Does the magnetic field point out of or point towards the plane of the figure? Reason your answer.



a)	b)	c)	Total
12 points	4 points	4 points	20 points

To be filled by the teacher!

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

TEACHER

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

Javító tanár / Teacher

Jegyző / Registrar