

ÉRETTSÉGI VIZSGA • 2011. május 17.

**FIZIKA
ANGOL NYELVEN**

**KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA**

2011. május 17. 8:00

Az írásbeli vizsga időtartama: 120 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

**NEMZETI ERŐFORRÁS
MINISZTERIUM**

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 paper. 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. On a trip from Miskolc to Budapest, we took the IC express train, whose average speed was 100 km/h. On the return trip from Budapest to Miskolc, we took the passenger train whose average speed was 60 km/h. What can we say about the average speed of our travel for the whole round trip?

- A) The average speed was less than 80 km/h.
B) The average speed was exactly 80 km/h.
C) The average speed was greater than 80 km/h.

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2 points

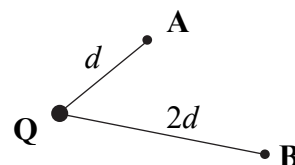
2. Does solid-state carbon dioxide exist?

- A) It does exist, but only at a very high pressure.
B) No, carbon dioxide can only be a gas.
C) Yes, it exists even under normal atmospheric pressure.

☐

2 points

3. A point-like metal sphere is electrically charged. The electric field strength is first measured at point A in space. How will the measured field strength change if the charge on the sphere is doubled, and it is measured at point B instead of A, at twice the distance from the sphere?



- A) It is reduced to half its previous value.
B) It remains the same.
C) It increases to double its previous value.

☐

2 points

4. It is well known that spaceships entering Earth's atmosphere heat up considerably, with certain parts glowing red-hot. Why is that?

- A) Because the upper parts of the atmosphere, which are closest to the Sun, are very hot.
- B) Because fire from the rocket engines used during landing heats them up.
- C) Because friction of the atmosphere heats up objects that have a great speed.

2 points	
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5. We place 1 kg of 100 °C iron into one liter of 0 °C water. What can we say about their equilibrium temperature? (The specific heat of iron is roughly one tenth of the specific heat of water.)

- A) Their equilibrium temperature is less than 50 °C.
- B) Their equilibrium temperature is 50 °C.
- C) Their equilibrium temperature is greater than 50 °C.

2 points	
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6. What is it that electric field lines do not indicate?

- A) The direction of motion of a positive test charge placed in the electric field.
- B) The direction of the force exerted on a positive test charge placed in the electric field.
- C) The direction of motion of a positive test charge placed in the electric field.

2 points	
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7. There is an unknown element ${}^A_Z\text{X}$. Which of the following elements can it transform to via radioactive decay?

- A) ${}^{A-4}_{Z-2}\text{Y}$
- B) ${}^{A+1}_Z\text{W}$
- C) ${}^{A-2}_{Z-2}\text{Q}$

2 points	
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8. What does the energy of photons depend on?

- A) The energy of photons is proportional to the wavelength of light.
- B) The energy of photons is proportional to the frequency of light.
- C) The energy of photons is proportional to the speed of light.

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2 points	
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9. During which process does the work done by the gas equal the heat transferred to the gas?

- A) During an isobaric process.
- B) During an isothermal process.
- C) During an isochoric process.

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2 points	
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10. A stone thrown vertically upward reaches the turning point of its trajectory and starts falling back. How does its acceleration change around the turning point? (Air drag is negligible.)

- A) Acceleration becomes zero at the turning point, and then reverses its sign.
- B) Acceleration decreases on approaching the turning point and increases after it.
- C) Acceleration remains constant during the entire motion.

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2 points	
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11. There are two light-rays. The color of one is blue; the color of the other is red. Which has a greater wavelength?

- A) The blue one.
- B) The red one.
- C) This question cannot be decided from the color.

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2 points	
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12. The swinging of a pendulum constantly decreases due to air drag. The initial displacement of the pendulum was small. How does the oscillation period change?

- A) The oscillation period decreases gradually.
 B) The oscillation period remains constant.
 C) The oscillation period increases gradually.

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2 points	
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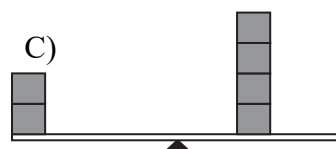
13. What did Ernest Rutherford realize?

- A) That the positive charges in an atom reside in a small region within the atom, the so-called nucleus.
 B) That the hypothesis that protons orbit around the atomic nucleus must be discarded.
 C) That electrons and protons are responsible for less than one thousandth of the mass of the atoms, the rest being due to the massive neutrons.

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2 points	
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14. A 2 m long wooden plank is supported at its mid-point, and wooden cubes with equal masses whose edge is 20 cm long are placed on it as depicted. When the cubes are placed on the plank as shown in the first figure, the plank is precisely balanced. Then additional cubes are placed on the plank in three different ways. In which case will the plank remain balanced?



- A) In the case shown in figure A).
 B) In the case shown in figure B).
 C) In the case shown in figure C).

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2 points	
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15. Which material has a smaller volumetric thermal expansion coefficient, copper at 20 °C, or air at 20 °C?

- A) Air.
- B) Copper.
- C) The two coefficients are approximately equal.

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2 points	
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16. A film is projected on a screen. The projector apparatus contains a converging lens. How far is the film from the optical center of the lens?

- A) It is closer than the focal distance of the lens.
- B) Precisely at the focal distance.
- C) Farther than the focal distance of the lens.

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2 points	
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17. In which case does the force of gravity NOT do any work?

- A) An object is in freefall.
- B) An object that we have thrown upward is ascending.
- C) A spaceship is held in a circular orbit around the Earth by the force of gravity.

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2 points	
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18. Two atomic nuclei are each other's isotopes. How big can the mass difference be between them?

- A) A few times the mass of an electron.
- B) About the mass of a nucleon, or even more.
- C) The two masses may even be precisely the same.

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2 points	
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19. Ever newer interesting discoveries of the space telescope Hubble appear regularly in the press. Why is it advantageous to operate a telescope in space, orbiting around the Earth?

- A) Because a much larger telescope can be maneuvered under conditions of weightlessness than at the surface of Earth.
- B) Because the image formation of a telescope above the atmosphere is not influenced by the atmosphere itself.
- C) Because the index of refraction of the telescope's lens relative to vacuum is greater than that relative to air.

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2 points	
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20. Who discovered the general law of gravity?

- A) Galileo Galilei
- B) Isaac Newton
- C) Johannes Kepler

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2 points	
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PART TWO

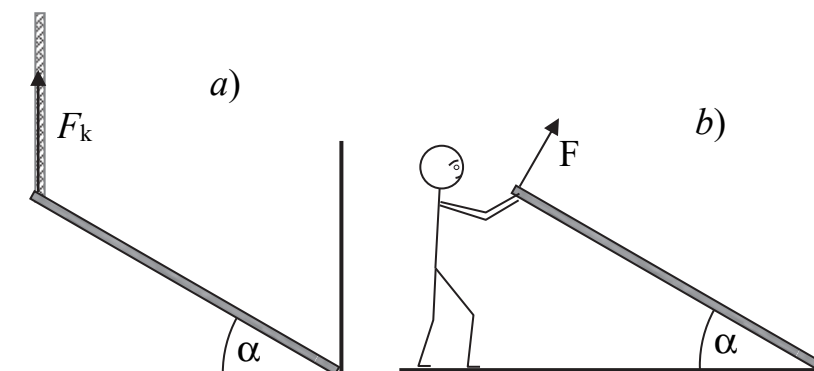
Solve the following problems. Justify your statements using calculations, diagrams or explanations, depending on the nature of the questions. Make sure that the notations you use are unambiguous.

1. One end of a regular prism-shaped, homogeneous beam is at rest on the ground adjacent to the wall, while a vertical rope supports the other one.

The beam encloses an $\alpha = 30^\circ$ angle with the ground, its mass is 20 kg, its length 3 m.

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

- a) How big is the tension in the rope? (Figure a))
 b) Instead of the rope supporting the end of the beam, a man holds it in the same position as before. The force he exerts on the beam with his hands is perpendicular to the beam. (Figure b))
 How big is this force?



a)	b)	Total
6 points	8 points	14 points

2. The first (experimental) thermonuclear reactor in the world, ITER (International Thermonuclear Fusion Reactor) is currently being built in Europe. In it, nuclear fusion reactions will release energy.
The fuel is a gas composed of deuterium (D) and tritium (T) in a hundred million degree plasma state. In it, the ${}^2_1\text{D} + {}^3_1\text{T} \rightarrow {}^4_2\text{He} + \text{n} + 17,6 \text{ MeV}$ process takes place – similar processes release energy in the interior of the Sun. According to the plans, ITER will generate 500 MW power (approximately the same as a single block of the power-plant at Paks).
- a) If ITER reaches the 500 MW power it is designed for, approximately how many nuclear reactions will take place in the plasma during a second?
- b) How many grams of fuel will be consumed during one minute?

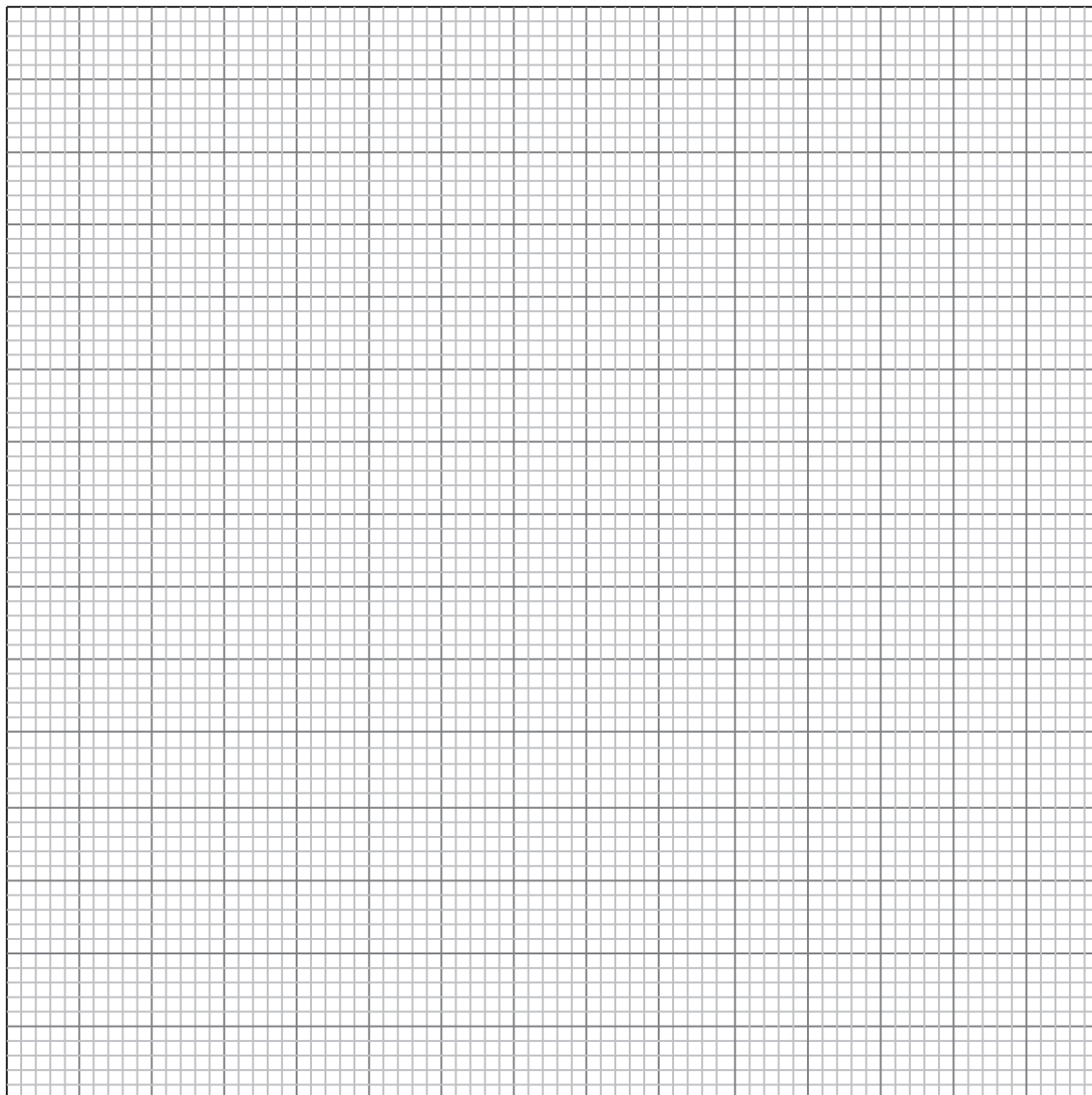
a)	b)	Total
7 points	11 points	18 points

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 following table contains the pressure measured in a lake as a function of the depth (h).

- a) Plot the data.
- b) How big is the pressure at a depth of 25 m?
- c) Determine the atmospheric pressure at the lake's surface.
- d) The volume of an air bubble escaping from a shipwreck triples as it rises to the surface. At what depth can the shipwreck be found?
(The temperature of the water and the air can be considered to be constant.)

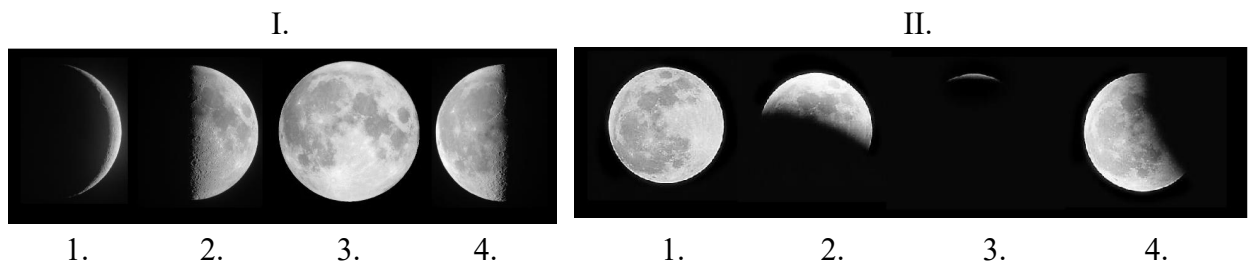
Depth	30 m	20 m	15 m	10 m	5 m
Pressure	404 000 Pa	295 000 Pa	260 000 Pa	204 000 Pa	145 000 Pa



a)	b)	c)	d)	Total
8 points	2 points	3 points	5 points	18 points

3/B Two series of photographs of the Moon are shown. The first series was photographed in about four weeks; the second series was shot in just a few hours

- What phenomena do the first and the second series of photographs depict?
- There are photos in both series, where a part of the Moon remains in dark. What is the reason for this in the first and the second case?
- Choose one series of photographs (indicate your choice by putting a circle around the number above the series) and draw a diagram that depicts the relative positions of the Sun, the Earth and the Moon at the time the picture was taken for each photo of the series. On the drawing indicate the number of the photo to show which position corresponds to which picture.



a)	b)	c)	Total
4 points	4 points	10 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)		

examiner (javító tanár)

notary (jegyző)

Date (Dátum): Date (Dátum):