Név: ..... osztály:.....

ÉRETTSÉGI VIZSGA • 2009. május 13.

FIZIKA
ANGOL NYELVEN

KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA

2009. május 13. 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 exam 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. How does the wavelength of light change, when it passes from air into water?

A) The wavelength of light increases.
B) The wavelength of light does not change.
C) The wavelength of light decreases.

2 points	

2. The nucleus of an atom contains one proton and two neutrons. What kind of an atom is it?

A) An isotope of hydrogen.
B) An isotope of helium.
C) Ionized helium.

2 points	

3. A projectile traveling with velocity *v* hits a block of wood, and covers a distance *d* inside the wood before it stops. Assuming that the projectile decelerates uniformly, what is its speed when it has covered a distance *d/2* inside the wood?

A) The velocity of the projectile is less than *v/2*.
B) The velocity of the projectile is just *v/2*.
C) The velocity of the projectile is greater than *v/2*.

2 points	

4. We connect a coil to a constant voltage source and we then insert an iron core into it. What kind of change do we observe?

A) The direction of the magnetic field vector is reversed.
B) The magnitude of the magnetic field vector increases.
C) The power consumption of the coil increases.

2 points	

5. In what way is a virtual image different from a real image? Pick one of the possibilities bellow!

A) A real image is always smaller than the object, a virtual image is not always smaller.
B) A real image can be created only with a lens, a virtual image can be created only with a mirror.
C) A real image can always be projected onto a screen, a virtual image cannot.

2 points	

6. If one night here in Europe we see a Full Moon, which lunar phase will people on the other side of the Earth see, about 12 hours later?

A) People on the other side of the Earth will also see a Full Moon.
B) People on the other side of the Earth will see a waning crescent.
C) People on the other side of the Earth will see a New Moon.

2 points	

7. A steel ball is held 10 m above a level surface. After being released, it drops and bounces back from the surface to a height of 5 m. How does its kinetic energy change during the collision? (Atmospheric drag is negligible.)

A) The kinetic energy of the ball just after the collision will be more than half of its value just before the collision.
B) The kinetic energy of the ball just after the collision will be precisely half of its value just before the collision.
C) The kinetic energy of the ball just after the collision will be less than half of its value just before the collision.

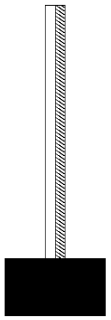
2 points	

8. An incandescent light bulb, being connected to a U = 10 V battery, lights up consuming 2 W of power. How much power will the same light bulb consume, if the terminals of the battery are exchanged, i.e. it is connected to a voltage of U = -10 V?

A) The power consumption of the light bulb will remain 2 W.
B) The power consumption of the light bulb will be –2 W.
C) The light bulb will not light up at all.

2 points	

9. On the figure, a bi-metallic strip is depicted (consisting of two metal strips with different coefficients of thermal expansion, bonded together) whose lower end is fixed. Which direction will the top end of the strip bend if it is heated?



A) It will bend towards the metal with greater thermal expansion coefficient.
B) It will bend towards the metal with smaller thermal expansion coefficient.
C) The strip will not bend at all; it will remain straight.

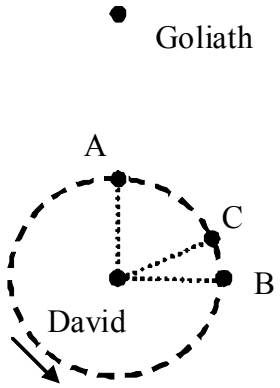
2 points	

10. Unmanned probes that have recently landed on Mars used parachutes to slow their descent to the surface. Why did spaceships landing on the Moon not use parachutes?

A) Because gravity on the Moon is much weaker, so spaceships never acquire a great speed during descent.
B) Because the Moon has no atmosphere, so a parachute is useless.
C) Because the Moon is covered by a thick layer of fine dust, which damps the collision upon landing sufficiently.

2 points	

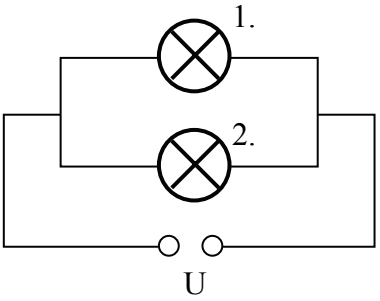
11. David stands ten paces from Goliath, spinning his sling above his head. At which point should he release the string of the sling, so that the stone thus thrown hits Goliath? (The sling is spinning in the direction indicated by the arrow.)



A) At point „A”.
B) At point „B”.
C) At point „C”.

2 points	

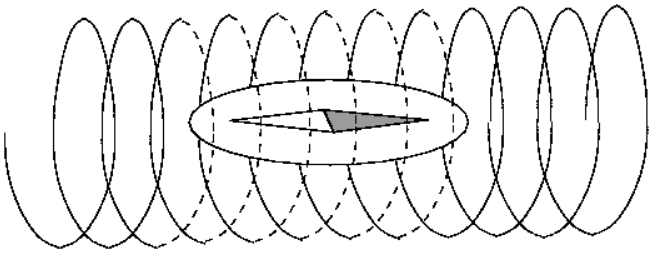
12. Assuming that the voltage U is constant, how does the light intensity (power) of the first light bulb change when the second light bulb burns out?



A) The light intensity of the first bulb increases.
B) The light intensity of the first bulb does not change.
C) The light intensity of the first bulb decreases.

2 points	

13. We place a compass inside a current-carrying coil. In which direction will it point after it comes to rest?



A) If Earth's magnetic field is much weaker than that produced by the coil, the compass will point along the axis of the coil.
B) If Earth's magnetic field is much weaker than that produced by the coil, the compass will point in a direction perpendicular to the axis of the coil.
C) The compass could point in any direction. This arrangement is a Faraday cage that shields the compass from Earth's magnetic field. ☐

2 points	

14. Cast iron objects often contain tiny bubbles of air. How big is the pressure inside these bubbles compared to the normal atmospheric pressure, if the air pressure in the workshop was normal atmospheric pressure when the object was cast?

A) Pressure inside the bubbles is smaller than normal atmospheric pressure.
B) Pressure inside the bubbles is just normal atmospheric pressure.
C) Pressure inside the bubbles is larger than normal atmospheric pressure. ☐

2 points	

15. An unstretched spring is hanging vertically from the ceiling. We hook a body onto the spring and let go very carefully, lowering the body to its equilibrium position. During this process, both the elastic energy stored in the spring, and the potential energy of the body have changed. What can we say about the relationship between these two quantities?

A) The change of the spring's elastic energy is less than the change of the body's potential energy.
B) The change of the spring's elastic energy is equal to the change of the body's potential energy.
C) The change of the spring's elastic energy is more than the change of the body's potential energy. ☐

2 points	

16. A conventional incandescent light bulb uses much more electrical energy than a compact fluorescent lamp (also known as a compact fluorescent tube) that generates the same amount of light. How is this possible?

A) A compact fluorescent lamp does not contain any moving parts, so there is no friction.
B) Conventional incandescent light bulbs convert most of the electrical energy to heat, so their efficiency is very low.
C) The frequency of the light produced by a compact fluorescent lamp is much lower than that of the light produced by an incandescent light bulb. ☐

2 points	

17. We examine the gravitational acceleration on the surface of a planet that has a mass smaller than the mass of Earth. Which statement is true?

A) The gravitational acceleration on the surface of the planet is certainly smaller than that on the surface of Earth.
B) The gravitational acceleration on the surface of the planet is certainly larger than that on the surface of Earth.
C) The gravitational acceleration on the surface of the planet may be smaller, or larger than that on the surface of Earth. ☐

2 points	

18. We compare the nucleus of nitrogen with mass number 14 and that of an isotope of carbon also with a mass number of 14. Which statement is true?

A) These two nuclei contain the same number of protons.
B) These two nuclei contain the same number of neutrons.
C) These two nuclei contain the same number of nucleons. ☐

2 points	

19. We drop two ice cubes into a thermos flask containing hot tea. In which case is the cooling effect on the tea stronger? (Heat loss due to opening the flask is negligible.)

A) The tea cools down more if I drop the second ice cube into it a few minutes after I have dropped in the first one.
B) The tea cools down more if I drop both ice cubes into the tea at once.
C) The cooling effect on the tea is the same in both cases.

2 points	

20. Consider the following statement: The energy of a photon can be arbitrarily small. Which evaluation is correct?

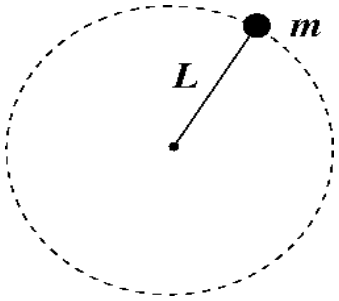
A) It is true, because energy is not quantized.
B) It is true, because the frequency of a photon may be arbitrarily small.
C) It is false, because energy is quantized.

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. A body of mass m=5 kg is tied to a string of length L=1 m and rotates in a vertical plane. The speed of rotation is such that at the highest point of its orbit the tension of the string is zero. $\left(g = 10\,\frac{\mathrm{m}}{\mathrm{s}^2}\right)$



a) What is the speed of the body at the highest point of its orbit?
b) What is the speed of the body at the lowest point of its orbit?
c) What is the tension arising in the string, when the body is at the lowest point of its orbit?

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

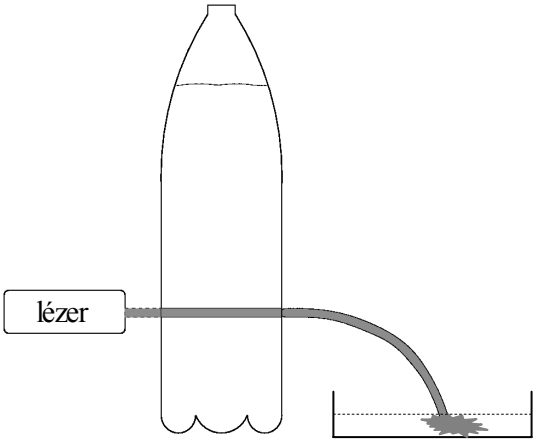
2. In a sample containing a radioactive isotope, the number of radioactive nuclei decreases to 12.5% of its original number after t_1=11.25 hours

a) How long is the half-life of the radioactive isotope?
b) Given that the mass of the nuclei that have decayed in the first t_2=7.5 hours is m=15 g, what was the total mass of the radioactive nuclei in the original sample?

a)	b)	Total
6 points	9 points	15 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 We have a transparent bottle with a small hole drilled in its side (shown in the photograph and the figure), which we fill with a transparent liquid, for example water. The liquid flows out of the bottle through the hole in a curved stream. We then take a laser and illuminate the side of the bottle that is opposite to the hole. The illumination is such that the beam of light is incident perpendicularly upon the bottle and after passing through the liquid it reaches the hole. We find, that the light beam follows the stream of liquid leaving the bottle (it remains within the stream) and it thus follows a curved path, instead of a straight one.



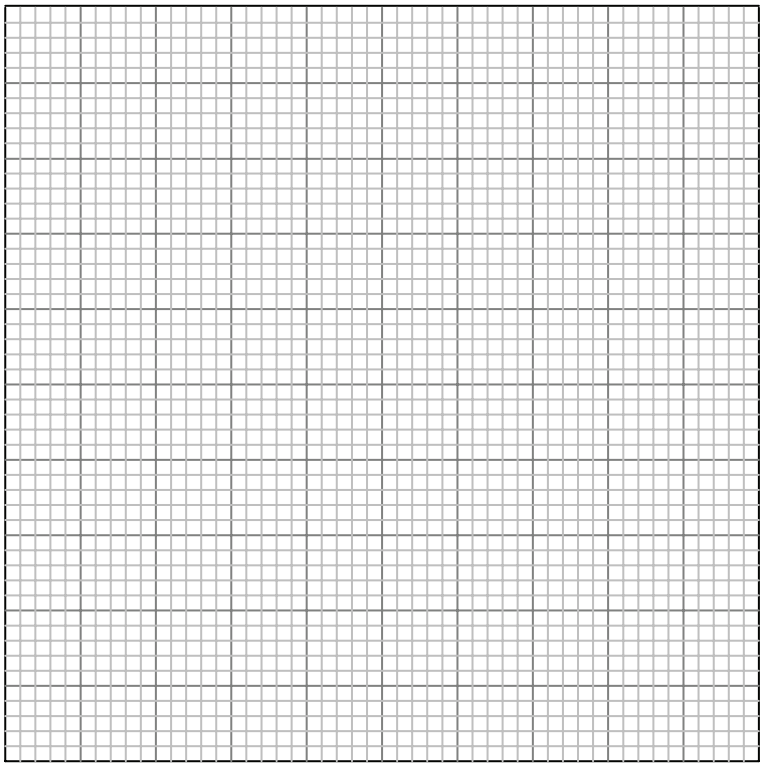
Explain the phenomenon!
Why doesn't the light leave the liquid?
What factors influence the occurrence of the phenomenon?
How can we observe the phenomenon if the light stays within the stream of liquid?
Can this phenomenon be utilized for some practical purpose?

Total
20 points

3 / B Some gas is enclosed by a piston in a container and it is heated at constant pressure. The following table contains the volume of the gas as a function of its temperature measured in degrees Celsius.

Temperature (°C)	Volume (cm^3)
10	3170
20	3310
30	3420
40	3550
50	3660
60	3780

a) Plot the data on the graph paper provided! What kind of curve can be fitted to the data?
b) Based on the graph, give (write down) the functional relationship between the volume of the gas and its temperature measured in degrees Celsius.
c) Determine the volume of the gas when its temperature is 0°C either using the functional relationship, or using the graph.
d) At what temperature would the volume of the gas decrease to zero, if the **relationship obtained above** between its temperature and volume would be valid even at very low temperatures?
e) What would the result obtained in point d) be, if the measurement could be performed more accurately? What temperature scale could be defined using this result?



a)	b)	c)	d)	e)	Total
4 points	4 points	3 points	5 points	4 points	20 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	**90**	

examiner

Date: .....

	score attained (elért pontszám)	score entered in the program (programba beírt pontszám)
I. Multiple choice questions (Feleletválasztós kérdéssor)		
II. Complex problems (Összetett feladatok)		

examiner (javító tanár) notary (jegyző)

Date (dátum): ..... Date (dátum): .....