ÉRETTSÉGI VIZSGA • 2007. május 14.

FIZIKA
ANGOL NYELVEN
PHYSICS

KÖZÉPSZINTŰ ÍRÁSBELI ÉRETTSÉGI VIZSGA
STANDARD LEVEL FINAL EXAMINATION

JAVÍTÁSI-ÉRTÉKELÉSI ÚTMUTATÓ
MARKSCHEME

OKTATÁSI ÉS KULTURÁLIS MINISZTÉRIUM
MINISTRY OF EDUCATION AND CULTURE

In marking the examination papers, follow the instructions of the markscheme, making clear corrections and comments. Do all marking in red ink, using the conventional notations.

PART ONE

In the multiple choice questions, the 2 points are only due for the correct answer as given below. Enter the scores (0 or 2) in the grey rectangles next to the individual questions, as well as the total score in the table at the end of the question paper.

PART TWO

The subtotals given in the markscheme cannot be broken up further, unless indicated otherwise. Do not give partial credit.

The lines in the markscheme printed in italics define the steps necessary for the solution. The indicated number of points are due if the activity or operation described in italics can be clearly identified in the work of the candidate, and it is basically correct and complete. Where the activity can be divided into smaller steps, the subtotals are indicated next to each line of the expected solution. The sample solution as given in the markscheme is not necessarily complete. It aims to illustrate what kind of solution (length, depth, details, etc.) is expected of the candidate. The remarks in brackets at the end of the unit give further guidance in the judgement of the possible errors, differences and incomplete answers.

Correct solutions using a different reasoning from the one(s) given in the markscheme are also acceptable. The lines in italics help in judging the appropriate proportions, i.e. what part of the full score can be awarded for the correct interpretation of the question, for setting up relationships between quantities, for calculation, etc.

If the candidate combines steps and expresses the results algebraically without calculating quantities shown by the markscheme but not asked for in the original problem, award full mark for these steps, provided that the reasoning is correct. The purpose of giving intermediate results and the corresponding subtotals is to make the marking of incomplete solutions easier.

Take off points only once for errors not affecting the correctness of reasoning (e.g. miscalculations, slips of the pen, conversion errors, etc.)

If the candidate's response contains more than one solution or more than one attempt without making clear which one they want to be assessed, assume that the last version is the final version (i.e. the one at the bottom of the page if there is no other way to decide the order.) If the candidate's response contains a mixture of elements of two different chains of reasoning, evaluate only one of the two. Select the one that is more favourable for the candidate.

The lack of units during calculation should not be considered a mistake if it does not cause an error in the result. The answers to the questions asked by the problem, however, are only acceptable with the appropriate units.

Graphs, diagrams and notations are considered correct if they can be clearly interpreted (i.e. if it is clear what they show, they contain the necessary notations, unconventional notations are explained, etc.) The labels of the axes in a graph do not need to indicate the units if they are clear from somewhere else (e.g. if the graph represents quantities given in a table that all have the same unit).

If the choice of the candidate is not indicated in problem 3, follow the description of the examination.

Enter the appropriate scores in the table at the bottom of each page.

PART ONE

1. B
2. A
3. A
4. B
5. C
6. C
7. B
8. B
9. A
10. B
11. C
12. C
13. C
14. A
15. C
16. B
17. B
18. A
19. B
20. C

Award ***2 points*** for each correct answer.

Total **40 points**

PART TWO

Problem 1.

Notation: $I = 0.5$ A

a) *Reading individual pairs of voltage and current values from the graph:*
(The 1 + 1 points may be awarded for any corresponding pair of values.)

1+1 points

Calculation of the resistances by using Ohm's law:

$$R_1 = \frac{30\,V}{1.5\,A} = 20\,\Omega, \quad R_2 = \frac{30\,V}{1\,A} = 30\,\Omega.$$

3 points
(may be divided)

(1 point for applying Ohm's law and 1 point for each correct answer.)

b) *Finding the resultant of the two resistances in series or reading the voltages across the individual resistors from the graph:*

$R_e = R_1 + R_2 \rightarrow R_e = 20\,\Omega + 30\,\Omega = 50\,\Omega.$
or
$U_1 = 10\,\text{V}, \quad U_2 = 15\,\text{V}.$
(In the latter case, award a maximum of 1 point if there is no explanation. E.g. a mark on the graph is acceptable as an explanation.)

2 points
(may be divided)

Finding the total voltage for the current $I = 0.5$ A:

$U = (R_1 + R_2)I = 25\,\text{V}$
or
$U = U_1 + U_2 = 25\,\text{V}.$
(2 points for using an appropriate formula, 1 point for the correct answer.)

3 points
(may be divided)

c) *Finding the powers of the individual resistors:*

$$P_1 = R_1 I^2 = 5\,W, \quad P_2 = R_2 I^2 = 7.5\,W.$$

5 points
(may be divided)

(3 points for using the appropriate formula, 1 point for each correct answer.)

Total **15 points**

Problem 2.
Notations: $L = 0.8$ m, $m = 0.2$ kg.

a) *Interpretation of the situation in terms of the energies involved:*

4 points
(may be divided)

Writing down or marking (e.g. in the diagram) the energy levels in the initial and final states.
(Do not take off points for not marking the zero-level, unless the candidate uses the zero-level inconsistently in determining the change of potential energy.)

Applying $\mathrm{E_{pot}} = \mathrm{mgh}$ *:*

1 point

Applying $\mathrm{E_{kin}} = \frac{1}{2}\mathrm{mv}^2$*:*

1 point

Applying the principle of conservation of mechanical energy:

$$mgL = \frac{1}{2}mv^2.$$

3 points
*(*may be divided*)*
(Acceptable in any form, provided that the candidate sets up the equality of the appropriate energies.)

Finding the speed:

3 points
*(*may be divided*)*

$$v = \sqrt{2gL} = 4\,\frac{\mathrm{m}}{\mathrm{s}}.$$

(Substitution, expressing the speed, and the correct answer are worth 1 point each.)

b) *Finding the centripetal acceleration:*

5 points
*(*may be divided*)*

$$a_{cp} = \frac{v^2}{r},$$

$$a_{cp} = \frac{v^2}{r} = 20\,\frac{\mathrm{m}}{\mathrm{s}^2}.$$

(2 points for applying the appropriate formula, 1 point for substitution and 2 points for the correct answer.)

Total **17 points**

Problem 3/A

Notations: m = 0.5 kg, c = 400 J/kg·°C, T_0 =80.0 °C, T_1 = 40.0 °C, T_2 = 20.0 °C, T_3=10.0 °C, T_4=5 °C, T_5 =2.5 °C, Δt = 200 s.

a) *Plotting the data of the table:*

3 points

Determining the final temperature of the cooling metal, with explanation:

3 points
(may be divided)

(2 points for the temperature, 1 point for the explanation.)

b) *Recognising that the metal will cool to the temperature of the balcony:*

2 points

(It is enough to state that the two temperatures are the same.)

c) *Calculating the amount of heat given off:*

$Q = cm\Delta T,$

2 points

$|Q_{23}| = cm(T_2 - T_3) = 2000$ J.

3 points
(may be divided)

(2 points for substituting the appropriate values and 1 point for the correct answer.)

d) *Calculating the power:*

$$P = \frac{Q}{\Delta t},$$

2 points

$$P_{23} = \frac{|Q_{23}|}{\Delta t} = 10 \text{ W}.$$

3 points
(may be divided)

(2 points for substituting the appropriate values and 1 point for the correct answer.)

Total **18 points**

Problem 3/B

a) *Naming the photoelectric effect:*

4 points

Stating what the phenomenon of photoelectric effect means:

4 points

The photons of the illuminating UV light cause electrons to be ejected from the zinc plate.

Interpretation of the decrease in the quantity of electrons:

5 points
(may be divided)

Since the metal plate is negatively charged, the ejected electrons are repelled away electrostatically by the plate. They leave the plate and do not return, carrying negative charge away with them. Thus the surplus negative charge of the plate and electroscope decreases, and the electroscope indicates a decreasing charge.

b) *Explanation of the faster loss of charge:*

If the intensity of the illuminating light is increased, there are more photons incident on the plate during the same time interval. More photons will necessarily eject more electrons from the plate, and thus the loss of charge becomes faster.

5 points
(may be divided)

Total **18 points**