ÉRETTSÉGI VIZSGA • 2005. május 17.

FIZIKA
ANGOL NYELVEN
PHYSICS

KÖZÉPSZINTŰ
ÉRETTSÉGI VIZSGA
STANDARD LEVEL
FINAL EXAMINATION

A vizsga időtartama: 120 perc
Time allowed for the examination: 120 minutes

JAVÍTÁSI-ÉRTÉKELÉSI
ÚTMUTATÓ
MARKSCHEME

OKTATÁSI MINISZTÉRIUM
MINISTRY OF EDUCATION

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

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

Total **40 points**.

PART TWO

Problem 1.

a) *Finding the spring constant*

Stating the force stretching the spring ***2 points***

$F = mg = 20$ N

(It is also acceptable if only the numerical value is given.)

Conversion of units ***1 point***

$\Delta x = 0.1$ m

Calculating the spring constant

$F = Dx$ ***1 point***

$$D = \frac{F}{x} = \frac{20\text{ N}}{0.1\text{ m}} = 200\frac{\text{N}}{\text{m}}$$ ***1+1 points***

(For the expression of D and for the final answer. If only the final answer is given, the 2 points are only due if the previous relationship is stated or there is a reference to direct proportionality. In the latter case, the 1 point for the relationship is due, too, even if it is not stated.)

b) *Finding the work done*

Solution I.

Determining the change in the elastic potential energy

$$E_1 = \frac{1}{2}Dx_1^2 = 1\text{ J}$$ ***4 points***

(give partial credit if appropriate)

$\Delta x_2 = 0.15$ m

(It is also acceptable if the given information is stated in cm.)

$$E_2 = \frac{1}{2}Dx_2^2 = 2.25\text{ J}$$

$\Delta E = 1.25$ J

Determining the work of the gravitational force ***2 points***

$W_{grav} = 1$ J

Determining our work ***2 points***

$W_F = \Delta E - W_{grav} = 0.25$ J

Solution II.

Graphing F versus s ***2 points***

Indicating the work done in the graph ***4 points***

(If the candidate graphs the spring force, and hence calculates the work as the area of the trapezoid, 2 points should be given.)

Determining our work from the area of the triangle ***2 points***

(If the candidate uses the average of the spring force, 4 points should be given for the calculation. The remaining 4 points should be given for referring to the direct proportionality between force and strain.)

Solution III.

Determining the formula for work done ***2 points***

$W = \frac{1}{2} Dx^2$

Conversion, substitution ***1+2 points***

$x = 0{,}05$ m

$W = \frac{1}{2} \cdot 200 \cdot 0{,}05^2$

Calculating the work done ***3 points***

$W = 0{,}25$ J

Total **14 points**

Problem 2.

a) *Finding the pressure owing to the compressing force*

Conversion of units ***1 point***

$A = 1$ dm^2 = 0.01 m^2

$p = \frac{F}{A} = \frac{400\text{ N}}{0.01\text{ m}^2} = 4 \cdot 10^4$ Pa ***2+1+1 points***

b) *Finding the pressure*

The initial pressure equals the atmospheric pressure. ***2 points***

$p_1 = 10^5$ Pa

(Award the 2 points if it is clear that the atmospheric pressure is used as initial pressure.)

The final pressure of the gas:

$p_2 = p_1 + p$ ***2 points***

$p_2 = 10^5$ Pa + $4 \cdot 10^4$ Pa = ***1 point***

$= 1.4 \cdot 10^5$ Pa or $14 \cdot 10^4$ Pa ***2 points***

(Take off 1 point if the unit is missing.)

c) *Finding the volume*

Since T = constant, Boyle's law can be applied. ***1 point***

(The 1 point is also due if "T = const." is not stated but the candidate uses Boyle's law later on.)

$V_1 = 7$ dm^3 ***1 point***

$p_1 \cdot V_1 = p_2 \cdot V_2$ ***1 point***

$V_2 = \frac{p_1 V_1}{p_2} = \frac{10^5 \cdot 7}{14 \cdot 10^4} = 5$ dm^3 ***1+1+1 points***

(Do not give points for substitution and answer if the candidate uses the pressure owing to the compressing force as final pressure.

Total **18 points**

Problem 3/A

In order to achieve full mark, the following ideas need to be explained:
- electrons are only allowed to move in specific orbits 4 ***points***
- there belongs a well-defined energy level to each of these orbits (The interpretation of the principal quantum number is also acceptable.) ***4 points***
- transition from one orbit to another involves the absorption or emission of a certain amount of energy ***5 points***
- that difference of energy means the emission of radiation of a certain frequency (Planck's formula is also acceptable) ***5 points***

(The explanation of either the emission or the absorption spectra is acceptable.)
(In all of the above, give partial credit if appropriate.)

Total **18 points**

Problem 3/B

a) *The role of insulation* ***3 points***
(give partial credit if appropriate)

(3 points should only be given if the candidate explains in general that the insulation stops the electric charges from leaving the conductor. If the candidate only gives practical examples as "it prevents electric shocks", etc. a maximum of 2 points should be given.)

Plastic is not a conductor of electric current, ***1 point***
because it does not contain free charge carriers. ***2 points***

Naming two insulators ***2+2 points***

b) *The difference between insulation and shielding*
The essence of shielding **3 points**
(give partial credit if appropriate)

(The answer should be fully rewarded if the candidate describes the shielding of the electric field, independent of the static or dynamic nature of the field.)

Comparison ***2 points***

Example for shielding (it is not required to refer to shielding from a static field) ***3 points***

Total **18 points**