ÉRETTSÉGI VIZSGA • 2018. május 22.

FIZIKA
ANGOL NYELVEN

KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA

JAVÍTÁSI-ÉRTÉKELÉSI
ÚTMUTATÓ

EMBERI ERŐFORRÁSOK MINISZTÉRIUMA

The examination papers should be evaluated and graded clearly, according to the instructions of the evaluation guide. Markings should be in red ink, using the conventional notations.

PART ONE

For the multiple choice questions, the two points may only be awarded for the correct answer given in the evaluation guide. Enter the score (0 or 2) in the gray rectangle next to the question as well as the table for total scores at the end of the exam paper.

PART TWO

The individual scores shown in the evaluation guide may not be broken up unless explicitly indicated.

The sentences printed in italics in the evaluation guide define the steps necessary for the solution. The scores indicated here may be awarded if the action or operation described by the text in italics can be clearly identified in the work of the student and is basically correct and complete. If the action can be broken down into smaller steps, partial scores are indicated beside each line of the expected solution. The „expected solution" is not necessarily complete; its purpose is to indicate the nature and extent of the expected solution, and the depth of detail required of the student. Comments in brackets that follow provide further guidance on the evaluation of possible errors, differences or incomplete answers.

Correct answers that differ from the reasoning of the one (ones) given in the evaluation guide are also acceptable. The lines in italics provide guidance in allocating scores, e.g. how much of the full score may be awarded for a correct interpretation of the question, for stating relationships, for calculations, etc.

Should the student combine some steps, or carry on calculations algebraically, he/she may skip the calculation of intermediate results shown in the evaluation guide. If these intermediate results are not being explicitly asked for in the original problem, the scores indicated for them can be awarded if the reasoning is otherwise correct. The purpose of indicating scores for intermediate results is to make the evaluation of incomplete solutions easier.

For errors that do not affect the correctness of reasoning (miscalculations, clerical errors, conversion errors, etc.) deduce points only once.

Should the student write more than one solutions, or display multiple attempts at solving the problem, and does not indicate clearly which one of those he/she wants evaluated, the last one should be considered (i.e. the one at the bottom of the page if there is nothing to indicate otherwise). If the solution contains a mixture of two different trains of thought, the elements of only one of them should be evaluated: that one which is more favorable for the student.

The lack of units during calculation should not be considered a mistake – unless it causes an error. However, the results asked for in the problem are acceptable only with proper units.

Graphs, diagrams and notations are acceptable only if they are unambiguous (it must be clear what the graphs show, markings should be in place, unconventional notations must be explained, etc.). The lack of units on the axis labels of graphs should not be considered a mistake however, if the units are otherwise obvious (e.g. quantities given in a table must be plotted, all with the same units).

If, in case of problem 3. the student does not indicate his/her choice, the procedure described in the exam description should be followed.

After evaluation, the appropriate scores should be entered in the summarizing tables at the bottom of the page.

PART ONE

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

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

Total 40 points.

PART TWO

When evaluating the calculations, care must be taken to deduce points for errors that do not affect the correctness of reasoning (miscalculations, clerical errors) only once. If the student uses a previously miscalculated result in further steps of the solution correctly, full points are to be awarded for these steps. Thus it may be possible that full points are due at certain steps for solutions that differ from the values given in the evaluation guide.

Problem 1

Data: v = 10 m/s, a = 6 m/s^2

a) *Recognizing that the body performs* <u>*uniform circular*</u> *motion:*

3 points

b) *Recognizing that the time and distance in question are the period of the circular motion and the double of its radius:*

1 + 1 points

This fact does not need to be written down explicitly, if the student performs the calculations according to it, full points are to be awarded.

Determining the quantities in question:

10 points
(may be divided)

Using the relationships of uniform circular motion:

$v = R \cdot \omega$ (1 point), and $a = R \cdot \omega^2$ (1 point), from which

$\omega = \frac{a}{v} = 0.6\ \frac{1}{\text{s}}$ (formula + calculation, 2 + 1 points) and so

$T = \frac{2\pi}{\omega} = 10.5\ \text{s}$ (formula + calculation, 1 + 1 points).

$R = \frac{v}{\omega} = 16.67\ \text{m}$ (formula + calculation, 1 + 1 points), from which the maximum distance:

$\Rightarrow\ s_{\max} = 33.3\ \text{m}$ (1 point).

Total 15 points

Problem 2

Data: m = 0.2 g, t = 0 °C, L = 335 kJ/kg.

a) Discussion of the energy exchanges during the transformation of the snowflake into supercooled water:

8 points
(may be divided)

The snowflake absorbs heat (1 point) in the warmer air layer, and first warms to a temperature of 0 °C (1 point) then melts (1 point) and warms up further (1 point).
In the lower, cold layer close to the ground it looses heat (1 point), it cools below freezing point (1 point) but it remains a liquid, there is no phase transition (2 points).

b) Explaining the heat released upon freezing:

3 points

Water that is freezing releases heat during the phase transition.

c) Determining the amount of heat released by the 0.2 g water droplet while freezing:

4 points
(may be divided)

$Q = L \cdot m = 67\ \text{J}$

(Selection of the appropriate thermodynamic data from the table 2 points, formula + calculation 1 + 1 points).

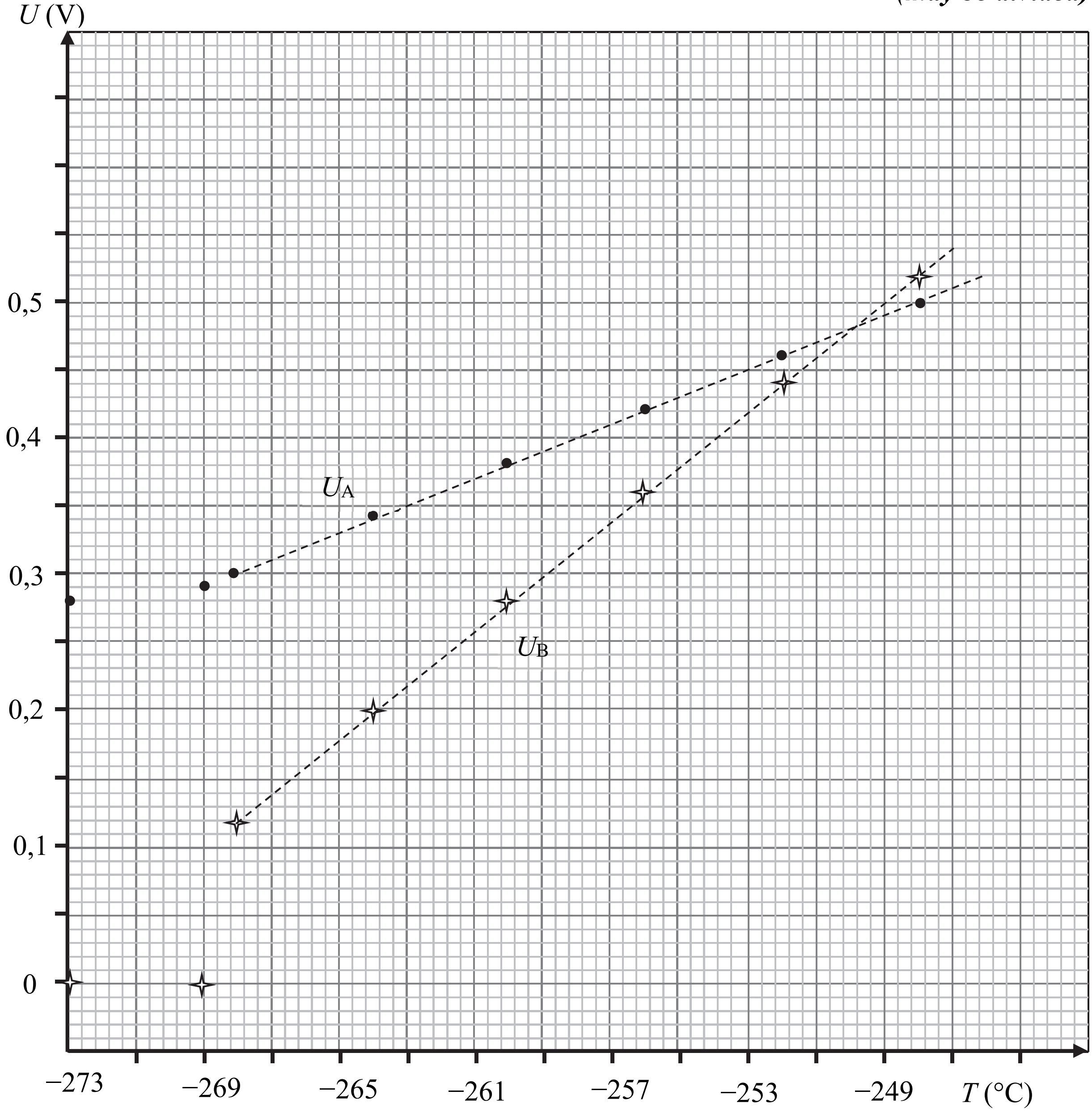
Total 15 points

Problem 3/A

Data: I = 1 A, T_1 = −260 °C

a) *Plotting the data on the graph correctly:*

8 points
(may be divided)



Plotting the data found in the table on the graph correctly is worth 6 points. (16 data points drawn correctly 6 points, 13-15 data points: 5 points, 10-12 data points: 4 points, 7-9 data points: 3 points, 4-6 data points: 2 points, 1-3 data points: 1 point.) Further two points are due for distinguishing unambiguously between data of the two sets on the graph and marking which data points belong to which piece of material.

b) *Naming the wire with the greater resistance and determining its resistance:*

4 points
(may be divided)

At -260 °C the resistance of wire "A" is greater (2 points), because this is the one with greater voltage at a given current. (The points are to be awarded even in the absence of an explanation.)

$R = \frac{U}{I} = 0.38\ \Omega$ (formula + calculation, 1 + 1 point).

c) *Determining the approximate temperature at which the resistances of the two wires are equal:*

4 points
(may be divided)

The resistances of the two wires will be equal at approximately -250 °C (4 points).

Full points are to be awarded for the correct answer.
In the absence of a correct answer:
If the student writes down or makes evident in some other manner the fact that the temperature in question is the one where the two *U(T)* graphs intersect each other, 1 point is to be awarded.
If the intersection is marked on the graph by connecting points or drawing straight lines that fit the data, a total of 2 points is to be given.

d) *Naming the wire that exhibits unusual behavior and describing the essence of the behavior:*

4 points
(may be divided)

Wire "B" (2 points) exhibits unusual behavior, because at low temperatures its resistance is zero (2 points).

(Any other correct description for the essence of the unusual behavior is acceptable, – e.g. the material is a superconductor – but merely stating that the voltage on it is zero is not sufficient.)

Total 20 points

Problem 3/B

If the pressure in the mouth and thus in the straw drops, then the liquid will flow towards the place of lower pressure in the straw (upwards) (2 points) due to the external air pressure (2 points).

(If the student writes that vacuum is created in the mouth instead of the pressure being decreased, one point is to be deduced.)

If the straw has a hole in its side, air enters the straw and the pressure equalizes (2 points).

If the external pressure is 10^5 Pa, the maximum difference in pressure is about $0.3 \cdot 10^5$ Pa (1 point), which is equivalent to the hydro-static pressure of a column of water about 3 m high (2 points). Thus water cannot rise to a height greater than 3 m in the straw (2 points). Therefore, only a vertical straw somewhat shorter than 3 m (2 points) can be used successfully.

For liquids with a smaller density, the column height corresponding to a hydro-static pressure of $0.3 \cdot 10^5$ Pa is greater, so alcoholic drinks may be sucked into the mouth using a longer straw (2 points).

For liquids with a greater density, the column height corresponding to a hydro-static pressure of $0.3 \cdot 10^5$ Pa is smaller, so sweet drinks may be sucked into the mouth using only a shorter straw (2 points).

On a high mountain, the external pressure is smaller (1 point), so the pressure difference is smaller (1 point), thus the length of the straw that may be used successfully will also be shorter (1 point).

Total 20 points