ÉRETTSÉGI VIZSGA • 2025. május 20.

FIZIKA
ANGOL NYELVEN

KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA

JAVÍTÁSI-ÉRTÉKELÉSI
ÚTMUTATÓ

OKTATÁSI HIVATAL

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

Principles for dividing allocated scores:

- The sentences printed in italics in the evaluation guide define the steps necessary for the solution. The scores indicated here may and should 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.
- 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 from the student. Comments in brackets that follow provide further guidance on the evaluation of possible errors, differences or incomplete answers.

Principles for evaluating alternative trains of thought:

- Correct answers that differ from the reasoning of the one (ones) given in the evaluation guide should also be evaluated. The lines in italics provide guidance in allocating scores, e.g. what part 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 should 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.

Principles for the avoidance of multiple deductions:

- For errors that do not affect the correctness of reasoning (miscalculations, clerical errors, conversion errors, etc.) deduce points only once.
- Should the student 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.
- If an action or operation defined in the evaluation guide is completed, but the results are incorrect due to errors committed previously, full points allocated for this action are to be awarded. If the action can be broken down into steps, partial scores are indicated beside each line of the expected solution.

Principles regarding the use of units:

- 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).

Further comments:

- If, in case of problem 3. the student does not indicate his/her choice, and the choice is also not immediately obvious from the exam paper, the solution for the first problem of the two optional ones must be evaluated in every case.
- After evaluation, the appropriate scores should be entered in the summarizing tables at the bottom of the page.

PART ONE

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

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: $U_h = 1.6$ V, $I_h = 18$ mA, $t_h = 2.4$ h, $U_t = 2.3$ V, $I_t = 13.5$ mA, $t_t = 4.2$ h.

a) Determining the total amount of charge of the fully charged battery:

4 points
(may be divided)

The total amount of charge: $I_h \cdot t_h = 18 \cdot 2.4 = 43.2$ mAh
(formula + substitution of data + calculation, 2 + 1 + 1 points)

b) Determining the energy consumed for charging:

4 points
(may be divided)

$W_t = U_t \cdot I_t \cdot t_t = 2.3 \cdot 0.0135 \cdot 4.2 \cdot 3600 = 469$ J
(formula + substitution of data + calculation, 2 + 1 + 1 points)

c) Determining the amount of energy supplied by the battery:

4 points
(may be divided)

$W_h = U_h \cdot I_h \cdot t_h = 1.6 \cdot 0.018 \cdot 2.4 \cdot 3600 = 249$ J
(formula + substitution of data + calculation, 2 + 1 + 1 points)

d) Determining the efficiency of the battery:

3 points
(may be divided)

$$\eta = \frac{W_h}{W_t} = \frac{249}{469} = 0.53 \rightarrow 53\%$$

(formula + calculation, 2 + 1 points)

Total: 15 points

Problem 2

Data: $c = 3 \cdot 10^8$ m/s, $s = 0.5$ A.U.

a) Naming the source of the radiation:

4 points
(may be divided)

Charged particles coming from the Sun (2 points) (the expression solar wind is also correct).

Cosmic radiation coming from distant regions of the Universe (2 points).

b) Explanation of the protective effect of Earth's atmosphere and its magnetic field:

4 points
(may be divided)

Particles of the radiation coming from space collide with the particles of the atmosphere (2 points) and lose their energy. Earth's magnetic field deflects charged particles towards the poles (2 points).

c) Answering the question about the danger and justifying the answer:

4 points
(may be divided)

Not only during the journey, because the atmosphere of Mars is thinner (2 points) and Mars has no magnetic field (2 points).

d) Determining the transit time of the radio message:

3 points
(may be divided)

$$t = \frac{s}{c} = \frac{0.5 \cdot 150 \cdot 10^9}{3 \cdot 10^8} = 250 \text{ s}$$

(formula + substitution of data + calculation, 1 + 1 + 1 points)

Total: 15 points

Problem 3/A

a) Reading the humidity values from the graph:

1 + 1 + 1 points

Room: ~25%, warm water maximum: ~90%, cold water maximum: 80%.

b) Determining the duration of the phases of the experiment:

5 points
(may be divided)

I. ~10 s , II. ~85 s, III. ~45 s, IV. ~95 s, V. ~40 s.
(Each correct value is worth 1 point.)

c) Explaining the increase of humidity:

4 points
(may be divided)

Water evaporates (1 point) from the cup, but the vapor cannot leave the vicinity of the cup (2 points) and spread throughout the air in the room if the cup is covered. If we take the cover off, the vapor spreads (1 point) and mixes with the air in the room, so vapor density decreases.

d) Explaining the difference between the evaporation rate of hot and cold water:

4 points
(may be divided)

Evaporation removes heat (1 point) (or: energy is required for evaporation), so warm water evaporates faster (2 points), therefore humidity increases faster (1 point).

e) Discussion of the measurement that lasts a very long time:

4 points
(may be divided)

Relative humidity would slowly approach 100% (2 points), because that is when there would be equilibrium between evaporation and condensation (2 points) (or: between the number of particles leaving from and returning to water).

Total: 20 points

Problem 3/B

a) Completing the figure that shows the light rays and explaining the origin of the numbered rays:

10 points
(may be divided)

Drawing the ray of refracted light inside the prism from the point of incidence to the point of exit of ray number 2: 2 points

Drawing the ray reflected from the second face of the prism until the point of exit of ray number 3: 2 points

Explanation:
1. The singly reflected ray – 2 points
2. The ray refracted twice – 2 points
3. Refracted – reflected – refracted ray – 2 points

b) Explaining the color of the ray number 2:

4 points
(may be divided)

Because of the dispersion of the prism's material (2 points), different wavelength components of ray number 2 will be refracted at slightly different angles (2 points).

c) Explaining the color of ray number 1:

2 points

For the reflected ray, all components are reflected at the same angle (2 points).

d) Determining the change of direction for ray number 1 and justifying the answer:

4 points
(may be divided)

Ray 1. will also be rotated left (2 points) (or: it will be deflected more strongly).

Rotating the prism will decrease the angle of incidence, so the incoming ray will be incident more steeply on the prism's surface (1 point), so the reflected ray will enclose a smaller angle with the incident ray (1 point).

(A suitable drawing is also acceptable as explanation.)

Total: 20 points

The origin of the sources for the problem sheet (pictures, drawings, data):

II/3B. hu.wikipedia.org/wiki/prizma#/media/Fájl:Színszóródás-prizmán1.jpg
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