

**ÉRETTSÉGI VIZSGA • 2005. november 5.**

**FIZIKA ANGOL NYELVEN  
PHYSICS**

**KÖZÉPSZINTŰ ÍRÁSBELI  
ÉRETTSÉGI VIZSGA  
STANDARD LEVEL  
FINAL EXAMINATION**

**JAVÍTÁSI-ÉRTÉKELÉSI  
ÚTMUTATÓ  
MARKSCHEME**

**OKTATÁSI MINISZTERIUM  
MINISTRY OF EDUCATION**

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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.

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**PART ONE**

- 1. C
- 2. A
- 3. A
- 4. A
- 5. C
- 6. B
- 7. A
- 8. A
- 9. C
- 10. B

- 11. B
- 12. C
- 13. A
- 14. B
- 15. A
- 16. C
- 17. B
- 18. C
- 19. A
- 20. B

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

**Total**

**40 points.**

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## PART TWO

### Problem 1.

#### a) *Conversion of units*

**1 point**

Using that  $1 \text{ aJ} = 10^{-18} \text{ J}$

#### *Interpretation*

The work function of the electron is covered by the energy of the photon.

**2 points**

Therefore the photon energy has to be greater than or equal to the work function.

**2 points**

Or:  $\varepsilon \geq W$

(The inequality has to be mentioned verbally or stated in symbols. In the subsequent calculations, however, it is not considered an error if the inequality is not carried forward.)

#### *Finding the frequency*

$$W = h \cdot f$$

**2 points**

$$f = \frac{W}{h} = 1.04 \cdot 10^{15} \text{ Hz}$$

**1 + 1 + 1 points**

(Award full mark if the candidate calculates the frequency from the wavelength looked up in the data tables. The order of expressing the frequency and substitution may be reversed)

#### b) *Answer with explanation*

**1 + 2 points**

It may only be ultraviolet since the frequency (energy) of either of the other two is too low.

**Total****13 points**

**Problem 2.***Data and conversions:*

$$t = 12 \text{ minutes} = 720 \text{ s}$$

**1 point**

Conversion of kWh into J or the other way round

**2 points**

$$m = 4 \text{ kg}$$

**1 point**

(Accepted without an explanation.)

(The points for the first two conversions belong to part a) while the point for the third one belongs to part b) in the grey table of points in the question paper.)

**a) Calculation of the energy used**

$$W_{el} = U \cdot I \cdot t;$$

**2 points**

$$W_{el} = 230 \text{ V} \cdot 2 \text{ A} \cdot 720 \text{ s} = 3.3 \cdot 10^5 \text{ Ws}$$

**1 + 1 points***Calculation of the cost*

$$W_{el} = 3.3 \cdot 10^5 \text{ Ws} = 0.09 \text{ kWh}$$

The cost  $K$  in forints is

$$K = 0.09 \text{ kWh} \cdot 32.20 \text{ Ft/kWh} = 2.9 \text{ Ft} \approx 3 \text{ Ft}$$

**1 + 1 points****b) Finding the energy used for heating**

$$Q = 0.9 \cdot W_{el} = 2.97 \cdot 10^5 \text{ Ws}$$

**2 + 1 points***Calculation of the change in temperature*

$$Q = m \cdot c \cdot \Delta T$$

**1 point**

$$\Delta T = \frac{Q}{m \cdot c} = \frac{2.97 \cdot 10^5 \text{ Ws}}{4 \text{ kg} \cdot 4200 \frac{\text{J}}{\text{kg}^\circ\text{C}}} = 17.7^\circ\text{C}$$

**2 + 1 + 1 points**(The order of expressing  $\Delta T$  and the substitution may be reversed.)*Stating the final temperature***1 point**

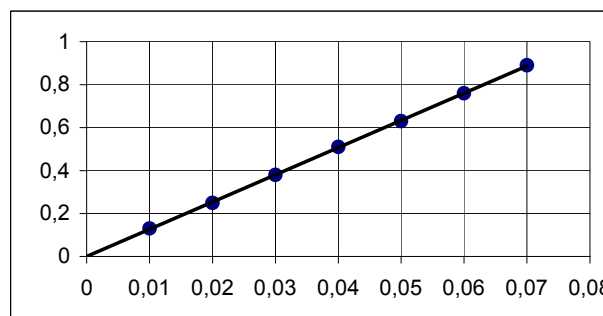
$$T = 37.7^\circ\text{C}$$

**Total****19 points**

**Problem 3/A****a)** *Stating that  $F$  and  $\Delta x$  are directly proportional***2 points**(The relationship is also accepted in the form  $F = D \cdot \Delta x$ .)*Verification by using the data***3 points**

By calculation or graphically

$\Delta x$	$F$	$D$
0.01	0.13	13
0.02	0.25	12.5
0.03	0.38	12.67
0.04	0.51	12.75
0.05	0.63	12.6
0.06	0.76	12.67
0.07	0.89	12.71



(In the case of more than one error in calculation or plotting the points, take off points proportionately.)

*Conclusion and explanation*

The relationship is supported by the data

**1 point**since a line through the origin fits the plotted points well; or since the values of  $\frac{F}{\Delta x}$  arebetween 12.5 and 13 and thus it is a good approximation to consider it constant. **3 points**  
(may be divided)**b)** *Finding  $D$* **3 points** $D = 12.7 \text{ N/m}$ (The calculation is acceptable if the candidate uses several data to determine  $D$ , either as the mean of the values of  $D$  or as the ratio of the mean values of  $F$  and  $\Delta x$ . In a graphical solution it can also be determined by finding the slope of the line from values read from the graph.)**c)** *Interpretation of the work done***3 points**Graphically (by marking the appropriate area) or as the difference of the values of the work done in extending the spring by 3 cm and by 7 cm (either verbally or by formulating an equation, e.g.  $W = W_2 - W_1$ ).*Calculation of the work***3 points**

$$W = \frac{1}{2} D \cdot (\Delta x_2)^2 - \frac{1}{2} D \cdot (\Delta x_1)^2 = 2.54 \cdot 10^{-2} \text{ J}$$

(These points can be divided: stating relationship(s); substitution; calculation of the result. If the calculation is correct, award the three points for interpretation even if it is not explicitly stated by the candidate.)

**Total****18 points**

**Problem 3/B**

a) *Stating the type of the mirror*

**2 points**

The mirror is concave.

*Explanation*

The image is real

**2 points**

since it is projected onto a screen.

**2 points**

Therefore it *must* be a concave mirror (a convex mirror only forms virtual images).

**2 points**

b) *Analysis of the image formation*

$$k = t$$

**2 points**

$$\text{Magnification: } N = \frac{K}{T} = \frac{k}{t} = 1$$

**3 points**

(may be divided)

(Award the 3 points for any reasoning that uses the equality  $k = t$  and arrives at the conclusion that the object and image are of the same size.)

*Answer*

**1 point**

The drawing is correct, the image size really equals the object size; etc.

c) *Finding the distance of the sheet*

40 cm

**1 point**

*Explanation*

**3 points**

(may be divided)

From the mirror law by using the equality  $k = t$  or by referring to the fact that it is at the double of the focal length that the image distance equals the object distance (or that it is there that the magnification is 1).

**Total**

**18 points**