



**ΠΑΝΕΛΛΗΝΙΕΣ ΕΞΕΤΑΣΕΙΣ Γ' ΤΑΞΗΣ
ΗΜΕΡΗΣΙΟΥ ΓΕΝΙΚΟΥ ΛΥΚΕΙΟΥ ΚΑΙ ΕΠΑΛ (ΟΜΑΔΑ Β΄)
ΔΕΥΤΕΡΑ 20 ΜΑΪΟΥ 2013
ΕΞΕΤΑΖΟΜΕΝΟ ΜΑΘΗΜΑ: ΦΥΣΙΚΗ ΓΕΝΙΚΗΣ ΠΑΙΔΕΙΑΣ**

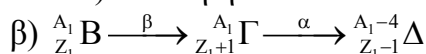
ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ Α

- A1. γ A2. δ A3. γ A4. β
A5. α) Σ β) Σ γ) Σ δ) Λ ε) Σ

ΘΕΜΑ Β

B.1. α) Σωστή η ii.



B.2. α) Σωστή η iii

β)
$$\left. \begin{aligned} \lambda_{\min} &= \frac{hc}{eV} \\ \lambda'_{\min} &= \frac{hc}{eV'} \end{aligned} \right\} \Rightarrow \frac{\lambda_{\min}}{\lambda'_{\min}} = \frac{V'}{V} \Rightarrow \frac{\lambda_{\min}}{\lambda'_{\min}} = \frac{1,25 \cdot V}{V} \Rightarrow \lambda_{\min} = 1,25 \cdot \lambda'_{\min} \Rightarrow \lambda'_{\min} = \frac{\lambda_{\min}}{1,25}$$

Ποσοστό:

$$\begin{aligned} \frac{\Delta\lambda_{\min}}{\lambda_{\min}} \cdot 100\% &= \left(\frac{\lambda'_{\min} - \lambda_{\min}}{\lambda_{\min}} \right) \cdot 100\% = \left(\frac{\lambda'_{\min}}{\lambda_{\min}} - 1 \right) \cdot 100\% = \left(\frac{1}{1,25} - 1 \right) \cdot 100\% = \\ &= \left(\frac{1}{1,25} - 1 \right) \cdot 100\% = \left(\frac{4}{5} - 1 \right) \cdot 100\% = -\frac{1}{5} \cdot 100\% = -20\%. \end{aligned}$$

B.3. α) Σωστή η iii

β) $f_A > f_B$ $P_A = P_B$

$$P_A = P_B \Rightarrow \frac{E_{\text{ολ}A}}{t} = \frac{E_{\text{ολ}B}}{t} \Rightarrow \frac{N_A E_{\varphi(A)}}{t} = \frac{N_B E_{\varphi(B)}}{t} \Rightarrow N_A \cdot hf_A = N_B \cdot hf_B \Rightarrow \frac{N_A}{N_B} = \frac{f_B}{f_A}$$

Αφού $f_B < f_A$ τότε $N_A < N_B$

ΘΕΜΑ Γ

Γ.1. $E_{\text{το}V} = -E_1 = 54,4\text{eV}$

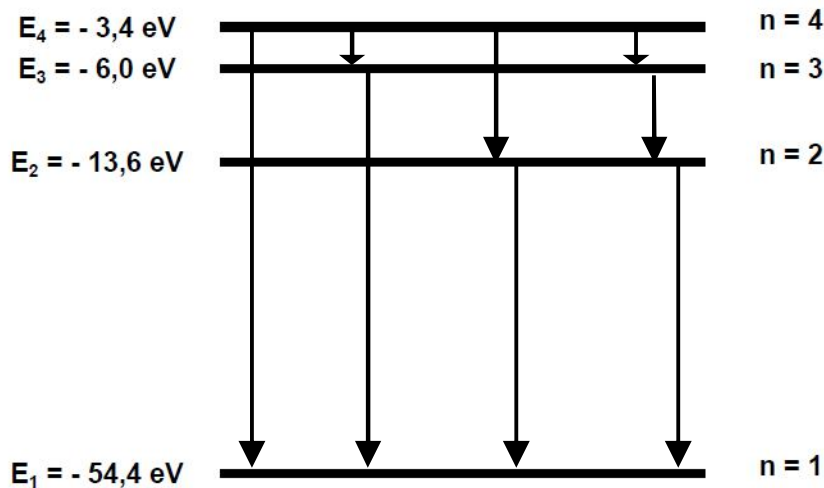
Γ.2.

$$E_{\varphi} = E_n - E_1 \Rightarrow E_n = E_{\varphi} + E_1 \Rightarrow \frac{E_1}{n^2} = E_{\varphi} + E_1 \Rightarrow \frac{n^2}{E_1} = \frac{1}{E_{\varphi} + E_1} \Rightarrow n^2 = \frac{E_1}{E_{\varphi} + E_1} \Rightarrow n^2 = \frac{-54,4\text{eV}}{51\text{eV} - 54,4\text{eV}} \Rightarrow n^2 = \frac{-54,4}{-3,4} \Rightarrow n^2 = 16 \Rightarrow n = 4$$

Γ.3. $L_4 = nL_1 \Rightarrow L_4 = 4L_1$

Αφού τετραπλασιάζεται, θα αυξηθεί 3 φορές.

Γ.4.



$$E_{4 \rightarrow 1} = E_4 - E_1 = -3,4\text{eV} - (-54,4\text{eV}) = 51\text{eV}$$

$$E_{4 \rightarrow 3} = E_4 - E_3 = -3,4\text{eV} - (-6,0\text{eV}) = 2,6\text{eV}$$

$$E_{3 \rightarrow 1} = E_3 - E_1 = -6,0\text{eV} - (-54,4\text{eV}) = 48,4\text{eV}$$

$$E_{4 \rightarrow 2} = E_4 - E_2 = -3,4\text{eV} - (-13,6\text{eV}) = 10,2\text{eV}$$

$$E_{2 \rightarrow 1} = E_2 - E_1 = -13,6\text{eV} - (-54,4\text{eV}) = 40,8\text{eV}$$

$$E_{3 \rightarrow 2} = E_3 - E_2 = -6,0\text{eV} - (-13,6\text{eV}) = 7,6\text{eV}$$

ΘΕΜΑ Δ

$$\Delta 1. E_{\varphi} = hf = h \frac{c_0}{\lambda} = 6,6 \cdot 10^{-34} \text{ J} \cdot \text{s} \frac{3 \cdot 10^8 \text{ m}}{4 \cdot 10^{-7} \text{ m}} \Rightarrow E_{\varphi} = 4,95 \cdot 10^{-19} \text{ J.}$$

Δ2.

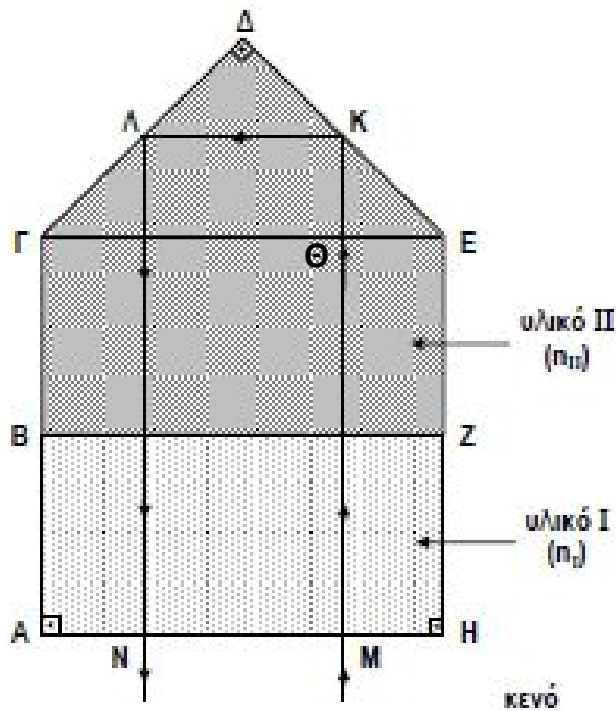
$$\lambda_2 = \frac{\lambda_0}{n_2} = \frac{4 \cdot 10^{-7} \text{ m}}{1,8} = \frac{20}{9} \cdot 10^{-7} \text{ m}$$

$$\overset{\Delta}{\text{ΚΛΔΚ}}: \Delta K = \sqrt{\Delta \Pi^2 + \Delta K^2} = \sqrt{\left(\frac{\sqrt{2}}{2}\right)^2 + \left(\frac{\sqrt{2}}{2}\right)^2} \Rightarrow \Delta K = 1\text{cm}$$

$$\text{ΚΘΕ}: \eta_{\mu 45^\circ} = \frac{K\theta}{KE} \Rightarrow K\theta = KE \cdot \eta_{\mu 45^\circ} \Rightarrow K\theta = \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{2}}{2} \Rightarrow K\theta = 0,5\text{cm}$$

Η διαδρομή S_2 του υλικού στο μέσο Π είναι:

$$S_2 = 2(\Theta E + \Theta K) + \text{ΚΛ} \Rightarrow S_2 = 2(1\text{cm} + 0,5\text{cm}) + 1\text{cm} \Rightarrow S_2 = 4\text{cm} = 4 \cdot 10^{-2} \text{ m}$$



$$\text{Άρα } N_2 = \frac{S_2}{\lambda_2} = \frac{4 \cdot 10^{-2} \text{ m}}{\frac{20}{9} \cdot 10^{-7} \text{ m}} = \frac{36}{20} \cdot 10^5 = 1,8 \cdot 10^5 \text{ μ.κ.}$$

Δ.3. Η διαδρομή S_1 στο υλικό Ι είναι $S_1 = HZ + AB = 2 \text{ cm} = 2 \cdot 10^{-2} \text{ m}$

$$c_1 = \frac{c_0}{n_1} = \frac{3 \cdot 10^8 \frac{\text{m}}{\text{s}}}{1,5} \Rightarrow c_1 = 2 \cdot 10^8 \text{ m/s}$$

$$S_1 = c_1 \cdot t_1 \Rightarrow t_1 = \frac{S_1}{c_1} \Rightarrow t_1 = \frac{2 \cdot 10^{-2} \text{ m}}{2 \cdot 10^8 \frac{\text{m}}{\text{s}}} \Rightarrow t_1 = 1 \cdot 10^{-10} \text{ s}$$

$$c_2 = \frac{c_0}{n_2} = \frac{3 \cdot 10^8 \frac{\text{m}}{\text{s}}}{1,8} = \frac{5}{3} \cdot 10^8 \frac{\text{m}}{\text{s}}$$

$$\text{και } S_2 = c_2 t_2 \Rightarrow t_2 = \frac{S_2}{c_2} \Rightarrow t_2 = \frac{4 \cdot 10^{-2} \text{ m}}{\frac{5}{3} \cdot 10^8 \frac{\text{m}}{\text{s}}} \Rightarrow t_2 = 2,4 \cdot 10^{-10} \text{ s}$$

$$t_{\text{ολ}} = t_1 + t_2 \Rightarrow t_{\text{ολ}} = 3,4 \cdot 10^{-10} \text{ s}$$

Δ.4. Για να αυξηθεί η θερμοκρασία του υλικού κατά 2°C πρέπει να απορροφήσει ενέργεια $E_{\text{απορ}} = 20 \text{ J}$. Η ενέργεια που πρέπει να εισέλθει στο υλικό ΙΙ, E_{II} είναι:

$$E_{\text{απορ}} = \frac{5}{100} E_{\text{II}} \Rightarrow E_{\text{απορ}} = \frac{1}{20} E_{\text{II}} \Rightarrow E_{\text{II}} = 20 E_{\text{απορ}} \Rightarrow E_{\text{II}} = 20 \cdot 20 \text{ J} \Rightarrow E_{\text{II}} = 400 \text{ J}$$

$$E_{\text{II}} = N E_{\varphi} \Rightarrow N = \frac{E_{\text{II}}}{E_{\varphi}} \Rightarrow N = \frac{400 \text{ J}}{4,95 \cdot 10^{-19} \text{ J}} \Rightarrow N = \frac{80}{99} 10^{21} \text{ φωτόνια}$$