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

ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ Α

Α1. γ Α2. δ Α3. γ Α4. β

Α5. α) Σ β) Σ γ) Σ δ) Λ ε) Σ

ΘΕΜΑ Β

Β.1. α) Σωστή η ii.

β) ${}^{A_1}_{Z_1}B \xrightarrow{\beta} {}^{A_1}_{Z_1+1}\Gamma \xrightarrow{\alpha} {}^{A_1-4}_{Z_1-1}\Delta$

Β.2. α) Σωστή η iii

β) $\left.\begin{array}{l}\lambda_{min}=\dfrac{hc}{eV}\\ \lambda'_{min}=\dfrac{hc}{eV'}\end{array}\right\}\overset{(\div)}{\Rightarrow}\dfrac{\lambda_{min}}{\lambda'_{min}}=\dfrac{V'}{V}\Rightarrow\dfrac{\lambda_{min}}{\lambda'_{min}}=\dfrac{1,25\cdot V}{V}\Rightarrow\lambda_{min}=1,25\cdot\lambda'_{min}\Rightarrow\lambda'_{min}=\dfrac{\lambda_{min}}{1,25}$

Ποσοστό:

$$\frac{\Delta\lambda_{min}}{\lambda_{min}}\cdot 100\%=\left(\frac{\lambda'_{min}-\lambda_{min}}{\lambda_{min}}\right)\cdot 100\%=\left(\frac{\lambda'_{min}}{\lambda_{min}}-1\right)\cdot 100\%=\left(\frac{\frac{\lambda_{min}}{1,25}}{\lambda_{min}}-1\right)\cdot 100\%=$$

$$=\left(\frac{1}{1,25}-1\right)\cdot 100\%=\left(\frac{4}{5}-1\right)\cdot 100\%=-\frac{1}{5}\cdot 100\%=-20\%.$$

Β.3. α)Σωστή η iii

β) $f_A > f_B$ $P_A=P_B$

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

Αφού $f_B < f_A$ τότε $N_A < N_B$

ΘΕΜΑ Γ

Γ.1. $E_{ιον}=-E_1=54,4eV$

Γ.2.

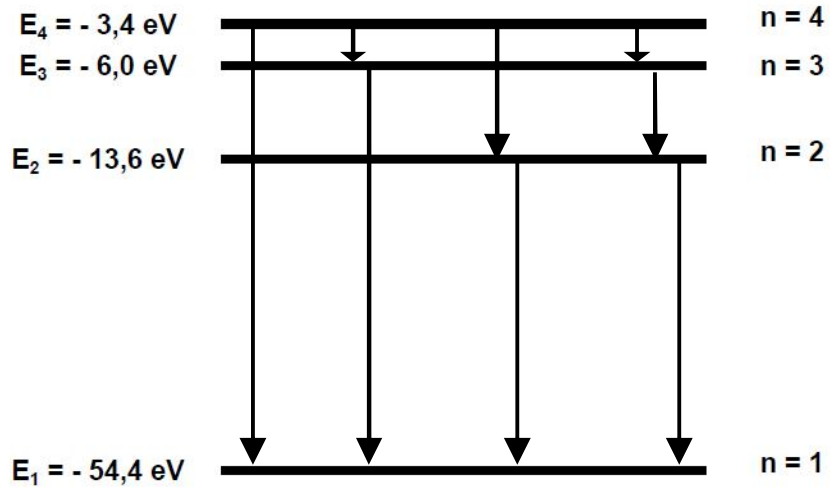
$$E_\varphi = E_n - E_1 \Rightarrow E_n = E_\varphi + E_1 \Rightarrow \frac{E_1}{n^2} = E_\varphi + E_1 \Rightarrow \frac{n^2}{E_1} = \frac{1}{E_\varphi + E_1} \Rightarrow n^2 = \frac{E_1}{E_\varphi + E_1} \Rightarrow n^2 = \frac{-54,4eV}{51eV - 54,4eV} \Rightarrow$$

$$n^2 = \frac{-54,4}{-3,4} \Rightarrow n^2 = 16 \Rightarrow n = 4$$

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

Αφού τετραπλασιάζεται, θα αυξηθεί 3 φορές.

Γ.4.



$E_{4\to1} = E_4 - E_1 = -3,4eV - (-54,4eV) = 51eV$
$E_{4\to3} = E_4 - E_3 = -3,4eV - (-6,0eV) = 2,6eV$
$E_{3\to1} = E_3 - E_1 = -6,0eV - (-54,4eV) = 48,4eV$
$E_{4\to2} = E_4 - E_2 = -3,4eV - (-13,6eV) = 10,2eV$
$E_{2\to1} = E_2 - E_1 = -13,6eV - (-54,4eV) = 40,8eV$
$E_{3\to2} = E_3 - E_2 = -6,0eV - (-13,6eV) = 7,6eV$

ΘΕΜΑ Δ

Δ1. $E_\varphi = hf = h\frac{c_0}{\lambda} = 6,6\cdot10^{-34}\,J\cdot s\frac{3\cdot10^8\,\frac{m}{s}}{4\cdot10^{-7}\,m} \Rightarrow E_\varphi = 4,95\cdot10^{-19}\,J.$

Δ2.

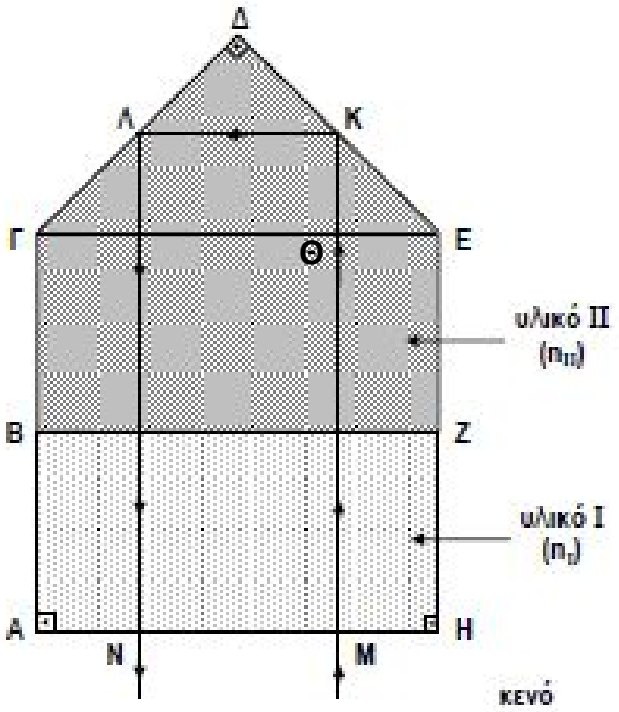
$$\lambda_2 = \frac{\lambda_0}{n_2} = \frac{4\cdot10^{-7}\,m}{1,8} = \frac{20}{9}\cdot10^{-7}\,m$$

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

$K\Theta E$: $\eta\mu45^o = \frac{K\theta}{KE} \Rightarrow K\theta = KE\cdot\eta\mu45^o \Rightarrow K\theta = \frac{\sqrt{2}}{2}\cdot\frac{\sqrt{2}}{2} \Rightarrow K\theta = 0,5cm$

Η διαδρομή S_2 του υλικού στο μέσο ΙΙ είναι:

$S_2 = 2(\Theta E + \Theta K) + K\Lambda \Rightarrow S_2 = 2(1cm + 0,5cm) + 1cm \Rightarrow S_2 = 4cm = 4\cdot10^{-2}\,m$



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

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

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

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

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

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

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

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

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

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