ΠΑΝΕΛΛΗΝΙΕΣ 2014

ΦΥΣΙΚΗ ΓΕΝΙΚΗΣ ΠΑΙΔΕΙΑΣ Γ΄ΛΥΚΕΙΟΥ

ΕΝΔΕΙΚΤΙΚΕΣ ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ Α

Α1. δ

Α2. γ

Α3. β

Α4. α

Α5. α. Σ β .Σ γ. Λ δ. Σ ε. Λ

ΘΕΜΑ Β

Β1. Σωστό (i)

$$\left.\begin{array}{l} n_a > n_\beta \\ n = \dfrac{c_0}{c} \end{array}\right\} \Rightarrow \frac{c_0}{c_a} > \frac{c_0}{c_\beta} \Rightarrow \frac{1}{c_a} > \frac{1}{c_\beta} \Rightarrow c_a < c_\beta$$

Αφού η ταχύτητα είναι μεγαλύτερη στο υλικό β $t_\beta < t_\alpha$

Β2. Σωστό (ii)

$$\mathrm{n}=1\left\langle \begin{array}{l} \mathrm{L}_1 = \hbar \\ \mathrm{L}_3 = 3\hbar \end{array}\right\} \Rightarrow \frac{\mathrm{L}_3}{\mathrm{L}_1} \overset{(\mathrm{L}=\mathrm{n}\hbar)}{=} 3$$

$$\left.\begin{array}{l} \mathrm{E} = -\dfrac{\mathrm{ke}^2}{2\mathrm{r}} \\ \mathrm{K} = \dfrac{\mathrm{ke}^2}{2\mathrm{r}} \end{array}\right\} \Rightarrow \mathrm{K} = -\mathrm{E}$$

Άρα: $\left.\begin{array}{l} K_1 = -E_1 \\ K_3 = -E_3 = -\dfrac{E_1}{9} \end{array}\right\} \Rightarrow \dfrac{K_3}{K_1} = \dfrac{-\frac{E_1}{9}}{-E_1} = \dfrac{1}{9}$

Β3. Σωστό (ii)

Για να διασπαστεί ο Χ πυρήνας πρέπει να απορροφηθεί ενέργεια:

$E_{\alpha\pi} = 7,8 \cdot 200 = 1560\,MeV$

Για να δημιουργηθεί ο πυρήνας Υ θα εκλυθεί ενέργεια:

$E_Y = 120 \cdot 8,5 = 1020\,MeV$

Όταν δημιουργηθεί ο πυρήνας Ω θα εκλυθεί ενέργεια:

$$Q = E_Y + E_\Omega - E_{\alpha\pi} \Rightarrow 164 = 1020 + E_\Omega - 1560 \Rightarrow E_\Omega = 704\text{MeV}$$

Άρα: $\frac{E_\Omega}{A_\Omega} = \frac{704}{80} = 8,8\text{MeV / νουκλεόνιο}$

ΘΕΜΑ Γ

Γ1.

$$\left.\begin{array}{l} E = hf \\ c = \lambda \cdot f \Rightarrow f = \frac{c}{\lambda} \end{array}\right\} \Rightarrow E = h\frac{c}{\lambda} \Rightarrow \lambda = \frac{h \cdot c}{E} \Rightarrow \lambda = \frac{6,6 \cdot 10^{-34} \cdot 3 \cdot 10^8}{15 \cdot 10^3 \cdot 1,6 \cdot 10^{-14}} = 0,825 \cdot 10^{-10}\,m = 8,25 \cdot 10^{-11}\,m$$

Γ2. $\lambda_{min} = \frac{\lambda_1}{3} = \frac{8,25 \cdot 10^{-11}}{3} \Rightarrow \lambda_{min} = 2,75 \cdot 10^{-11}\,m$

$$\lambda_{min} = \frac{h \cdot c}{e \cdot V} \Rightarrow V = \frac{h \cdot c}{e \cdot \lambda_{min}} = \frac{6,6 \cdot 10^{-34} \cdot 3 \cdot 10^8}{1,6 \cdot 10^{-19} \cdot 2,75 \cdot 10^{-11}} \Rightarrow V = 4,5 \cdot 10^4 = 45000\ \text{Volt}$$

Γ3.

$$\left.\begin{array}{l} P = V \cdot I \\ I = \frac{Q}{t} = \frac{N \cdot e}{t} \end{array}\right\} \Rightarrow P = \frac{N \cdot e \cdot V}{t} \Rightarrow P = \frac{2 \cdot 10^{17} \cdot 1,6 \cdot 10^{-19} \cdot 45 \cdot 10^3}{1} \Rightarrow P = 1440\text{W}$$

Γ4.

$$\left.\begin{array}{l} K = eV \\ K = \frac{1}{2}m\upsilon^2 \end{array}\right\} \Rightarrow \frac{1}{2}m\upsilon^2 = eV \Rightarrow \upsilon = \sqrt{\frac{2eV}{m}}$$

Άρα: $\frac{\upsilon}{\upsilon'} = 2 \Rightarrow \frac{\sqrt{\frac{2eV}{m}}}{\sqrt{\frac{2eV'}{m}}} = 2 \Rightarrow \frac{V'}{V} = \frac{1}{4}$

$$\left.\begin{array}{l} P' = V' \cdot \mathrm{I} \\ P = V \cdot I \end{array}\right\} \Rightarrow \frac{P'}{P} = \frac{V'}{V} = \frac{1}{4} \Rightarrow P' = \frac{P}{4} = \frac{1440}{4} = \frac{720}{2} = 360W$$

ΘΕΜΑ Δ

Δ1. $$\left.\begin{array}{l} \mathrm{E_n} = -\dfrac{\mathrm{ke}^2}{2\mathrm{r}} \\ \mathrm{U_n} = -\dfrac{\mathrm{ke}^2}{\mathrm{r}} \end{array}\right\} \Rightarrow \mathrm{U_n} = 2\mathrm{E_n} \Rightarrow \mathrm{E_n} = \frac{\mathrm{U_n}}{2} \Rightarrow \mathrm{E_n} = -0,85\mathrm{eV}\ .$$

Άρα $E_n = \dfrac{E_1}{n^2} \Rightarrow n = 4$

Δ2.

$$\left.\begin{array}{l} \Delta\mathrm{E} = \dfrac{K}{2} \\ \Delta\mathrm{E} = E_{1\to 4} = E_4 - E_1 = -0,85 - (-13,6) = 12,75eV \end{array}\right\} \Rightarrow \Delta\mathrm{E} = \frac{K}{2} = 12,75 \Rightarrow K = 25,5eV$$

Δ3. $\mathrm{L} = \mathrm{n}\hbar$

$$\left.\begin{array}{l} \mathrm{L_1} = \hbar \\ \mathrm{L_n} = \mathrm{n}.\hbar \end{array}\right\} \Rightarrow \frac{\mathrm{L_1}}{\mathrm{L_n}} = \frac{1}{\mathrm{n}} \Rightarrow \left.\begin{array}{l} \mathrm{L_n} = \mathrm{nL_1} \\ \mathrm{L_n} = 2\mathrm{L_1} \end{array}\right\} \Rightarrow \mathrm{n} = 2$$

$$\left.\begin{array}{l} \mathrm{f_A} : \mathrm{E_{4\to 2}} = \mathrm{E_4} - \mathrm{E_2} = \dfrac{\mathrm{E_1}}{16} - \dfrac{\mathrm{E_1}}{4} = \dfrac{\mathrm{E_1} - 4\mathrm{E_1}}{16} = \dfrac{-3\mathrm{E_1}}{16} \\ \mathrm{f_B} : \mathrm{E_{2\to 1}} = \mathrm{E_2} - \mathrm{E_1} = \dfrac{\mathrm{E_1}}{4} - \mathrm{E_1} = \dfrac{-3\mathrm{E_1}}{4} \end{array}\right\} \Rightarrow \frac{\mathrm{f_A}}{\mathrm{f_B}} = \frac{\frac{-3\mathrm{E_1}}{16}}{\frac{-3\mathrm{E_1}}{4}} = \frac{4}{16} = \frac{1}{4}$$

Δ4. $$\left.\begin{array}{l} F = \dfrac{m \cdot \upsilon^2}{r} \\ F = k\dfrac{e^2}{r^2} \end{array}\right\} \Rightarrow \frac{m \cdot \upsilon^2}{r} = \frac{ke^2}{r^2} \Rightarrow \upsilon^2 = \frac{ke^2}{rm} \Rightarrow \upsilon = e\sqrt{\frac{k}{mr}}$$

$$\left.\begin{array}{ll} \text{περίοδος:} & \mathrm{t} = \mathrm{T} \\ \text{διαδρομή:} & \mathrm{s} = 2\pi\mathrm{r} \end{array}\right| \quad \mathrm{T} = \frac{2\pi\mathrm{r}}{\upsilon} \Rightarrow \mathrm{T} = \frac{2\pi\mathrm{r}}{\mathrm{e}\sqrt{\frac{\mathrm{k}}{\mathrm{mr}}}} = \frac{2\pi}{\mathrm{e}} \cdot \sqrt{\frac{\mathrm{r}^3\mathrm{m}}{\mathrm{k}}}$$

$$\left.\begin{array}{l} \dfrac{T_4}{T_2} = \dfrac{\dfrac{2\pi}{e}\cdot\sqrt{\dfrac{r_4^{\,3}m}{k}}}{\dfrac{2\pi}{e}\cdot\sqrt{\dfrac{r_2^{\,3}m}{k}}} = \sqrt{\dfrac{r_4^3}{r_2^3}} = \left(\dfrac{r_4}{r_2}\right)^{3/2} \Rightarrow \dfrac{T_4}{T_2} = \left(\dfrac{r_4}{r_2}\right)^{3/2} \\ \\ r_n = n^2 \cdot r_1 \end{array}\right\} \Rightarrow \dfrac{T_4}{T_2} = \left(\dfrac{16\cdot r_1}{4\cdot r_1}\right)^{3/2} = 4^{3/2} = (\sqrt{4})^3 = 2^3 = 8$$