Λύσεις κριτηρίου 31

ΘΕΜΑ Α **Α1**. (δ) **Α2**. (γ) **Α3**. (β) **Α4**. (β) **Α5**. α. Λ β. Σ γ. Λ δ. Σ ε. Λ

ΘΕΜΑ Β

Β1. (i)

$$\Delta x = 2\lambda_D = \frac{2h}{p}$$

$$\Delta p\,\Delta x \geq \frac{h}{2\pi} \Rightarrow \Delta p_{min}\Delta x = \frac{h}{2\pi} \Rightarrow m\Delta\upsilon_{min}\frac{2h}{p} = \frac{h}{2\pi} \Rightarrow \Delta\upsilon_{min} = \frac{p}{4\pi m} = \frac{\upsilon}{4\pi}$$

Β2. (ii)

$$K_1 = E_\varphi - \varphi = hf_1 - hf_0 = h\frac{c}{\lambda_1} - h\frac{c}{\lambda_0} \Rightarrow K_1 = h\frac{c}{\frac{\lambda_0}{2}} - h\frac{c}{\lambda_0} \Rightarrow K_1 = h\frac{c}{\lambda_0}$$

$$K_2 = hf_2 - \varphi = hf_2 - hf_0 = h\frac{c}{\lambda_2} - h\frac{c}{\lambda_0} \Rightarrow K_2 = h\frac{c}{\frac{\lambda_0}{4}} - h\frac{c}{\lambda_0} \Rightarrow K_2 = 3h\frac{c}{\lambda_0} \Rightarrow K_2 = 3K_1$$

Β3. (iii)

$$\lambda' - \lambda = \frac{h}{mc}(1 - \sigma\upsilon\nu\varphi) \Rightarrow \lambda' - \lambda = \lambda_c\left(1 - \sigma\upsilon\nu 60^0\right) \Rightarrow \lambda' - \lambda = 0{,}5\lambda_c$$

$$K_e = E_\varphi - E_\varphi' = hf - hf' = h\frac{c}{\lambda} - h\frac{c}{\lambda'} \Rightarrow K_e = hc\frac{\lambda' - \lambda}{\lambda'\lambda} = hc\frac{0{,}5\lambda_c}{\lambda\lambda'} \Rightarrow K_e = \frac{pf'\lambda_c}{2}$$

ΘΕΜΑ Γ

Γ1. $I = \frac{E_{ολ}}{S\cdot\Delta t} = \frac{Nhf}{S\cdot\Delta t} \Rightarrow f = \frac{IS\cdot\Delta t}{hN} \Rightarrow f = 2\cdot 10^{15}\,Hz$

$c = \lambda f \Rightarrow \lambda = 1{,}5\cdot 10^{-7}\,m$

$p = \frac{h}{\lambda} = 4{,}4\cdot 10^{-27}\,kg\cdot m/s$

Γ2. $K_{τελ} - K_{αρχ} = W_{F_{ηλ}} = eV \Rightarrow K_{αρχ} = 7eV - 2eV = 5eV$

$$K_{αρχ} = \frac{1}{2}m\upsilon_{αρχ}{}^2 \Rightarrow \upsilon_{αρχ} = \sqrt{\frac{2\cdot 5\cdot 1{,}6\cdot 10^{-19}}{9\cdot 10^{-31}}}\frac{m}{s} \Rightarrow \upsilon_{αρχ} = \frac{4}{3}\cdot 10^6\,m/s$$

Γ3. $\lambda_D = \frac{h}{p} = \frac{h}{m\upsilon_{αρχ}} = 5{,}5\cdot 10^{-10}\,m$

Γ4. $K_{αρχ} = E_\varphi - \varphi \Rightarrow \varphi = hf - K_{αρχ} = 6{,}6\cdot 10^{-34}\cdot 2\cdot 10^{15} - 5\cdot 1{,}6\cdot 10^{-19} \Rightarrow$

$\varphi = 5{,}2\cdot 10^{-19}\,J$ ή $\varphi = 3{,}25eV$

Γ5. $i = \frac{q}{\Delta t} = \frac{0{,}33Ne}{\Delta t} = \frac{0{,}33\cdot 10^{16}\cdot 1{,}6\cdot 10^{-19}}{3{,}3}A \Rightarrow i = 1{,}6\cdot 10^{-4}\,A$ ή $i = 0{,}16mA$

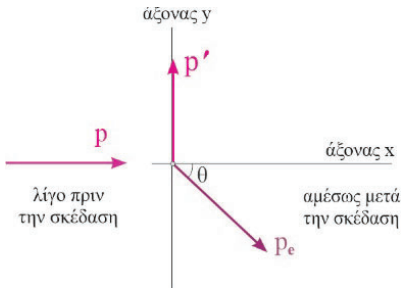
ΘΕΜΑ Δ

Δ1. $E = hf \Rightarrow f = 5\cdot 10^{20}\,Hz$, $c = \lambda f \Rightarrow \lambda = 0,6\cdot 10^{-12}\,m$

$$\lambda' - \lambda = \frac{h}{mc}\left(1-\sigma\upsilon\nu\varphi\right) \Rightarrow \lambda' = \lambda + \lambda_c\left(1-\sigma\upsilon\nu 90^0\right) \Rightarrow \lambda' = 3\cdot 10^{-12}\,m$$

Δ2. $$\pi\% = \frac{K_e}{E_\varphi}\% = \frac{E_\varphi - E_\varphi'}{E_\varphi}\% = \frac{hf - hf'}{hf}\% \Rightarrow \pi\% = \frac{h\frac{c}{\lambda} - h\frac{c}{\lambda'}}{h\frac{c}{\lambda}} = \frac{\lambda' - \lambda}{\lambda'} \Rightarrow \pi\% = 80\%$$

Δ3. $A\Delta O: \overrightarrow{p_{\alpha\rho\chi}} = \overrightarrow{p_{\tau\epsilon\lambda}} \Rightarrow \vec{p} = \vec{p_e} + \vec{p'} \Rightarrow$

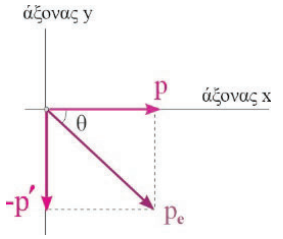


$$\overrightarrow{p_e} = \vec{p} + \left(-\vec{p'}\right)$$

$$p_e = \sqrt{p^2 + p'^2} = \sqrt{\left(\frac{h}{\lambda}\right)^2 + \left(\frac{h}{\lambda'}\right)^2} \Rightarrow$$

$$p_e = h\sqrt{\left(\frac{1}{0,6\cdot 10^{-12}}\right)^2 + \left(\frac{1}{3\cdot 10^{-12}}\right)^2} \Rightarrow$$

$$p_e = 2,2\cdot 10^{-22}\sqrt{26}\ kg\cdot m/s$$



$$\varepsilon\varphi\theta = \frac{p'}{p} = \frac{\frac{h}{\lambda'}}{\frac{h}{\lambda}} = \frac{\lambda}{\lambda'} = 0,2$$

Δ4. $$\lambda_{D,min} = \frac{h}{p_{e,max}} \quad (1)$$

$\overrightarrow{p_e} = \vec{p} + \left(-\vec{p'}\right) \Rightarrow p_{e,max} = p + p'$ (2) για σκέδαση 180^0

$$\lambda_{max}' - \lambda = \lambda_c\left(1-\sigma\upsilon\nu 180^0\right) \Rightarrow \lambda_{max}' = \lambda + 2\lambda_c = 5,4\cdot 10^{-12}\,m$$

Από (1) και (2) $\Rightarrow \frac{h}{\lambda_{D,min}} = \frac{h}{\lambda} + \frac{h}{\lambda'} \Rightarrow \lambda_{D,min} = \frac{\lambda\lambda'}{\lambda + \lambda'} = 0,54\cdot 10^{-12}\,m$