Λύσεις κριτηρίου 30

ΘΕΜΑ Α

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

ΘΕΜΑ Β

Β1. **(i)**

$$B_1 = B_{max}\eta\mu 2\pi\left(\frac{t}{T_1}-\frac{x}{\lambda_1}\right)=\frac{E_{max}}{c}\eta\mu 2\pi\left(\frac{NT_1+0,125T_1}{T_1}-\frac{N\lambda_1}{\lambda_1}\right)\Rightarrow$$

$$B_1=\frac{E_{max}}{c}\eta\mu\frac{\pi}{4}=\frac{E_{max}}{\frac{\lambda_1}{T_1}}\frac{\sqrt{2}}{2}\Rightarrow B_1=\frac{E_{max}T_1\sqrt{2}}{2\lambda_1}$$

Β2. **(iii)**

$$K_e=E_\varphi-\varphi=hf_1-hf_0\Rightarrow K_e=2hf_0$$

$$K_{\tau\varepsilon\lambda}-K_e=W_{F_{\eta\lambda}}\Rightarrow 3K_e-K_e=eV_1\Rightarrow 2K_e=4hf_0=eV_1\,,$$

$$K_e'=hf_2-hf_0$$

$$K_{\tau\varepsilon\lambda}-K_e'=W_{F_{\eta\lambda}}\Rightarrow 0-K_e'=e(-V_1)\Rightarrow hf_2-hf_0=4hf_0\Rightarrow f_2=5f_0$$

Β3. **(ii)**

$$\lambda'-\lambda=\frac{h}{mc}(1-\sigma\upsilon\nu\varphi)\Rightarrow\lambda'=2\lambda_c+\lambda_c(1-0,6)=2,4\lambda_c$$

$$K_e=E_\varphi-E_\varphi'=hf-hf'=h\frac{c}{\lambda}-h\frac{c}{\lambda'}\Rightarrow K_e=h\frac{c}{2\lambda_c}-h\frac{c}{2,4\lambda_c}=\frac{hc}{12\lambda_c}\Rightarrow$$

$$K_e=\frac{hc}{12\frac{h}{mc}}\Rightarrow K_e=\frac{1}{12}mc^2$$

ΘΕΜΑ Γ

Γ1. $V_0=\alpha+\beta f$

Για $f=0,75\cdot10^{15}\,Hz$ είναι $V_0=1V$, άρα, $1=\alpha+0,75\cdot10^{15}\beta$ (1)

Για $f=10^{15}\,Hz$ είναι $V_0=2V$, άρα $2=\alpha+10^{15}\beta$ (2)

Από (2)-(1) $\Rightarrow 1=0,25\cdot10^{15}\beta\Rightarrow\beta=4\cdot10^{-15}\,Vs$ και $\alpha=-2V$

$$K_e=E_\varphi-\varphi\Rightarrow eV_0=hf-\varphi\Rightarrow V_0=\frac{h}{e}f-\frac{\varphi}{e}\Rightarrow V_0=4\cdot10^{-15}f-2\quad(SI)\ (3)$$

$$\text{άρα}\ \frac{\varphi}{e}=2\Rightarrow\varphi=2\cdot1,6\cdot10^{-19}J=3,2\cdot10^{-19}J\Rightarrow\varphi=2eV$$

Γ2. $(3)\Rightarrow\frac{h}{e}f=4\cdot10^{-15}f\Rightarrow h=6,4\cdot10^{-34}\,Js$

Γ3. $V_0=4\cdot10^{-15}f-2\Rightarrow10=4\cdot10^{-15}f_1-2\Rightarrow f_1=3\cdot10^{15}\,Hz$,

$c = \lambda_1 f_1 \Rightarrow \lambda_1 = 10^{-7}\,m$

$p_1 = \dfrac{h}{\lambda_1} = 6,4 \cdot 10^{-27}\,kg \cdot m/s$,

$E_\varphi = hf_1 = 19,2 \cdot 10^{-19}\,J$

Γ4. $K_{\tau\varepsilon\lambda} = \dfrac{1}{2}m\upsilon_2{}^2 = \dfrac{1}{2}m\left(2\upsilon_1\right)^2 = 4K_{\alpha\rho\chi}$

$K_{\tau\varepsilon\lambda} - K_{\alpha\rho\chi} = W_{F_{\eta\lambda}} \Rightarrow 3K_{\alpha\rho\chi} = eV_1 \Rightarrow K_{\alpha\rho\chi} = \dfrac{eV_1}{3}$

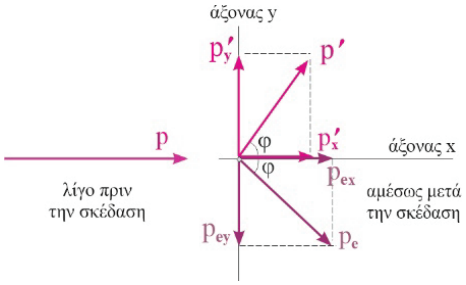
$K_{\alpha\rho\chi} = E_\varphi - \varphi = hf - \varphi \Rightarrow \dfrac{eV_1}{3} = hf - \varphi \Rightarrow V_1 = \dfrac{3\left(hf - \varphi\right)}{e} \Rightarrow V_1 = 6V$

ΘΕΜΑ Δ

Δ1. ΑΔΟ στον άξονα y:

$p_{\alpha\rho\chi,y} = p_{\tau\varepsilon\lambda,y} \Rightarrow 0 = p_{e,y} - p'_y \Rightarrow$

$p_e \eta\mu\varphi = p'\eta\mu\varphi \Rightarrow p_e = p'$



ΑΔΟ: $p_{\alpha\rho\chi} = p_{\tau\varepsilon\lambda} \Rightarrow$

$p = \sqrt{p_e{}^2 + p'^2} = \sqrt{2p'^2} \Rightarrow \dfrac{p}{p'} = \sqrt{2}$

Δ2.

$\dfrac{p}{p'} = \sqrt{2} \Rightarrow \dfrac{h}{\lambda} = \dfrac{h}{\lambda'}\sqrt{2} \Rightarrow \lambda' = \sqrt{2}\lambda = 1,4\lambda$

$\lambda' - \lambda = \dfrac{h}{mc}\left(1 - \sigma\upsilon\nu\varphi\right) \Rightarrow 0,4\lambda = \lambda_c\left(1 - \sigma\upsilon\nu 45^0\right) = \lambda_c\left(1 - \dfrac{\sqrt{2}}{2}\right) = 0,3\lambda_c \Rightarrow \lambda = 1,8 \cdot 10^{-12}\,m$

$c = \lambda f \Rightarrow f = \dfrac{5}{3}10^{20}\,Hz$

Δ3. $\lambda_e = \dfrac{h}{p_e} = \dfrac{h}{p'} = \lambda' = 1,4\lambda \Rightarrow \lambda_e = 2,52 \cdot 10^{-12}\,m$

Δ4. $x = c_2 t \Rightarrow c_2 = 1,5 \cdot 10^8 \dfrac{m}{c}$,

$f = \sigma\tau\alpha\theta.$

$c = \lambda f \Rightarrow f = \dfrac{c}{\lambda'} = \dfrac{c_2}{\lambda_2} \Rightarrow \dfrac{3 \cdot 10^8}{\lambda'} = \dfrac{1,5 \cdot 10^8}{\lambda_2} \Rightarrow \lambda_2 = \lambda'/2$

$\pi\% = \dfrac{\lambda_2 - \lambda'}{\lambda'}100\% = -50\%$