

Λύσεις κριτηρίου 30

**ΘΕΜΑ Α**

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

**ΘΕΜΑ Β**

**B1. (i)**

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

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

**B2. (iii)**

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

$$K_{\text{τελ}} - K_e = W_{F_{\text{ηλ}}} \Rightarrow 3K_e - K_e = eV_1 \Rightarrow 2K_e = 4hf_0 = eV_1$$

$$K_e' = hf_2 - hf_0$$

$$K_{\text{τελ}} - K_e' = W_{F_{\text{ηλ}}} \Rightarrow 0 - K_e' = e(-V_1) \Rightarrow hf_2 - hf_0 = 4hf_0 \Rightarrow f_2 = 5f_0$$

**B3. (ii)**

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

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

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

### ΘΕΜΑ Γ

#### Γ1.

$$V_0 = \alpha + \beta f$$

$$\Gamma\alpha \quad f = 0,75 \cdot 10^{15} \text{ Hz} \quad \text{είναι } V_0 = 1\text{V}, \quad \text{άρα, } 1 = \alpha + 0,75 \cdot 10^{15} \beta \quad (1)$$

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

Από (2)-(1)

$$\Rightarrow 1 = 0,25 \cdot 10^{15} \beta \Rightarrow \beta = 4 \cdot 10^{-15} \text{ Vs} \quad \text{και } \alpha = -2\text{V}$$

$$K_e = E_\varphi - \varphi \Rightarrow eV_0 = hf - \varphi \Rightarrow V_0 = \frac{h}{e}f - \frac{\varphi}{e} \Rightarrow V_0 = 4 \cdot 10^{-15} f - 2 \quad (\text{SI}) \quad (3)$$

$$\text{άρα } \frac{\varphi}{e} = 2 \Rightarrow \varphi = 2 \cdot 1,6 \cdot 10^{-19} \text{ J} = 3,2 \cdot 10^{-19} \text{ J} \Rightarrow \varphi = 2\text{eV}$$

#### Γ2.

$$(3) \Rightarrow \frac{h}{e}f = 4 \cdot 10^{-15} f \Rightarrow h = 6,4 \cdot 10^{-34} \text{ Js}$$

#### Γ3.

$$V_0 = 4 \cdot 10^{-15} f - 2 \Rightarrow 10 = 4 \cdot 10^{-15} f_1 - 2 \Rightarrow f_1 = 3 \cdot 10^{15} \text{ Hz}$$

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

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

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

$$\Gamma 4. \quad K_{\text{τελ}} = \frac{1}{2}mv_2^2 = \frac{1}{2}m(2v_1)^2 = 4K_{\text{αρχ}}$$

$$K_{\text{τελ}} - K_{\text{αρχ}} = W_{F_{\eta\kappa}} \Rightarrow 3K_{\text{αρχ}} = eV_1 \Rightarrow K_{\text{αρχ}} = \frac{eV_1}{3}$$

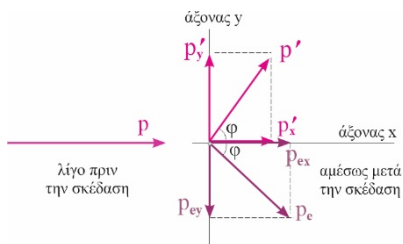
$$K_{\text{αρχ}} = E_{\varphi} - \varphi = hf - \varphi \Rightarrow \frac{eV_1}{3} = hf - \varphi \Rightarrow V_1 = \frac{3(hf - \varphi)}{e} \Rightarrow V_1 = 6V$$

### ΘΕΜΑ Δ

Δ1. ΑΔΟ στον άξονα y:

$$p_{\alpha\varphi\chi,y} = p_{\text{τελ},y} \Rightarrow 0 = p_{e,y} - p_y \Rightarrow p_e \eta \mu\varphi = p \eta \mu\varphi \Rightarrow p_e = p$$

$$\text{ΑΔΟ: } p_{\alpha\varphi\chi} = p_{\text{τελ}} \Rightarrow p = \sqrt{p_e^2 + p^2} = \sqrt{p_e^2} \Rightarrow \frac{p}{p_e} = \sqrt{2}$$



Δ2.

$$\frac{p}{p_e} = \sqrt{2} \Rightarrow \frac{h}{\lambda} = \frac{h}{\lambda_e} \sqrt{2} \Rightarrow \lambda = \frac{\lambda_e}{\sqrt{2}} = \lambda_e \cdot \frac{1}{\sqrt{2}}$$

$$\lambda' - \lambda = \frac{h}{mc} (1 - \sin\varphi) \Rightarrow 0,4\lambda = \lambda_e (1 - \sin 45^\circ) = \lambda_e \left(1 - \frac{\sqrt{2}}{2}\right) = 0,3\lambda_e \Rightarrow \lambda = 1,8 \cdot 10^{-12} \text{ m}$$

$$c = \lambda f \Rightarrow f = \frac{5}{3} 10^{20} \text{ Hz}$$

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

Δ3.

$$x = c_2 t \Rightarrow c_2 = 1,5 \cdot 10^8 \frac{\text{m}}{\text{s}}$$

Δ4.

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

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

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