lembar Tugas Mahasiswa

TOPIK = Fisika Modern.

No sabtu, 18 Mei
Date 2024

$h = 6,63 \times 10^{-34}$ JS ; $c = 3 \times 10^{8}$ m/s ; $m_e = 6,63 \times 10^{-34}$ JS ; $e = 1,6 \times 10^{-19}$ C

1) energi foton : $E = \frac{h.c}{\lambda}$; $h = 6,63 \times 10^{-34}$ J.S $= 4,14 \times 10^{-15}$ eV.s

a) 5,00 cm (λ) $= 5 \times 10^{-2}$ m

$\Rightarrow E = \frac{4,14 \times 10^{-15} . 3 \times 10^{8} \text{ m/s}}{5 \times 10^{-2}}$

$= 24,04 \mu = 2,404$ eV

b) 500 nm $= 500 \times 10^{-9}$ m

$\Rightarrow E = \frac{4,14 \times 10^{-15} . 3 \times 10^{8} \text{ m/s}}{500 \times 10^{-9}}$

$= 2.484$ eV

c) 5,00 nm $= 5 \times 10^{-9}$ m

$\Rightarrow E = \frac{4,14 \times 10^{-15} . 3 \times 10^{8} \text{ m/s}}{5 \times 10^{-9}}$

$= 248,9$ eV //

2) $\lambda = 590$ nm $= 590 \times 10^{-9}$ m

laju?

$\hookrightarrow$ Ek = Efoton

$\frac{1}{2} . m_e v^2 = \frac{hc}{\lambda}$

$v = \sqrt{\frac{2hc}{\lambda m_e}}$

$m_e = 9,10 \times 10^{-31}$ kg

$= \sqrt{\frac{2 . 6,63 \times 10^{-34} . 3 \times 10^{8}}{590 \times 10^{-9} . 9 \times 10^{-31}}}$

$= 8,6 \times 10^{5}$ m/s //

* Karena $v << c$, non-relativistik

Ek dapat digunakan.

3) Dik : $\lambda = 589$ nm $= 5,89 \times 10^{-7}$ m.

P = 100 W

Dit = a. laju produk foton?

$\hookrightarrow E = \frac{nhc}{\lambda}$ (=) $P.t = \frac{nhc}{\lambda}$

$\frac{n}{t} = \frac{\lambda . P}{hc} = \frac{n}{t} = \frac{5,89 \times 10^{-7} . 100}{6,63 \times 10^{-34} . 3 \times 10^{8}}$

$= 2,96 \times 10^{20}$ foton/s //

(b) Pada jarak berapa layar ke lampu agar layar menyerap?

$\hookrightarrow \frac{\text{foton}}{(\text{cm}^2 \text{s})} = \frac{\frac{\text{foton}}{\text{detik}}}{A}$

$\frac{1 \text{ foton}}{(\text{cm}^2 \text{s})} = 2,96 \times 10^{16} \frac{\frac{\text{foton}}{\text{detik}}}{A}$

$A = 2,96 \times 10^{16} \frac{\frac{\text{foton}}{\text{detik}}}{1 \text{ foton}}$

$= 2,96 \times 10^{16}$ cm²

$r = \sqrt{\left(\frac{A}{\pi}\right)}$

$= \sqrt{\left(\frac{2,96 \times 10^{16}}{\pi}\right)} = 5,42 \times 10^{7}$ //

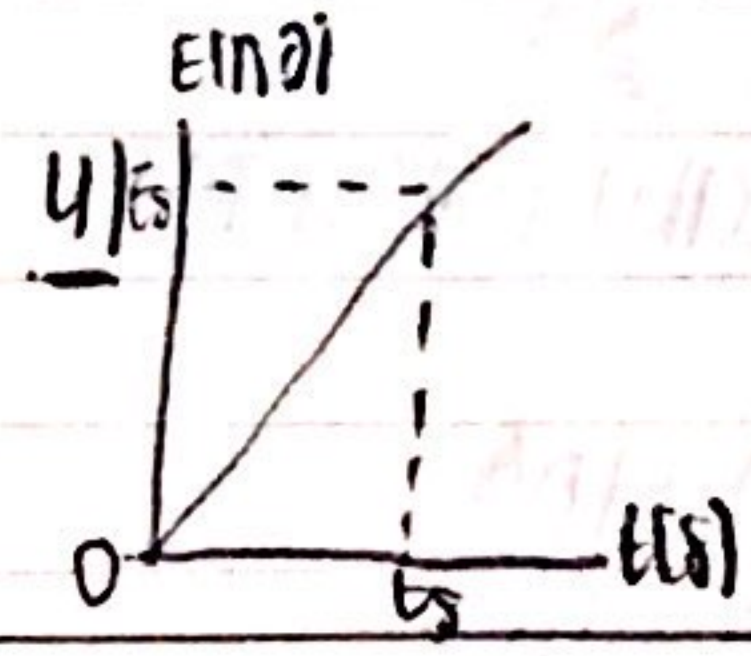
(c) $I = \frac{(n/t)}{4 \pi r^2}$

r = 2 m

$I = (5,89 , 10^{18}$ foton/m²s)

=

=



area penyerapan 2×10^{-6} m²

menyerap 50%

$\lambda = 600$ nm

s = 12,0 m

Es = 7,2 nJ

ts = 2 s

Rabs = ?

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(4) Dari grafik,

$P_{pancar} = \frac{\Delta E}{\Delta t} = \frac{7,2 \times 10^{-9} - 0}{2 - 0}$

$= 3,6 \times 10^{-9}$ J/s

sehingga dapat dicari foton yang dipancarkan per detik (n/t)

misalkan $= \frac{n}{t}$

$P.t = \frac{n hc}{\lambda} \rightarrow \frac{n}{t} = \frac{\lambda . P}{hc} = R$

$R_{pancar} = \frac{600 . 3,6 \times 10^{-9}}{6,63 \times 10^{-34} . 3 \times 10^{8}}$

$= 1,09 \times 10^{10}$ foton/s

di jarak $r = 12$ m

$I_p = \frac{R_{pancar}}{4 \pi r^2}$

$I_{serap} = 0,5 \, I_p$

$R_{serap} = 0,5 . \frac{A_{serap}}{4 \pi r^2} . R_{pan}$

$= 0,5 . \frac{2 \times 10^{-6}}{4 . \pi . 12^2} . 1,09$

$= 6,02357$ foton

5. gel. elektromagnetik (AM)

$f = 665$ kHz

(FM)

$f = 91,9$ MHz

Berapa banyak foton AM?

(4) $E = \frac{h.c}{\lambda} = h.f$

Agar sama dgn satu foton FM

$n E_{AM} = E_{FM}$

$n = \frac{E_{FM}}{E_{AM}} = \frac{h F_{FM}}{h F_{AM}} = \frac{91,9 \times 10^{6}}{665 \times 10^{3}}$

$= 138,2$ foton

agar mempunyai energi 1 foton FM.

6.) Dik: $V_s = 5,0$ V

$\phi = 2,2$ eV

Dit: λ?

(4) $E = \frac{hc}{\lambda} - \Phi = q_e V_{stop}$

$\frac{hc}{\lambda} = q_e V_{stop} + \Phi$

$\lambda = \frac{hc}{q_e V_{stop} + \Phi}$

$= \frac{(6,63 \times 10^{-34})(3 \times 10^{8})}{(1,6 \times 10^{-19})(5) + (2,2 \times 1,6 \times 10^{-19})}$

$= 1,726 \times 10^{-7}$ m

$= 172,65$ nm

7) Dik $\phi = 2,3$ eV

$F = 3 \times 10^{15}$ Hz

Dit = K_{max} = ?

(4) $K_{max} = h.F - \phi$

$= (4,14 \times 10^{-15})(3 \times 10^{15}) - 2,3$

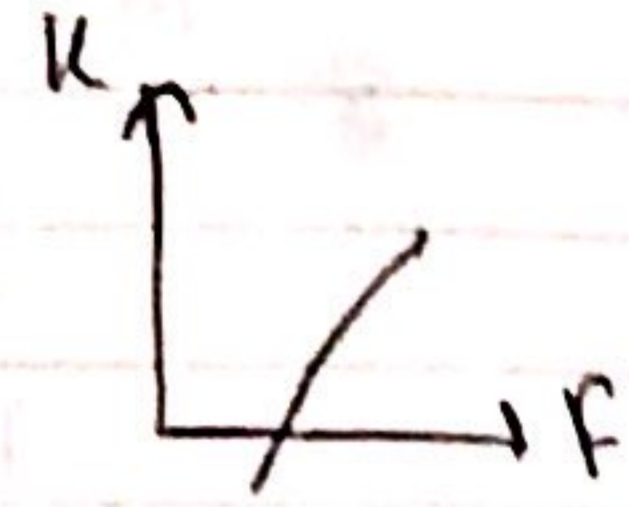
$= 10,12$ eV

8) (a) untuk elektron yang paling cepat,

$K_{max} = hf - \phi$

$= \frac{hc}{\lambda} - \phi$

$= 2$ eV



(b) elektron paling lambat

$K = 0$

(minimum)

(c) potensial penghenti

$q_e V_{stop} = K_{max}$

$V_{stop} = 2$ V

(d) panjang gelombang cut off

$K_{max} = 0$

(4) $K_{max} = hf - \phi = 0 \Rightarrow \phi = h . f_0$

$\lambda = \frac{hc}{\phi}$

$= 295$ nm

9. Diberikan $\phi = 2,26$ ...

$K_{max} = 1,5$ ...

(a) $K_{max} = \frac{hc}{\lambda} - \phi$

$\lambda = \frac{hc}{K_{max} ...}$

$= \frac{(4,14 ...}{1,5 ...}$

$= 3,0 ...$

$= 32 ...$

(b) $E = \frac{hc}{\lambda} = 6. ...$

(c) Frekue... frekuen... sehing...

10. Perhati... untuk ...

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9. Diberikan $\phi = 2{,}26$ eV,
$K_{max} = 1{,}56$ eV

(a) $K_{max} = \frac{hc}{\lambda} - \phi$

$\lambda = \frac{hc}{K_{max} + \phi}$

$= \frac{(4{,}14 \times 10^{-15})(3 \times 10^{8})}{1{,}56 + 2{,}26}$

$= 3{,}25 \times 10^{-7}$ m

$= 325$ nm

(b) $E = \frac{hc}{\lambda} = 6{,}12 \times 10^{-19}$ J

$= 3{,}825$ eV

(c) Frekuensi ambang adalah frekuensi saat $K_{max} = 0$ sehingga

$K_{max} = \frac{hc}{\lambda} - \phi = 0$

$\phi = hf_0$

$f_0 = \frac{\phi}{h} = \frac{2{,}26}{4{,}14 \times 10^{-15}}$

$= 5{,}46 \times 10^{14}$ Hz //

10. Perhatikan bahwa.
untuk percobaan I,

$eV_1 = \frac{hc}{\lambda_1} - \phi$ (1)

untuk percobaan II,

$eV_2 = \frac{hc}{\lambda_2} - \phi$ (2)

(a) dgn mengurangi (1) & 2 akan didapat

$h = \frac{e(V_1 - V_2)}{c\left(\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right)} = 4{,}12 \times 10^{-15}$ eV.s //

(b) dgn menambahkan (1) & (2) akan didapat

$\phi = \frac{hc}{2e}\frac{\left(\frac{1}{\lambda_1} + \frac{1}{\lambda_2}\right)}{(V_1 + V_2)} =$

$= 2{,}27$ eV

(c) Cut Off $K_{max} = 0 \Rightarrow \phi = \frac{hc}{\lambda_0}$

$\lambda_0 = \frac{hc}{\phi}$

$= 545$ nm //

11. Momentum foton

$P = \frac{h}{\lambda}$

dan bola

$P = M.V$

karena sama, maka

$M.V = \frac{h}{\lambda} \Rightarrow V = \frac{h}{\lambda.M}$

$= 4{,}18 \times 10^{-25}$ m/s

12. Dari pers Hamburan compton

$\lambda - \lambda' = \frac{h}{mec}(1 - \cos\theta)$

$\Leftrightarrow 1 - \cos\theta = \frac{(\lambda - \lambda')mec}{h} = 0{,}7444$

$\cos\theta = 1 - 0{,}7444$

$\theta = 75{,}16°$

13. Perhatikan bahwa:

$u' = 2u$

dimana $\lambda' = \frac{h}{\sqrt{2mu'}}$ & $\lambda = \frac{h}{\sqrt{2mu}}$

disini, $\frac{\lambda'}{\lambda} = \frac{\sqrt{2mu}}{\sqrt{2mu'}} = \sqrt{\frac{u}{u'}} = \frac{1}{\sqrt{2}}$

$\Rightarrow \lambda' = \frac{\lambda}{\sqrt{2}} = 1{,}9 \times 10^{-10}$ m //