Nama : Fadila Adistiani

Kelas : 23 A

1. $x' = \gamma (x - ut)$

dengan $\gamma = \frac{1}{\sqrt{1 - \frac{u^2}{c^2}}}$

$x_1' = 0, \quad x_2' = L_0$

$x_1' = \gamma (x_1 - ut_1)$

$x_2' = \gamma (x_2 - ut_2)$

Pengukuran panjang di O terjadi $(t_1 = t_2)$.

$L_0 = x_2' - x_1' = \gamma (x_2 - x_1)$

untuk L

$L = \frac{L_0}{\gamma}$

Substitusikan faktor lorentz γ

$L = L_0 \sqrt{1 - \frac{u^2}{c^2}}$

2. a. Faktor lorentz

$$\gamma = \frac{E}{m_0 c^2} = \frac{(25 \times 10^9 \times 1.6 \times 10^{-19})}{(9.11 \times 10^{-31})(3 \times 10^8)^2}$$

$$\gamma = 48786.44$$

Kecepatan elektron

$$v = c\sqrt{1 - \frac{1}{\gamma^2}}$$

$$v = 2.99999999937 \times 10^8 \ m/s$$

Selisih dengan kecepatan cahaya

$$\Delta v = c - v$$

$$\Delta v = 0.063 \ m/s$$

b. $$t = \frac{L}{v}$$

$$t = \frac{3000}{2.99999999937 \times 10^8}$$

$$t = 1.00 \times 10^{-5} \ s$$

c. $$L' = \frac{L}{\gamma}$$

$$L' = \frac{3000}{48786.44}$$

$$L' = 0.0615 \ m$$

d. $$t' = \frac{t}{\gamma}$$

$$t' = \frac{1.00 \times 10^{-5}}{48786.44} \quad t' = 2.05 \times 10^{-10} \ s$$

3. a gunakan rumus efek doppler relativistik:

$$\lambda_o = \lambda_s \sqrt{\frac{1+\frac{v}{c}}{1-\frac{v}{c}}}$$

$$\frac{\lambda_o}{\lambda_s} = \sqrt{\frac{1+\frac{v}{c}}{1-\frac{v}{c}}}$$

$$\left(\frac{\lambda_o}{\lambda_s}\right)^2 = \frac{1+\frac{v}{c}}{1-\frac{v}{c}}$$

$$v = c\,\frac{\left(\frac{\lambda_o}{\lambda_s}\right)^2 - 1}{\left(\frac{\lambda_o}{\lambda_s}\right)^2 + 1}$$

$$v = (3.0\times10^8)\,\frac{\left(\frac{366}{122}\right)^2 - 1}{\left(\frac{366}{122}\right)^2 + 1}$$

$$v = (3.0\times10^8)\,\frac{9-1}{9+1}$$

$$v = (3.0\times10^8) \times \frac{8}{10}$$

$$V = 2.4\times10^8 \text{ m/s} = 0.8c$$

b. $$\lambda_o' = \lambda_s \sqrt{\frac{1-\frac{v}{c}}{1+\frac{v}{c}}}$$

$$\lambda_o' = 122 \times \sqrt{\frac{1-0.8}{1+0.8}}$$

$$\lambda_o' = 122 \times \sqrt{\frac{0.2}{1.8}}$$

$$\lambda_o' = 122 \times \sqrt{0.1111}$$

$$\lambda_o' = 122 \times 0.3333$$

$$\lambda_o' = 40.67 \text{ mm}$$

4. - 1 meV = 1.6×10^{-13} J

- massa atom uranium-235 (^{235}U) = 235 u

- 1 u = 1.66×10^{-27} kg

- Energi & masa terkait melalui persamaan

$$E = \Delta m c^2$$

dengan $c = 3 \times 10^8$ m/s

$$n = \frac{\text{massa}}{\text{massa}} = \frac{1000}{235}$$

$$= 4.255 \text{ mol}$$

atom dim 1 kg

$$N = n \times N_A$$

$$= 4.255 \times (6.022 \times 10^{23})$$

$$N = 2.56 \times 10^{24} \text{ atom}$$

Energi total yang dilepaskan

$$E = N \times 200 \times 10^6 \times 1.6 \times 10^{-13}$$

$$E = (2.56 \times 10^{24}) \times (3.2 \times 10^{-11})$$

$$E = 8.19 \times 10^{13} \text{ j}$$

Dari $E = \Delta m c^2$ maka:

$$\Delta m = \frac{E}{c^2} = \frac{8.19 \times 10^{13}}{(3 \times 10^8)^2}$$

$$\Delta m = \frac{8.19 \times 10^{13}}{9 \times 10^{16}}$$

$$\Delta m = 9.1 \times 10^{-4} \text{ kg} = 0.91 \text{ g}$$

5. a. Menghitung beda massa

$M_{total} = (2 \times 1,007276) + (2 \times 1,008665)$

$M_{total} = 2,014552 + 2,017330$

$M_{total} = 4,031882\ u$

$\Delta m = M_{total} - M_{helium}$

$\Delta m = 4,031882 - 4,001506$

$\Delta m = 0,030376\ u$

$\Delta m_{kg} = 0,030376 \times (1,66 \times 10^{-27})$

$\Delta m_{kg} = 5,04 \times 10^{-29}\ kg$

b. Menghitung energi ikat

$E = \Delta m c^2$

$E = (5,04 \times 10^{-29}) \times (3 \times 10^{8})^2$

$E = (5,04 \times 10^{-29}) \times (9 \times 10^{16})$

$E = 4,54 \times 10^{-12}\ J$

$E = 0,030376 \times 931,5$

$E = 28,3\ MeV$

6. - Kecepatan pesawat A terhadap B = $v_{A/B} = 0.8c$

- Kecepatan Pesawat B terhadap Pengamat di bulan $v_{B/m} = 0.6c$

$$v_{A/m} = V_{A/m} = \frac{v_{A/B} + v_{B/m}}{1 + \frac{v_{A/B}\, v_{B/m}}{c^2}}$$

$$V_{A/m} = \frac{0.8c + 0.6c}{1 + \frac{(0.8c)(0.6c)}{c^2}}$$

$$v_{A/m} = \frac{1.4c}{1 + 0.48}$$

$$v_{A/m} = \frac{1.4c}{1.48}$$

$$v_{A/m} = 0.946\ c$$

7. $$\epsilon = \frac{hc}{\lambda}$$

$$\epsilon = \frac{(6.626 \times 10^{-34}) \times (3 \times 10^{8})}{589 \times 10^{-9}}$$

$$\epsilon = \frac{1.9878 \times 10^{-25}}{589 \times 10^{-9}}$$

$$\epsilon = 3.37 \times 10^{-19}\ j$$

hitung jumlah foton per detik

$$N = \frac{P}{\epsilon}$$

$$N = \frac{20}{3.37 \times 10^{-19}}$$

$$N = 5.94 \times 10^{19}\ \text{foton/detik}$$

8. Panjang gelombang cahaya = $\lambda = 3500\ A = 350 \times 10^{-9}\ m$

Fungsi kerja kalium : $W = 2.2\ eV$

konstanta planck : $h = 6.626 \times 10^{-34}\ J.s$

kecepatan cahaya : $3 \times 10^{8}\ m/s$

konversi energi $1\ eV = 1.6 \times 10^{-19}\ j$

menghitung energi foton

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

$$\epsilon = \frac{(6.626 \times 10^{-34}) \times (3 \times 10^{8})}{350 \times 10^{-9}}$$

$$\epsilon = \frac{1.9878 \times 10^{-25}}{350 \times 10^{-9}}$$

$$\epsilon = 5.68 \times 10^{-19}\ j$$

$$\epsilon = \frac{5.68 \times 10^{-19}}{1.6 \times 10^{-19}}$$

$$\epsilon = 3.55\ eV$$

menghitung energi kinetik fotoelektron

$$\epsilon_K = \epsilon - W$$

$$\epsilon_K = 3.55 - 2.2$$

$$\epsilon_K = 1.35\ eV$$