-----ooooo-----

Full Name: Phạm Hoàng Minh Subjects: Physics 04

Student's ID: ITITIU19031 Lecturer/Professor: Dr.

Study Date: Subject's Code: Group

Deadline: Class's Code:

Homework/Assignments:

SCORES	COMMENTS

Q1)

a) As the image can be obtained via screen and the lens is at middle between object (candle) and image (screen), this lens is convergent

b)

#1: $d = ?$ cm ; $d' = 30$ cm ; $f = ?$ cm

#2: $d \leftarrow d+4$; $d'' = 30 - 2\times 4 = 22$ cm ; $f = ?$ cm

$$\Rightarrow \begin{cases} \dfrac{1}{d} + \dfrac{1}{30} = \dfrac{1}{f} \\ \dfrac{1}{d+4} + \dfrac{1}{22} = \dfrac{1}{f} \end{cases} \rightarrow \frac{1}{d} - \frac{1}{d+4} = \frac{1}{22} - \frac{1}{30}$$

$\Leftrightarrow \quad d(d+4) = 165 \times 2$

$\Rightarrow \begin{cases} d = \sqrt{334} - 2 & \text{(accepted)} \\ d = -\sqrt{334} - 2 & \text{(rejected)} \end{cases}$

Q2)

$m_1 = 10^{-9}(g) \Rightarrow 10^{-12}(Kg)$; $v_1 = 10^{-2}(m/s.)$

$m_2 = 9.1 \times 10^{-31}(Kg)$; $E_2 = 1.6 \times 10^{-19}$ (J)

a) Wavelength of smoke:

$$\lambda = \frac{h}{mv} = \frac{6.63 \times 10^{-34}}{10^{-12} \times 10^{-2}} = 6.63 \times 10^{-20} \text{ (m)}$$

Wave length of electron

$$v = \sqrt{\frac{2E}{m}} = \sqrt{\frac{1.6 \times 10^{-19} \times 2}{9.1 \times 10^{-31}}} \approx 593000 \text{ (m/s.)}$$

$$\lambda = \frac{h}{mv} = \frac{6.63 \times 10^{-34}}{9.1 \times 10^{-31} \times 593000} \approx 1.229 \times 10^{-9} \text{ (m)}$$

$$= 1.229 \text{ (n.m.)}$$

b) As the wavelength of smoke particle was too small, even smaller than X-ray or Gamma decay, it cannot be detected While the wave property of electron in the ultraviolet range, which makes it detectable

Q3)

$$E_n = \frac{-13.6}{n^2} \text{ (eV)}$$

a) ~~Why~~ Balmer spectrum: $n \geq 2 \to n_0 = 2$

consider $n_{2^+} = \{3; 4; 5; 6; \infty\}$

$$\Delta E_{2,} = \frac{hc}{\lambda} = \left(\frac{-13.6}{n^2} - \frac{-13.6}{2^2}\right)$$

$$\Rightarrow \lambda = \frac{hc}{\frac{-13.6}{n^2} + \frac{13.6}{2^2}} = \frac{(6.63\times10^{-34} \text{ Js})(3\times10^8 \text{ m/s})}{\left(1.6\times10^{-19} \frac{\text{J}}{\text{eV}}\right)\left(\frac{13.6}{2^2} - \frac{13.6}{n^2}\right)(\text{eV})}$$

$n = 3 \to \lambda_3 = 6.58 \times 10^{-7}$ (m) $= 658$ (nm)

$n = 4 \to \lambda_4 = \cancel{487.5}\ 4.875 \times 10^{-7}$ (m) $= 487.5$ (nm)

$n = 5 \to \lambda_5 = 4.353 \times 10^{-7}$ (m) $= 435.3$ (nm)

$n = 6 \to \lambda_6 = 4.113 \times 10^{-7}$ (m) $= 411.3$ (nm)

$n = \infty \to \lambda_\infty = 3.656 \times 10^{-7}$ (m) $= 365.6$ (nm)

b) As can be seen, the most frequent state $\{3; 4; 5; 6\}$ is within the range of visible ~~to~~ color || light (red → purple). Even at the critical point of visible light (purple: 380 nm) the ~~stat quantum must be state~~ highest quantum state must be $n = 10\}$, so this Balmer spectrum was the earliest discovered. Compared to Layman and Pafsen, where ~~the~~ the light was partially unvisible

~~(80)~~

Q4)

$v_1 = 40000 \text{ Km/h} = \frac{1}{27} c$

$v_2 = 0.25c$

$t = 37.5 \text{ mins} = 5/8 \text{ (h)} = 2250 \text{ (s)}$

a) Distance of spaceship

$d_1 = v_1 t = (400000 \text{ km/h}) \times (5/8 \text{ h})$

$= 25000 \text{ (Km)} = 25 \times 10^6 \text{ (m)}$

b) As ~~two~~ objects move relatively fast, time delay was significant:

$$t_{rest} = \frac{t}{\sqrt{1-\frac{u^2}{c^2}}} \Leftrightarrow \frac{t_2}{\sqrt{1-\frac{u_2^2}{c^2}}} = \frac{t_1}{\sqrt{1-\frac{u_1^2}{c^2}}}$$

$$\Leftrightarrow t_2 = \frac{\cancel{2250}\ (2250\text{ s})}{\sqrt{1-(1/27)^2}} \times \sqrt{1-0.25^2}$$

$= 1489.26 \text{ (s)}$

Distance of particle:

$d_2 = 0.25 \times (3 \times 10^8 \text{ m/s})(1489.26 \text{ s})$

$= 3.351 \times 10^{11} \text{ (m)}$

b) As can be seen, due to time delaytion, the actual time that particle ~~accel a~~ moves was equal to 66.189% ~~compared to the res~~ comparable which lowers the actual distance if without time delay

Q5)

$$^{232}_{90}Th \rightarrow ^{208}_{82}Pb + x\,^{4}_{2}\alpha + y\,^{0}_{-1}\beta$$

a) Reaction above : From them we have

$$\begin{cases} 232 = 208 + 4x + 0y \\ 90 = 82 + 2x - 1y \end{cases} \rightarrow \begin{cases} x = 6 \\ y = 4 \end{cases}$$

b) 0.25 g $^{208}_{82}Pb$ $\rightarrow$ $3/832$ mol Pb

3.65 g $^{232}_{90}Th$ $\rightarrow$ $73/4640$ mol Th

$$Th \longrightarrow Pb + 6\alpha + 4\beta$$

$73/4640$ $\qquad$ $3/832$

$+$ $3/832 \longleftarrow 3/832$

0.0193

So from 0.0193 mol of Th decays to $73/4640$ ~~at~~ at the end, we have equation

$$N = N_0 e^{-t/T}$$

$$\frac{73}{4640} = 0.0193 \times e^{-t/14} \rightarrow e^{-t/14} = 0.8152$$

$$\rightarrow t = -14 \ln(0.8152)$$

$$= 2.861 \text{ (billion years)}$$

So the age of rock is approximate 2.861 billion years