National Junior College

Name: Tan Zhi Yong
Subject: Physics
Reg. No. 03S2624 C
Date: 30/6/04

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32a) $V_1 = \frac{1.2\times10^{-2}}{4.0\times10^{-3}}$

$= 3.0\ ms^{-1}$

$V_2 = \frac{1.2\times10^{-2}}{8.0\times10^{-4}}$

$= 15.0\ ms^{-1}$

Sect C : 1/2

32b) $\Delta K.E = \frac{1}{2}mV_2^2 - \frac{1}{2}mV_1^2$

$= \frac{1}{2}(1)(15.0^2 - 3.0^2)$

$= 108\ J\,kg^{-1}$ (3s.f)

32c) $P_1 = \frac{F_1}{A_1}$

$F_1 = P_1 A_1$

$= P_1 \frac{m}{\rho s}$ where s is distance moved

$W_1 = \frac{P_1}{\rho}$ since $m=1$ (shown)

approach ✗

32di) $W_1 = \frac{1.0\times10^4}{750}$

$= 13.3\ J\,kg^{-1}$ (3s.f)

32dii) $W_2 = \frac{2.8\times10^5}{750}$

$= 373\ J\,kg^{-1}$ (3s.f)

32e) Net work done per unit mass $= 13.33 + 373.3$ ($W_2 - W_1$)

$= \cancel{386}\ 387\ J\,kg^{-1}$ (3s.f)

32f) Since work done is positive, therefore the flow to the right is not spontaneous as energy is needed to move it against the spontaneous flow from right to left. Thus, an ~~excerta~~ external power source is required.

32g) $W_p = 387\ J\ \cancel{kg^{-1}}\ (3s.f)$ 380 + 108

32h) Power = $388.7 \times 750 \times 1.2 \times 10^{-2}$

$= 3480\ Js^{-1}\ (3s.f)$ 2

32i) The ~~fluid~~ petrol is a viscous fluid and flows in a non-laminar fashion, thus mechanical power required is higher as frictional forces must be overcome.

33ai) ~~The gas atoms~~ The electrons of the gas molecules are at rest state. When ~~3~~ radiation of the appropriate frequency strike them, they will absorb the radiation and are elevated to a higher energy level, from which they will fall back to resting state and dissipate their energy as radiation, giving rise to an emission spectrum where only ~~at~~ particular frequencies of light are emitted.

33aii) 1. $E = hf$

$E_1 = 6.63 \times 10^{-34} \times 97.1 \times 10^{-9}$

$= 6.44 \times 10^{-41}\ J\ (3s.f)$

$E_2 = 6.63 \times 10^{-34} \times 485 \times 10^{-9}$

$= 3.22 \times 10^{-40}\ J\ (3s.f)$

$E_3 = 6.63 \times 10^{-34} \times 654 \times 10^{-9}$

$= 4.34 \times 10^{-40}\ J\ (3s.f)$

$E_4 = 6.63 \times 10^{-34} \times 1875 \times 10^{-9}$

$= 1.24 \times 10^{-39}\ J\ (3s.f)$

Careless

3+4

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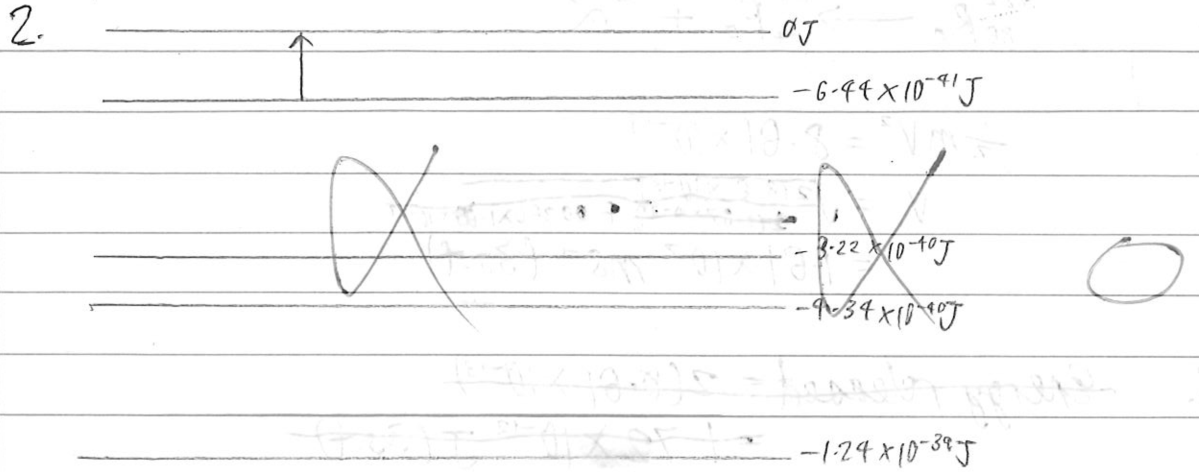
2.



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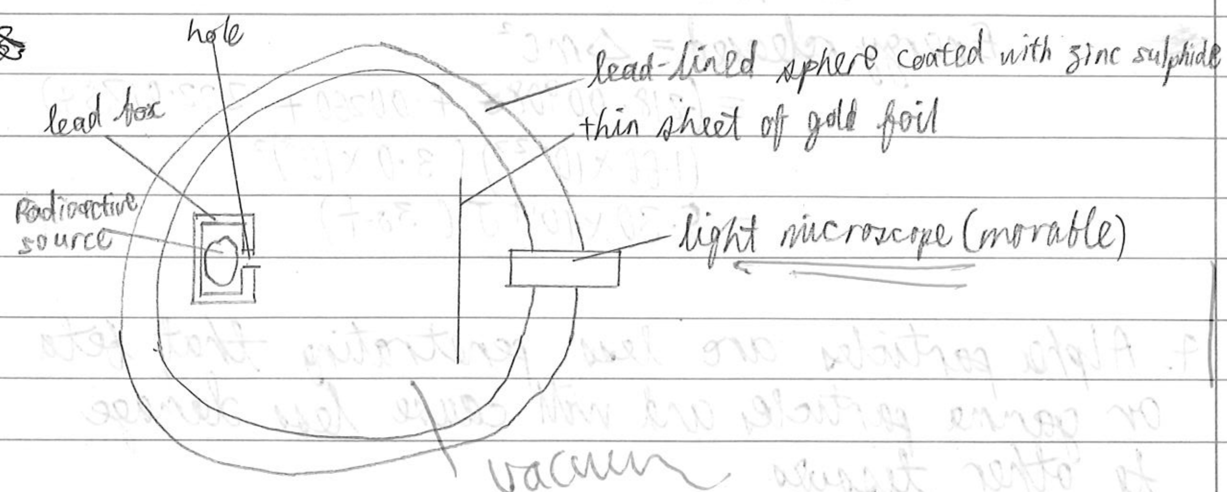
33 b i) ~~8~~



The radioactive source was enclosed in a lead box with only a small hole facing the gold foil to allow α-particles through. The light microscope was used to observe scintillation of light caused by α-particles striking the zinc sulphide.

Most scintillations were observed behind the gold foil, showing that ~~ot~~ most ~~α~~ α-particles passed through the foil and that the gold nucleus occupied a negligible volume.

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~~Some scintillat~~ A few scintillations were observed behind the radioactive source, showing that the α-particles have been reflected by the small but highly ~~positively~~

positively-charged ~~nucleus~~ nuclei.

33b(ii) 1. $^{222}_{86}Rn \longrightarrow {}^{218}_{84}Po + {}^{4}_{2}\alpha$

2. $\frac{1}{2}mV^2 = 8.61\times10^{-13}$

$V = \sqrt{\frac{2(8.61\times10^{-13})}{\cancel{4(1.67\times10^{-27})}\ 4.00260\times1.66\times10^{-27}}}$

$= 1.61\times10^{7}\ ms^{-1}$ (3s.f)

3. ~~Energy released = 2(8.61×10⁻¹³)~~

~~= 1.72×10⁻¹² J (3s.f)~~

$E = mc^2$

Energy released $= \Delta mc^2$

$= (-218.00908 - 4.00260 + 222.01754)$

$(1.66\times10^{-27})(3.0\times10^{8})^2$

$= 5.30\times10^{-14}$ J (3s.f)

4. Alpha particles are less penetrating that beta or gamma particles and will cause less damage to other tissues.

34(a) ~~$\phi = BA$~~ Flux $= NBA\cos\theta$

where N represents no. of coils

B represents magnetic field strength

A represents area of flux-cutting

θ represents angle to the normal of plane

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Name: ......

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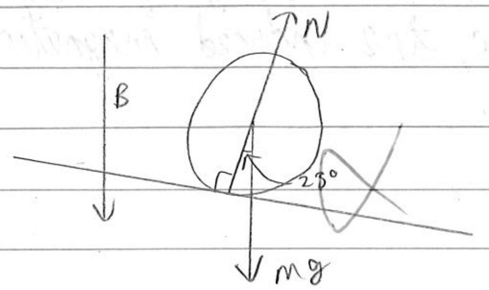
34(b)(i) 1.



2. Current must flow from X to W

3. $F = BIL \sin\theta$

$mg\cos(90°-23°) \cancel{mg} = BIL \sin\theta$

$\cancel{\left(\frac{6.0}{1000}\right)(9.81) = (0.40)(0.15)(\sin\ )(I)}$

$I = \frac{\left(\frac{6.0}{1000}\right)(9.81)\cos(90°-23°)}{(0.40)(0.15)}$

$= 0.37\text{ A (2 s.f.) shown}$

34(b)(ii) 1. $\cancel{F = BIL \sin\theta}$

By Fleming's right hand rule, current flows from X to W.

$F = BIL\sin\theta$

$I = \frac{F}{BL\sin\theta}$

$=$

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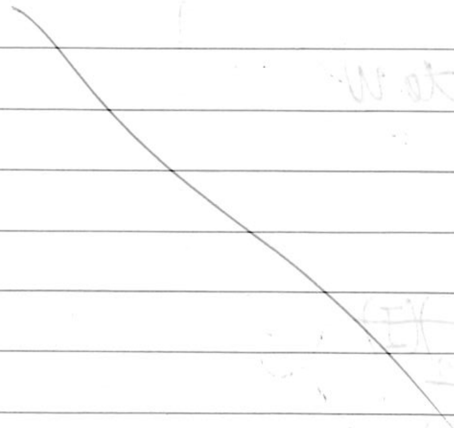
2. By Lenz's law, direction of induced electromotive force is such as to oppose the charge of magnetic flux producing it. Thus, the induced magnetic force tends to stop the rod. 2

3.



4. ~~F=mg~~

The terminal velocity will remain the same as g does not change.