SOUTH PACIFIC BOARD FOR
EDUCATIONAL ASSESSMENT

PHYSICS

Marking Schedule 2008

Pacific Senior Secondary Certificate

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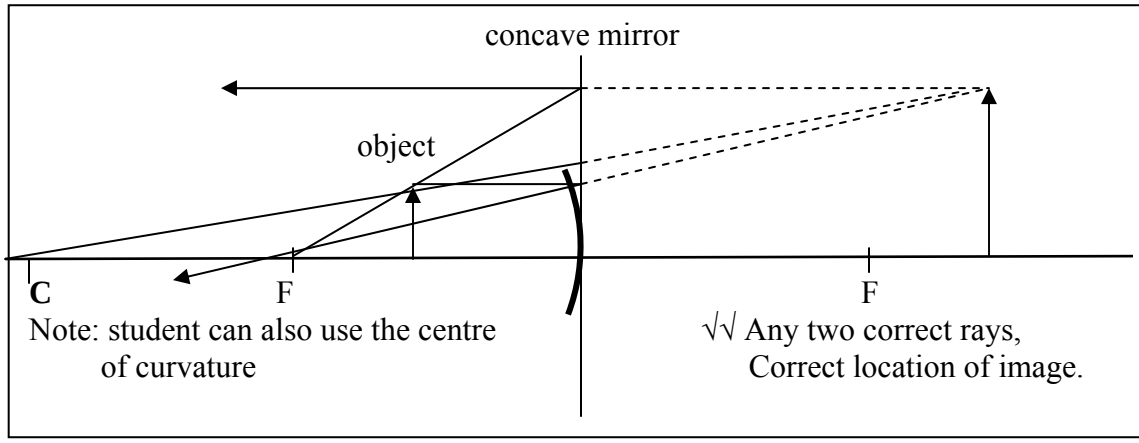
SECTION A (160 marks)

QUESTION 1 (15 marks)

(a) (i) (2 marks)



Note: student can also use the centre of curvature

√√ Any two correct rays, Correct location of image.

(ii) (2 marks)

$$\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$$

$$\frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{3.6}-\frac{1}{2.1}$$

$$\frac{1}{v}=0.2 \qquad V = -5\text{ cm}$$

√ 5 cm

√ (-) value or behind mirror

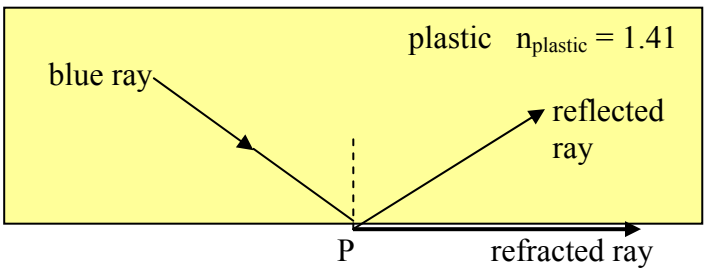
Or Answer can be measured from the diagram

Position: - 5 cm or 5 cm behind the mirror

(iii) (1 mark)

virtual

(b) (1 mark)



(√) must show both labelled rays

NOTE: This diagram is NOT drawn to scale.

(ii) (2 marks)

$n_1 \sin\Theta_1 = n_2 \sin\Theta_2$

(√√) Correct Answer

$$\Theta_c = \left[\frac{n_2}{n_1}\right]^{-\sin} = \left[\frac{1}{1.41}\right]^{-\sin} = 45.2^o$$

Critical Angle: ____45° or 45.2°_____

(iii) (1 mark)

The ray will experience TOTAL INTERNAL REFLECTION. (√)

(c) (i) (2 marks)

$n_1 \sin\Theta_1 = n_2 \sin\Theta_2$

(√√) correct value of degree

$$\Theta_2 = \left[\frac{n_1 \sin\theta_1}{n_2}\right]^{-\sin} = \left[\frac{1.20 \sin 40^o}{1.52}\right]^{-\sin} = 30.5^o$$

Angle: 30.5 or 31°

(ii) (2 marks)

Velocity will get less (√) when light enters a more optically dense medium(√).

(iii) (2 marks)

(√) correct answer

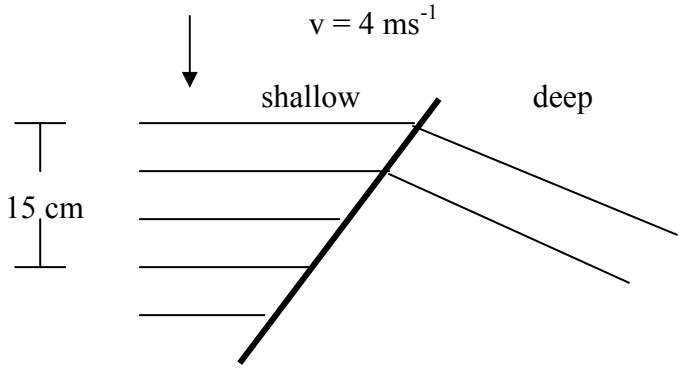
$${}_1n_2 = \frac{\sin\theta_1}{\sin\theta_2} = \frac{\sin 40}{\sin 30.5} = 1.266 \quad \text{or} \quad {}_1n_2 = \frac{n_2}{n_1} = \frac{1.52}{1.2} = 1.266$$

(√) correct use of equation using answer in (c)1

Relative Refractive Index: 1.266 or 1.3

QUESTION 2 (16 marks)

(a)



(i) (√√) both wavefronts correct (2 marks)

(ii) (2 marks)

√ Correct λ

$\lambda = \frac{15}{3} = 5 \text{ cm} \div 100 = 0.05 \text{ m}$ $f = \frac{v}{\lambda} = \frac{4}{0.05} = 80 \text{ Hz}$ √ Correct use of $f = \frac{v}{\lambda}$

Frequency: 80 Hz

(b) (i) (1 mark)

The light from the sources is the same f and V(or λ or is in phase)

√ one of the above is mentioned

(ii) (2 marks)

The dark band forms when: destructive interference occurs OR two waves out of phase meet (√) AND the light is cancelled(√).

(iii) (3 marks)

$\lambda = \frac{dx}{L}$ $x = \frac{\lambda L}{d} = \frac{590x10^{9}x0.75}{0.15x10^{-3}} = 2.95 \text{ x } 10^{15} \text{ m}$

$2x = 5.9 \text{ x } 10^{15}$

√ correct use of equation
√ correct value for x
√ correct answer

Distance: 5.9 or 6 x 10^{15}m

(iv) (2 marks)

Path Difference: 2λ (√√) correct answer

(v) (2 marks)

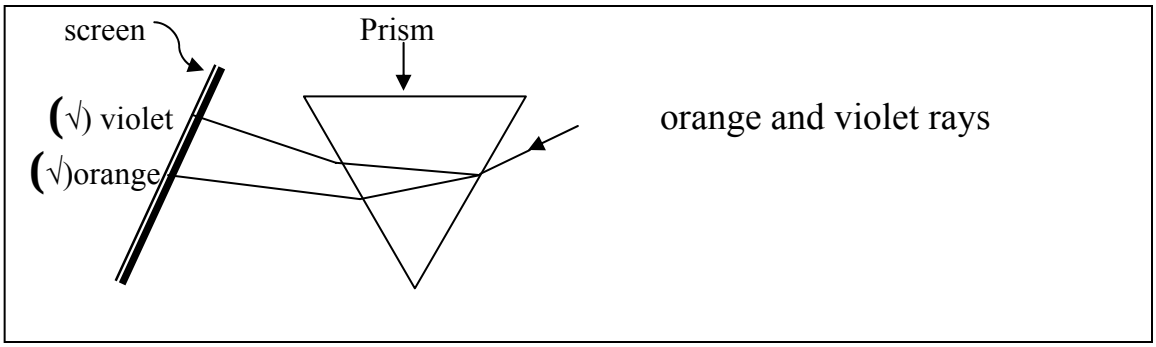
There will be a central white band (√) with bands of the spectrum on both sides. (√)

(c) (2 marks)

The speed of sound varies with the medium it is travelling through (√).
The first tap is the sound travelling through the metal in the pipe, the second tap is from the sound travelling through the air. (√)

QUESTION 3 (20 marks)

(a) (i) (2 marks)



(ii) (2 marks)

The glass has different refractive for the different colours (f, λ) of light, (√) causing them to change to different velocities which separates them. (√)

(b) (2 marks)

dsinΘ= (n- ½)λ

(√) correct use of equation
(√) correct answer

$$\lambda = \frac{d\sin\theta}{n-\frac{1}{2}} = \frac{4\sin 20}{2-1/2} = 0.456 \text{ m}$$

Wavelength: 0.456 – 0.5 m

(c) (i) (2 marks)

(a) 2.5 and 4.5 seconds: She is slowing down or decelerating (no change in direction) (√)

(b) 4.5 and 6 seconds: She has a constant velocity. (√)

(ii) (1 mark)

$$\text{slope} = \frac{10-0}{2.5-0} = 4 \text{ ms}^{-2}$$

(√) correct answer

Acceleration: 4 ms^{-2}

(iii) (2 marks)

Area under the slope = ½ x 2.5 x 10 = 12.5 m (√√) correct answer

Distance: 12.5 m

(iv) (2 marks)

(√√) correct answer

$v = \frac{distance}{time} = \frac{12.5}{2.5} = 5$ or $v = \frac{v_o + v_f}{2} = 5\ ms^{-1}$

Average Velocity: $5\ ms^{-1}$

(d) (i) (1 mark)

Net Force: zero N (√) correct answer

(ii) (2 marks)

$v = v_o + at$ $a = \frac{v - v_o}{t} = \frac{2.7 - 1.2}{6} = 0.25\ ms^{-2}$ (√√) correct answer

Acceleration: $0.25\ ms^{-2}$

(iii) (2 marks)

$d = ½ (v + v_o)\ t = ½ (2.7 + 1.2)\ 6 = 11.7$ m (√√) correct answer

Distance: 11.7 – 12 m

(iv) (2 marks)

$v^2 = v_o^2 + 2as$ $a = \frac{v^2 - v_o^2}{2s} = \frac{0^2 - 2.7^2}{2x8} = -0.455\ ms^{-2}$

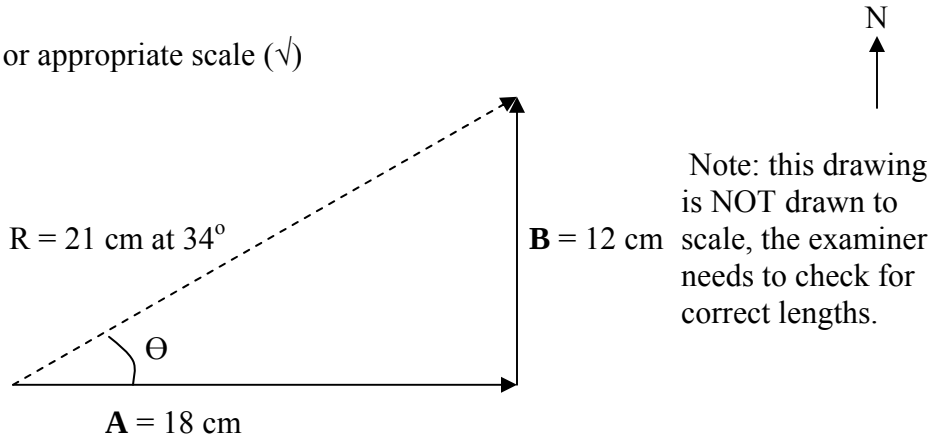
(√√) correct answer
must be (-)

Acceleration: - 0.455 to - 0.5 ms^{-2}

QUESTION FOUR (19 marks)

(a) (3 marks)

scale: 1 : 3 or appropriate scale (√)



Note: this drawing is NOT drawn to scale, the examiner needs to check for correct lengths.

(√) correctly drawn and labelled vectors
(√) correct resultant (with angle)

Resultant = 21 - 22 cm at 34°

(b) (i) (2 marks)

$F_{net} = ma = 95 \times 4 = 380$ N (√√) correct answer

Force: 380 N

(ii) (3 marks)

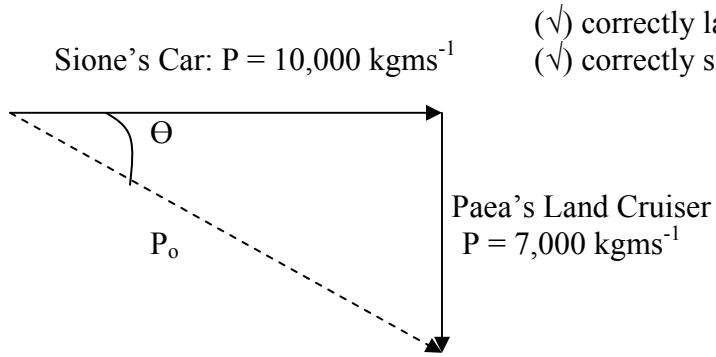
$F_{net} = F_{lift} - F_g$ $F_g = mg = 95 \times 9.8 = 931$ (√)

$F_{lift} = F_{net} - F_g = 380 - (-931) = 1311$ N (√√)

Force: 1311 N

(c) (i) (2 marks)

(√) correctly labelled
(√) correctly sketched



(ii) (2 marks)

$P_o = P_T = \sqrt{10{,}000^2 + 7000^2} = 12{,}206$ kgms^{-1}(√)

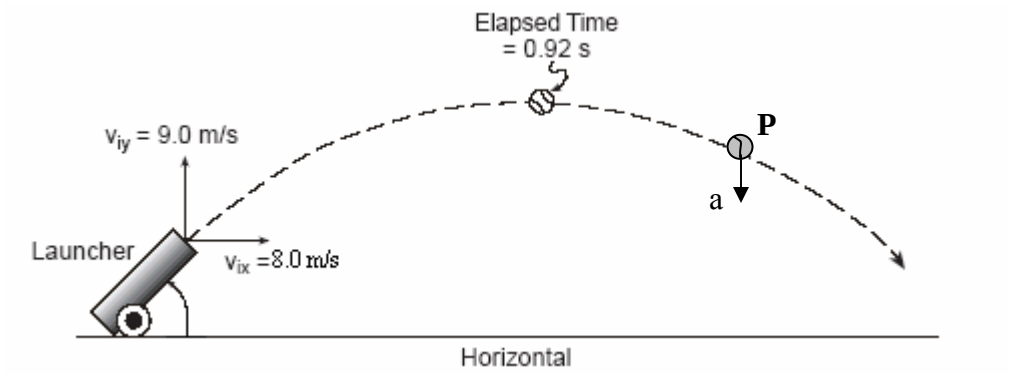
$\Theta = \left[\frac{o}{a}\right]^{-\tan} = \left[\frac{7000}{10000}\right]^{-\tan} = 35^o$ (√) Total Momentum: 12,206 kgms^{-1} at 35°

(iii) (2 marks)

(√√) - correct method using P_T from Q(ii)

$v_T = \frac{P_T}{m+m} = \frac{12{,}206}{1000+1400} = 5.1$ ms^{-1} Final Speed: 5 - 5.1 ms^{-1}

(d)



(i) (√) correct direction: see above (1 mark)
(ii) (1 mark)

$V = V_X$ (√) correct answer

Velocity: 8.0 ms^{-1}

(iii) (2 marks)

$s = ½ (v + v_o)t = ½ (0 + 9.0)\ 0.92 = 4.14$ m (√√) correct answer

or use of $v^2 = v_o^2 + 2as$ to solve for s

Height: 4 – 4.14 m

(iv) (1 mark)

$t = 2 \times 0.92 = 1.84$

$d = vt = 8.0 \times 1.84 = 14.72$

Range: 14.72 – 15 m (√)

QUESTION FIVE (18 marks)

(a) (i) (1mark)

$a = \frac{F}{m+m} = \frac{11,000}{2,500+2,500} = 2.2\ ms^{-2}$

(√) correct magnitude

Acceleration = 2.2 ms^{-2}

(ii) (1 mark)

F = ma = 2500 x 2.2 = 5,500

(√) correct magnitude

Force: 5,500 N

(iii) (2 marks)

The force of friction (√) opposes the motion, causing a net force (√) that slows down or decelerates the car.

(iv) (4 marks)

$E_k = ½\ mv^2 = ½ \times 2500 \times 3.6^2 = 16,200$ J (√)

$E_k = E_p$ (√) or showing this through using the method below

$h = \frac{2E_p}{mg} = \frac{2x16,200}{2500x9.8} = 1.3$ m (√√)

Height = 1 - 1.3 m

(v) (2 marks)

$\Delta P = P - P_o = 5,500 - 9,000 = -3,500\ kgms^{-1}$
or using $\Delta P = m(v - v_o)$

(√√) correct answer
(must have (-) sign)

Change in Momentum: - 3,500 $kgms^{-1}$

(b) (i) (2 marks)

$E_k = ½\ mv^2 = ½ \times 0.6 \times 2^2 = 1.2$ J

(√) correct value of mass
(√) correct answer

Kinetic Energy: 1.2 J

(ii) (2 marks)

$E_p = ½ kx^2$	(√√) correct answer
$x = \sqrt{\frac{2E_p}{k}} = \sqrt{\frac{2x1.2}{200}} = 0.1m$	Distance: 0.1m

(iii) (1 mark)

$E_p = E_k$ Same answer as (i) (√)	Potential Energy: 1.2 J

(c) (i) (1 mark)

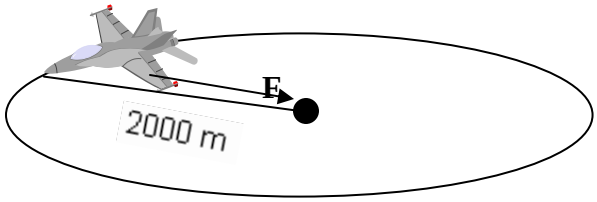
$\text{slope} = \frac{0-200}{0.1-0.04} = -3{,}333\ Nm^{-1}$	(√√) correct answer (does not need (-) sign) Spring Constant: - 3,333 Nm^{-1}

(ii) (2 marks)

Work = Area = ½ bh = ½ x 0.06 x 200 = 6 J or using $E_p = ½ kx^2$ correctly using the value in (i)	(√√) Either solution shown
	Work Done: 6 J

QUESTION SIX (16 marks)

(a) A 3 500 kg aeroplane is flying in a circular path of a radius of 2 000 m at a constant speed of 40 ms^{-1}.



(i) (√) correct answer (See diagram above) (1 mark)

(ii) (2 marks)

$$T = \frac{2\pi r}{v} = \frac{2\pi 2000}{40} = 314 \text{ s}$$

(√√) correct answer

Time: 314 s

(iii) (2 marks)

$$a = \frac{v^2}{r} = \frac{40^2}{2000} = 0.8 \text{ ms}^{-2} \text{ towards the centre}$$

(√√) correct answer (must include direction of vector)

Acceleration: 0.8 ms^{-2} towards the centre

(b) (2 marks)

Mass of moon = 0.0123 x mass of Earth = 0.0123 x 5.98 x 10^{24} = 7.554 x 10^{22} kg

$$F = \frac{Gm_1m_2}{r^2} = \frac{6.67x10^{-11}x5.98x10^{24}x7.5554x10^{22}}{(3.80x10^8)^2} = 2 \text{ x } 10^{20}$$

(√) correct calculation of moon's mass
(√) correct use of equation

Force: 2 – 2.1 x 10^{20} N

(c) (i) (1 mark)

State of Matter: solid (√)

(ii) (2 marks)

t = 4 x 60 = 240 s (√)

W = Pt = (2000 x 240) = 480,000 J (√ correct use of formula)

Heat Energy: 480,000 J

(iii) (3 marks)

H = mcΔt

$$c = \frac{48{,}000}{2(210-(-160))} = 648.6\ JKg^{-1}\ {}^{o}C^{-1}$$

(√) correct Δt

(√) Correct use of formula with value of H from (ii)

Specific Heat Capacity: 648.6 $JKg^{-1}\ {}^{o}C^{-1}$

(iv) (2 marks)

The heat energy is Latent Heat (√) which is used to change the state of a substance (√), not its temperature.

(v) (1 mark)

Latent Heat, used to evaporate the methylated spirits, is absorbed from her hand, making her hand feel cold. (√)

QUESTION SEVEN (13 marks)

(a) (i) (1 mark)

20 + 273 = 293 K (√)

(ii) (2 marks)

PV = kT

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $T_2 = \frac{P_2V_2T_1}{P_1V_1} = \frac{100x600x293}{120x400}$ =366.25 K (√) correct use with value from (i)

366 – 273 = 93 ^oC (√)

Temperature: 93 ^oC

(b) (2 marks)

$P = \frac{F}{A} = \frac{700}{0.0001}$ = 7,000,000 Pa (√√) correct answer

Pressure: 7,000,000 Pa

(c) (i) (1 mark)

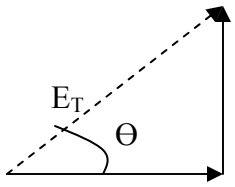
The motion of the particles of the gas collide with the walls of the container. (√)

(ii) (2 marks)

The increase in the heat of the particles causes them to move faster (√), colliding more often with the walls of the container, increasing the pressure. (√)

(d) (3 marks)

$E = \frac{KQ}{r^2} = \frac{9x10^9 x5}{0.06^2} = 1.25 \times 10^{13}\ NC^{-1}$ (√) This is the value of E for each charge.



$E_T = \sqrt{(1.25x10^{13})^2 + (1.25x10^{13})^2} = 1.76 \times 10^{13}\ NC^{-1}$ (√)

$\Theta = (1)^{-tan} = 45^0$ (√)

<u>Field Strength and Direction: 2 - $1.76 \times 10^{13}\ NC^{-1}$ at 45°</u>

(e) . (2 marks)

Refraction does not support the particle theory of light, it states that if light was a particle, then it would bend away from the normal when the velocity increases. (√√)

or

Diffraction does not support the particle theory of light, if light was a particle, it would not bend when it went through a gap or around a barrier. (√√)

QUESTION EIGHT (15 marks)

(a) (i) (2 marks)

18 V means that the power supply gives each Coulomb of charge 18 J of energy.

(√√)

(ii) (1 mark)

Q = It = 4.5 x 5 = 22.5 C (√)

Coulombs: 22.5

(iii) (2 marks)

$R = \frac{V}{I} = \frac{18}{4.5} = 4\ \Omega$ (√√) correct answer

Resistance: 4 Ω

(iv) (2 marks)

$I = \frac{V}{R} = \frac{18}{4+8} = 1.5$ A (√√) Correct Answer

Current: 1.5 A

(v) (2 marks)

V = IR = 1.5 x 4 = 6 V

(√) Correct method using I from (iv) and R from (iii)
(√) Correct Anwer

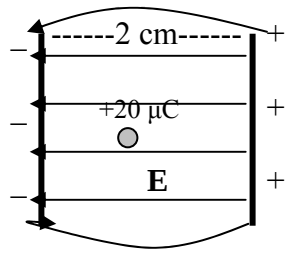
Potential Difference: 6 V

(vi) (1 mark)

The current is unchanged.

Current: 1.5 A or answer in (iv) (√)

(b)



(i) (√) See above, the can be no gaps between the arrow and the plates. (1 mark)

(ii) (2 marks)

V = Ed

(√√) Correct Answer

$E = \frac{V}{d} = \frac{450}{0.02} = 22{,}500\ Vm^{-1}$

Field Strength: 22,500 Vm^{-1}

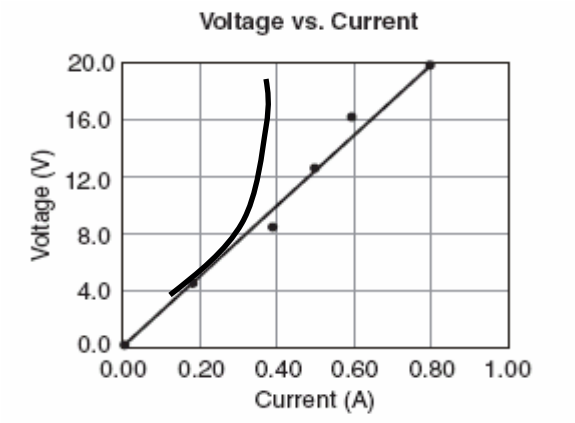
(iii) (2 marks)

W = EQd or W = Vq = 450 x 20 x 10^{-6} = 9 x 10^{-3} J (√√) Correct Answer

Potential Energy: 9 x 10^{-3} J

QUESTION NINE (14 marks)

(a)



(i) (1 mark)

Copper has many free electrons – metallic bonding. (√)

(ii) (1 mark)

The atoms in the copper oppose the flow of the electrons. (√)

(iii) (1 mark)

$R = \frac{V}{I} = \frac{20}{0.8} = 25\ \Omega$ (√) Correct Answer

<u>Resistance: 25 Ω</u>

(iv) (See graph above) (√) (1 mark)

b. (i) (1 mark)

The split-ring commutator reverses the current every ½ turn (√) , which allows for the continuous rotation.

(ii) (2 marks)

The **electrons moving** (√)in the wire are moving **across a magnetic field**. (√)

This results in a force acting on the electrons (coil).

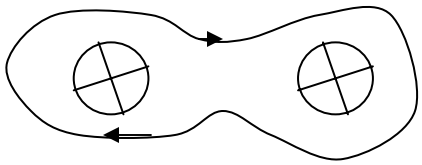
(iii) (2 marks)

The return or hair spring (or the student can refer to the pointer system) will stretch proportionally to the force acting on it. (√)

A larger current results in a larger turning force on the coil, therefore the coil turns in proportion to the current. (√)

(c) (i) (2 marks)

(√) correct shape of field
(√) correct direction



(ii) (1 mark)

attract (√)

(iii) (2 marks)

$$F = \frac{kI_1I_2\ell}{r} = \frac{2x10^{-7}x2x2x9.2}{0.12} = 6.13 \text{ x } 10^{-3} \text{ N}$$

(√√) Correct Answer

Force: $6 - 6.13 \text{ x } 10^{-3}$ N

QUESTION TEN **(10 marks)**

(a) (i) (1 mark)

The atom is mostly empty space. (√)

(ii) (1 mark)

The atom has a small, dense, positive nucleus surrounded by negative electrons. (√)
(The answer is wrong if it includes the presence of neutrons.)

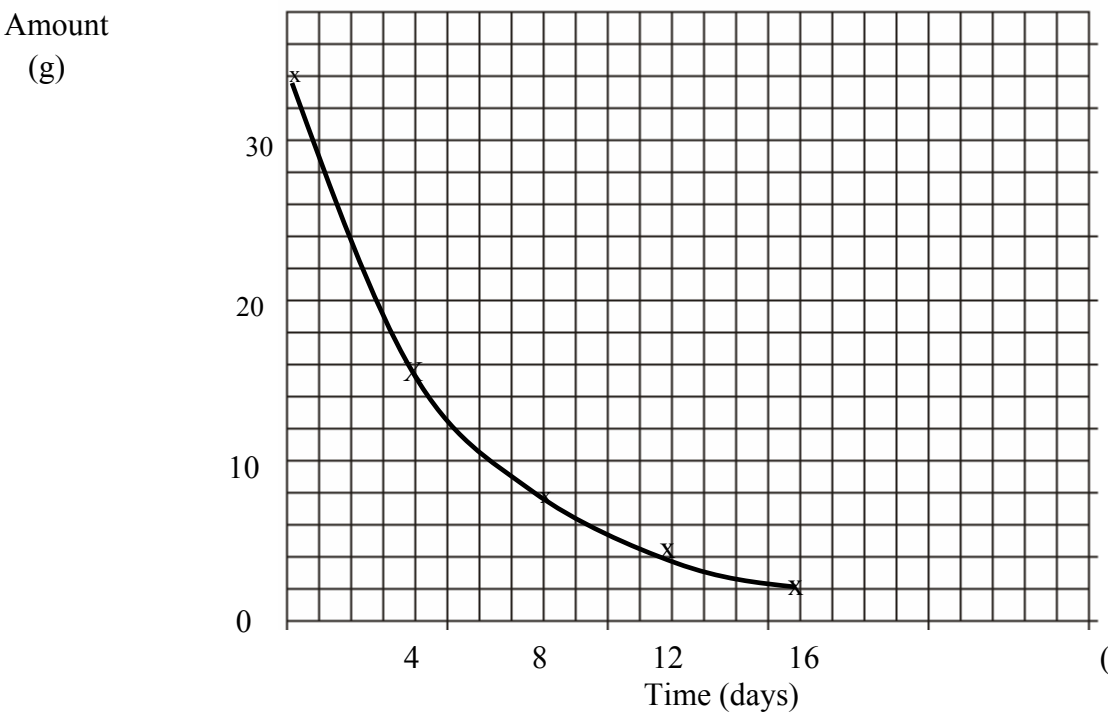
(b) (2 marks)

$$^{212}_{82}Pb \longrightarrow {}^{212}_{83}Bi + {}^{0}_{-1}e \quad (\text{ or } {}^{0}_{-1}\beta\ )$$

(√√) Correct Answer

(c) (i) (3 marks)

The Amount against Time for Substance Q



(√) Title and correct labelling
(√√) Correct Curve

(ii) (2 marks)

$\frac{4}{32}$ x 100 = 12.5 % (√) Correct Answer

Percentage: 12.5 %

(d) (1 mark)

All radioactive medical supplies are kept in locked, lead lined containers. (√)
or
All doctors and patients are protected by lead lined walls or coverings.
or
All radioactive waste material is disposed of in the proper manner.

Section A: Correct Unit Marks: **4**

ANSWER SHEET FOR SECTION B

Remember you are to write in each box the letter of the correct answer only

1.	C	11.	A
2.	B	12.	A
3.	A	13.	D
4.	D	14.	B
5.	A	15.	D

Check Question Number

6.	D	16.	A
7.	B	17.	B
8.	A	18.	B
9.	B	19.	A
10.	A	20.	C

20 x **2 =**

40