SERANGOON JUNIOR COLLEGE
General Certificate of Education Advanced Level
Higher 1

NAME			
CG		**INDEX NO.**	

PHYSICS 8866/02

Preliminary Examination **14th Sept 2016**
Paper 2 Structured Questions **2 hours**

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THIS INSTRUCTIONS FIRST

Write your name, civics group and index number in the spaces at the top of this page.

Write in dark blue or black pen on both sides of the paper.
You may use HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.

Answer **A**
Answer **all** questions.

Section **B**
Answer any **two** questions

At the end of the examination, fasten all your work securely together.
The number of marks is given in bracket [ ] at the end of each question or part question.

For Examiners' Use	
Q1	/ 8
Q2	/ 8
Q3	/ 5
Q4	/ 9
Q5	/ 10
Q6	/ 20
Q7	/ 20
Q8	/ 20
Total marks	/ 80

DATA AND FORMULAE

Data

speed of light in free space,	c	=	3.00×10^{8} m s^{-1}
elementary charge,	e	=	1.60×10^{-19} C
the Planck constant,	h	=	6.63×10^{-34} J s
unified atomic mass constant,	u	=	1.66×10^{-27} kg
rest mass of electron,	m_e	=	9.11×10^{-31} kg
rest mass of proton,	m_p	=	1.67×10^{-27} kg
acceleration of free fall,	g	=	9.81 m s^{-2}

Formulae

uniformly accelerated motion,	s	=	$ut + \frac{1}{2}at^2$
	v^2	=	$u^2 + 2as$
work done on/by a gas,	W	=	$p\Delta V$
hydrostatic pressure,	p	=	ρgh
resistors in series,	R	=	$R_1 + R_2 + \ldots$
resistors in parallel,	$1/R$	=	$1/R_1 + 1/R_2 + \ldots$

Section A

Answer **all** the questions in the spaces provided

1 A stationary radioactive nucleus undergoes α-decay process. In the α-decay process, a daughter nucleus X is formed with the simultaneous emission of an α-particle and a photon of energy 6.1 MeV.

(a) **(i)** Show that the wavelength of the photon is 2.04 x 10^{-13} m. [1]

$$E = hf = h\frac{c}{\lambda} \Rightarrow (6.1\times10^{6}\times1.6\times10^{-19}) = (6.63\times10^{-34})\frac{3\times10^{8}}{\lambda}[1]$$
$$\Rightarrow \lambda = 2.04\times10^{-13}\,\text{m}$$

(ii) Hence, show that the linear momentum of the photon is 3.25 x 10^{-21} N s. [1]

$$p = \frac{h}{\lambda} = \frac{6.63\times10^{-34}}{2.04\times10^{-13}} = 3.25\times10^{-21}\,\text{kg m s}^{-1}$$

(b) An illustration of the decay is as shown in Fig. 1.1.

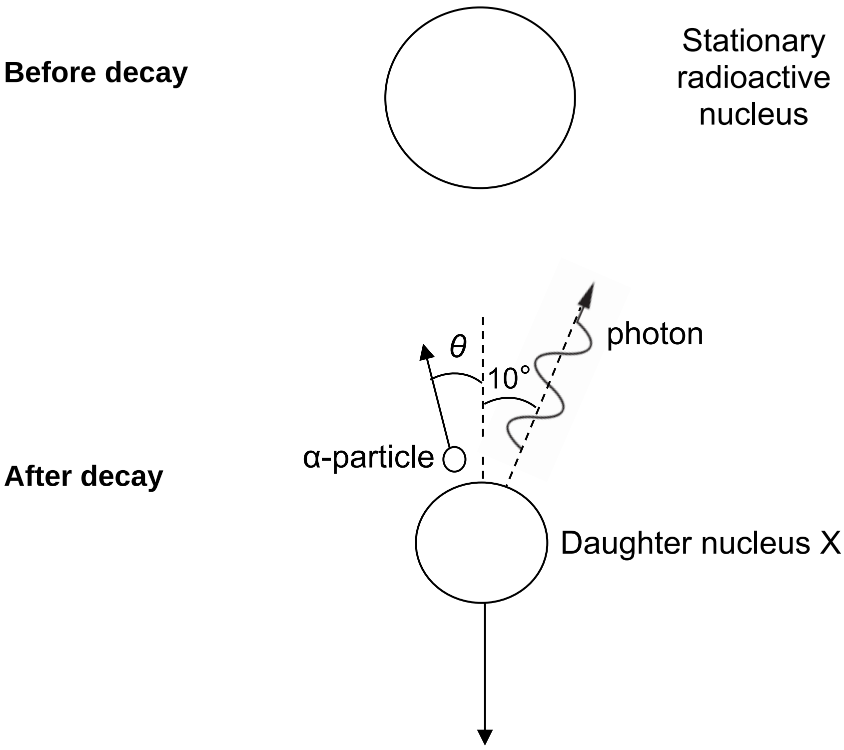


Fig. 1.1

After the emission, the daughter nucleus X, α-particle and photon are emitted in the directions as shown in Fig. 1.1.

(i) During this emission, explain why momentum is conserved.

There is no resultant external force on the system consisting of X, α-particle and photon during the radioactive decay. [1]

[1]

(ii) Momentum is a vector quantity and can be resolved into perpendicular components.

After the decay, the daughter nucleus X has a momentum of 1.11×10^{-19} N s. Using your answers in **(a)(ii)**, calculate the angle θ as shown in Fig. 1.1.

By COLM,

Horizontally, $\rho_{\alpha} \sin\theta = \rho_{photon} \sin 10°$ [1]

Vertically, $\rho_{\alpha} \cos\theta + \rho_{photon} \cos 10° = \rho_{X}$ [1]

$$\tan\theta = \frac{\rho_{photon} \sin 10°}{\rho_{X} - \rho_{photon} \cos 10°}$$

Solving,

$$\theta = \tan^{-1}\left[\frac{\rho_{photon} \sin 10°}{\rho_{X} - \rho_{photon} \cos 10°}\right]$$

$$= \tan^{-1}\left[\frac{3.25 \times 10^{-21} \sin 10°}{1.11 \times 10^{-19} - 3.25 \times 10^{-21} \cos 10°}\right]$$

$$= 0.3°$$ [1]

angle θ = ………………..… ° [3]

(iii) If the daughter nucleus X is stationary after the decay, deduce and explain the directions of motion of the α-particle and the photon.

As the total initial momentum is zero, by COLM, the total momenta of the daughter nucleus X, α-particle and the photon will be zero. [1]
Since X remains stationary, the α-particle and the photon must move off in opposite directions with the same momentum [1]
to ensure the total momentum of the system remains zero

[2]

For Examiner's Use

2 **(a)** A sound wave passes into a 4.0 m pipe that is open at both ends as shown in Fig. 2.1.

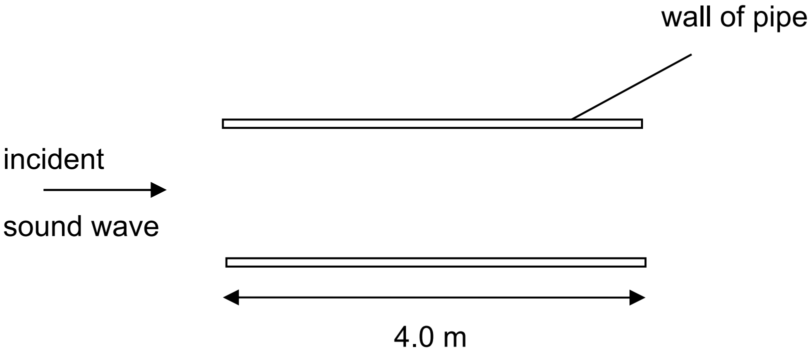


Fig. 2.1

The sound wave travels along the axis of the pipe.

(i) State 2 possible wavelengths that can form a stationary sound wave within this pipe.

$0.5\lambda = 4.0 \Rightarrow \lambda = 8.0$ m
$\lambda = 4.0$ m [1]

.... [1]

(ii) Explain why only specific wavelengths will form stationary waves within this pipe.

The open ends of the pipe have to be displacement antinodes hence, creating boundary conditions for forming stationary wave within the pipe. Hence, only specific wavelengths will be able to form stationary waves with antinodes at the open ends. [1]

.... [1]

(iii) While moving a microphone along the length inside the pipe, loud and soft sounds are detected. State whether loud or soft sound will be detected by the microphone at the open ends of the pipe.

Soft sound. [1]

.... [1]

For Examiner's Use

(b) Coherent light is incident normally on a double slit, as shown in Fig. 2.2.

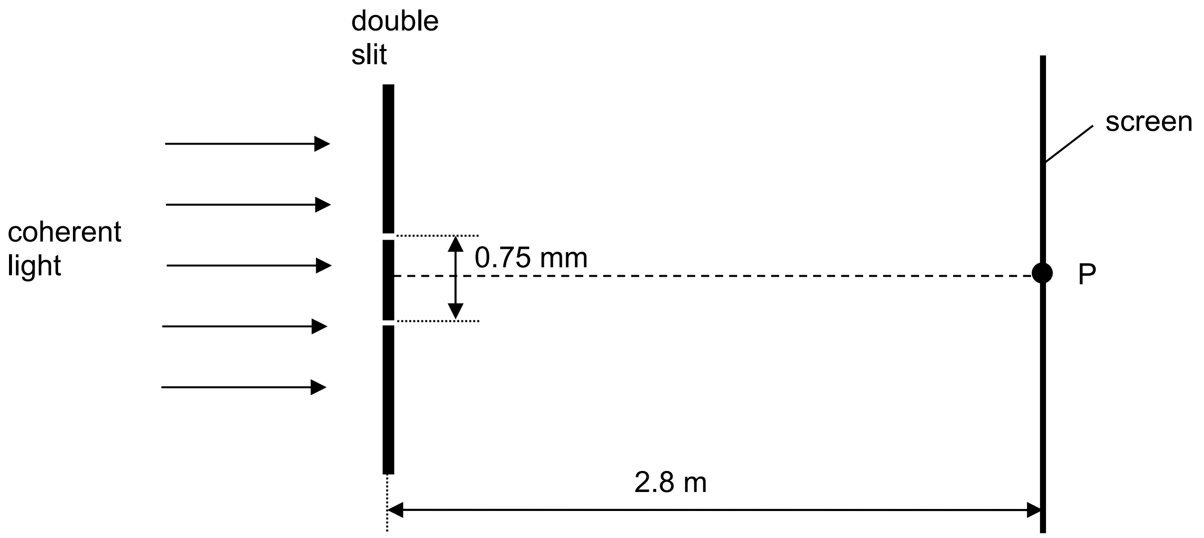


Fig. 2.2

The separation of the slits in the double slit arrangement is 0.75 mm.

A screen is placed parallel to, and a t a distance of 2.8 m, from the double slit. P is a point on the screen that is equidistant from the two slits.

The interference pattern formed on the screen has a fringe separation of 1.2 mm.

(i) Calculate the wavelength, in nm, of the coherent light.

$$x = \frac{\lambda D}{a}$$

$$\lambda = \frac{xa}{D}$$

$$= \frac{(1.2 \times 10^{-3})(0.75 \times 10^{-3})}{2.8} \text{ [1]}$$

$$= 321 \text{ nm [1]}$$

wavelength = …………………….. nm [2]

(ii) The intensity of the light on one of the slits is reduced to 25% of the intensity of light from the other slit.

Determine, for the bright fringe at P and the dark fringe closest to point P, the ratio

$$\frac{\text{amplitude of light at the bright fringe}}{\text{amplitude of light at the dark fringe}}.$$

Intensity α Amplitude^2

$\frac{I_1}{I_2} = (\frac{A_1}{A_2})^2$

$A_1 = \sqrt{0.25}A_2$ [1]

Resultant A at bright fringe=$A_1 + A_2 = (\sqrt{0.25} + 1)A_2$

Resultant A at dark fringe=$A_2 - A_1 = (1 - \sqrt{0.25})A_2$ [1 for both expressions]

$\frac{\text{amplitude of light at the bright fringe}}{\text{amplitude of light at the dark fringe}}$

$= \frac{\sqrt{0.25} + 1}{1 - \sqrt{0.25}}$

$= 3.0$ [1]

ratio = ……………………… [3]

3 In order to investigate the value of the internal resistance of a battery r, a student sets up a circuit as shown in Fig. 3.1.

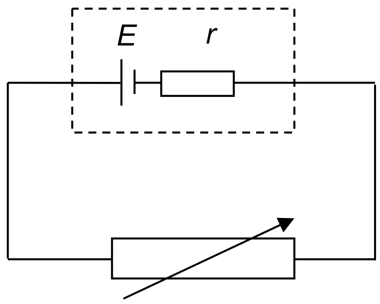


Fig. 3.1

The power dissipated in the variable resistor is P_v. The variation of P_v with resistance R of the variable resistor is shown in Fig 3.2.

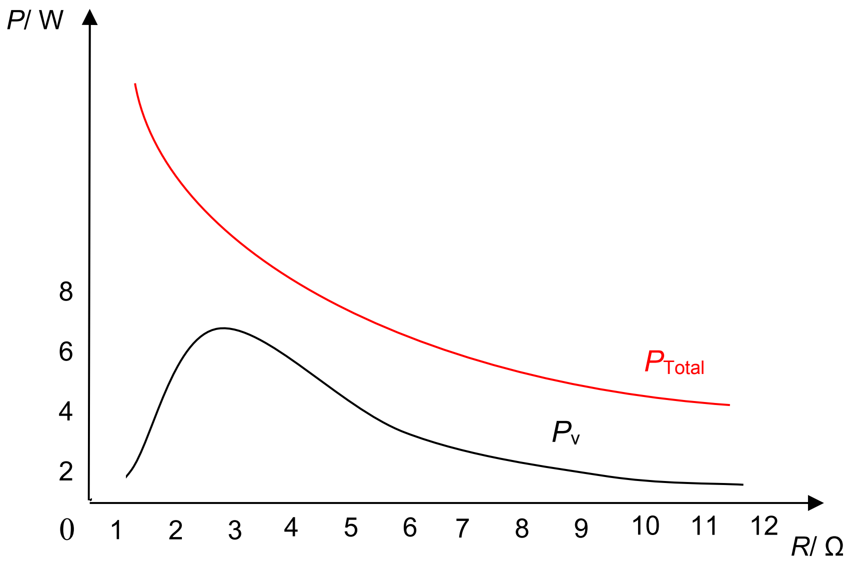


Fig. 3.2

(a) Explain how the student can deduce that the value of the internal resistance of the circuit, r is 3 Ω.

(By Maximum Power Theorem), the power dissipated by the load (variable resistor) is the maximum when the resistance of the load (variable resistor) is equal to the resistance of the internal resistance. [1]

.... [1]

(b) For resistance R = 3 Ω, calculate the efficiency of transfer of power from the supply to the variable resistor.

$$\eta = \frac{P_{out}}{P_{gen}} = \frac{IV}{IE} = \frac{V}{E} = \frac{IR}{I(R+r)} = \frac{R}{R+r} = \frac{3}{3+3} = 50\%$$

efficiency = ……………………….% [2]

(c) Sketch, without any further calculations, the variation of the total power with resistance of the variable resistor in Fig. 3.2. Label the graph as $P_{\mathbf{Total}}$. [1]

(d) A student is asked to design a circuit that provides maximum efficiency of energy transfer to a component. Thus, he correctly selected a battery that has an internal resistance that is much lower than the resistance of the load.

Explain the reason for his choice.

From part (b), since $\eta = \frac{R}{R+r}$, a smaller value of internal resistance relative to the load's resistance would mean that there is lower percentage of the total power dissipated in the internal resistance. [1] Hence, that would increase the efficiency of the energy transfer to the load.

[1]

For Examiner's Use

4 **(a)** Some data for the variation with frequency *f* of the maximum kinetic energy E_{MAX} of electrons emitted from a metal surface are shown in Fig. 4.1.

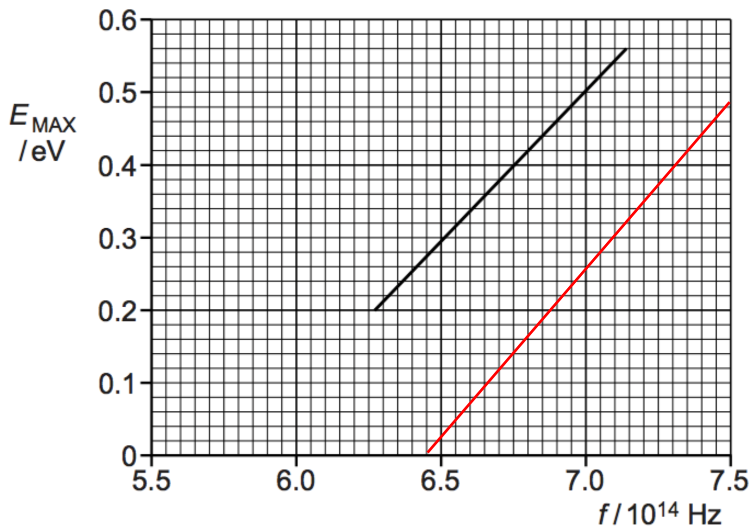


Fig. 4.1

(i) Explain why emitted electrons may have kinetic energy less than the maximum at any particular frequency.

(Photon) interaction with electron may be below surface [B1]
Energy required to bring electron to surface. [B1]
OR electron loses energy as it moves to the surface of the metal. [2]

.... [2]

(ii) Use Fig. 4.1 to determine

1. the threshold frequency,

threshold frequency = ...5.8×10^{14}............ Hz [1]

2. the work function energy, in eV, of the metal surface.

$\Phi = hf_0 = 6.63 \times 10^{-34} \times 5.8 \times 10^{14}$ [M1]
$= 3.85 \times 10^{-19}$ J
$= 2.40$ eV [A1]

work function energy = ... eV [2]

(iii) Sketch on Fig. 4.1 the variation with *f* of E_{max} for a metal with a larger work function. [1]

Don't need to draw complete graph; as long as graphs are parallel.

For Examiner's Use

(b) A parallel beam of electrons, all travelling at the same speed, is incident normally on a carbon film. The scattering of the electrons by the film is observed on a fluorescent screen, as illustrated in Fig. 4.2.

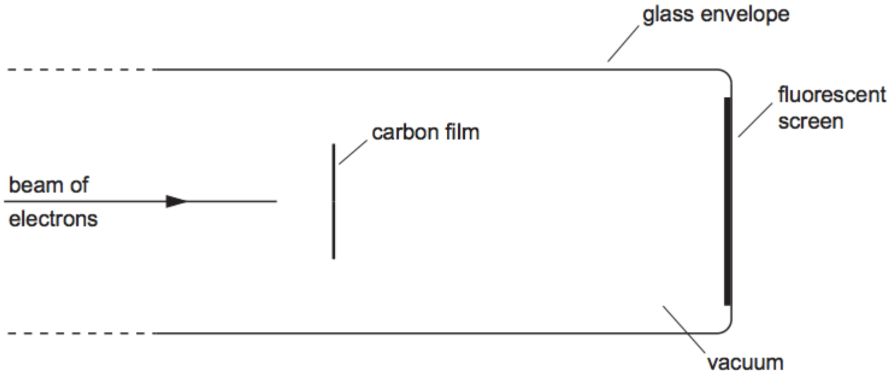


Fig. 4.2

(i) Describe briefly the pattern that is actually observed on the screen.

Concentric rings

.... [1]

(ii) The speed of the electrons is gradually increased.

State and explain what change, if any, is observed in the pattern on the screen.

Higher speed, higher momentum [M1]
Since *λ* = *h*/*p*, and *λ* decreases, ring diameter decreases. [A1]

.... [2]

5 Ultrasonic sound waves (ultrasound) have frequencies outside the audible range of the human ear, that is, greater than about 20 kHz.

As ultrasound passes through a medium, wave energy is absorbed. The rate at which energy is absorbed by unit mass of the medium is known as *dose-rate*. The dose-rate is measured in W kg^{-1}. The total energy absorbed by unit mass of the medium is known as the *absorbed dose.* This is measured in J kg^{-1} or, as in this question, kJ kg^{-1}.

Under certain circumstances, biological cells may be destroyed by ultrasound. The effect on a group of cells is measured in terms of the survival fraction *(SF)*,

$$SF = \frac{\text{number of cells surviving after exposure}}{\text{number of cells before exposure}}.$$

For any particular absorbed dose, it is found that the survival fraction changes as the dose-rate increases.
Error! Reference source not found.Fig 5.1 shows the variation with dose-rate of the survival fraction for samples of cells in a liquid. The absorbed dose for each sample of cells was 240 kJ kg^{-1}.

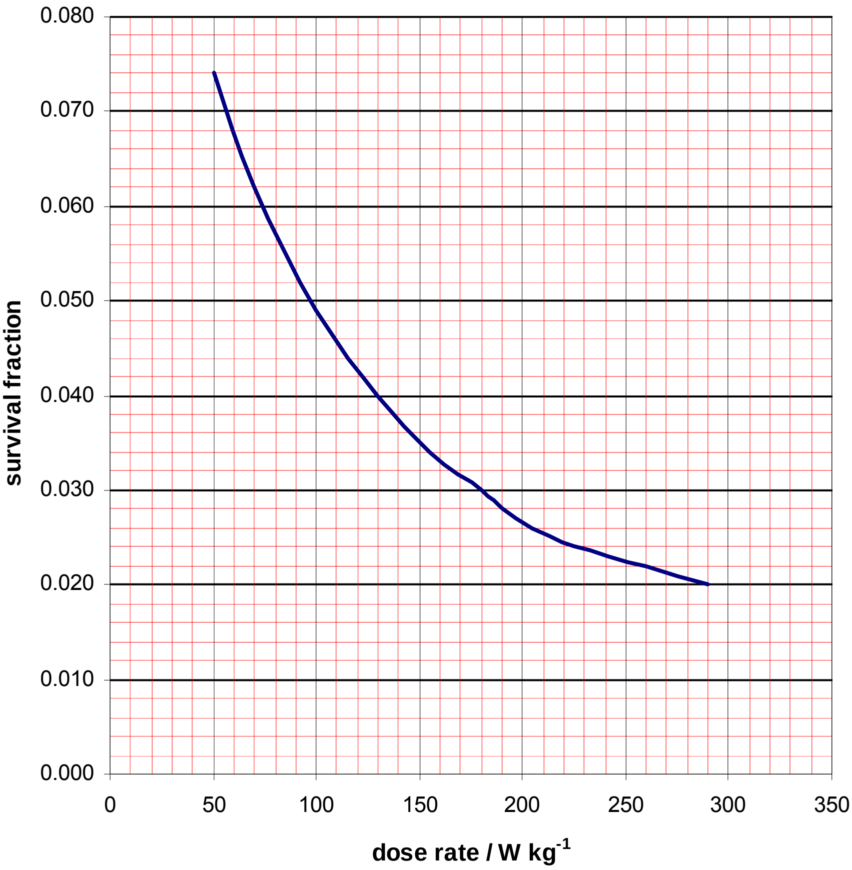


Fig. 5.1

(a) **(i)** Read off from Fig. 5.1 the survival fraction for a dose rate of 200 W kg^{-1}.

SF = …………………… [1]

(ii) Calculate the exposure time for an absorbed dose of 240 kJ kg^{-1} and at a dose-rate of 200 W kg^{-1}.

exposure time = ……………………s [2]

(b) Survival fraction depends not only on dose-rate but also on absorbed dose. Fig. 8.2 shows the variation with dose rate of $\log_{10}(SF)$ for different values of absorbed dose.

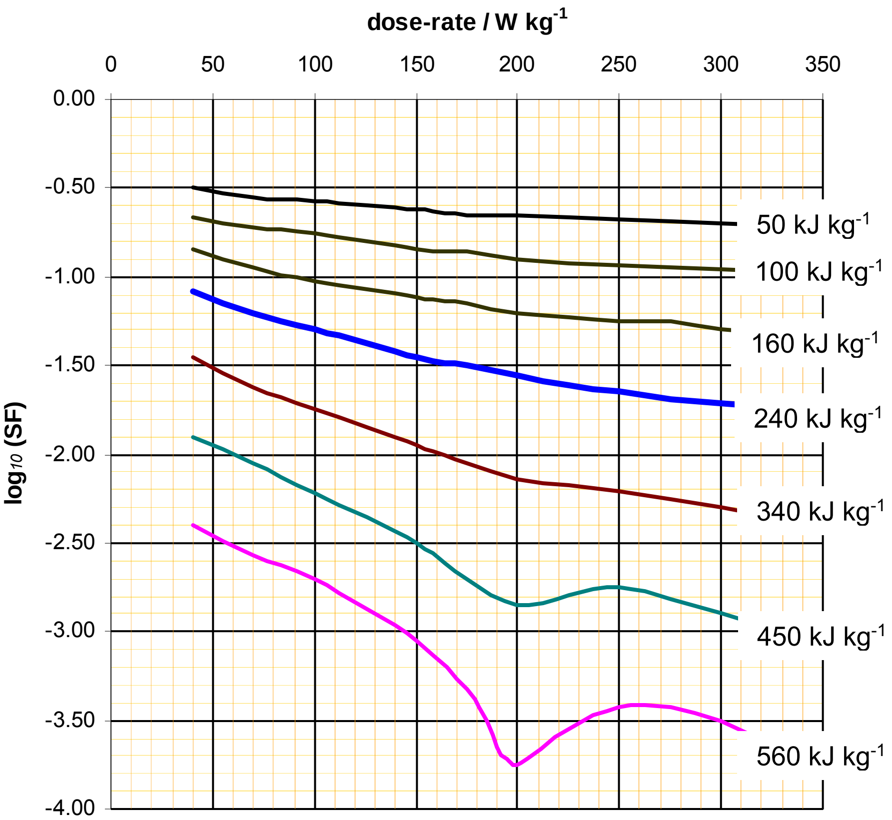


Fig. 8.2

(i) Identify the line in Fig. 8.2 that corresponds to the data given in Fig. 8.1.
Label this line ***L***. [1]

(ii) By reference to Fig. 8.2, complete the table of Fig. 8.3 for a dose-rate of 200 W kg^{-1}. [1]

***Absorbed dose* / kJ kg^{-1}**	**$\log_{10}$ (*SF*)**
50	-0.65
100	-0.90
160	-1.20
240	-1.55
340	-2.13
450	
560	

Fig. 8.3

(c) Use your values in table of Fig. 8.3 to plot, on the axes of Fig. 8.4**,** a graph to show variation with absorbed dose of $\log_{10}(SF)$ for dose rate of 200 W kg^{-1}. [3]

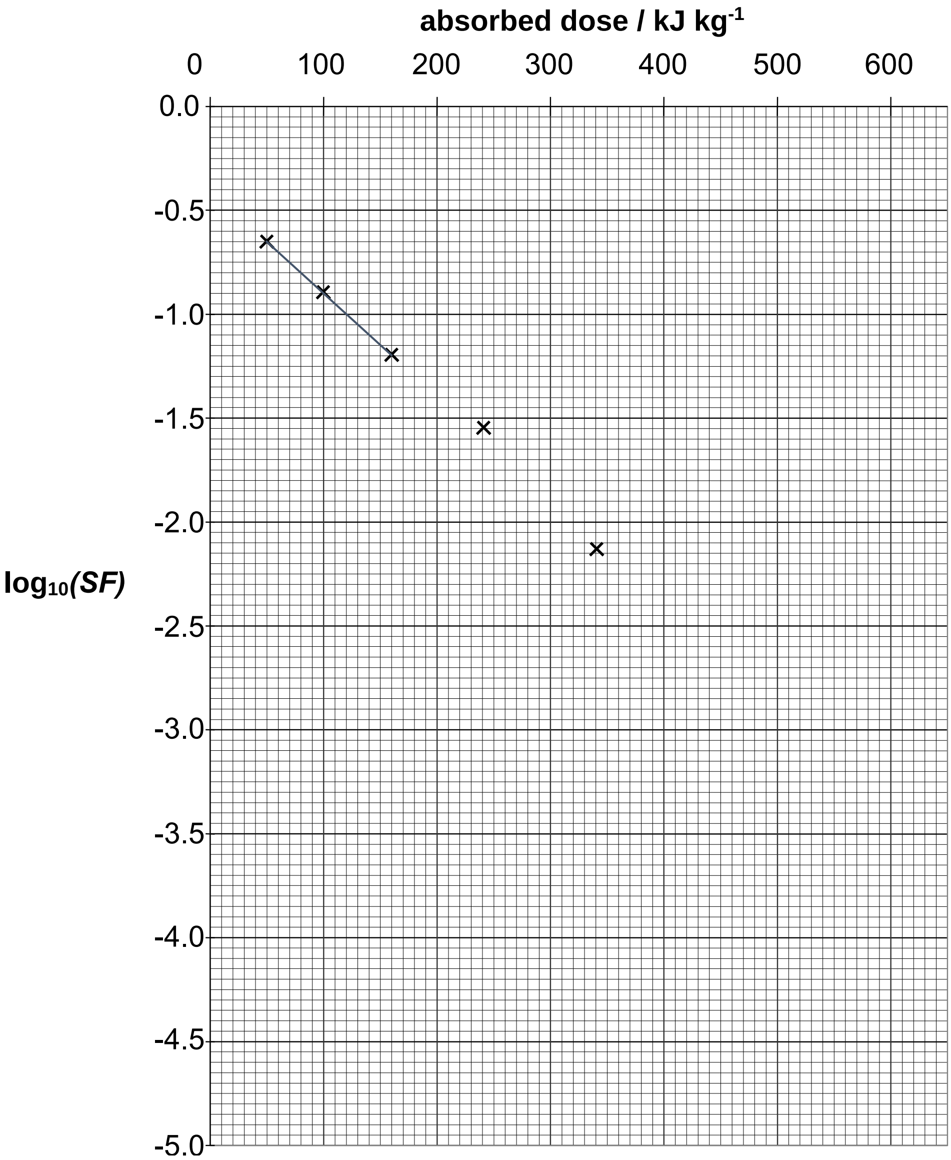


Fig. 8.4

For Examiner's Use

(d) Theory suggests that at a dose-rate of 200 W kg^{-1}, two separate effects may give rise to cell destruction. According to this theory, one of the effects becomes apparent only at higher absorbed doses. State the evidence that is provided for this theory by Fig. 8.4.

……

……

……

………………………………………………………………………………………………………. [2]

8(a)(i) *SF* = 0.027 **[1]**

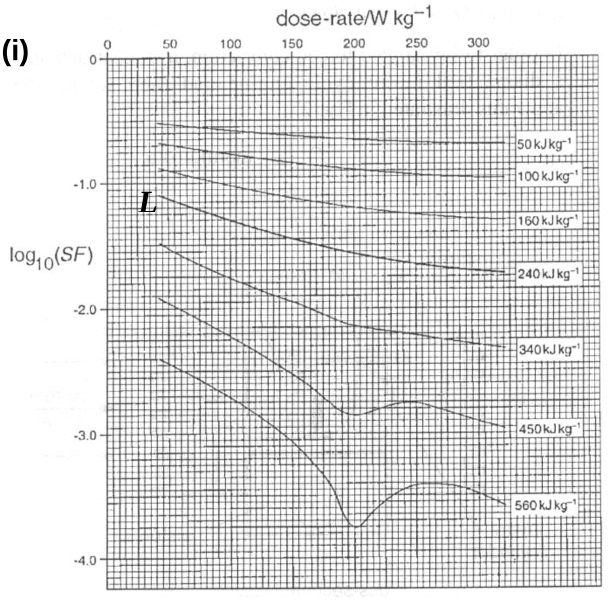
For Examiner's Use

(ii) Exposure time $= \dfrac{\text{Absorbed dose}}{\text{Dose Rate}}$

$= \dfrac{(240 \times 10^3\ \text{J kg}^{-1})}{(200\ \text{W kg}^{-1})}$ **[1]**

$= 1200$ s **[1]**

(b)(i)



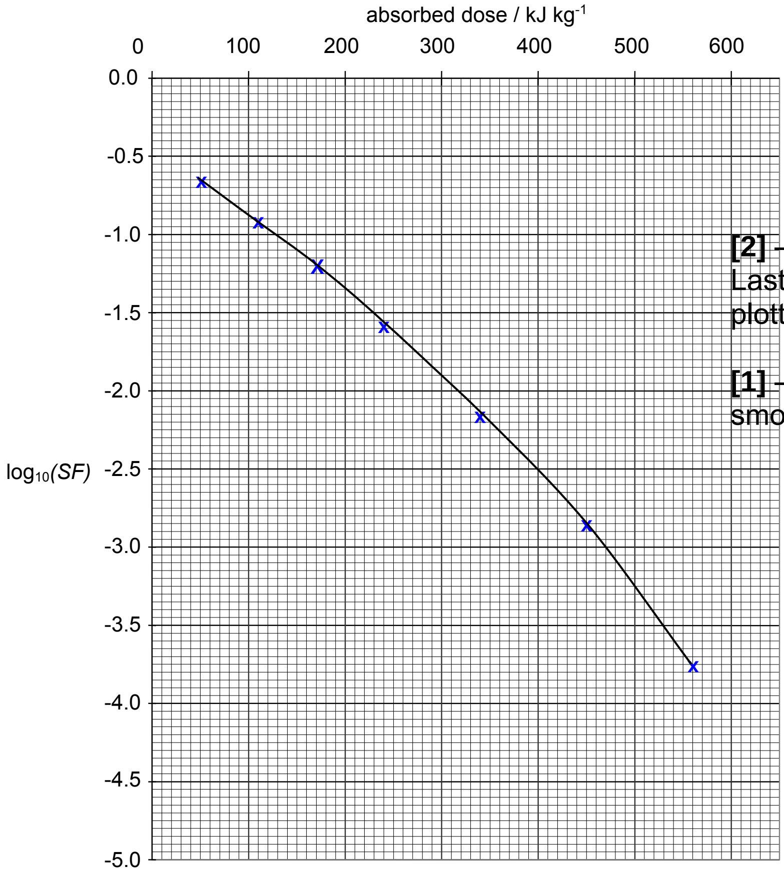
[1] – identifying the correct line

(ii) (Acceptable range)

Absorbed dose / kJ kg^{-1}	$\log_{10}(SF)$
50	-0.65
100	-0.90
160	-1.20
240	-1.55
340	-2.13
450	**-2.85 to -2.87**
560	**-3.75 to -3.77**

- 1 mark for both correct

(c)



[2] – Last two points correctly plotted.

[1] – Curve of best fit. A smooth curve is needed.

(d) From Fig 8.4, we see that the initial part of the graph, up to approximately 24 kJ kg^{-1} is linear **[1]**, after which the onset of the curve **[1]** in the later part suggests a secondary effect.

For Examiner's Use

Section B

Answer **two** questions from this Section in the spaces provided

6 A ball falls off a building that is (70 ± 1) m high. It takes 3.78 s to hit the ground. It is estimated that there is a percentage uncertainty of ± 8% in measuring this time interval.

(a) Determine the acceleration of free fall of the ball to an appropriate number of significant figures.

$s = \frac{1}{2}gt^2$

$g = \frac{2s}{t^2} = \frac{2(70.0)}{3.78^2}$ [M1]

$= 9.798$ m s^{-2}

$\frac{\Delta g}{g} = \frac{\Delta s}{s} + 2\frac{\Delta t}{t} = \frac{1}{70} + 2(0.08)$ [M1]

$\Delta g = 0.174 \times 9.798 = 1.708 = 2$ [M1 for rounding up Δg correctly]

g = (10 ± 2) m s^{-2} [A1 for rounding off g correctly]

acceleration = ……..… ± …….. m s^{-2} [4]

(b) At the moment that the ball was dropped, a boy throws a wooden object vertically upwards towards the ball at speed u, as shown in Fig. 6.1. The distance between the ball and the wooden object is 68.5 m at the start. The objects collide 2.4 s later. Assume air resistance is negligible.

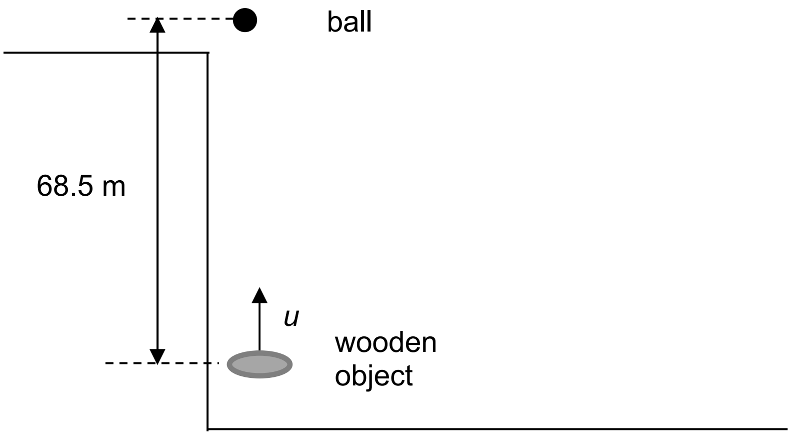


Fig. 6.1

For Examiner's Use

(i) Calculate the distance travelled by the ball just before it hits the wooden object.

Distance travelled by ball = $\frac{1}{2}gt^2$ = ½ (9.81) (2.4)² = 28.3 m [1]

distance = ……………… m [1]

(ii) State an expression for distance travelled by the wooden object just before it hits the ball in terms of *u*.

Distance travelled by wooden object = $ut - \frac{1}{2}gt^2$

= 2.4 *u* – 28.3 [1]

……………………………………………………………………………………[1]

(iii) Hence, determine the speed *u* at which the boy throws the wooden object.

Total distance = 68.5 = $\frac{1}{2}gt^2 + ut - \frac{1}{2}gt^2$ [M1]

$= u(2.4)$

u = 28.5 m s^{-1} [A1]

u = ……………………… m s^{-1} [2]

(iv) Determine the magnitude and direction of velocity of the wooden object just before it collides with the ball.

$v = u + at$

$v = 28.5 + (-9.81)(2.4)$ [M1]

= 4.96 m s^{-1}

Object is moving upwards. [A1]

magnitude of velocity = …………………… m s^{-1}

direction ……………………………… [2]

(v) Calculate the speed of the ball just before it hits the wooden object.

$v = u + at$

$v = 9.81 \times 2.4$ [M1]

= 23.5 m s^{-1} [A1]

speed of ball = ……………………….. m s^{-1} [2]

(vi) Sketch on Fig. 6.2 the variation with time *t* of velocity *v* of the two objects before they collide. Label the graph for the ball as B and the graph for the wooden object as W. Take upwards as positive. [3]

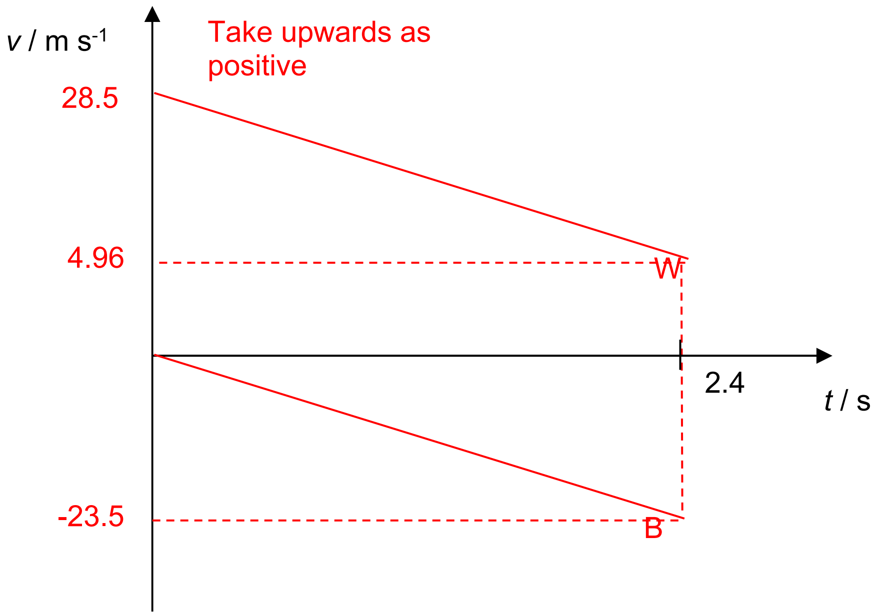


Fig. 6.2

1m for correct shape for W and B – negative gradient. 1m for parallel graphs. 1m for labelling of initial speed of wooden object, final speed of ball and time.

For Examiner's Use

(c) The variation with time *t* of the velocity *v* of another ball falling through air is shown in Fig. 6.3. The mass of the ball is 25 g.

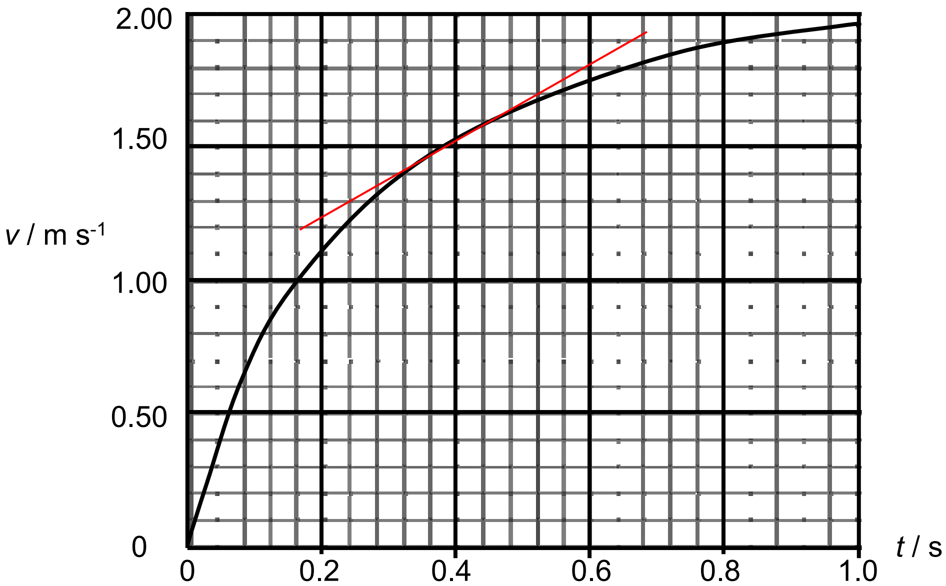


Fig. 6.3

(i) Using Fig. 6.3, describe how the speed of the ball varies with time.

Speed increases at a decreasing rate. [B1]

.... [1]

(ii) Determine the acceleration of the ball falling through air at time t = 0.4 s.

acceleration = gradient of v-t graph

$$= \frac{1.95 - 1.20}{0.68 - 0.16} \quad \text{[M1]}$$

$= 1.44$ m s^{-2} [A1]

Accepted 1.21 ~ 1.67 m s^{-2}.

acceleration = ... m s^{-2} [2]

(iii) The mass of the ball is 25 g. Determine the resistive force acting on the ball at time t = 0.4 s.

$F_{net} = ma$
$W - F_R = ma$
$F_R = W - ma = 0.025\,(9.81 - 1.44)$ [M1]
$= 0.209$ N [A1]

resistive force = ... N [2]

For Examiner's Use

7 **(a)** State the law of conservation of energy.

………

Conservation of energy states that energy can neither be destroyed nor created in any process. It can be transformed from one form to another, and transferred from one body to another but the total amount remains constant.

……… [1]

(b) A bungee jumper of mass 65.0 kg stands on a platform and falls down from rest**.** The length of the unstretched bungee cord is 10.5 m. The force constant of the cord is 40.0 N m^{-1}. The jumper falls by a distance of 48.0 m and attains a speed of *v*.

(i) Calculate the elastic potential energy possessed by the jumper after falling 48.0 m.

Extension of bungee cord when jumper touches water = 48 – 10.5
= 37.5 m

EPE = ½ kx^2
= ½ (40) $(37.5)^2$ = 28100 J [1]

elastic potential energy = ……………………… J [1]

(ii) Calculate the value of *v*.

By Conservation of Energy,

Gain in EPE + Gain in KE = Loss in GPE

28100 + ½ (65) (v^2) = 65 (9.81) (48) [1]

v = 8.78 m s^{-1} [1]

v = …………………………m s^{-1} [2]

(iii) Complete Fig 7.1 to show the gravitational potential energy and the kinetic energy of the man at the three points stated, together with the elastic potential energy stored in the rope. The gravitational potential energy of the man after falling 48.0 m is taken to be zero. [3]

	At the top	After falling 10.5 m	After falling 48.0 m
gravitational potential energy / J	30600	23900	0
elastic potential energy / J	0	0	28100
kinetic energy / J	0	6700	2500

Fig. 7.1

(iv) Calculate the magnitude of the elastic force acting by the cord on the man after falling 48.0 m.

F = kx
= 40 (37.5) = 1500 N [1]

elastic force =……………………..N [1]

(v) Hence or otherwise, calculate the direction and magnitude of the net force acting on the man after falling 48.0 m.

Upward force = 1500 N
Downward force = 65 x 9.81 = 640 N
Net Force = 860 N (upwards)

magnitude of net force = ………………...….N [1]

direction of net force = ………………………… [1]

For Examiner's Use

(vi) Determine the distance from the platform when the jumper possessed a maximum kinetic energy.

Maximum KE occurs when net force on man = 0 N [1]
F_{net} = 0 when upward force equals downward force

mg = kx
65 (9.81) = 40 (x)
x = 15.9 m [1]

Distance from platform = 15.9 + 10.5 = 26.4 m [1]

distance from platform = ……………………………m [3]

(vii) State and explain how the value in **(vi)** would change if air resistance was considered when the jumper fell from the platform.

……………………………………………………………………………………………………

If air resistance was considered, the value in (vi) would decrease. [1]
Since air resistance will upwards, [1] (can use equation to explain)

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [2]

(c) A toy car operates on battery that provides a constant power of 5.0 W. On a level ground, the maximum speed attained by the toy car is 0.90 m s^{-1}.

The resistive force acting on the toy car is assumed to be the same at all speeds.

(i) Calculate the driving force experienced by the toy car when it is moving at its maximum speed.

P = Fv
5.0 = F (0.9)
F = 5.55 N (driving force)
[1]

driving force = …………………..….N [1]

(ii) Calculate the resultant force acting on the toy car when it is travelling at a speed of 0.4 m s^{-1}.

From (i), the resistive force = driving force (since toy car is moving at maximum speed)
Resistive force = 5.55 N
When travelling at a speed of 0.4 m s^{-1},
Driving force = Power / velocity = 5 / 0.4 = 12.5 N [1]
Resultant force = Driving force – resistive force
= 12.5 N – 5.55
= 6.95 N [1]

resultant force = …………………..….N [2]

(iii) Explain whether a higher or lower driving force is experienced by the toy car when the car travels at 0.4 m s^{-1} as compared when it travels at 0.9 m s^{-1}.

At 0.4 m s^{-1}, a higher driving force is provided as there is a need to increase the speed of the toy car while doing work against the resistive force. However, when the toy car is moving at maximum speed, the driving force is only needed to do work against the resistive force.

…..……………………………………………………………………………………….……………...

……..………………………………………………………………………………………….. [2]

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8 **(a)** Define *tesla*.

The tesla is defined by reference to the equation for the motor effect, namely $F = B_{\perp}Il$.
If a <u>long straight</u> conductor carrying <u>a current of 1 ampere</u> is placed at right angle to a uniform magnetic field of flux density 1 tesla, then the <u>force per unit length</u> on the conductor is 1 newton per metre

[2]

(b) Two long straight parallel wires X and Y are clamped vertically. The wires pass through a horizontal card PQRS. Fig. 8.1 shows the plan view of the wires and the card.

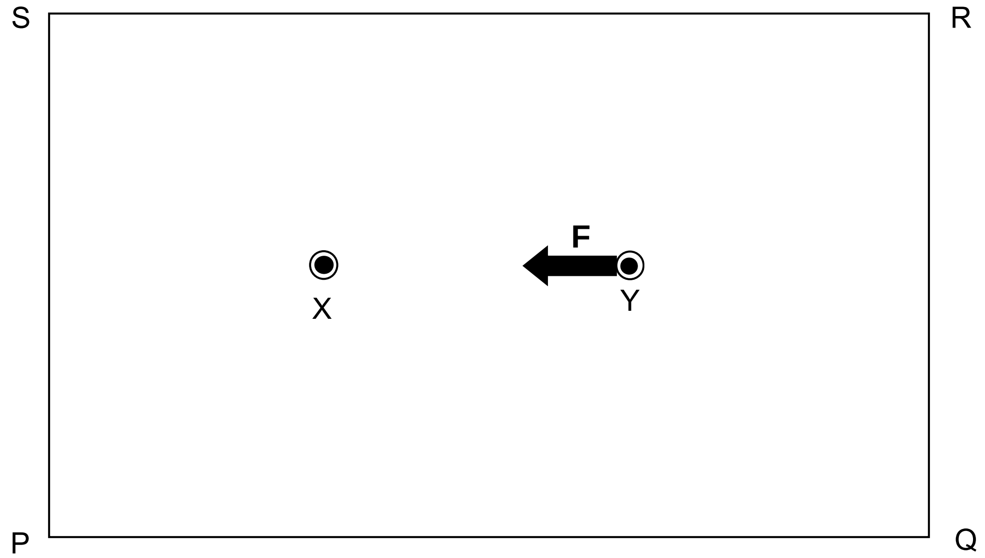

Fig. 8.1

Wire X and wire Y carry an electric current out of the plane of the card.

The current in wire Y is smaller than the current in wire X.

(i) Sketch on Fig. 8.1, the magnetic flux pattern around wires X and Y within the plane PQRS. [3]

Correct Direction [1] Neutral pt closer to Y [1]
Shape/more lines for X [1]

(ii) On Fig. 8.1, draw an arrow in the plane PQRS to show the direction of the force on wire Y due to the magnetic field produced by the current in wire X. Label it F. [1]

(iii) Wire X also experiences a force. State and explain which wire, if any, will experience a larger force.

Both experience the same force [1]
By Newton's 3rd law, Wire Y exerts a force that is equal in magnitude but in opposite in direction on wire X [1]

[2]

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(c) An electron is projected at right-angles to a uniform field.

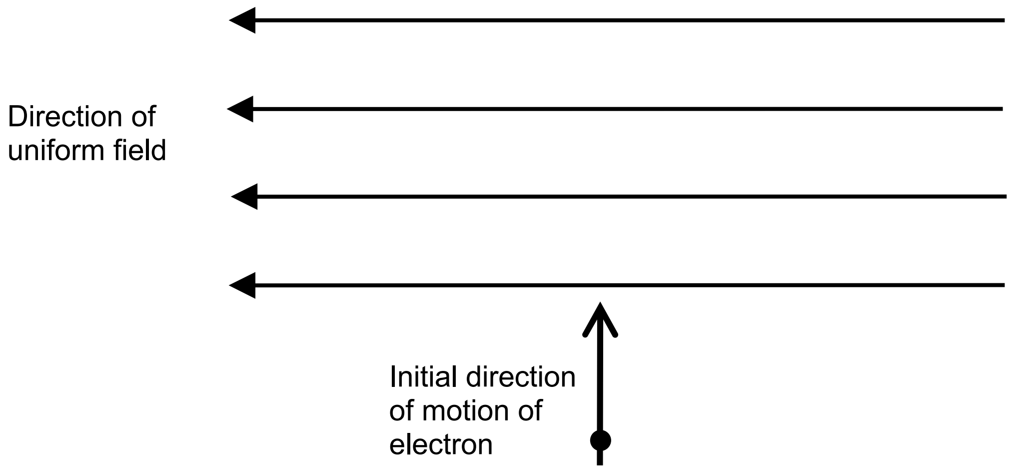

Fig. 8.2

State the initial direction of the force due to the uniform field and hence state the subsequent path taken by the electrons in the field if the field is

(i) a uniform gravitational field only.

Force in the <u>direction of the field</u> [1], to the left
Electrons deflected leftwards in a <u>parabolic path</u> [1]

[2]

(ii) a uniform electric field only.

Force in the <u>opposite direction of the field</u> [1], to the right
Electrons deflected rightwards in a <u>parabolic path</u> [1]

[2]

(iii) a uniform magneic field only.

Force <u>into the page</u> [1]
Electrons deflected into page and move in <u>circular path</u> [1]

[2]

(iv) The electron is now projected at an angle to the uniform magnetic field as shown in Fig. 8.3.

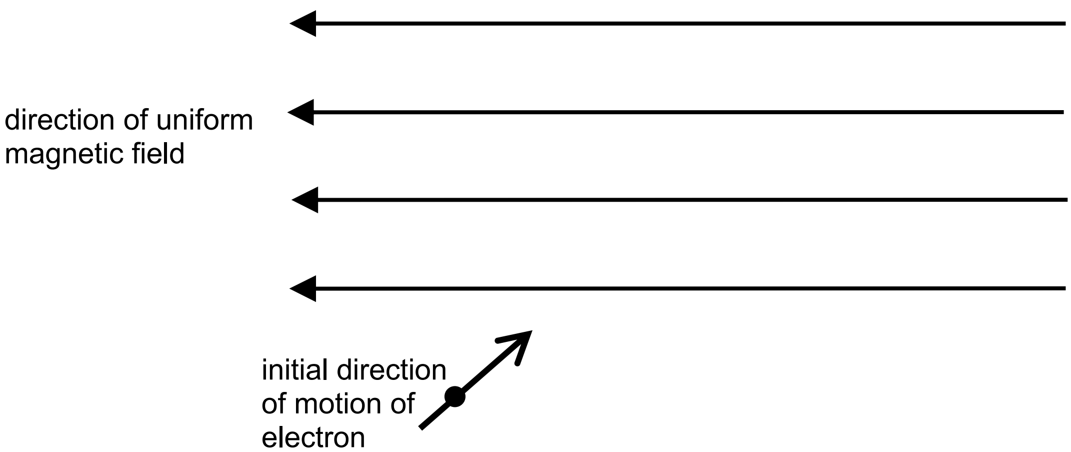

Fig. 8.3

By considering the components of the velocity parallel to the magnetic field and at right-angles to the magnetic field, describe and explain qualitatively the motion of the electron in the field.

Component of velocity perpendicular to B-field result in <u>circular path</u> into the page [1]
Component parallel to B-field result in <u>linear motion</u> in the direction to the right [1]
Combined effects give rise to a <u>helical path</u> [1]

[3]

(d) A rigid wire frame ABCD of negligible mass is supported on two knife-edges O and M so that the section OADM of the frame lies within a solenoid, as shown in Fig 8.4. The side OA = MD = 15.0 cm, side AD = 8.0 cm

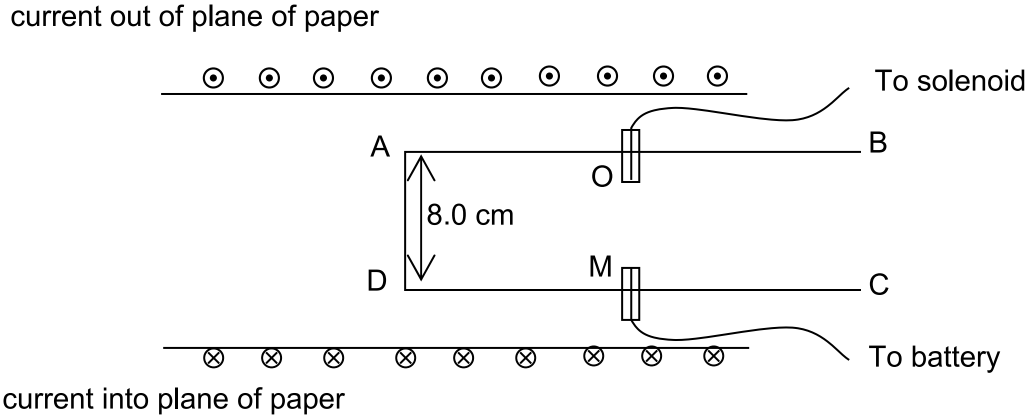

Fig. 8.4

Electrical connections are made to the frame through knife edges so that the part OADM of the frame and the solenoid can be connected to the battery.

When there is no current in the circuit, the frame is horizontal.

When the circuit is closed, it is observed that the side AD experiences a force into the page.

(i) State the direction of current flowing along the side AD.

By FLHR, direction is D to A

………………………………………………………………………………………… [1]

(ii) A non-conducting rod of mass 5.0 g is placed across BC to keep the frame horizontal as shown in Fig. 8.5.

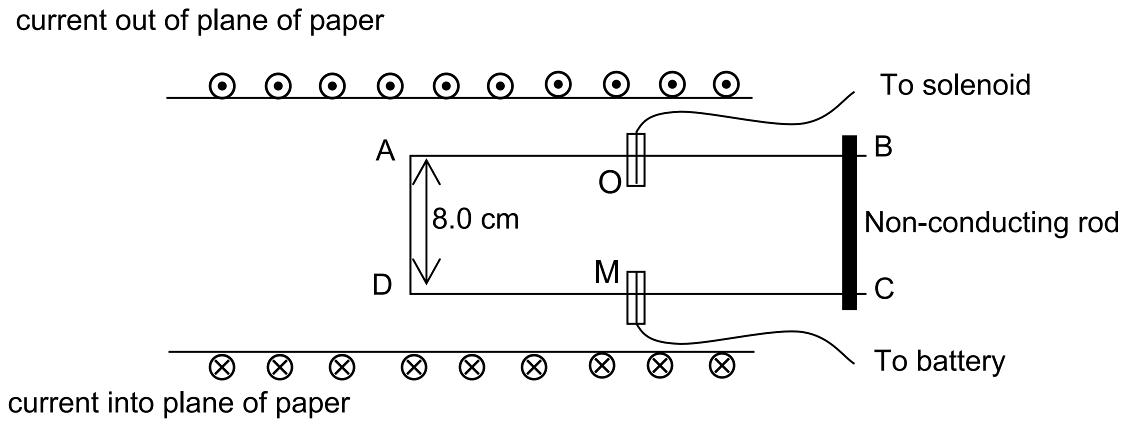

Fig. 8.5

Given that the magnetic flux density in the solenoid is 0.30 T and the current in the circuit is 0.90 A, determine the distance from the knife edge that the non-conducting rod has to be positioned.

By POM,
$0.30(0.90)(0.08)(0.15)=5.0\times10^{-3}(9.81)(x)$
$x = 0.0661$ m

distance from knife edge = ……………….… m [2]

~ END OF PAPER~

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