INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION 2
in preparation for General Certificate of Education Advanced Level
Higher 1

CANDIDATE NAME

CLASS

INDEX NUMBER

PHYSICS

8866/02

Paper 2 Structured Questions

15 September 2015

2 hours

Candidates answer on the Question Paper

No Additional Materials are required

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use an 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.

Section 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 the brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
1	5
2	4
3	5
4	5
5	10
6	6
7	5
Section B	
8	20
9	20
10	20
Penalty	
Total	80

This document consists of **22** printed pages.

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	=	$\rho g h$
resistors in series,	R	=	$R_1 + R_2 + \ldots$
resistors in parallel,	$\frac{1}{R}$	=	$\frac{1}{R_1} + \frac{1}{R_2} + \ldots$

For Examiner's Use

Section A

Answer **all** questions in this section.

1 The energy per unit time, P radiated by an object with a surface area A at thermodynamic temperature T is given by

$$P = e\sigma AT^4$$

where e is the emissivity of the surface and σ is the Stefan-Boltzmann constant.

(a) Given that the emissivity, e has no unit, use the equation to find the base units of Stefan-Boltzmann constant, σ.

$$P = e\sigma AT^4$$

$$\sigma = \frac{P}{eAT^4}$$

$$[\sigma] = \frac{[P]}{[e][A][T]^4}$$

$$[\sigma] = \frac{\text{kg m}^2\ \text{s}^{-3}}{\text{m}^2 \times \text{K}^4}$$

$$= \text{kg s}^{-3}\ \text{K}^{-4}$$

base units of σ = …………………… [2]

(b) In an experiment to determine the Stefan-Boltzmann constant, σ, a circular surface of diameter d with an emissivity of 0.431 was used and the following measurements were taken:

P = (3.0 ± 0.2) W
d = (5.0 ± 0.1) cm
T = (500 ± 1) K

Calculate a value for the Stefan-Boltzmann constant, σ and express it with its associated uncertainty.

$$\sigma = \frac{P}{eAT^4}$$

$$\sigma = \frac{P}{e\left(\pi\frac{d^2}{4}\right)T^4} \qquad \text{(for circular surface)}$$

$$= \frac{4P}{e\pi d^2T^4}$$

$$= \frac{4(3.0)}{0.431 \times \pi \times (5.0 \times 10^{-2})^2 \times (500)^4}$$

$$= 5.67 \times 10^{-8}\ \text{kg s}^{-3}\ \text{K}^{-4}$$

$$\frac{\Delta\sigma}{\sigma} = \frac{\Delta P}{P} + 2\frac{\Delta d}{d} + 4\frac{\Delta T}{T}$$

$$\frac{\Delta e}{5.67 \times 10^{-8}} = \left(\frac{0.2}{3.0}\right) + 2\left(\frac{0.1}{5.0}\right) + 4\left(\frac{1}{500}\right)$$

$\Delta\sigma = 6.5 \times 10^{-9}$
$\approx 0.7 \times 10^{-8}$ (1 s.f.)

$\sigma = (5.7 \pm 0.7) \times 10^{-8}$ kg s^{-3} K^{-4}

σ = ………………………………………… [3]

2 A ball is thrown from a point P, which is at ground level, as illustrated in Fig. 2.1.

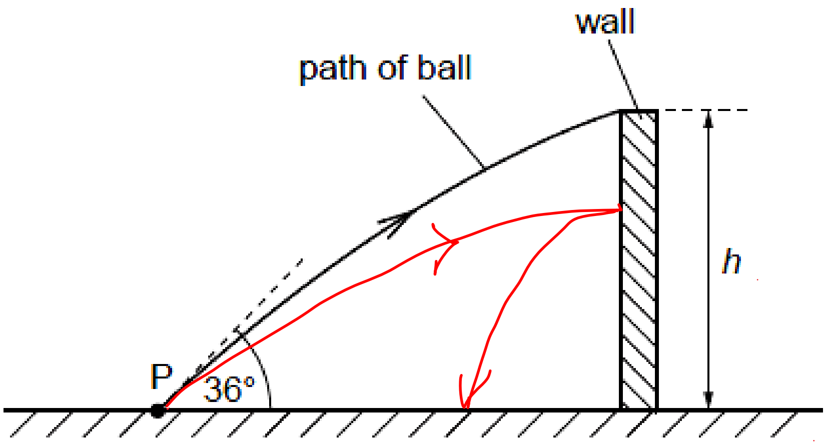


Fig. 2.1

The initial velocity of the ball is 12.4 m s^{-1} at an angle of 36° to the horizontal.

The ball just passes over a wall of height *h*. The ball reaches the wall 0.17 s after it has been thrown.

(a) Assuming air resistance to be negligible, calculate the height *h* of the wall.

$s_y = u_y t + ½ a_y t^2$
$h = (12.4 \sin 36°)(0.17) + ½ (-9.81)(0.17)^2$
$= 1.239 – 0.142$
$h = 1.1$ m

h = …………………… m [2]

(b) A second ball is thrown from point P with the same velocity as the ball in **(a)**. For this ball, air resistance is not negligible. This ball hits the wall and rebounds.

On Fig. 2.1, sketch the path of this ball between point P and the point where it first hits the ground.

[2]

- smooth curve with ball hitting the wall below the original
- smooth curve showing rebound to ground with correct reflection at wall

For Examiner's Use

3 **(a)** State the principle of conservation of momentum.

The total momentum of a system (of interacting bodies) remains constant provided there are no resultant external forces acting on the system [B1]. [1]

(b) An object A of mass 4.2 kg and horizontal velocity 3.6 m s^{-1} moves towards object B as shown in Fig. 3.1. Object B of mass 1.5 kg is moving with a horizontal velocity of 1.2 m s^{-1} towards object A.

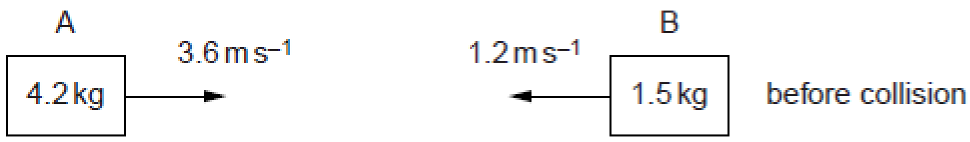


Fig. 3.1

The objects collide and then both move to the right as shown in Fig. 3.2.

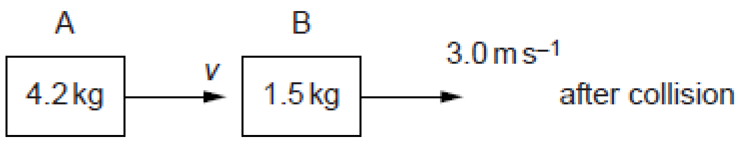


Fig. 3.2

Object A has velocity v and object B has velocity 3.0 m s^{-1}.

(i) Calculate the velocity v of object A after collision.

$m_A u_A + m_B u_B = m_A v_A + m_B v_B$

$(4.2 \times 3.6) + (1.5 \times -1.2) = (4.2v) + (1.5 \times 3.0)$ *[M1]*

$v = 2.10$ m s^{-1} *[A1]*

velocity = …………………… m s^{-1} [2]

(ii) Determine whether the collision is elastic or inelastic.

Method1:

Initial kinetic energy $= ½m_A u_A^2 + ½m_B u_B^2$

$= ½ \times 4.2 \times 3.6^2 + ½ \times 1.5 \times (-1.2)^2 = 28.3$ J

Final kinetic energy $= ½m_A v_A^2 + ½m_B v_B^2$

$= ½ \times 4.2 \times 2.1^2 + ½ \times 1.5 \times 3.0^2 = 16.0$ J

Since the initial KE is not the same as the final KE, the collision is inelastic [A1].

Method2:

Relative speed of approach $= u_1 - u_2$

$= (3.6) - (-1.2) = 4.8$ m s^{-1}

Relative speed of separation $= v_2 - v_1$

$= (3.0) - (2.1) = 0.9$ m s^{-1} *[M1]*

Since the relative speed of approach is not the same as relative speed of separation, the collision is inelastic [A1]. [2]

For Examiner's Use

4 Two blocks, P and Q, of masses 0.30 kg and 1.50 kg respectively, are connected by a string that passes over a pulley as shown in Fig. 4.1. The pulley is frictionless and the string is inelastic. The system is released from rest. Block Q falls vertically before it strikes a spring that is firmly attached to the floor. The spring constant is 500 N m^{-1}.

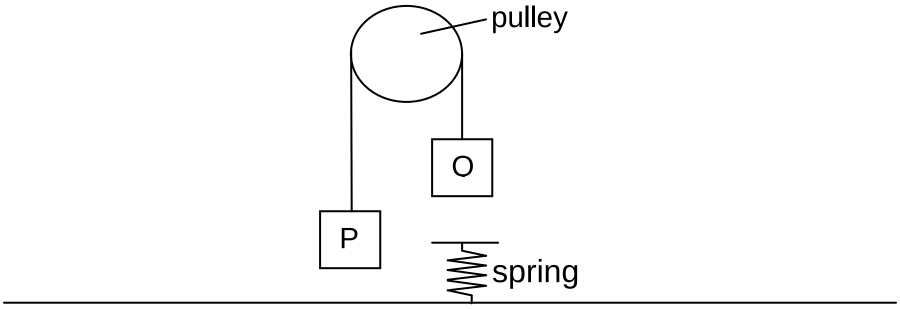


Fig. 4.1

(a) **(i)** Show that the magnitude of the acceleration of block Q is 6.54 m s^{-2} before striking the spring.

[2]

Method 1

Consider P and Q separately.

$T - W_P = m_P a$ ------------------ (1)

$W_Q - T = m_Q a$ ------------------ (2) [M1]

Solving the simultaneous equations,

$(1.50)(9.81) - [(0.30)(9.81) + 0.30a] = 1.50$

$a = \frac{11.772}{1.80} = 6.54\ \text{m s}^{-2}$ [A1]

Method 2

Consider P and Q as 1 system.

$W_Q - W_P = (m_Q + m_P)a$ [M1]

$(1.50)(9.81) - (0.30)(9.81) = (1.50 + 0.30)a$

$a = 6.54\ \text{ms}^{-2}$ [A1]

(ii) Hence, determine the tension in the string before block Q strikes the spring.

From equation (2) in 1(a)(ii),

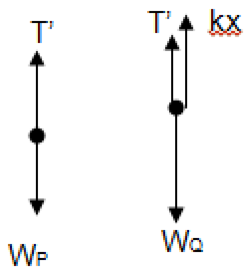
T = 0.30(9.81) + 0.30(6.54) = 4.905 = 4.91 N [A1]

Some students concluded that the tension is the resultant force that acts on P/Q or the weight of P/Q.

tension = ... N [1]

For Examiner's Use

(b) Block Q slows down after it touches the spring and the system eventually c to a stop after some time. The spring is observed to be compressed. Calcula compression of the spring.



After Block Q comes to a stop, the forces acting on P and Q are in equilibrium.

$T' = W_P$ ------------------ (1)

$T' + kx = W_Q$ ------------------ (2)

Substitute (1) into (2)

$0.30g + (500)x = 1.50g$ [M1]

$x = \dfrac{1.20 \times 9.81}{500} = 0.0235\,\text{m}$ [A1]

compression = ... m [2]

For Examiner's Use

5 The graph in Fig. 5.1 shows how the acceleration of freefall *g* changes with distance from the centre of the Earth.

The distance from the centre of the Earth, *x* is given in terms of the radius *r* of the Earth. At the centre of the Earth the value of the acceleration is zero and the value increases to the value of 9.8 m s^{-2} at the Earth's surface. From the surface of the Earth the value decreases as shown.

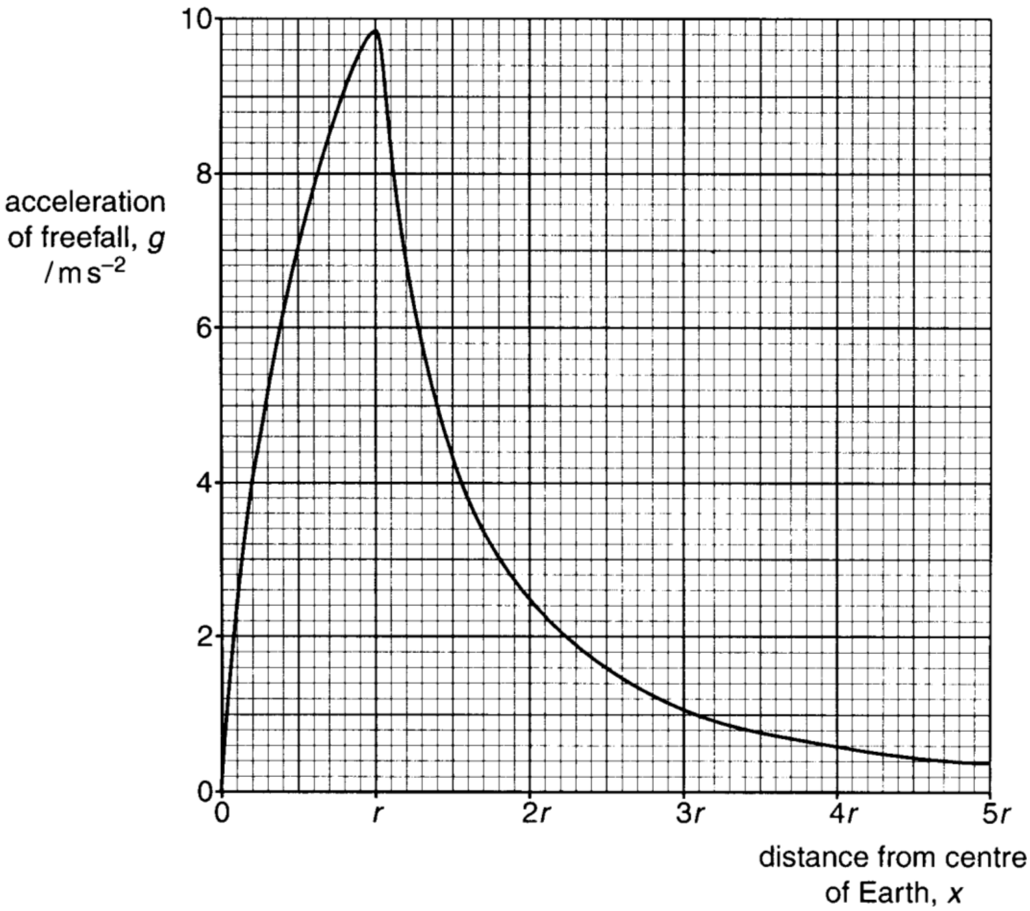


Fig. 5.1

(a) Show, by taking readings from the graph, that *g* is inversely proportional to x^2, for distances beyond the Earth's surface. [3]

If g is inversely proportional to x^2, $g = \dfrac{k}{x^2}$

x	g	gx^2
1.1r	8.0	9.68 r^2
1.5r	4.3	9.68 r^2
3.0r	1.1	9.90 r^2
4.0r	0.6	9.60 r^2

i.e. $gx^2 = k =$ *constant*

Since all the values of gx^2 *is approximately the same, g is inversely proportional to* x^2.

(b) The centre of the Moon is at a distance of 60*r* from the centre of the Earth.

Deduce the value of g at this distance.

$$k = \frac{9.68r^2 + 9.68r^2 + 9.90r^2 + 9.60r^2}{4} = 9.715r^2$$

$g \times (60r)^2 = 9.715\ r^2$

$g = 2.70 \times 10^{-3}$ m s^{-1}

g at the Moon's distance = …………………… m s^{-2} [2]

(c) The International Space Station is at a height h above the Earth's surface. The value of g at this height is 8.81 m s^{-2}. Calculate h.

The radius of the Earth is 6370 km.

$$g = \frac{k}{x^2}$$

$$8.81 = \frac{9.715r^2}{x^2}$$

$x = 1.050\ r$

$h = x - r = 0.050\ r = 319$ km

height of station = …………………… km [2]

(d) The graph in Fig. 5.2 shows how the force F acting on a mass of 1.0 kg changes with distance from the centre of the Earth.

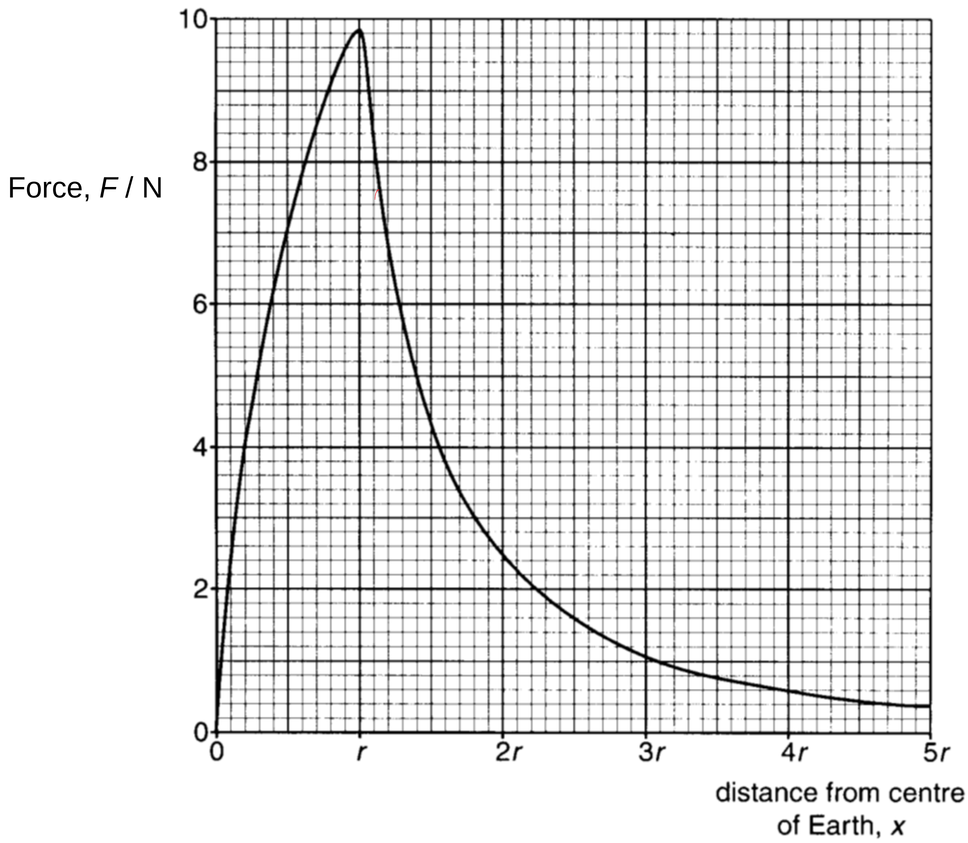


Fig. 5.2

(i) Use the graph in Fig. 5.2 to estimate the increase in gravitational potential energy of the mass when the mass moves from the Earth's surface and reaches a height of 2*r*.

The radius of the Earth is 6370 km.

Increase in GPE = work done = area under the F-r graph
= Number of squares × area of each square
= 10 (25) (0.2)(0.1)(6.37×10^6)
= 3.2×10^7 J

increase in gravitational potential energy = ... J [2]

(ii) Hence, or otherwise, determine the minimum speed that the mass needs to have to move from the Earth's surface to reach the height of 2*r*.

Loss in KE = gain in GPE
½ mv2 = 3.2×10^7 J
v = 7.98×10^3 m s^{-1}

speed = ... m s^{-1} [1]

6 **(a)** State what is meant by a photon.

A photon is a discrete quantity/ packet/ quantum of energy of electromagnetic radiation

The energy of photon = Planck constant × frequency
Accept mathematical formula provided students define clearly what is *h* and *f*.

(b) It has been observed that, where photoelectric emission of electrons takes place, there is negligible time delay between illumination of the surface and emission of an electron. State two other pieces of evidence provided by the photoelectric effect for the particulate nature of electromagnetic radiation.

Any 2:

- The existence of a threshold frequency where photons below this frequency, regardless of how high the intensity, did not eject electrons.
- The rate of emission of electrons is proportional to the intensity of the incident photon.
- The max. kinetic energy of emitted electron dependent on frequency of the incident photons
- The max. kinetic energy of emitted electron is independent of intensity of the incident photons.

[2]

(c) The work function of a metal surface is 3.5 eV. Light of wavelength 450 nm is incident on the surface. Determine whether electrons will be emitted, by the photoelectric effect, from the surface.

[2]

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

$$= \left(6.63\times10^{-34}\right)\frac{3.0\times10^{8}}{450\times10^{-9}}$$

$$= 4.42\times10^{-19}\text{ J}$$

$$= 2.76\text{ eV}$$

Since the energy of the incident photons is less than the work function of the metal, no electrons will be emitted.

7 Fig 7.1 shows a diagram of the electron energy levels in the hydrogen atom.

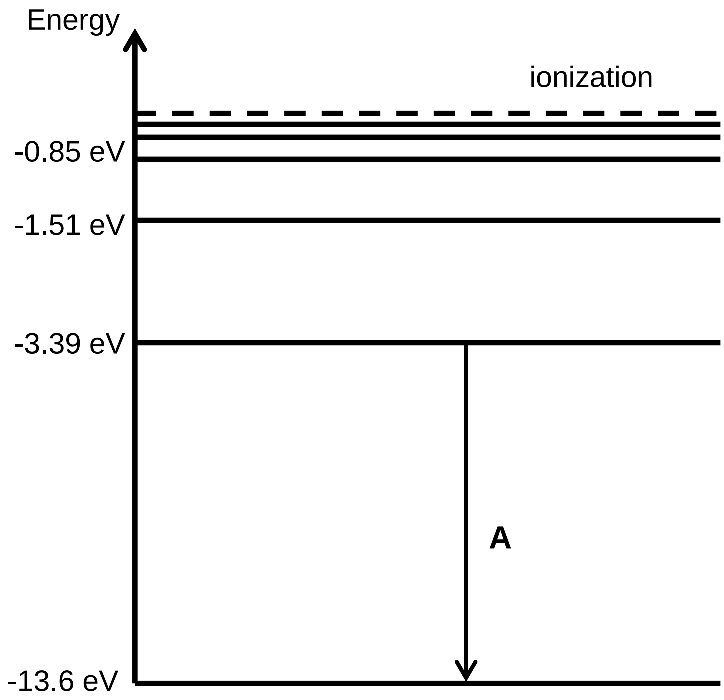


Fig. 7.1

(a) Explain why all the energy states shown in Fig. 7.1 have negative values.

As reference, the energy of an unbounded electron is 0eV, and since electron need to absorb energy to reach that state, thus, all the other energy levels need to be at lower state, thus they need to be at negative value

[2]

(b) A possible transition **A** is shown on Fig.7.1. Calculate the momentum of the radiation emitted by the atom.

$$\Delta Energy = -3.39 - (-13.6) = 10.21eV$$
$$= 10.21 \times 1.6 \times 10^{-16}$$
$$= 1.63 \times 10^{-18}\ \mathrm{J}$$

$$Energy = \frac{hc}{\lambda}$$
$$16.3 \times 10^{-19} = \frac{(6.63\times10^{-34})(3\times10^{8})}{\lambda}$$
$$\lambda = 1.22 \times 10^{-7}$$

$$p = \frac{h}{\lambda} = \frac{(6.63\times10^{-34})}{(1.22\times10^{-7})} = 5.43 \times 10^{-27}\ \mathrm{N\ s}$$

momentum = …………………… N s [3]

Section B

Answer **two** of the questions in this section.

8 **(a)** With reference to a battery connected to a resistor, distinguish between the definitions of *electromotive force* and *potential difference*.

The **electromotive force** of the battery is defined as the **energy converted** from **chemical energy to electrical energy per unit charge** passing through the source.

The potential difference (p.d.) across the resistor is defined as the energy converted from **electrical energy to thermal energy per unit charge** that passes between two points.

"Other forms of energy" may not be used in place of "chemical energy" for emf, and "thermal energy" for p.d. because question had explicitly said, with reference to a battery connected to a resistor.

(b) A battery of electromotive force (e.m.f.) 12 V and internal resistance *r* is connected in series to two resistors, each of constant resistance *X*, as shown in Fig. 8.1.

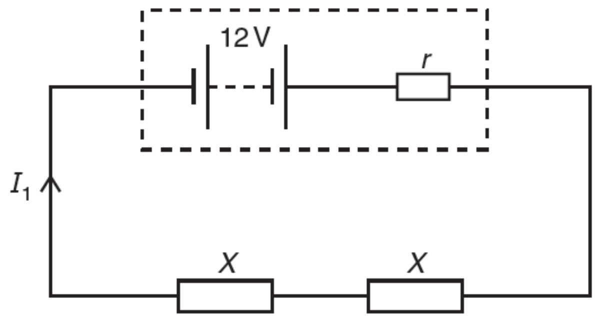


Fig. 8.1

The current I_1 supplied by the battery is 1.2 A. The same battery is now connected to the same two resistors in parallel, as shown in Fig. 8.2.

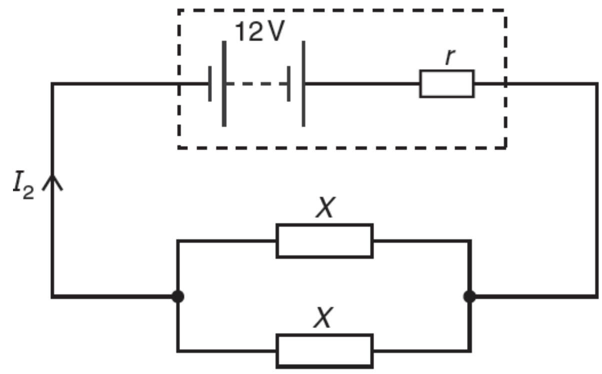


Fig. 8.2

The current I_2 supplied by the battery is 3.0 A.

(i) Show that the combined resistance of the two resistors, each of resistance X, is four times greater in Fig. 8.1 than in Fig. 8.2.

[2]

$$R_{\text{series}} = X + X$$
$$= 2X$$

$$\frac{1}{R_{\text{parallel}}} = \frac{1}{X} + \frac{1}{X} = \frac{2}{X}$$
$$R_{\text{parallel}} = \frac{X}{2}$$

$$\therefore R_{\text{series}} = 4R_{\text{parallel}}$$

(ii) Explain why I_2 is not four times greater than I_1.

The total resistance in Fig. 8.1 is 2X + r

The total resistance in Fig. 8.2 is $\frac{X}{2} + r$

Although the effective resistance of the two identical resistors in series is 4 times the effective resistance of two identical resistors connected in parallel, we see from above the **total resistance in Fig. 8.1. is not four times the resistance of the total resistance in Fig. 8.2** due to internal resistance.

If student does not write resistances of the two circuits but explains that total resistance of the series circuit is not four times that of the parallel circuit because of internal resistance, award M1 mark.

Hence,

$$I_2 = \frac{V}{\frac{X}{2} + r}$$

$$I_1 = \frac{V}{2X + r}$$

The current in the parallel circuit will not be four times that of the series circuit.

[3]

(iii) State equations, in terms of e.m.f., current, *X* and *r*, for

1. the circuit of Fig. 8.1,

$$Emf = Ir + IR_{\text{series}}$$
$$12 = I_1 r + I_1(2X)$$
$$12 = 1.2r + 1.2(2X)$$
$$12 = 1.2r + 2.4X$$

2. the circuit of Fig. 8.2

$$Emf = Ir + IR_{\text{parallel}}$$
$$12 = I_2 r + I_2\left(\frac{X}{2}\right)$$
$$12 = 3r + 3\left(\frac{X}{2}\right)$$

(iv) Use the equations in **(iii)** to calculate the resistances *X* and *r*.

$$12 = 1.2r + 2.4X \qquad (1)$$
$$12 = 3r + 1.5X \qquad (2)$$

Equating both equations:

$$1.2r + 2.4X = 3r + 1.5X$$
$$0.9X = 1.8r$$
$$X = 2r \qquad (3)$$

Subst (3) into (2): $12 = 3r + 3r$

$$r = 2.0\ \Omega$$
$$X = 4.0\ \Omega$$

X = ……………………. Ω

r = ……………………. Ω [3]

(v) Suggest two factors which could affect the internal resistance of the battery.

Any two: Temperature, age chemical properties of battery, current, size

[2]

(c) Calculate the ratio

$$\frac{\text{power transformed in one resistor of resistance } X \text{ in Fig. 8.1}}{\text{power transformed in one resistor of resistance } X \text{ in Fig. 8.2}}.$$

$P = I^2R$ or V^2/R or VI

ratio = $[(1.2)^2 \times 4] / [(1.5)^2 \times 4]$
= 0.64

ratio = ……………………. [2]

(d) The resistors in Fig. 8.1 and Fig. 8.2 are replaced by identical 12 V filament lamps. Explain how the resistance of each lamp, when connected in series, is different from the resistance of each lamp when connected in parallel.

The filament in the lamp is a **<u>non-ohmic conductor</u>**, resistance of the filament increases when the potential difference and current passing through it increases.

<u>V across each lamp, and I passing through each lamp is greater in the parallel circuit</u>

Hence, the resistance of the lamp in Fig. 8.2 is of a **<u>higher resistance</u>** as compared to lamp in Fig. 8.1

[3]

9 **(a)** State the conditions necessary for an object to be in static equilibrium.

Resultant force acting on the object is zero [B1]. Resultant torque about any point is zero [B1].

....

....

.... [2]

(b) A block of mass 3.50 kg is placed on a rough slope, which is inclined at 30° to the horizontal, as shown in Fig. 9.1 below. The block is in equilibrium.

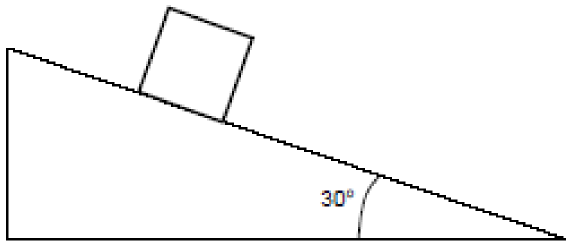
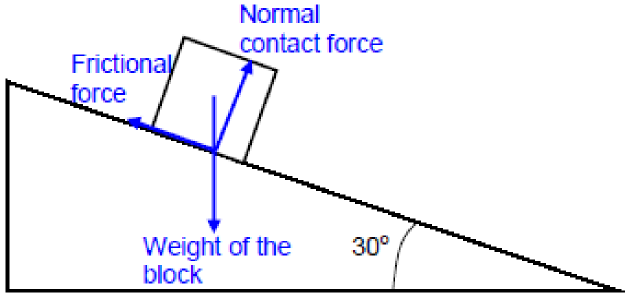


Fig. 9.1

(i) On Fig. 9.1, draw and label the forces experienced by the block. [3]



1 mark for each force with correct labelling and direction

(ii) Calculate the magnitude of the frictional force experienced by the block.

Taking down the slope as positive,

$$\sum F = ma$$

$$mg\sin 30^0 - f = 0 \quad \textbf{[M1]}$$

$$f = 17.2 \text{ N} \quad \textbf{[A1]}$$

frictional force = …………………… N [2]

(c) The slope is now lubricated such that the frictional force experienced by the block is halved. As a result, the block accelerates down the slope from rest. During this motion, the block slides down a distance of 0.800 m before reaching the bottom of the slope.

(i) Calculate the acceleration of the block down the slope.

Taking down the slope as positive,

$$\sum F = ma$$

$$mg\sin 30^0 - 0.5f = ma$$

$$a = 2.45 \text{ m s}^{-2}$$

acceleration = …………………… m s^{-2} [2]

(ii) Hence, or otherwise, determine the kinetic energy of the block when it reaches the bottom of the slope.

Taking down the slope as positive,

$$\begin{aligned} v^2 &= u^2 + 2as \\ &= 0 + 2(2.45)(0.800) \\ &= 3.92 \text{ m}^2 \text{ s}^{-2} \end{aligned}$$

$$\begin{aligned} KE &= \frac{1}{2}mv^2 \\ &= \frac{1}{2}(3.50)(3.92) \\ &= 6.86 \text{ J} \end{aligned}$$

For Examiner's Use

kinetic energy = …………………… J [3]

(iii) Calculate the loss in gravitational potential energy of the block as a result of this motion.

$$\begin{aligned}\text{Loss in GPE} &= mgh \\ &= mg(0.800\sin 30^0) \\ &= 13.7\text{ J}\end{aligned}$$

loss in gravitational potential energy = …………………… J [2]

(iv) Compare and comment on your answers to parts **(ii)** and **(iii)**.

The loss in gravitational potential energy is greater than the gain in kinetic energy of the block. This is because there is energy lost due to work done against friction.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

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

(v) Determine the average rate of heat dissipated during this motion.

$$\begin{aligned}v &= u + at \\ \sqrt{2(2.45)(0.800)} &= 0 + 2.45t \\ t &= \frac{\sqrt{2(2.45)(0.800)}}{2.45}\text{ s} \\ P &= \frac{W}{t} \\ &= \frac{13.7 - 6.86}{\frac{\sqrt{2(2.45)(0.800)}}{2.45}} \\ &= 8.46\text{ W}\end{aligned}$$

average rate of heat dissipated = …………………… W [4]

For Examiner's Use

10 (a) Fig. 10.1 shows the variation with time t of the displacements x_A and x_B at a point P of two sound waves A and B.

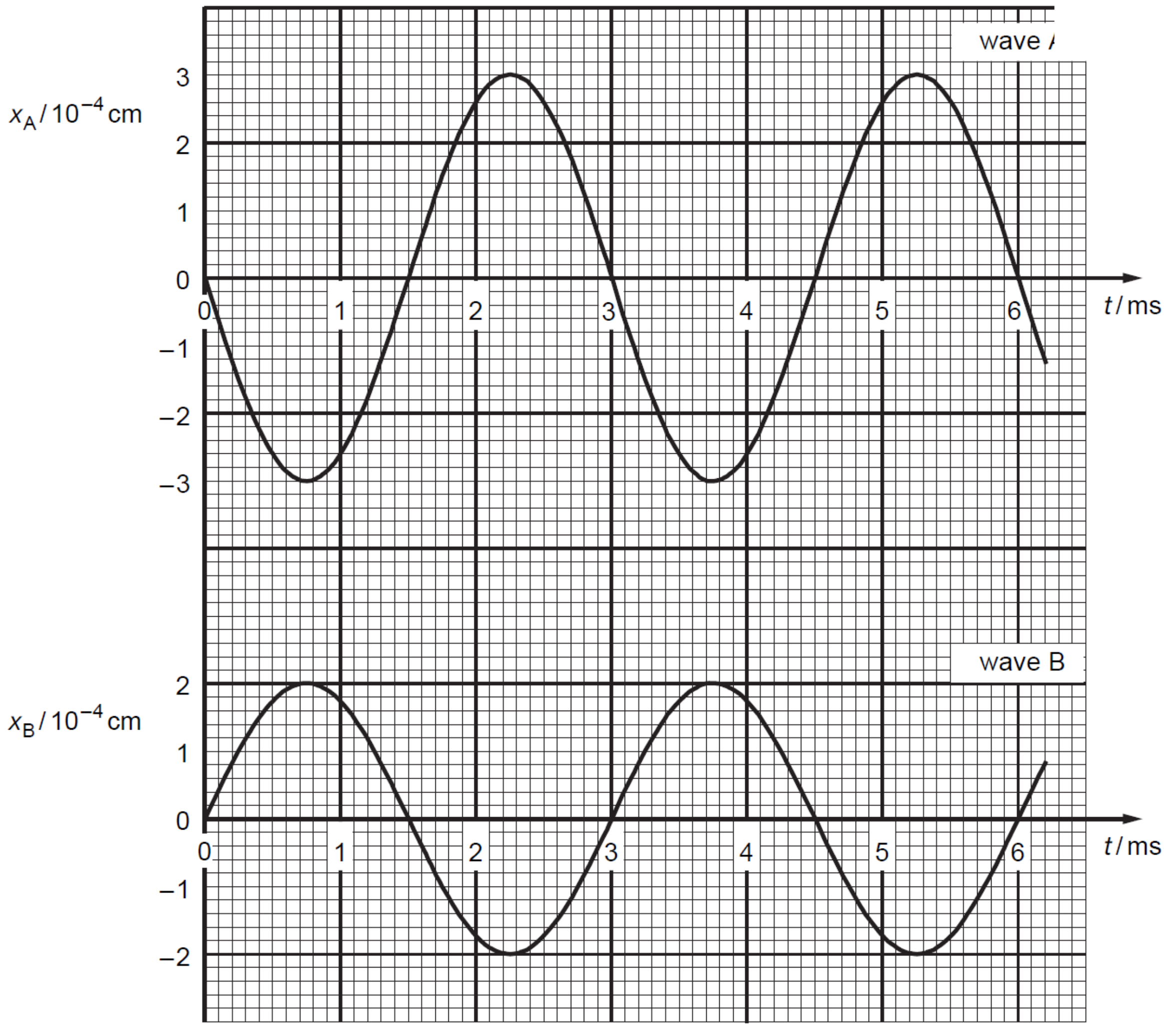


Fig. 10.1

(i) By reference to Fig. 10.1, state one similarity and one difference between these two waves.

Similarity:

Both waves have the same period of 3.0 ms

....

Difference:
The two waves have different amplitude

.... [2]

(ii) State, with a reason, whether the two waves are coherent.
The two waves have a constant phase difference, thus they are coherent.

For Examiner's Use

.... [1]

(iii) The intensity of wave A alone at point P is I.

1. Show that the intensity of wave B alone at point P is $\frac{4}{9}I$. [2]

Intensity ∝ square of amplitude (amplitude^2)

Amplitude of wave A = 3.0 × 10^{-4} cm
Amplitude of wave B = 2.0 × 10^{-4} cm

$$\frac{I_B}{I_A} = \frac{x_B^2}{x_A^2} = \frac{2^2}{3^2}$$

$$I_B = \frac{4}{9}I$$

2. Calculate the resultant intensity, in terms of I, of the two waves at point P.

resultant amplitude of the resultant wave = 1.0 × 10^{-4} cm

$$\frac{I_R}{I_A} = \frac{x_R^2}{x_A^2} = \frac{1^2}{3^2}$$

Resultant intensity, $I_R = \frac{1}{9}I$

resultant intensity = ... I [2]

(iv) Determine the resultant displacement for the two waves at point P

1. at time t = 3.0 ms.

displacement = 0.

resultant displacement = ... cm [1]

2. at time t = 4.0 ms.

x_A = –2.6 × 10^{-4} cm and x_B = + 1.7 × 10^{-4} [

Resultant displacement = –2.6 × 10^{-4} + (+ 1.7 × 10^{-4})
= – 0.9 × 10^{-4} cm

resultant displacement = ... cm [2]

(b) Light of frequency 4.8 × 10^{14} Hz incidents normally on a double slit, as illust in Fig. 10.2.

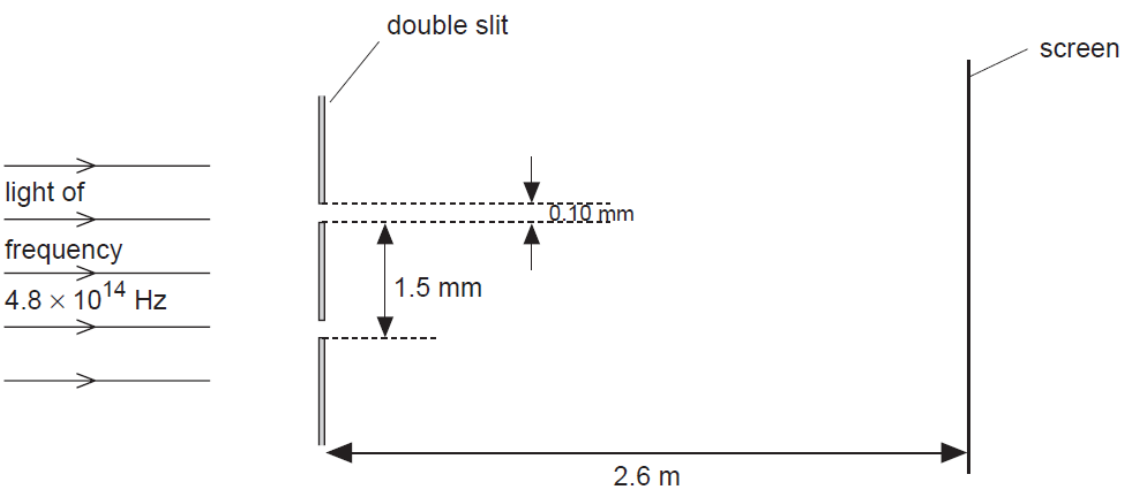


Fig. 10.2
(not to scale)

Each slit of the double slit arrangement is 0.10 mm wide and the slits are separated by 1.5 mm. The pattern of fringes produced is observed on a screen at a distance of 2.6 m from the double slit.

(i) **1.** Show that the width of each slit is approximately 160 times the wavelength of the incident light.

[2]

$c = f\lambda$

$\lambda = (3.00 \times 10^8) / (4.8 \times 10^{14}) = 6.25 \times 10^{-7}$ m

Number of wavelengths = width of slit / wavelength
$= (0.1 \times 10\text{-}3) / (6.25 \times 10^{-7})$
$= 160$

2. Hence, explain why the pattern of fringes is seen over a limited area of the screen.

The pattern is seen due to diffraction of the waves at each slit. Since the slit width is much larger than the wavelength of the light (160 times), there is a very little diffraction and the pattern is observed only over a limited area.

………………………………………………………………………………... [2]

(ii) Calculate the separation of the fringes observed on the screen.

$\lambda = ax/D$

$x = (6.25 \times 10^{-7} \times 2.6) / 1.5 \times 10^{-3}$
$= 1.1$ mm

separation = …………………… mm [2]

(iii) The intensity of the light incident on the double slit is increased. State and explain the effect, if any, on the separation and on the appearance of the fringes.

Since the fringe separation is only dependent on the slit separation, wavelength of the light source and the distance of the screen from the double slit, the fringe separation is unchanged with an increase in intensity.

The bright fringes are brighter as resultant intensity of the bright fringe increases.
The dark fringe remains dark as before since total cancellation of the waves occur at the destructive interference.

.... [4]