4P Cloister MS 2017 Summary

MC

1	B	6	A	11	C	16	A	21	D
2	D	7	B	12	B	17	C	22	B
3	C	8	A	13	A	18	B	23	D
4	B	9	A	14	B	19	C	24	D
5	D	10	B	15	D	20	B	25	D

SA 1(a) 8676 J
15.8 °C

3 b) 7.96×10^{-19} J = 4.97 eV
c) 1.28 eV

4 a) $n = 2.46$
$\theta_1 = 53.2°$

5. $a = F/6m$ $\quad F_1 = \frac{1}{6}F$ $\quad {}_4F_5 = \frac{1}{3}F$

6 a) $\Delta GPE = 0.508$ J
b) $v = 391$ m/s
c) $KE_{bullet} = 153$ J

7 c) $a = 0.0011$ m $= 1.1$ mm

9 b) $v = 2857$ m/s
c) $a = 4.1$ m/s²
d) $\Sigma F' = 18.9$ MN
$m' = 0.93 \times 10^6$ kg

10 b) $\Sigma \underset{\sim}{F} = \frac{\mu M g}{a} \cdot 2 \cdot x \quad \propto x$

 Mark Scheme

1) Which pair contains one vector and one scalar quantity?

A displacement : acceleration

(**B**) force : kinetic energy

C momentum : velocity

D power : speed

2) Which piece of evidence about the photoelectric effect **cannot** be explained using a wave model?

A Increasing the intensity of the illumination increases the rate at which electrons are ejected.

B Shining ultraviolet radiation onto a zinc surface ejects electrons.

C Shining visible light onto a potassium surface ejects electrons.

(**D**) There is a threshold frequency below which no electrons are ejected from a metal surface.

3) In a simple electrical circuit, the current in a resistor is measured as (2.50 ± 0.05) mA. The resistor is marked as having a value of 4.7Ω ± 2%. [2%] $P = I^2R$

If these values were used to calculate the power dissipated in the resistor, what would be the percentage uncertainty in the value obtained?

A 2% **B** 4% (**C**) 6% **D** 8%

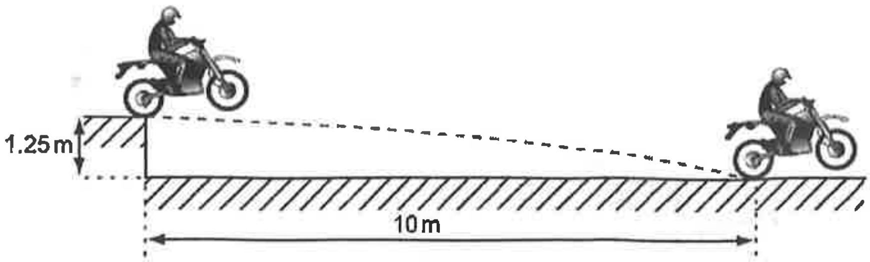
4) A car is travelling with uniform acceleration along a straight road. The road has marker posts every 100 m. When the car passes one post, it has a speed of $10\,m\,s^{-1}$ and, when it passes the next one, its speed is $20\,m\,s^{-1}$.

$v^2 = u^2 + 2as$ $20^2 = 10^2 + 2a \cdot 100$

What is the car's acceleration?

A $0.67\,m\,s^{-2}$ (**B**) $1.5\,m\,s^{-2}$ **C** $2.5\,m\,s^{-2}$ **D** $6.0\,m\,s^{-2}$

5) A motorcycle stunt-rider moving horizontally takes off from a point 1.25 m above the ground, landing 10 m away as shown.



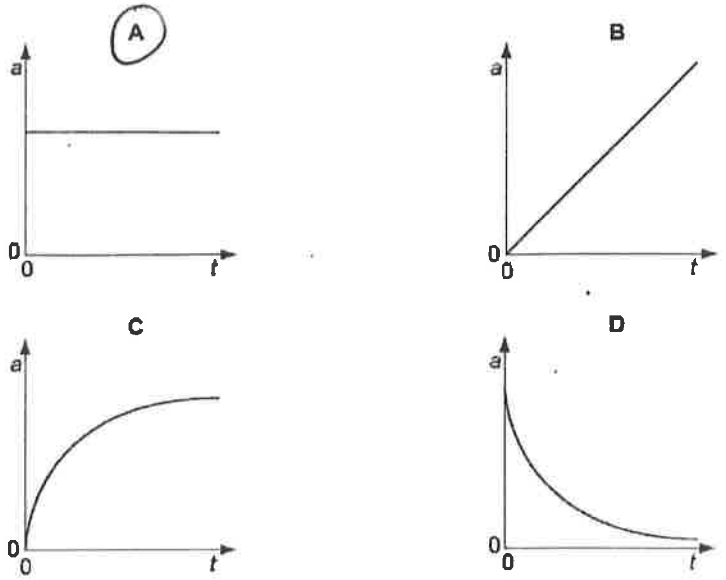
What was the speed at take-off?

A $5\,m\,s^{-1}$ **B** $10\,m\,s^{-1}$ **C** $15\,m\,s^{-1}$ (**D**) $20\,m\,s^{-1}$ using $g = 10\,N\,kg^{-1}$

$s = \frac{1}{2}at^2 \therefore t = \sqrt{\frac{2h}{a}} \Rightarrow u = \frac{L}{\sqrt{2h/a}} =$

6) A tennis ball is released from rest at the top of a tall building.

Which graph best represents the variation with time t of the acceleration a of the ball as it falls, assuming that the effects of air resistance are appreciable?



7) A ball falls vertically and bounces on the ground.

The following statements are about the forces acting while the ball is in contact with the ground.

Which statement is correct?

A The force that the ball exerts on the ground is always equal to the weight of the ball.

B The force that the ball exerts on the ground is always equal in magnitude and opposite in direction to the force the ground exerts on the ball.

C The force that the ball exerts on the ground is always less than the weight of the ball.

D The weight of the ball is always equal in magnitude and opposite in direction to the force that the ground exerts on the ball.

8) Two equal masses travel towards each other on a frictionless air track at speeds of $60\,cm\,s^{-1}$ and $40\,cm\,s^{-1}$. They stick together on impact.

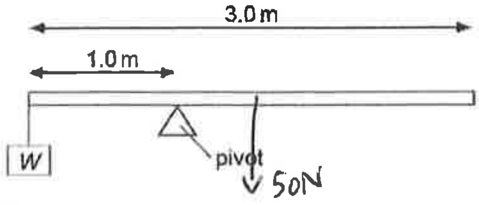
What is the speed of the masses after impact?

A $10\,cm\,s^{-1}$ **B** $20\,cm\,s^{-1}$ **C** $40\,cm\,s^{-1}$ **D** $50\,cm\,s^{-1}$

9) A uniform beam of weight 50 N is 3.0 m long and is supported on a pivot situated 1.0 m from one end. When a load of weight W is hung from that end, the beam is in equilibrium, as shown in the diagram.

$50 \times 0.5 = W \times 1.0$

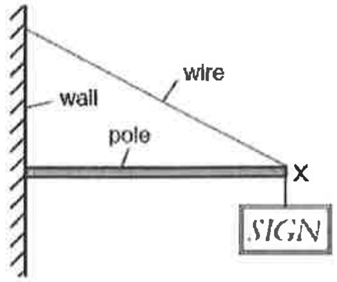
$\therefore W = 25N$



What is the value of W?

(A) 25 N B 50 N C 75 N D 100 N

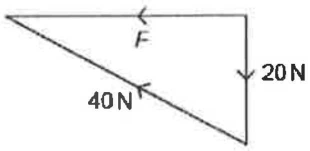
10) The diagram shows a sign of weight 20 N suspended from a pole, attached to a wall. The pole is kept in equilibrium by a wire attached at point X of the pole.



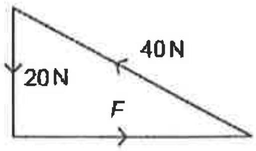
The force exerted by the pole at point X is F, and the tension in the wire is 40 N.

Which diagram represents the three forces acting at point X?

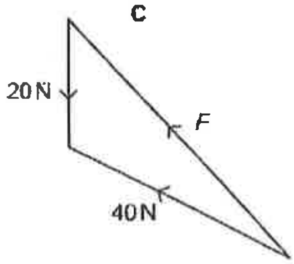
A



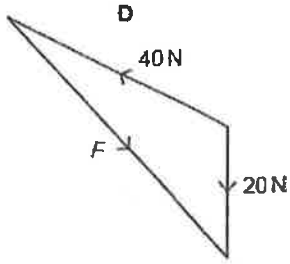
(B)



C



D



11) What is the expression used to **define** power?

A $\frac{\text{energy output}}{\text{energy input}}$

B energy x time taken

(C) force x velocity

D $\frac{\text{work done}}{\text{time taken}}$

12)

A ball is thrown vertically upwards.

Neglecting air resistance, which statement is correct?

A The kinetic energy of the ball is greatest at the greatest height attained. X

(B) By the principle of conservation of energy, the total energy of the ball is constant throughout its motion.

C By the principle of conservation of momentum, the momentum of the ball is constant throughout its motion. X

D The potential energy of the ball increases uniformly with time during the ascent. X

13) Car X is travelling at half the speed of car Y. Car X has twice the mass of car Y.

Which statement is correct?

$v_x = \frac{1}{2} v_y$ $\quad \frac{1}{2} m_x v_x^2 = \frac{1}{2} \cdot 2 m_y (\frac{1}{2} v_y)^2$

$m_x = 2 m_y$ $\quad = \frac{1}{4} m_y v_y^2$

(A) Car X has half the kinetic energy of car Y.

B Car X has one quarter of the kinetic energy of car Y.

C Car X has twice the kinetic energy of car Y.

D The two cars have the same kinetic energy.

14) A plane wave of amplitude A is incident on a surface of area S placed so that it is perpendicular to the direction of travel of the wave. The energy per unit time reaching the surface is E.

The amplitude of the wave is increased to $2A$ and the area of the surface is reduced to $\frac{1}{2}S$.

How much energy per unit time reaches this smaller surface?

A $4E$ (B) $2E$ C E D $\frac{1}{2}E$

15) The lines of a diffraction grating have a spacing of 1.6×10^{-6} m. A beam of light is incident normally on the grating. The first order maximum makes an angle of 20° with the undeviated beam.

What is the wavelength of the incident light?

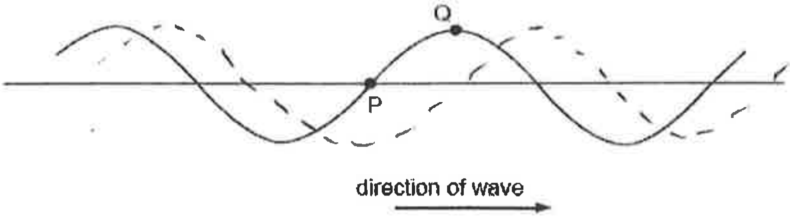
A 210 nm B 270 nm C 420 nm (D) 550 nm

$n\lambda = d \sin\theta = 1.6 \times 10^{-6}\,\text{m} \cdot \sin 20° = 547\,\text{nm}$

$n = 1$

16) The diagram shows a transverse wave on a rope. The wave is travelling from left to right.

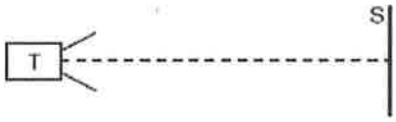
At the instant shown, the points P and Q on the rope have zero displacement and maximum displacement respectively.



Which of the following describes the direction of motion, if any, of the points P and Q at this instant?

	point P	point Q
(A)	downwards	stationary
B	stationary	downwards
C	stationary	upwards
D	upwards	stationary

17) T is a microwave transmitter placed at a fixed distance from a flat reflecting surface S.



A small microwave receiver is moved steadily from T towards S and receives signals of alternate maxima and minima of intensity.

The distance between successive maxima is 15mm.

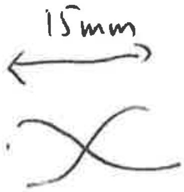
What is the frequency of the microwaves?

A 1.0×10^7 Hz

B 2.0×10^7 Hz

(C) 1.0×10^{10} Hz

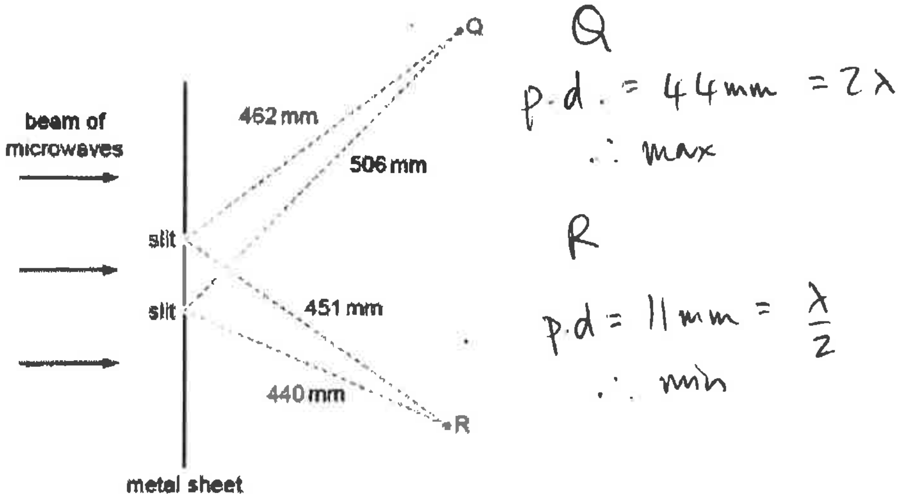
D 2.0×10^{10} Hz



∴ $\lambda = 30$ mm

∴ $f = \frac{3 \times 10^8}{0.03} = 10^{10}$ Hz

18) A beam of microwaves, with wavelength 22 mm, passes through two slits in a metal sheet. Q and R are microwave detectors.



When Q and R are at the distances shown, what are their readings?

	Q	R
A	maximum	maximum
(B)	maximum	zero
C	zero	maximum
D	zero	zero

19) The terminal voltage of a battery is observed to fall when the battery supplies a current to an external resistor.

What quantities are needed to calculate the fall in voltage?

A the battery's e.m.f. and its internal resistance

B the battery's e.m.f. and the current

(C) the current and the battery's internal resistance

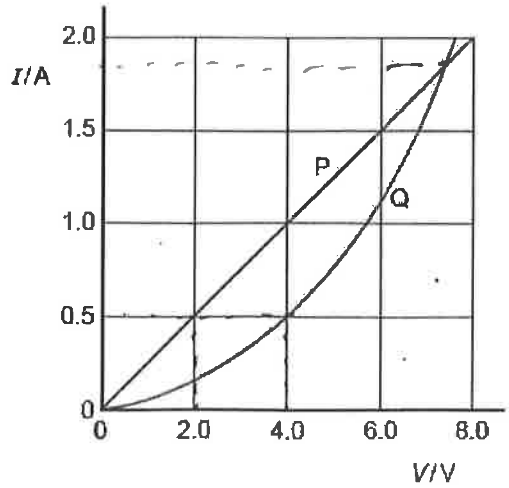
D the current and the external resistance

20) Kirchhoff's two laws for electric circuits can be derived by using conservation laws.

On which conservation laws do Kirchhoff's laws depend?

	Kirchhoff's first law	Kirchhoff's second law
A	charge	current
(B)	charge	energy
C	current	mass
D	energy	current

21) The *I*-*V* characteristics of two electrical components P and Q are shown below.



Which statement is correct?

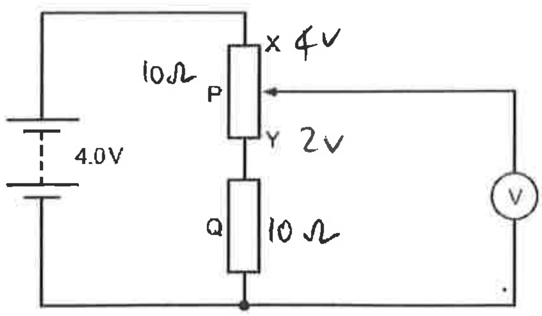
A P is a resistor and Q is a filament lamp.

B The resistance of Q increases as the current in it increases.

C At 1.9 A the resistance of Q is approximately half that of P.

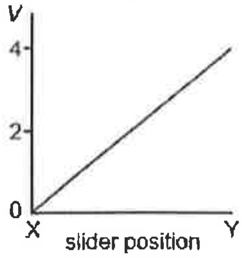
D At 0.5 A the power dissipated in Q is double that in P.

22) In the circuit below, P is a potentiometer of total resistance 10 Ω and Q is a fixed resistor of resistance 10 Ω. The battery has an e.m.f. of 4.0 V and negligible internal resistance. The voltmeter has a very high resistance. The slider on the potentiometer is moved from X to Y and a graph of voltmeter reading V is plotted against slider position.

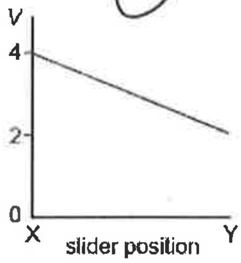


Which graph is obtained?

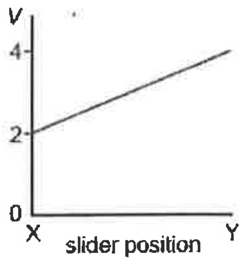
A



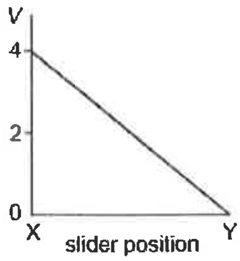
B



C



D



23) A cylindrical piece of a soft, electrically-conducting material has resistance R. It is rolled out so that its length is doubled but its volume stays constant.

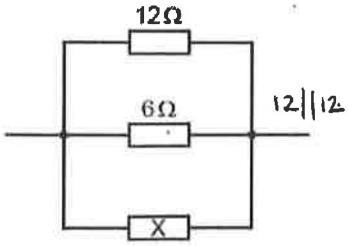
What is its new resistance?

A $\frac{R}{2}$ B R C $2R$ D $4R$

$L \to 2L \quad V = AL \quad \therefore A \to \frac{1}{2}A$

but $R = \frac{\rho L}{A} \quad \therefore R \to 4R$

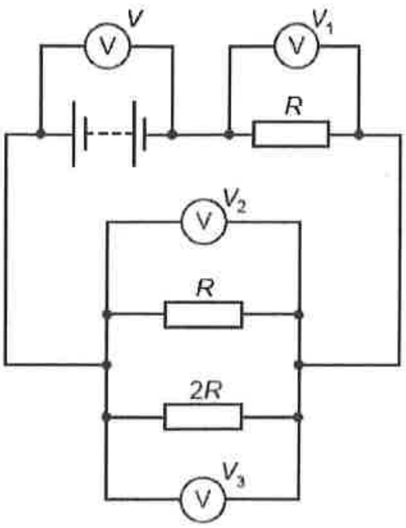
24) The diagram shows a parallel combination of three resistors. The total resistance of the combination is 3Ω.



What is the resistance of resistor X?

A 2Ω **B** 3Ω **C** 6Ω **D** 12Ω

25) The diagram shows a circuit with four voltmeter readings V, V_1, V_2 and V_3.



Which equation relating the voltmeter readings must be true?

A $V = V_1 + V_2 + V_3$

B $V + V_1 = V_2 + V_3$

C $V_3 = 2(V_2)$

D $V - V_1 = V_3$

Total marks for Multiple choice Section A [50]

SECTION B, SHORT ANSWER

Paper 2

1) (a) Define *specific latent heat of fusion.*

Energy required to melt 1 kg (at const temp.) [2]

(b) A mass of 24 g of ice at −15 °C is taken from a freezer and placed in a beaker containing 200 g of water at 28 °C. Data for ice and for water are given in Fig. 3.1.

	specific heat capacity / $J kg^{-1} K^{-1}$	specific latent heat of fusion / $J kg^{-1}$
ice	2.1×10^3	3.3×10^5
water	4.2×10^3	–

Fig. 3.1

(i) Calculate the quantity of thermal energy required to convert the ice at −15 °C to water at 0 °C.

$E = 0.024\,kg\,[(2.1\times10^3 \times 15) + (3.3\times10^5)]$ ✓ ✓

energy = 8676 ✓ J [3]

(ii) Assuming that the beaker has negligible mass, calculate the final temperature of the water in the beaker.

8676 J taken from water so $\Delta T = \frac{8676}{0.2 \cdot 4200} = 10.3°C$ ✓

$\therefore T_2 = 28 - 10.3 = 17.7°C$

then energy transfers from 200 g warmer water to 24 g of water at 0°C

$\therefore x \cdot 24g = (17.7 - x) \cdot 200g$ ✓ (shc cancels)

$\therefore x = 15.8°C$ ✓

temperature = 15.8 °C [3]

Total Question 1 [8] ✓

2)

(a) Explain what is meant by a *standing wave*.

A non-progressive wave : fixed nodes and anti-nodes, stores energy, sum of two progressive waves of equal A & f travelling in opposite directions

[2] any ✓✓

(b) Describe one method of setting up a standing wave. Use a diagram with your answer and state the source of waves you are suggesting.

e.g. taut string
long spring
Rubens' tube
Penny whistle
Chladni plate
sound waves
microwaves

[4] ✓✓✓✓

(c) The pattern in Fig. 5.1 shows how the displacement of a standing wave of amplitude *A* varies with the distance *x* along the wave at a time $t = 0$.

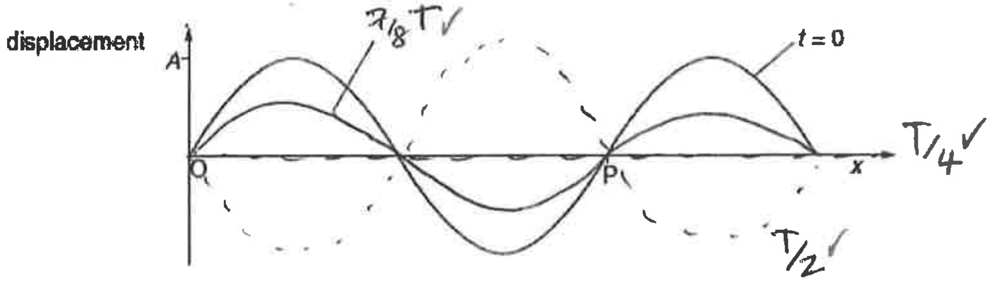


Fig. 5.1

(i) What does the distance OP represent?

OP = λ ✓

[1]

(ii) On Fig. 5.1, sketch and label graphs to show the pattern at times

$$t = \frac{T}{2} \text{ and } t = \frac{T}{4} \text{ and } t = \frac{7T}{8}$$

where *T* is the time period of the oscillation. [3]

Total Question 2 [10]

3) A clean magnesium plate is placed in an evacuated glass container and illuminated with ultra-violet radiation of wavelength 250 nm, as shown in Fig. 7.1. Another metal plate is at the opposite end of the container and the two plates are connected through a microammeter to a variable d.c. supply. The polarity of the variable d.c. supply can be reversed.

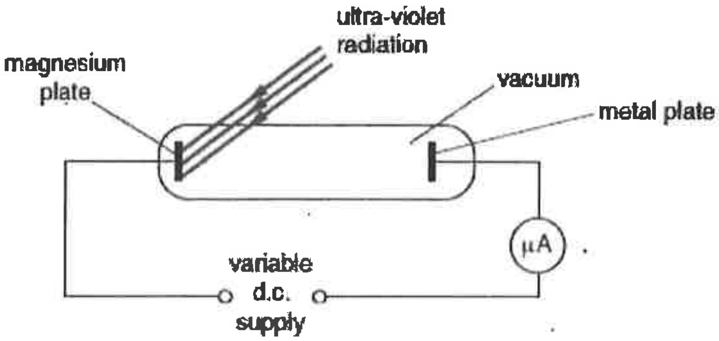


Fig. 7.1

(a) State the name of the effect that causes electrons to be emitted from the magnesium plate.

photoelectric effect ✓ [1]

(b) Calculate the photon energy of the ultra-violet radiation

(i) in joules,

$E = hf = \frac{hc}{\lambda} = \frac{6.63\times10^{-34} \cdot 3\times10^{8}}{250\times10^{-9}}$ ✓ or ✓

energy = 7.96×10^{-19} ✓ J [2]

(ii) in electron-volts.

energy = 4.97 ✓ eV [1]

(c) The work function of magnesium is 3.69 eV. Calculate the maximum energy, in eV, of electrons emitted from the magnesium plate.

$E_{max} = 4.97 - 3.69 =$

energy = 1.28 ✓ eV [1]

Question 3 continued on next page

3)

(d) Sketch a graph on the axes of Fig 7.2 to show how the current I in the microammeter will vary with the potential difference V between the two metal plates.

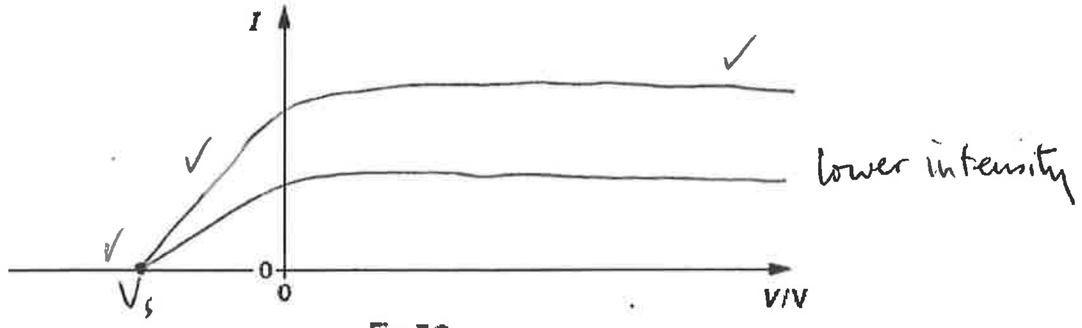


Fig. 7.2

[3]

(e) Add another line on your sketch graph to show the effect of reducing the intensity of the ultra-violet radiation. Label this line 'lower intensity'. [2]

Same V_s ✓
lower steady I

(f) Explain why the answer to (e) was so unexpected when the experiment was first performed.

Unexpected :
- stopping potential V_s is unchanged by intensity
- $V_s \propto$ max KE of ejected electrons
- wave theory predicts KE_{max} will be increased by higher light intensity ✓✓✓

owtte

[3]

Total Question 3 [13]

4) Diamonds sparkle because light entering the diamond undergoes numerous internal reflections before emerging.

Fig. 7.1 shows the path of a ray of light through a diamond.

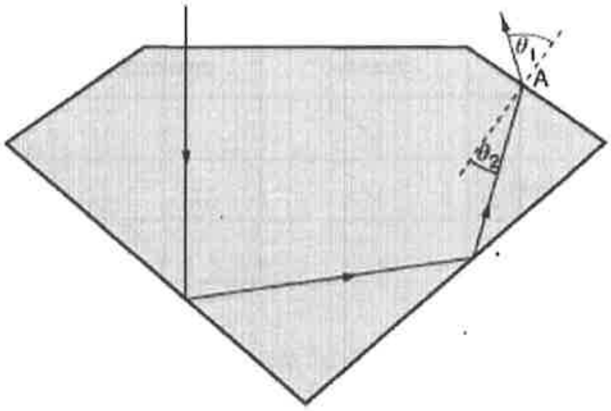


Fig. 7.1 (not to scale)

(a) The critical angle of light in diamond is 24°. Calculate the refractive index n of diamond to 2 decimal places.

$n = \frac{1}{\sin C} = \frac{1}{\sin 24} = 2.46$

✓ or ✓

$n =$ 2.46 ✓ [2]

(b) The ray finally emerges at the point labelled A. The angle of incidence θ_2 within the diamond is 19.0°.

(i) Calculate the angle of refraction θ_1 in air.

$\sin\theta_1 = 2.46 \sin 19 =$

$\theta_1 =$ 53.2° ✓ [1]

Question 4 continued on next page

GCSE?

4) **(ii)** **Place ticks in the table below to identify the effect on waves of light as they refract from diamond into air at A.**

wave property of the light	**effect**		
	increase	unchanged	decrease
speed	✓		
wavelength	✓		
frequency		✓	

[3]

✓✓ Add space

Total Question 4 [6]

5) Six identical numbered cubes, each of mass *m*, lie in a straight line on a smooth horizontal table, Figure 1.a, touching adjacent cubes. A constant force *F* is applied along the line of cubes.

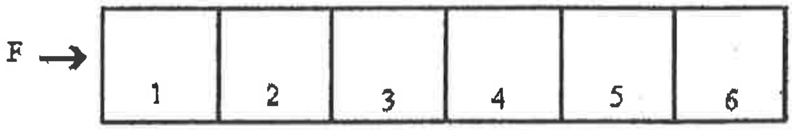


Figure 1.a

Derive expressions for:

(i) the acceleration of the system

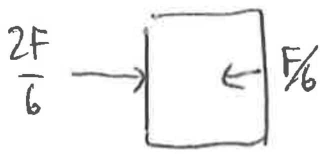
$a = \frac{F}{6m}$ ✓

(ii) the resultant force on each cube.

$F_1 = \frac{F}{6m} \cdot m = \frac{F}{6}$ ✓

(iii) the force exerted on the fifth cube by the fourth cube.

$\frac{2F}{6} = F/3$ ✓✓



Total Question 5 [4]

6) A bullet of mass 2.0 g is fired horizontally into a block of wood of mass 600 g. The block is suspended from strings so that it is free to move in a vertical plane.
The bullet buries itself in the block. The block and bullet rise together through a vertical distance of 8.6 cm, as shown in Fig. 3.1.

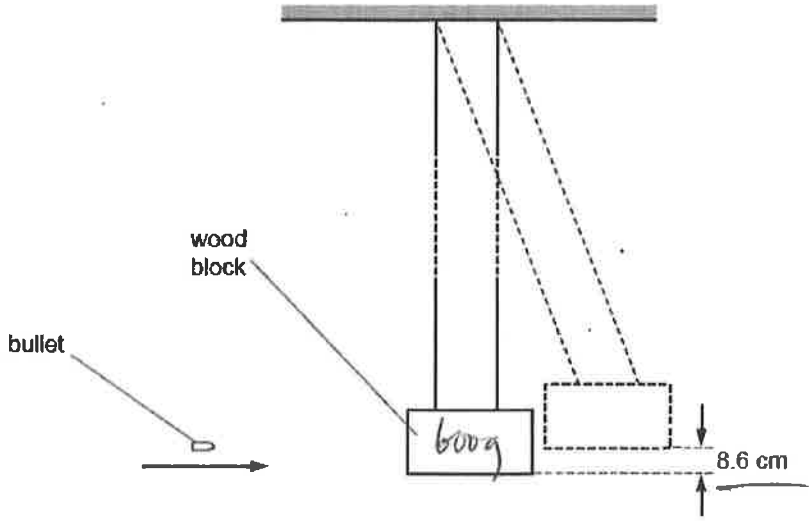


Fig. 3.1

(a) (i) Calculate the change in gravitational potential energy of the block and bullet.

$\Delta GPE = mg\Delta h = 0.602\,kg \cdot 9.81\,N/kg \cdot 8.6\times10^{-2}\,m$ ✓ or ✓

change = 0.508 ✓ J [2]

(ii) Show that the initial speed of the block and the bullet, after they began to move off together, was 1.3 m s^{-1}.

$\frac{1}{2}mv^2 = 0.508\,J$ ✓

$\therefore v = \sqrt{\frac{2\times0.508}{0.602}} = (1.3\,m/s)$

[1]

Question 6 continued on next page

6) **(b)** Using the information in **(a)(ii)** and the principle of conservation of momentum, determine the speed of the bullet before the impact with the block.

$2g \cdot v = 602g \times 1.3 m/s$ ✓

$\therefore v = 391 m/s$ ✓

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

(c) **(i)** Calculate the kinetic energy of the bullet just before impact.

KE bullet $= \frac{1}{2}mv^2 = \frac{1}{2} \cdot 0.002kg\,(391 m/s)^2$
✓ ✓

kinetic energy = 153 ✓ J [2]

(ii) State and explain what can be deduced from your answers to **(c)(i)** and **(a)(i)** about the type of collision between the bullet and the block.

Plastic collision ✓
KE not conserved : work done deforming wood ✓
(153 J → 0.51 J) [2]

Total Question 6 [9]

7)

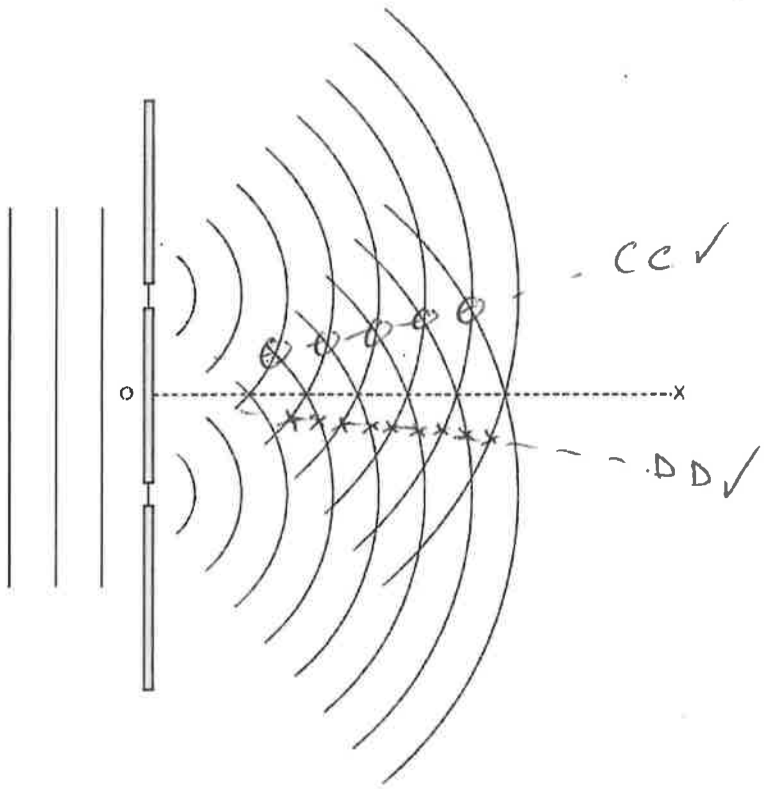


Fig. 6.1

Fig. 6.1 shows wavefronts incident on, and emerging from, a double slit arrangement.

The wavefronts represent successive crests of the wave. The line OX shows one direction along which constructive interference may be observed.

(a) State the principle of superposition.

When two waves X(t) and Y(t) meet at a point they add together such that the sum = X(t) + Y(t) owtte [3]

(b) On Fig. 6.1, draw lines to show

(i) a second direction along which constructive interference may be observed (label this line CC),

(ii) a direction along which destructive interference may be observed (label this line DD).

[2]

Question 7 continued on next page

7) **(c)** Light of wavelength 650 nm is incident normally on a double slit arrangement. The interference fringes formed are viewed on a screen placed parallel to and 1.2 m from the plane of the double slit, as shown in Fig. 6.2.

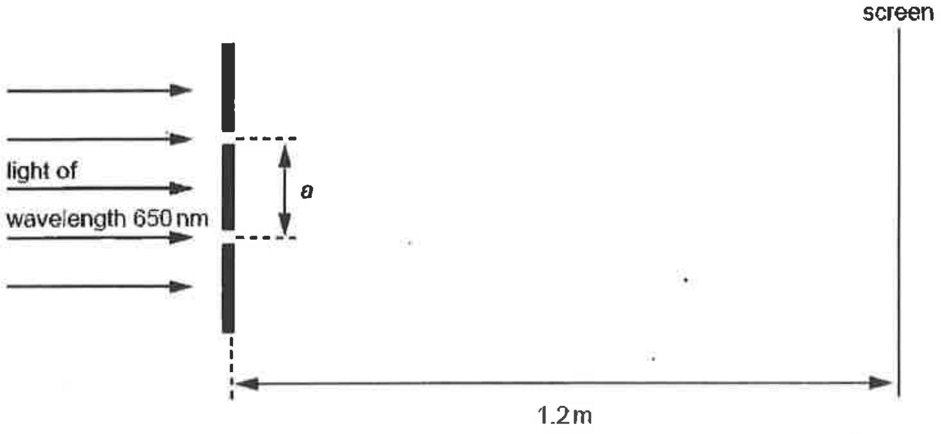


Fig. 6.2

The fringe separation is 0.70 mm.

(i) Calculate the separation *a* of the slits.

Young's slit $\lambda / a = x / D$ ✓

$\therefore a = \lambda \frac{D}{x} = \frac{650\,nm \cdot 1.2\,m}{0.70\,mm}$ or = ✓

✓ for getting correct powers of 10

separation = 0·0011 ✓ m [3] or 1·1 mm

(ii) The width of both slits is increased without changing their separation *a*. State the effect, if any, that this change has on

1. the separation of the fringes,

no change ✓

2. the brightness of the light fringes,

brighter ✓

3. the brightness of the dark fringes.

theoretical no change ✓, (but probably brighter, because path differences less precisely defined).

[3]

Total question 7 [11]

8) In 2011, physicists claimed to have detected neutrinos travelling faster than the speed of light. The neutrinos travelled from CERN, in Switzerland, to the OPERA particle detector at the Gran Sasso laboratory in Italy.

The experiment that produced a result suggesting that neutrinos travel faster than the speed of light was repeated 15000 times. It caused a sensation because this seemed to violate Einstein's theory of relativity. However, many physicists assumed that there must be a measurement error in the experiment. CERN called for other researchers to make independent checks of the result and four different experiments all showed that the neutrinos did not travel faster than the speed of light.

(a) State the postulates of Einstein's special theory of relativity.

The Laws of Physics are the same in all inertia frames. ✓
The speed of light is constant relative to the observer ✓ [2]

(b) Explain why a value of neutrino velocity v, greater than the speed of light c, would cause problems for the theory of relativity. Your answer should refer to Einstein's 'gamma-factor',

$$\gamma = \frac{1}{\sqrt{(1 - \frac{v^2}{c^2})}}$$

$v >> c$ leads to $\sqrt{\text{number} < 0}$ ✓✓
since $\frac{v^2}{c^2} > 1$ so ..

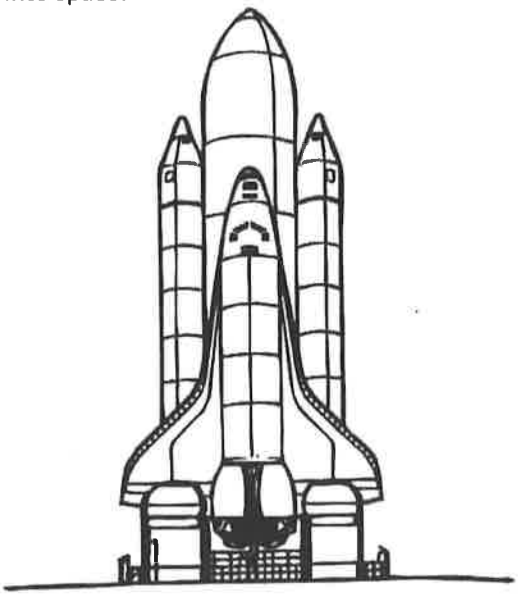
[2]

(c) A student suggests that time dilation effects can be measured directly by placing a 'light' clock inside a moving spacecraft alongside a wristwatch. He argues that the clock will lose more and more time with respect to the wristwatch. Discuss and explain whether or not this method would work.

Both clocks will be slowed. ✓
Time dilation is a real effect not confined to light clocks. ✓
owtte [2]

Total question 8 [6]

9) The (now defunct) NASA space shuttle did a great job of ferrying people and equipment into space:



~~Here are some data about~~ Here are some data about the space shuttle at the instant of take-off:

- Total weight = 19.7 MN
- Total thrust upwards = 28MN
- Total rate of burning fuel = 9800 kg/s

a) Use Newton III to explain how the rocket develops thrust.

Force backwards on exhaust gas due to rocket ✓ correct/clear reversal of words ✓
= force forcewards on rocket due to exhaust gas.

[2]

b) Use the data to calculate the (mean) exhaust velocity of the gases being ejected by the rockets.

$F = \frac{dp}{dt} = \Delta v \frac{dm}{dt}$ ✓ $\therefore \Delta v = \frac{28 \times 10^6 N}{9800 kg s^{-1}} = 2857 m/s$ ✓

[2]

c) Calculate the initial acceleration. of the space shuttle

$a = \frac{\Sigma F}{m} = \frac{(28 - 19.7) \times 10^6 N}{19.7 \times 10^6 \div 9.81 kg} = 4.1 m/s^2$ ✓ ✓

[3]

explanation ✓

Question 9 continued on the next page

9) d) Show that after 110 seconds the acceleration has increased to over 20 m/s². Assume that the thrust stays the same, gravity stays the same, the rocket goes vertically upwards and that there is no air resistance.

$\Delta m = 9800 \cdot 110 = 1078000\ \text{kg}$ and $\Delta W = 10.6\ \text{MN}$

$\therefore a' = \frac{\sum F}{m'} = \frac{(28 - 19.7 + 10.6)\times 10^6\ \text{N}}{(19.7\times 10^6 \div 9.81) - (1.08\times 10^6)\ \text{kg}}$ ✓

$= \frac{18.9\times 10^6\ \text{N}}{0.93\times 10^6\ \text{kg}} = 20.4\ \text{m/s}^2$

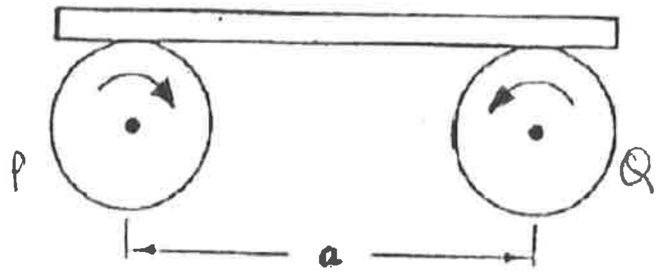
realisation F & m alter m' ✓
correct calculation of new F and new m

[4]

Total Question 9 [11]

Add gap

10) A straight uniform horizontal rod of mass M rests symmetrically on top of two rollers as shown below. The rollers, separated by a distance a, are rotating at high speed in opposite directions. The sliding friction force acting at each point of contact on the rollers is given by μ N, where N is the normal reaction at that point and μ is the coefficient of sliding friction.



The rod is now displaced from this equilibrium position a small horizontal distance x to the left, and then released.

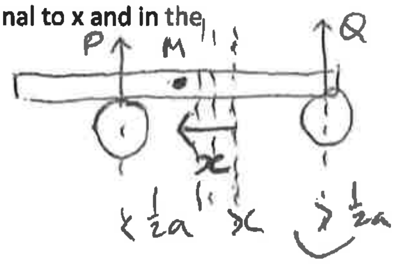
a) Explain qualitatively why the rod will experience a nett force back towards the equilibrium position.

(Labelling the rollers P & R) When the rod moves to the left, the weight on P ↑ and the weight on Q ↓ ✓ The friction forces change in proportions so the friction force on P is greater ✓, creating a nett force to the right.

[2]

Question 10 continued on next page

10) b) Show that the horizontal force acting on the rod is proportional to x and in the opposite direction to x.



$\circlearrowright Q$: $Mg\cdot(x+\tfrac{1}{2}a) = Pa$ ✓

$\circlearrowright P$: $Mg(\tfrac{1}{2}a-x) = Qa$ ✓

$P+Q = Mg$ ✓

$\therefore R\rightarrow \sum F = \mu(P-Q) = \frac{\mu Mg}{a}\cdot 2x$ ✓

[4]

c) Show that the constant of proportionality equals 49 N/m, given that: M = 2kg, μ = 0.5 and a = 0.4 m.

$k = 2\frac{\mu Mg}{a} = \frac{2\cdot 0.5\cdot 2\text{kg}\cdot 9.81}{0.4} = 49\,\text{N/m}$ ✓ ✓

ecf

[2]

Total question 10 [8]

Total marks for Section B [86]