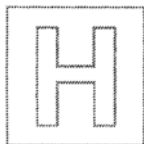


NAME: _____ CLASS: _____ INDEX: _____



CATHOLIC JUNIOR COLLEGE
JC2 Preliminary EXAMINATIONS
Higher 1

PHYSICS

Paper 1

8866/01
2014
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, tutorial group and index number on this cover page.

Write and/or shade your name, NRIC / FIN number and HT group on the Answer Sheet (OMR sheet), unless this has been done for you.

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

There are a total of **30 Multiple Choice Questions (MCQs)** in this paper.

Answer **all** questions. For each question, there are four possible answers, **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the Answer Sheet (OMR sheet) provided.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

Calculators may be used.

PHYSICS DATA:

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

PHYSICS FORMULAE:

uniformly accelerated motion,	s	$=$	$u t + \frac{1}{2} a t^2$
	v^2	$=$	$u^2 + 2 a s$
work done on / by a gas,	W	$=$	$p \Delta V$
hydrostatic pressure	p	$=$	$\rho g h$
resistors in series,	R	$=$	$R_1 + R_2 + \dots$
resistors in parallel,	$\frac{1}{R}$	$=$	$\frac{1}{R_1} + \frac{1}{R_2} + \dots$

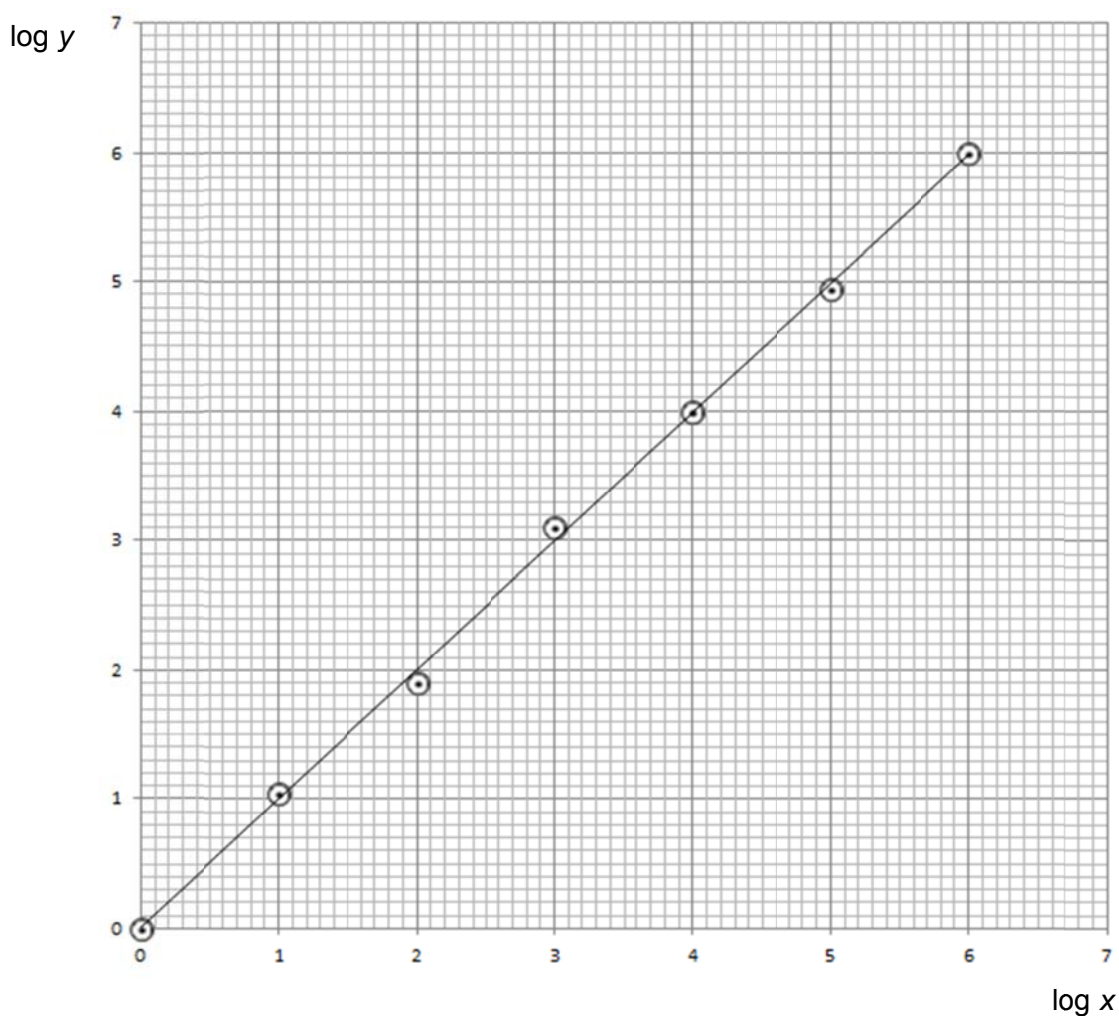
- 1 Which of the following quantities are paired with the correct units?

	quantity	units
A	work	newton (N)
B	e.m.f.	ampere (A)
C	current	coulomb (C)
D	pressure	pascal (Pa)

- 2 Two physical quantities, x and y , are related by the equation,

$$y = kx^n$$

where n and k are non-zero positive integers. A series of measurements of x and y were carried out by a student, and the graph of $\log y$ against $\log x$ is plotted as shown below.



Which of the following statements best describes the data acquired by the student?

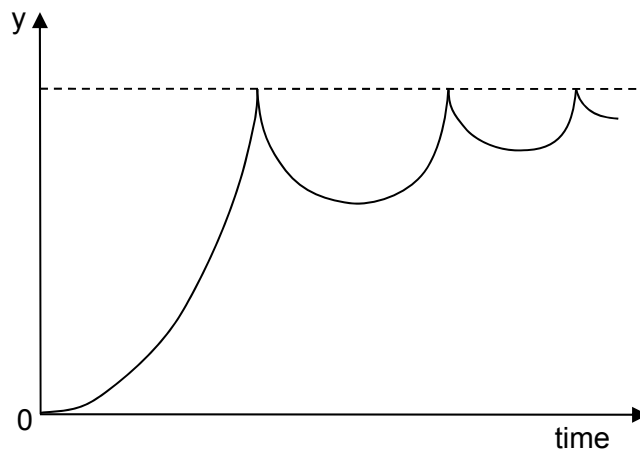
- A** It is accurate and precise.
- B** It is inaccurate but precise.
- C** It is accurate but not precise.
- D** It is inaccurate and not precise.

[Turn over]

- 3 A car initially moving at 40 m s^{-1} due west makes a turn at a junction, and is now travelling at a speed of 30 m s^{-1} due north.

What is the car's change in velocity?

- A 10 m s^{-1} at a direction 53° east of north
 B 10 m s^{-1} at a direction 37° west of north
 C 50 m s^{-1} at a direction 53° east of north
 D 50 m s^{-1} at a direction 37° west of north
- 4 The graph below describes the motion of an object rebounding from a horizontal surface after being released from a point above the surface.

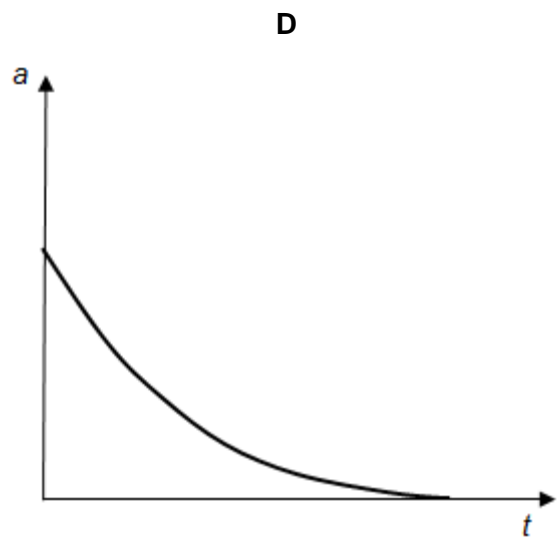
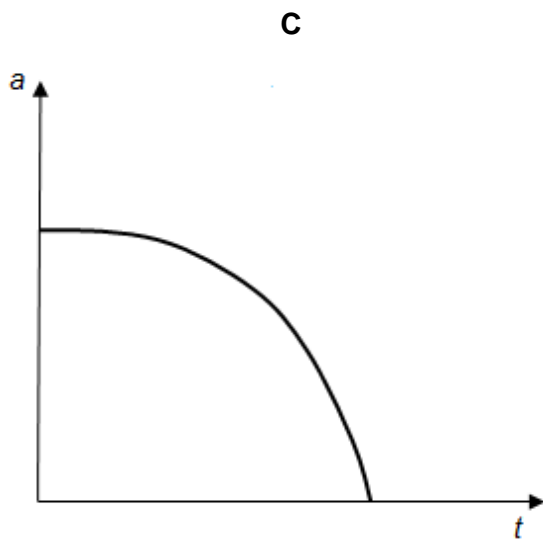
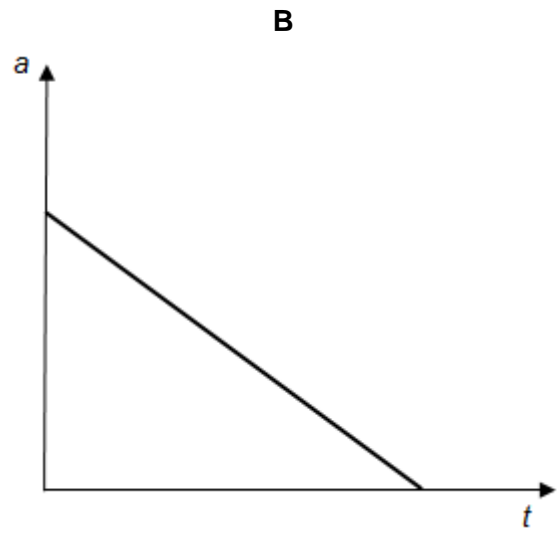
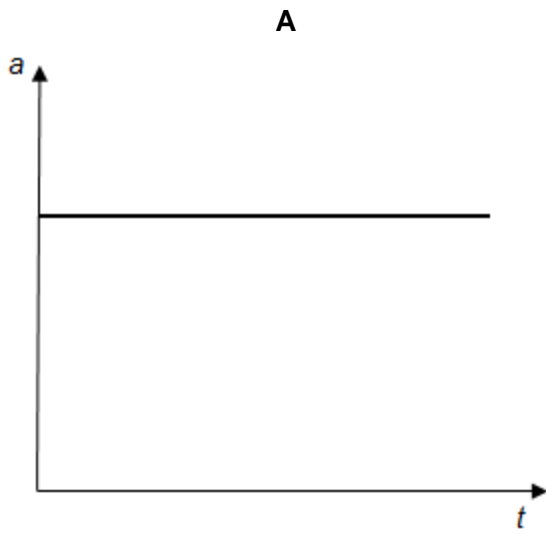


The quantity represented on the y-axis is the ball's

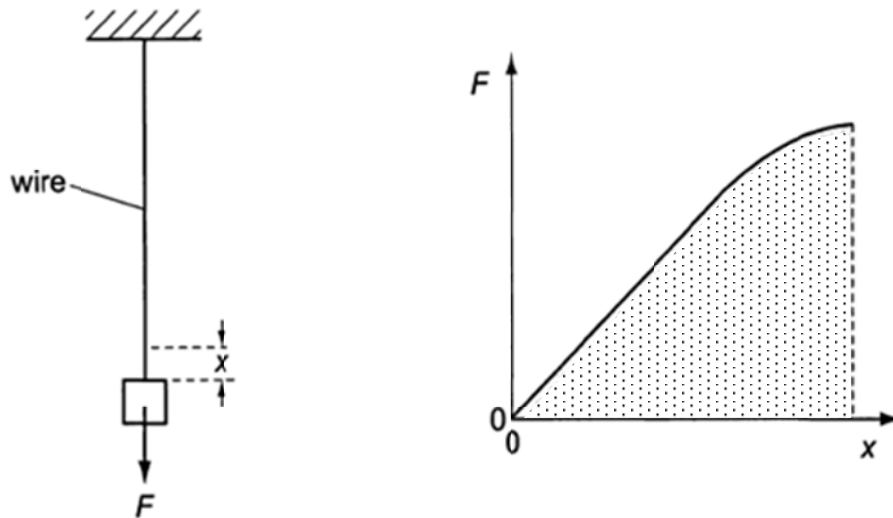
- A acceleration B displacement C momentum D velocity

- 5 A metal sphere is held just below the surface of a deep tank of liquid and released.

Which of the following best illustrates how the acceleration a varies with time t after release?



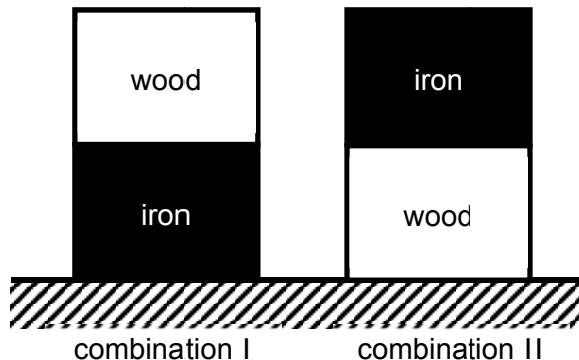
- 6 A wire, fixed at its upper end, is subjected to an increasing load F by increasing the mass attached to its lower end. A graph of F against the extension x of the wire is shown.



The wire is stretched beyond its elastic limit.

What does the shaded area on the graph represent?

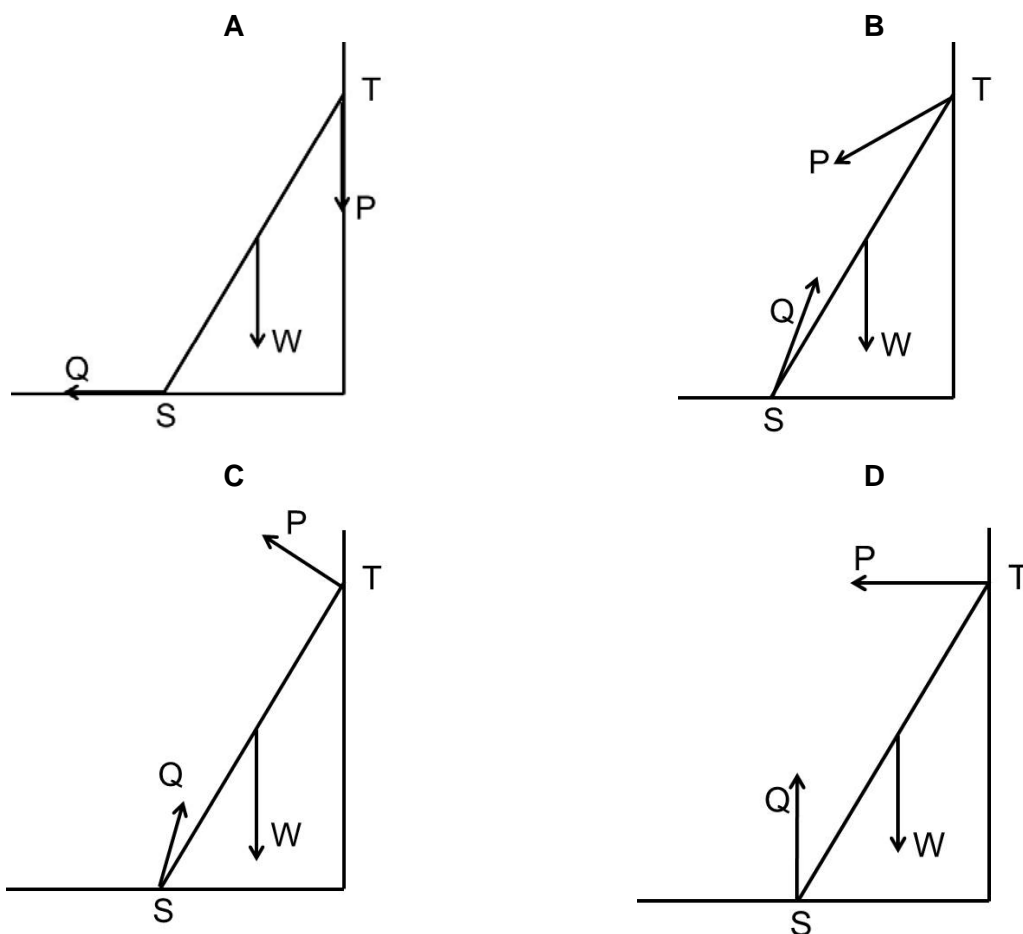
- A the amount of elastic potential energy stored in the wire
 - B the loss of gravitational potential energy of the mass
 - C the amount of heat produced in the wire
 - D the work done by F on the wire
- 7 Two blocks, one made of wood and the other of iron, are arranged at rest on the ground as depicted in combination I and II below.



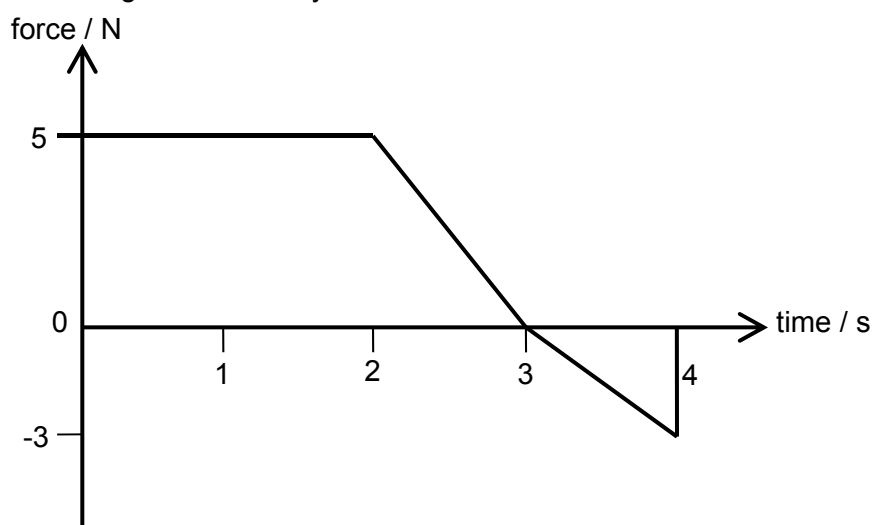
Which one of the following statements is correct?

- A The force by the iron block on the wooden block in I is greater than that by the wooden block on the iron block in II.
- B The force by the wooden block on the iron block in I is the same as that by the iron block on the wooden block in II by virtue of Newton's 3rd law.
- C The force by the wooden block on the iron block is equal to the weight of the wooden block in I while the force by the iron block on the wooden block is equal to the weight of the iron block in II.
- D The force by the ground on the iron block in I is greater than the force by the ground on the wooden block in II because the iron block, being denser than the wooden block, exerts more force on the ground.

- 8 A ladder ST, resting on a rough floor and leaning against a rough wall, is on the point of slipping. It is of weight W and the contact forces exerted on the ladder by the wall and floor are P and Q respectively. Which one of the following diagrams correctly shows the directions of these forces?



- 9 A body of mass 3.0 kg is acted on by a force which varies with time t as shown below.



If the force acts along the same axis as its motion and its initial velocity is 2.0 m s^{-1} , what is its velocity at time $t = 4.0 \text{ s}$?

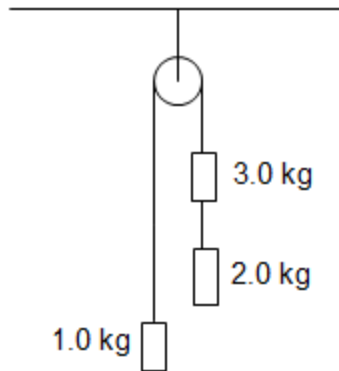
- A 5.7 m s^{-1} B 6.7 m s^{-1} C 11 m s^{-1} D 33 m s^{-1}

[Turn over]

- 10 A stationary thorium nucleus of mass $220u$ splits into an α particle of mass $4u$ and a lighter nucleus of mass $216u$. The α particle has kinetic energy E_α . What is the kinetic energy of the lighter nucleus?

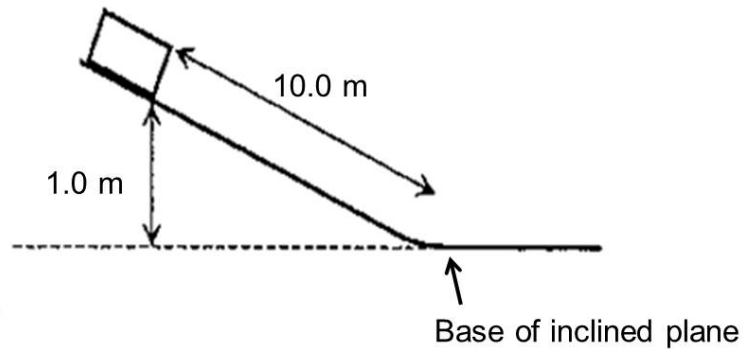
A $\frac{E_\alpha}{110}$ B $\frac{E_\alpha}{108}$ C $\frac{E_\alpha}{55}$ D $\frac{E_\alpha}{54}$

- 11 A light inextensible string is wound, as shown, over a frictionless, light pulley. What is the tension in the string between the 2.0 kg and the 3.0 kg masses when the system is released?



A 6.5 N B 16 N C 20 N D 39 N

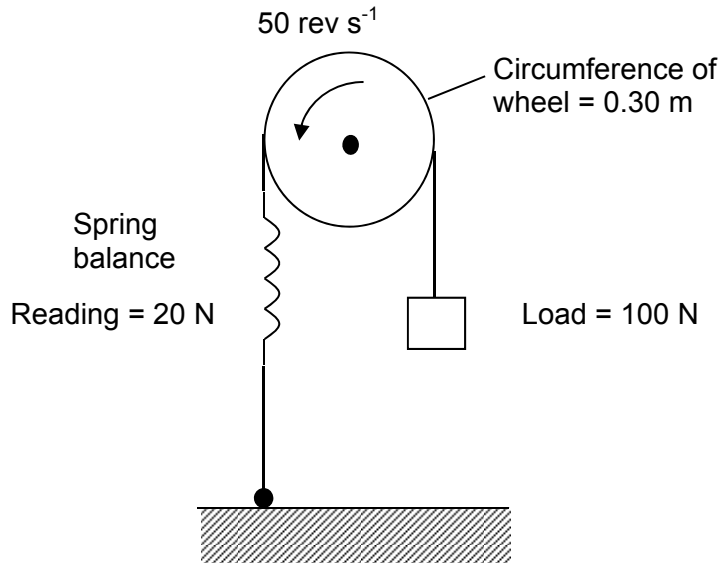
- 12 A body of mass 1.0 kg initially at rest slides down an inclined plane that is 1.0 m high and 10.0 m long as shown in the figure below.



If the body experiences a constant resistive force of 0.5 N while travelling on the slope, what is the kinetic energy of the body at the base of the plane?

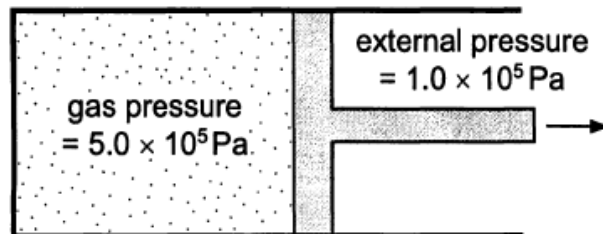
A 4.8 J B 9.3 J C 10 J D 15 J

- 13 The figure shows a wheel which is driven by an electric motor. A rope is fastened at one end to a spring balance. The rope passes over the wheel and supports a freely hanging load. When the wheel is turning anticlockwise at a steady speed, the balance reading is constant.



What is the output power of the motor?

- A** 0.3 kW **B** 1.2 kW **C** 1.5 kW **D** 1.8 kW
- 14 A gas at a pressure of $5.0 \times 10^5 \text{ Pa}$ is enclosed in a cylinder fitted with a piston.



The gas expands by 4.0 m^3 against a constant external pressure of $1.0 \times 10^5 \text{ Pa}$.

How much work does the gas do against the external pressure?

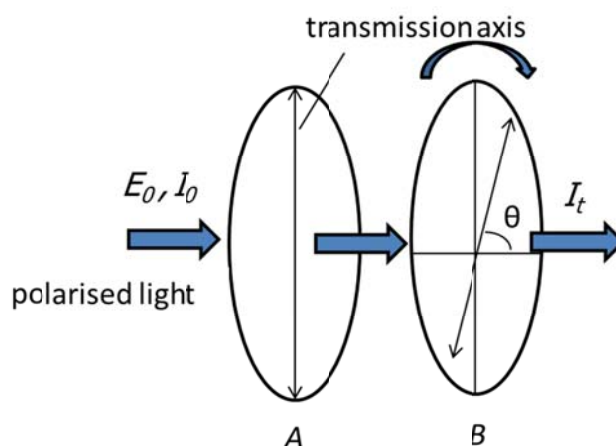
- A** $4.0 \times 10^5 \text{ J}$ **B** $12 \times 10^5 \text{ J}$ **C** $16 \times 10^5 \text{ J}$ **D** $20 \times 10^5 \text{ J}$

- 15 A stationary sound wave is set up in a 4.0 m column, with both ends open, using a sound generator producing waves of frequency 400 Hz. The speed of the sound is 320 m s^{-1} .

If the sound generator doubles the frequency of the sound wave produced, how many more antinodes will be present in the stationary wave?

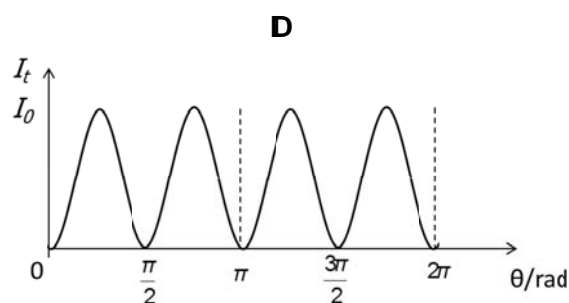
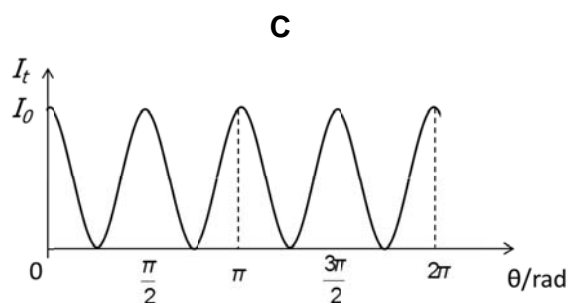
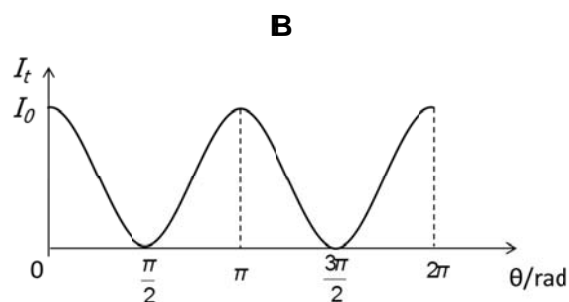
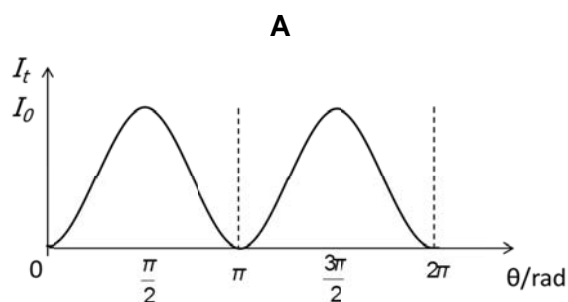
- A 5 B 10 C 11 D 21

- 16 The figure below shows two ideal polarisers A and B where their transmission axes are parallel to each other.

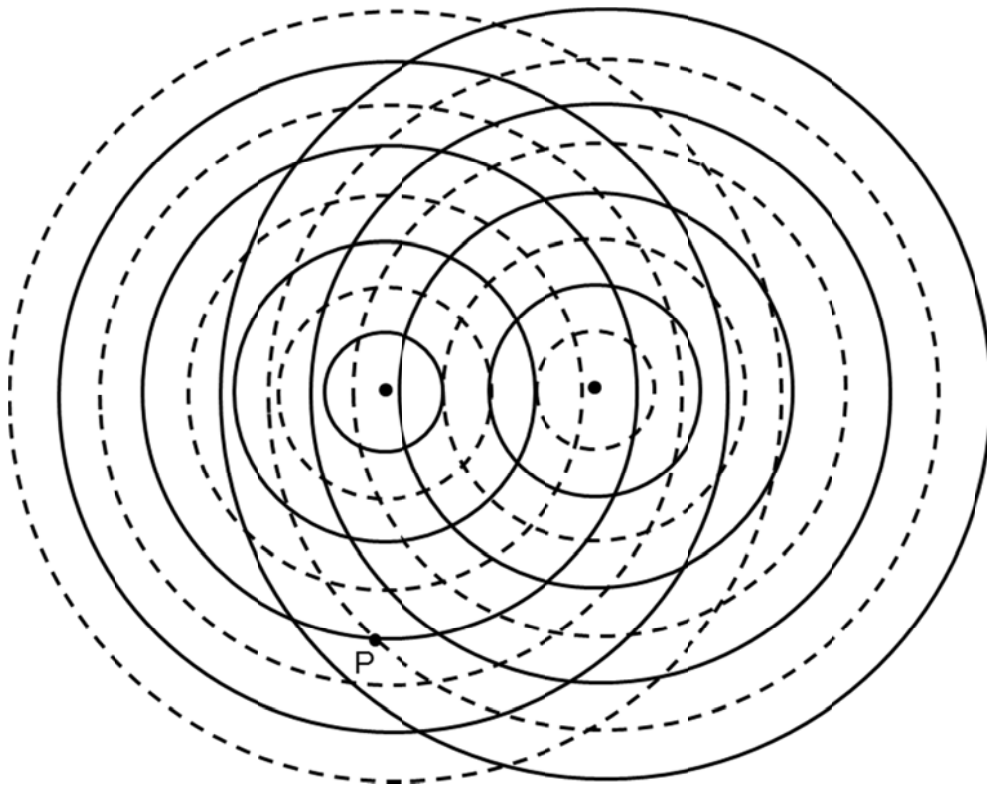


Polarised light of amplitude E_0 and intensity I_0 is incident on A with its electric field vector parallel to the transmission axis. Polariser B is then rotated so that its transmission axis makes an angle θ , as shown in the figure above.

Which of the following graphs shows how the intensity of the transmitted light I_t varies with the angle θ ?



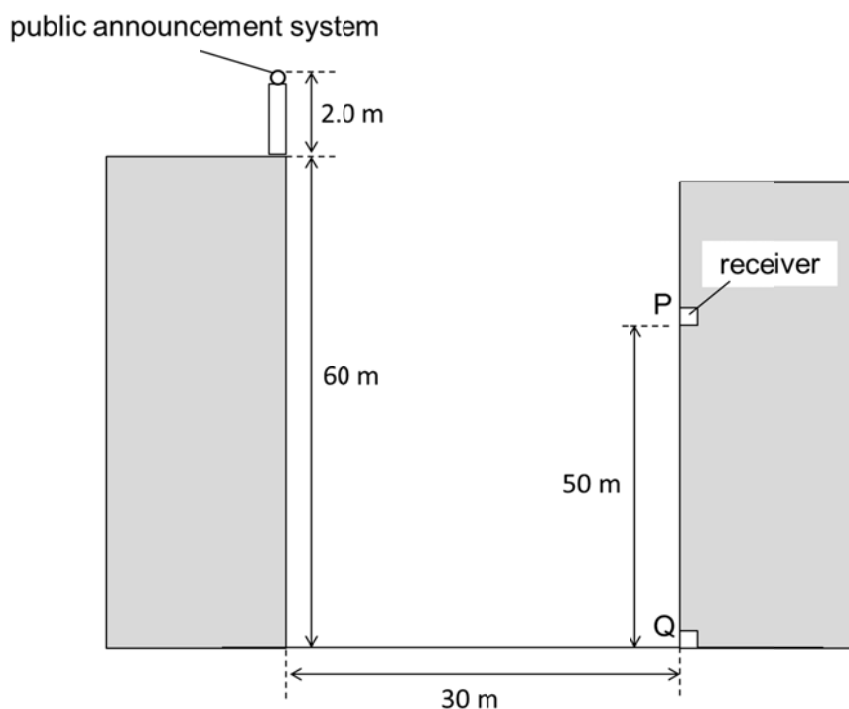
- 17 The diagram below shows the wavefronts of two periodic circular waves in a portion of a ripple tank. The bold lines represent the crests while the dotted lines represent the troughs of the wave.



From the diagram, which of the following statements is false?

- A The two sources are coherent.
- B The two sources are out of phase with one another.
- C The two sources are about four wavelengths apart.
- D At point P, destructive interference occurs as the two sources meet with a path difference of one wavelength.

- 18** A public announcement system, placed 2.0 m on top of a building as shown in the diagram below (not drawn to scale), gives out a signal to the neighbouring area. A person at P, in a building 30 m away and 50 m high from the ground, receives the signal with a receiver of area 0.010 m^2 .



What will be the area of the receiver required by a person at Q, at the bottom of the building, if he needs to receive the signal with the same power?

- A** 0.045 m^2 **B** 0.052 m^2 **C** 1.2 m^2 **D** 4.5 m^2

- 19** A blue laser light is used in a Young's double-slit experiment.

Which of the following will be observed when a change is made to the experiment?

	Change to experiment	Observation
A	Covering one of the slits completely.	No fringe pattern is seen.
B	Moving the source of light nearer to the double slits.	Fringe separation will increase.
C	Covering one of the slits with a polaroid.	No change in position of central bright fringe.
D	Replacing the blue laser light with a red laser light.	Central bright fringe will shift upwards.

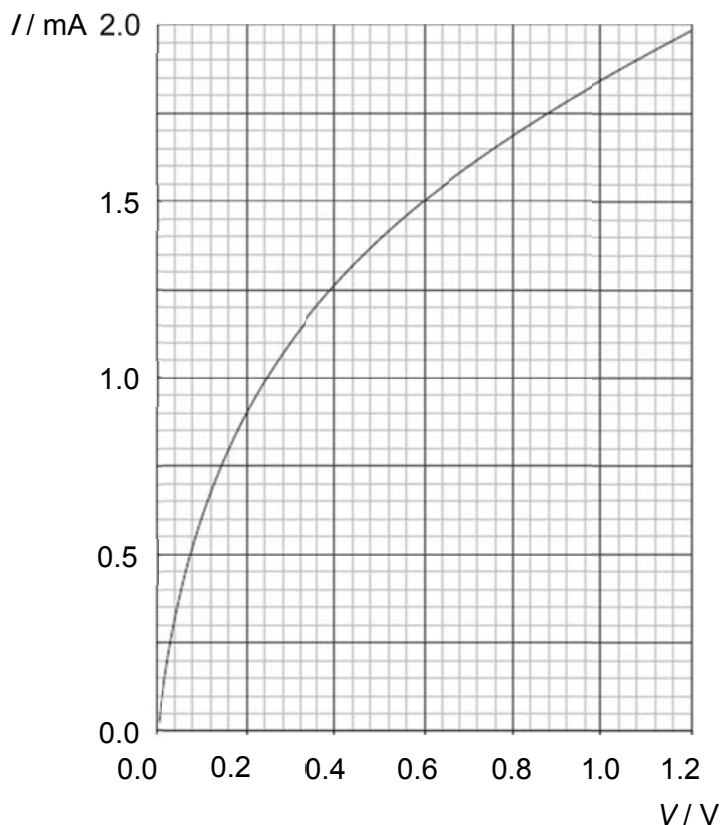
- 20** A high potential difference is applied between the electrodes of a zinc-bromine battery when it is recharged. Negative bromide ions then move towards the positive electrode and positive zinc ions move towards the negative electrode.

In each second, twice the number of bromide ions compared to zinc ions arrive at their respective electrodes. Each bromide ion has a charge of $-1.60 \times 10^{-19} \text{ C}$, while each zinc ion has a charge of $+3.20 \times 10^{-19} \text{ C}$. The steady current through the circuit is 128 mA.

What is the number of bromide ions arriving in each second at the positive electrode?

- A** 2.0×10^{17} **B** 4.0×10^{17} **C** 2.0×10^{20} **D** 4.0×10^{20}

- 21** The graph below shows the variation with current I of the potential difference V across an electronic component.



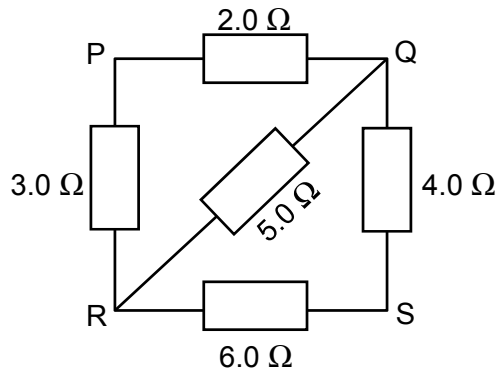
Which of the following statement is correct?

- A** The electric component is a diode.
B The resistance is increasing with increasing potential difference.
C The resistance of the component is $950 \, \Omega$ when the potential difference is 0.60 V.
D When the potential difference is 0.60 V, the power dissipated at the component is 0.90 W.

- 22** A strain gauge consists of a length of wire with uniform cross-sectional area. Its resistance is $4.000\text{ k}\Omega$. It is attached to a gas container. When the container expands, the strain gauge changes its dimensions. Its length increases by 2.0% and diameter reduces by 1.0% . What is the new resistance of the strain gauge?

A $3.842\text{ k}\Omega$ **B** $4.121\text{ k}\Omega$ **C** $4.163\text{ k}\Omega$ **D** $4.897\text{ k}\Omega$

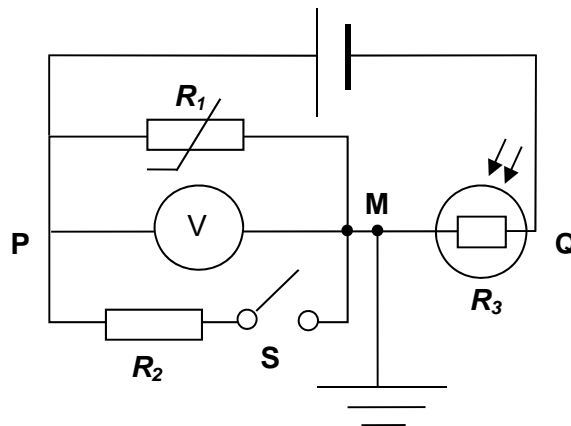
- 23** The diagram shows a network of five resistors.



What is the effective resistance between P and S?

A $1.9\text{ }\Omega$ **B** $2.1\text{ }\Omega$ **C** $2.5\text{ }\Omega$ **D** $3.6\text{ }\Omega$

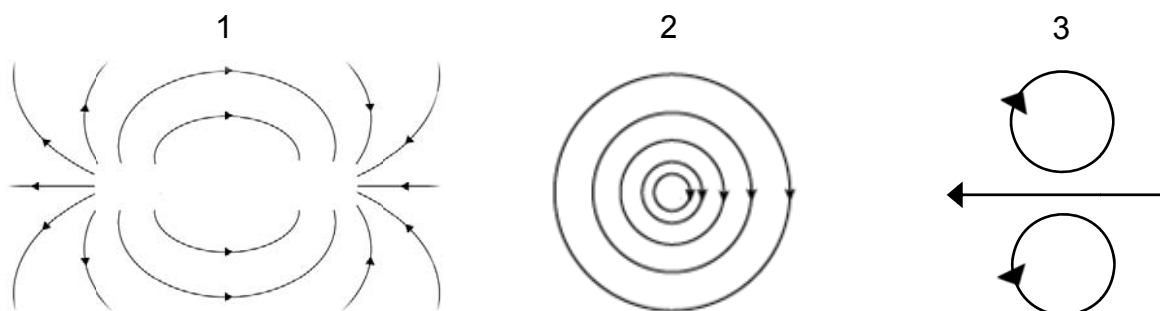
- 24** A thermistor R_1 is connected to a battery of constant e.m.f. with negligible internal resistance as shown in the figure.



Which of the following actions will cause an increase in the potential difference V measured by the voltmeter? Assume that the voltmeter has infinite resistance.

- A** Close switch S
B Increase the light intensity at R_3 with S open
C Remove the earth connection at M with S open
D Increase the temperature of the thermistor with S open

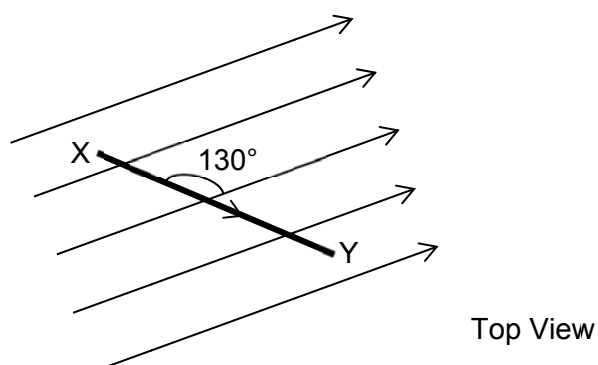
25 Three magnetic fields are shown.



Which objects correctly match the fields 1, 2 and 3 respectively?

	1	2	3
A	long straight wire	bar magnet	flat circular coil
B	bar magnet	long straight wire	flat circular coil
C	flat circular coil	long straight wire	bar magnet
D	bar magnet	flat circular coil	long straight wire

26 A 45 cm segment of a straight conducting wire is placed in a magnetic field of flux density 0.035 T, with a current of 3.8 A flowing from X to Y as shown in the figure below.

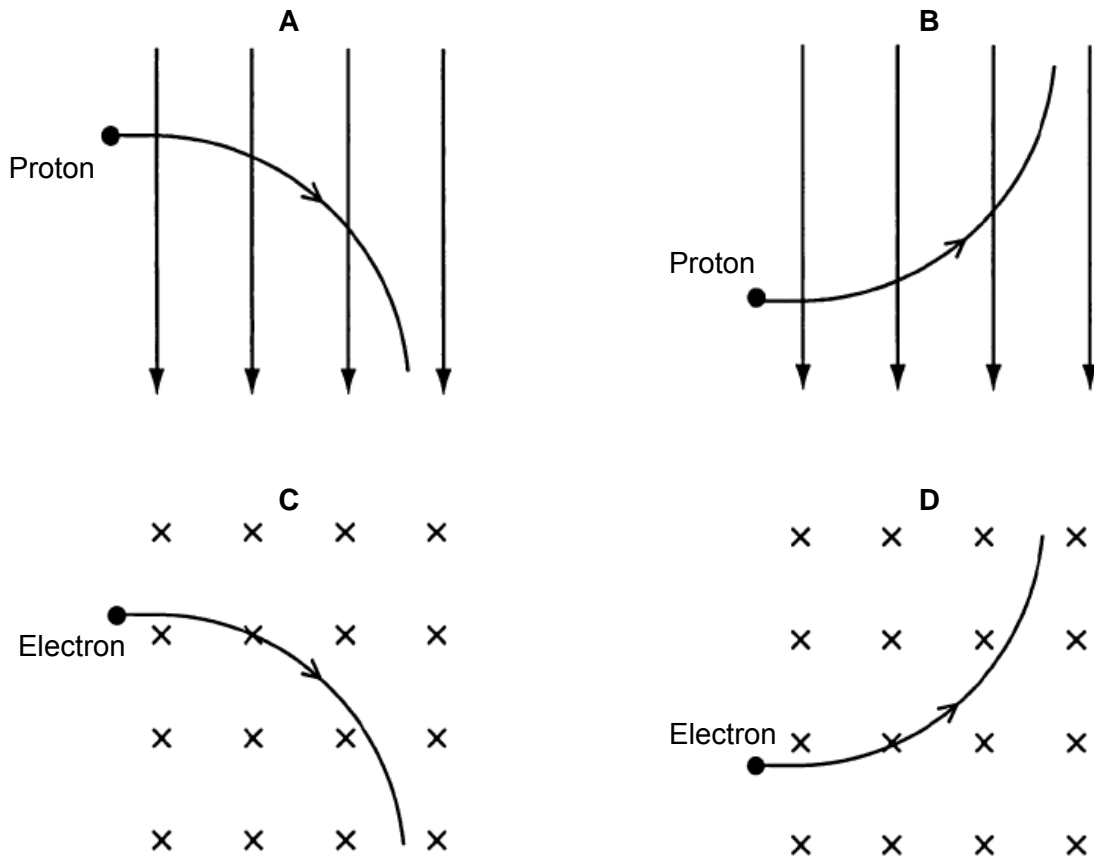


What are the magnitude and the direction of the magnetic force acting on the wire?

	Magnitude / N	Direction
A	0.038	into the page
B	0.038	out of the page
C	0.046	into the page
D	0.046	out of the page

27 A charged particle enters a uniform magnetic field.

Which of the following diagram represents the path of the particle in the magnetic field?



28 Light of frequency f falls on a metal surface of work function energy ϕ and ejects electrons of maximum kinetic energy K .

If the wavelength of this light is doubled and its intensity halved, what will be the maximum kinetic energy of the emitted electrons?

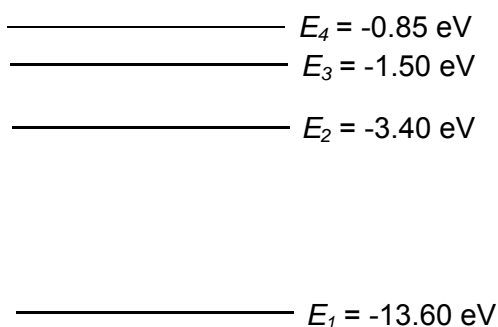
- A K
- B $2K$
- C $2hf - \phi$
- D $\frac{1}{2}hf - \phi$

- 29 When electrons are accelerated towards a crystal with an appropriate speed, an electron diffraction pattern may be observed.

What is the potential difference through which the electron must be accelerated from rest for it to have a wavelength of $3.2 \times 10^{-10} \text{ m}$?

- A 9.51 V B 14.7 V C 39.3 V D $9.51 \times 10^{24} \text{ V}$

- 30 In an experiment, students are required to observe the results from an absorption spectrum and infer the respective transitions that were involved. They were given the figure below showing four energy levels E_1 , E_2 , E_3 and E_4 of the atom used in the experiment.



Which of the following statements written by the student is false?

- A There are distinct dark lines seen in the spectrum.
B One of the photons absorbed is in the red-orange region of the visible spectrum.
C One of the absorption lines observed corresponds to a transition from the E_2 to E_3 state.
D There are four dark lines which indicate that there are four discrete energy levels in the atoms.

-- End of Paper --

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