Class:	Candidate Name:	Candidate Index Number:

EDGEFIELD SECONDARY SCHOOL
2025 PRELIMINARY EXAMINATION
Secondary 4 and 5

O Syllabus

SCIENCE (PHYSICS)

5086/02

Paper 2 Physics

August 2025

Candidates answer on the Question Paper.
No additional materials are required

1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the box above.
Write in dark blue or black ink.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A
Answer **all** questions.

Section B
Answer any **one** question.
Write your answers in the spaces provided on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

Acceleration due to gravity, g, is assumed to be 10 m/s^2 unless otherwise stated.

FOR EXAMINER'S USE	
SECTION A	/55
SECTION B	/10
TOTAL	/65

My target grade/mark: _____

Parent's Signature

This document consists of **18** printed pages.

Section A
Answer **all** the questions in the spaces provided.

1 Fig. 1.1 shows a vertical uniform cylinder containing 0.6 g of liquid.

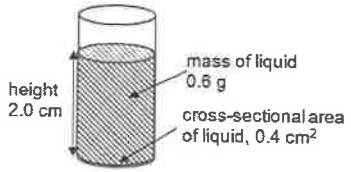


Fig. 1.1

The cylinder has a thin wall.
The cross-sectional area of liquid is 0.4 cm^2.
The height of the liquid is 2.0 cm.

(a) Calculate the weight of the liquid in the cylinder.

weight = ... N [2]

(b) Calculate the pressure which the liquid exerts on the base of the cylinder.

pressure = ... N/cm^2 [2]

[Total: 4]

2 (a) State the Principle of Moments.

.....

.....

.....

..... [2]

(b) A uniform metre rule is balanced horizontally on a pivot at the 75.0 cm mark. There are four forces acting on it are shown in Fig. 2.1.

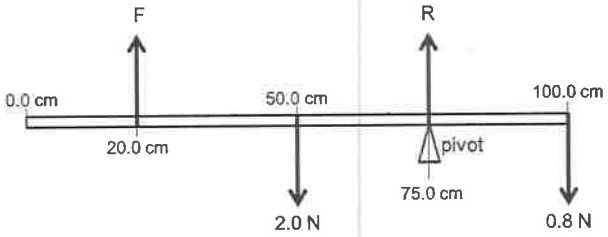


Fig. 2.1

(i) Calculate the force F by taking moments about the pivot.

F = ... N [3]

(ii) Determine the force R.

R = ... N [1]

[Total: 6]

[Turn over

3 Fig. 3.1 shows a rider or an electric scooter.

Fig. 3.1

The scooter contains a battery and a motor to drive the back wheel.

(a) Describe the main energy changes from the energy store in the battery to the energy store of the scooter.

.....

..... [1]

(b) The total mass of the scooter and the rider is 70 kg.

Calculate the total kinetic energy of the rider and scooter when the scooter has a speed of 4.0 m/s.

kinetic energy = ... J [2]

[Total: 3]

4 Fig. 4.1 shows a joulemeter that measures the energy given out by the heater. An experiment is conducted to determine the total amount of energy required to heat liquid **X** from a temperature of 25 °C to 70 °C. The heater is switched on for 300 s and then switched off. The variation of temperature of liquid **X** with time is plotted in the graph shown in Fig. 4.2.

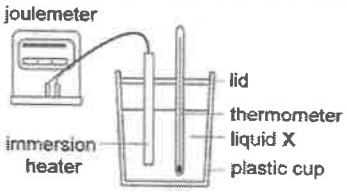


Fig. 4.1

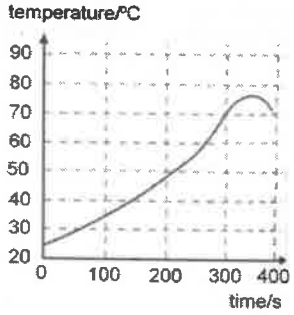


Fig. 4.2

(a) Describe the function of the lid.

.....

..... [1]

(b) Explain why the cup is made of plastic.

.....

..... [1]

(c) State and explain whether the joulemeter reading will be more or less accurate if the outer layer of the plastic cup is painted black.

.....

.....

.....

..... [2]

(d) State the changes to internal potential and kinetic energies of the particles of liquid **X** as the heater is switched on for 300 s.

.....

.....

.....

..... [2]

[Total: 6]

5 Fig. 5.1 shows an incorrect electromagnetic spectrum drawn by a student. The parts of the spectrum and the wavelengths are in the wrong order.

low frequency						high frequency
visible light	ultra-violet	gamma rays	infra-red	X-rays	radio waves	micro waves

Fig. 5.1

(a) On Fig. 5.2, complete the table of electromagnetic spectrum to show the correct order for the components. 'Gamma rays' has been inserted for you.

low frequency						high frequency
						gamma rays

Fig 5.2 [1]

(b) State one property that all electromagnetic waves have in common.

.....

..... [1]

(c) State one application of infra-red radiation.

.....

..... [1]

[Total: 3]

6 When measuring refractive index of materials, refractometers most often use a bright yellow light that corresponds to a wavelength of 589 nm in vacuum.

(a) Given that the speed of light in vacuum is 3.0×10^8 m/s, calculate the frequency of the yellow light.

frequency = ... Hz [2]

(b) Fig. 6.1 shows a ray of the yellow light entering a rectangular glass block at point A. The refractive index of the glass block is 1.5.

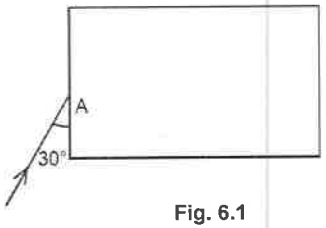


Fig. 6.1

(i) Calculate the angle of refraction at point A.

angle of refraction = ...° [2]

(ii) Draw the refracted ray until the light ray strikes the top surface of the glass block in Fig. 6.1. Label the normal, angle of incidence and angle of refraction in Fig. 6.1. [1]

[Total: 5]

7 Fig 7.1 shows resistors **P** and **Q** connected in series to a variable power supply.

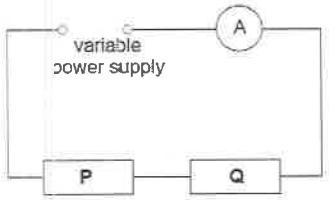


Fig. 7.1

Different readings for current and potential difference (p.d.) for resistor **Q** are obtained by varying the power supply. The readings obtained are shown in Table 7.1.

current / A	0	0.20	0.40	0.60	0.80	1.00
p.d. / V	0	0.60	1.10	1.80	2.50	3.00

Table 7.1

The graph of potential difference (p.d.) across the resistor with current for resistor **P** is as shown in Fig. 7.2.

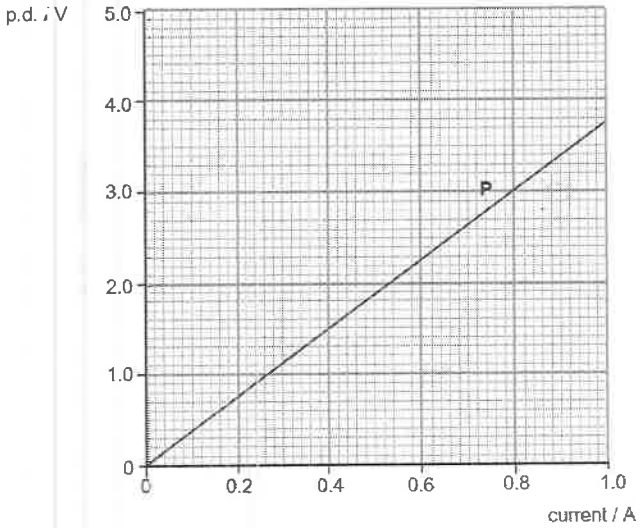


Fig. 7.2

(a) On Fig. 7.2, plot the graph of potential difference against current for resistor **Q**. Draw the line of best fit. Label your graph clearly. [2]

(b) Without calculation, state and explain if resistor **P** has a higher or lower resistance than resistor **Q**.

.....

..... [1]

(c) For a certain value of output potential difference from the power supply, the ammeter reads a current of 0.30 A. Use Fig.7.2 to determine potential difference across the power supply for this current of 0.30 A.

p.d. = ... V [2]

[Total: 5]

8 Fig. 8.1 shows an iron pendulum bob placed near a solenoid.

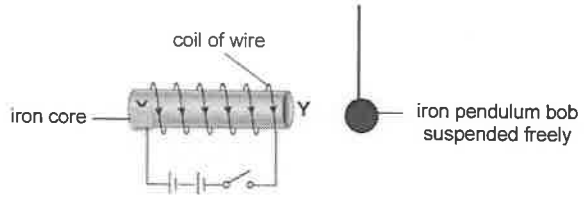


Fig. 8.1

The switch is closed and the iron pendulum bob is observed to swing towards **Y**, one end of the iron core.

(a) (i) State the magnetic pole that would be formed at **Y**, and describe how you obtained your answer.

.....

..... [1]

[Turn over

(ii) Hence, explain why the pendulum bob swings towards Y when the switch is closed.

.....

.....

.....

.....

..... [2]

(b) The switch is opened and the terminals of the battery are reversed. The switch is then closed. Describe the motion of the pendulum bob.

.....

..... [1]

(c) Describe one modification that can be made to the set up in Fig. 8.1 to increase the effect the solenoid has on the motion of the pendulum bob when the switch is closed.

.....

..... [1]

[Total: 5]

9 Fig. 9.1 shows an electric circuit that contains four resistors. Three switches S_1, S_2 and S_3 are then closed.

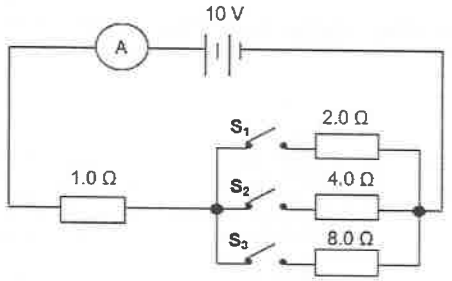


Fig. 9.1

(a) Calculate the effective resistance of the whole circuit.

resistance = ... Ω [2]

(b) Calculate the current across the 1.0 Ω resistor.

current = ... A [1]

(c) What will happen to the ammeter reading if S_2 and S_3 is subsequently opened while S_1 is still closed? Provide a reason for your answer.

.....

.....

.....

..... [2]

[Total: 5]

10 Fig. 10.1 shows details of five different nuclides.

nuclide	radiation emitted	half-life
hydrogen - 3	beta	12 years
iridium - 192	gamma	74 days
phosphorus - 32	beta	14 days
radon – 222	alpha	4 days
technetium - 99	gamma	6 hours

Fig. 10.1

One of the sources in Fig. 10.1 is used in a medical procedure to detect unusual bone structures. It is injected into a patient and the radiation emitted is detected outside the body.

(a) State which source in Fig. 10.1 is most suitable for this type of medical use.

..... [1]

(b) State **two** reasons for your choice in part **(a)**.

.....

.....

.....

..... [2]

[Total: 3]

11 Fig. 11.1 shows a row of sensors and indicator lights mounted above parking lots.

Each sensor consists of a transmitter that sends down an ultrasound wave and a receiver that detects the wave that reflects back. The indicator light, green or red, will indicate whether the lot is occupied.

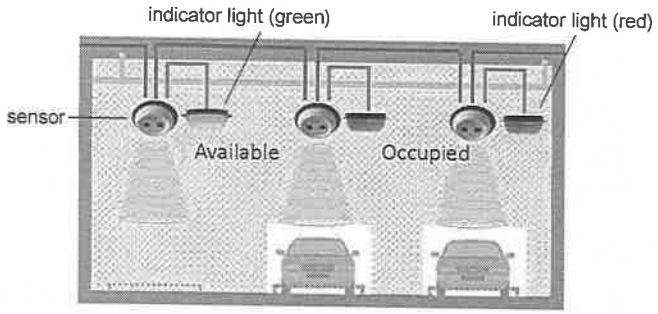


Fig. 11.1

(a) Ultrasound is a sound wave with a frequency higher than 20 kHz.

(i) State how the air particles are displaced with respect to the direction of the ultrasound wave travel.

..... [1]

(ii) Describe how the sound energy is transferred from the transmitter to the floor or vehicle through the air.

.....

.....

.....

..... [2]

(iii) Humans can hear sound within the range of 20 Hz to 20 kHz.

Explain why a human is still unable to hear ultrasound even when it is louder.

.....

..... [1]

[Turn over

(b) Ultrasound signals of high frequency are emitted from the transmitter once every 50 ms. Fig. 11.2 shows the emitted signals from one transmitter and their reflected signals over a period of time for one of the parking lots.

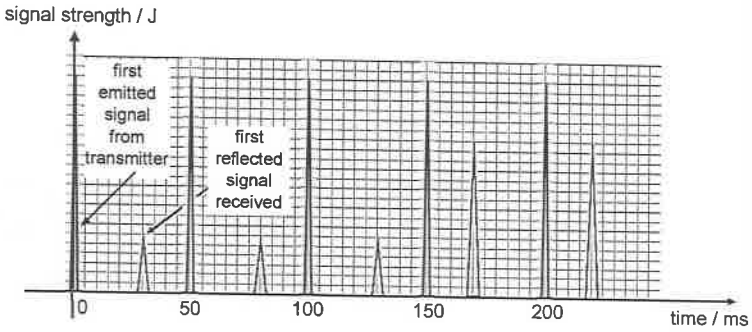


Fig. 11.2

(i) State the time at which the receiver first detects a vehicle in the lot.

time = ...ms [1]

(ii) Two different pieces of information from Fig. 11.2 about the reflected signals help us to tell if a parking lot is vacant or occupied.

State these information.

1. .....

.....

2. .....

..... [2]

(iii) Ultrasound travels in the air at a speed of 340 m/s.
Using Fig. 11.2, calculate the distance between the top of the vehicle and the sensor.

distance = ... m [3]

[Total: 10]

Section B

Answer any **one** question from this section in the spaces provided.

12 Fig. 12.1 shows the speed-time graph of a cyclist. The cyclist has a mass of 60 kg.

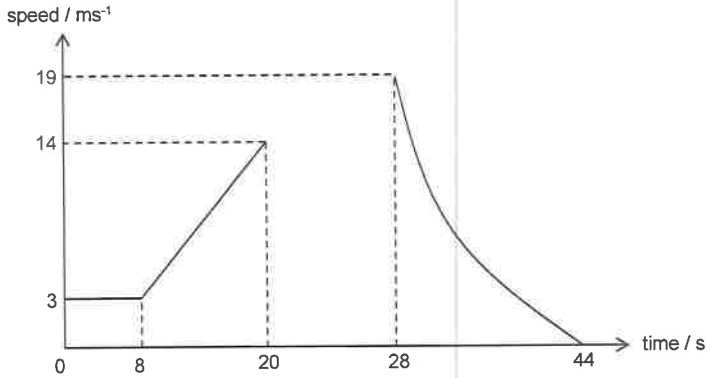


Fig. 12.1

(a) Describe the motion of the cyclist from t = 28 s to t = 44 s.

..... [1]

(b) The cyclist moves with decreasing acceleration from t = 20 s to t = 28 s. Sketch the cyclist's motion for this duration on Fig. 12.1. [1]

(c) The forward force by the cyclist in his first 8 seconds is 70 N. Using data in Fig. 12.1,

(i) state the magnitude of the frictional force experienced by the cyclist.

frictional force = ... N [1]

(ii) calculate the acceleration of the cyclist from t = 10 s to t = 15 s,

acceleration = ... m/s^2 [2]

(iii) calculate the force pushing the cyclist forward from t = 10 s to t = 15 s. Assume the frictional force remains the same.

forward force = ... N [2]

(d) Calculate the distance covered by the cyclist from t = 6 s to t = 20 s.

distance = ... m [2]

(e) If the cyclist were to brake suddenly and the brakes were positioned in the front wheel, predict if he is most likely to fall in front of, behind or to the side of his bicycle.

..... [1]

[Total: 10]

13 (a) Fig. 13.1 shows the rating label at the bottom of an electric kettle which is connected to a 240 V mains supply.

Fig. 13.1

(i) Calculate the maximum current flowing through the electric kettle when it is connected to 240 V mains supply.

maximum current = ... A [2]

(ii) Suggest a suitable fuse rating for the electric kettle.

fuse rating = ... [1]

(iii) The kettle is used at maximum power for 10 minutes every day. Calculate the cost of using this kettle for 30 days if each kWh of electrical energy costs 29.89 cents.

cost = ... [2]

(b) Fig. 13.2 shows the wiring of an electrical lamp. The lamp has a metal case and a switch. There are three wires **X**, **Y** and **Z** in the mains cable connected to the plug shown in Fig. 13.3.

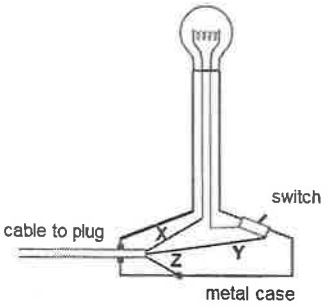


Fig. 13.2

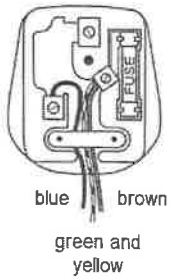


Fig. 13.3

(i) Match the wires **X**, **Y** and **Z** to the corresponding type of wire found in a plug.

wire **X** •	• earth
wire **Y** •	• live
wire **Z** •	• neutral

[3]

(ii) The plug of the lamp is wired wrongly. Explain the danger of using the plug wired this way.

.....

.....

.....

..... [2]

[Total: 10]

End of paper

Class:	Candidate Name:	Candidate Index Number:

EDGEFIELD SECONDARY SCHOOL
2025 PRELIMINARY EXAMINATION
Secondary 4 and 5

O Syllabus

SCIENCE (PHYSICS, CHEMISTRY) **5086/01**

Paper 1 Multiple choice **August 2025**

Additional Materials: OTAS **1 hour**

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the box above and the OTAS sheet.
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.

There are **forty** questions on 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 separate Answer Sheet.

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.
A copy of the Data Sheet is printed on page 18.
A copy of the Periodic Table is printed on page 19.
The use of an approved scientific calculator is expected, where appropriate.

FOR EXAMINER'S USE	
TOTAL	**/ 40**

My target grade/mark: _____

_____
Parent's Signature

This document consists of **19** printed pages.

Answer **all** questions

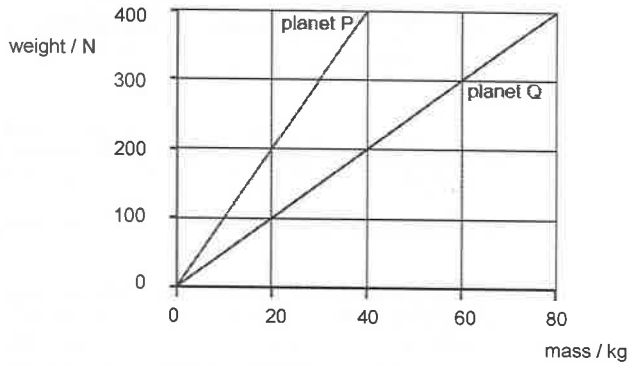
1 Which two quantities are base quantities?

A charge and time
B mass and acceleration
C mass and weight
D temperature and current

2 An object undergoes free fall. Which row describes the acceleration and the velocity of the object?

	acceleration	velocity
A	constant	constant
B	constant	increasing
C	increasing	constant
D	increasing	increasing

3 The graph shows how weight varies with mass on planet P and on planet Q.



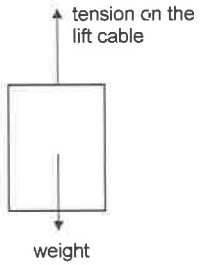
An object weighs 200 N on planet P. The object is taken to planet Q.

Which row is correct?

	mass of object on planet Q / kg	weight of object on planet Q / N
A	20	100
B	20	200
C	40	100
D	40	200

4 A lift with a weight of 6000 N is moving upwards at a constant speed of 4 m/s as shown in the diagram.

The directions of tension on the lift cable and the weight of the lift are shown.

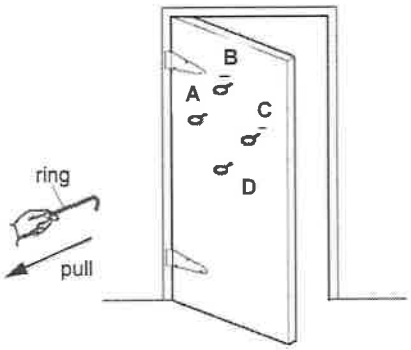


What is the tension in the cable attached to the lift?

A 0 N B 2400 N C 6000 N D 24 000 N

5 Four rings are screwed onto a door as shown. The door can be opened by putting a hook into one of the rings and pulling it.

Which ring should be used if the pulling force is to be as small as possible?



6 A crane lifts a weight of 1000 N through a vertical height of 30 m.
It uses 60 000 J of energy.

What is the efficiency of the crane?

A 20% B 30% C 40% D 50%

7 A block of ice is melting.

What happens to the potential energy and kinetic energy of the molecules?

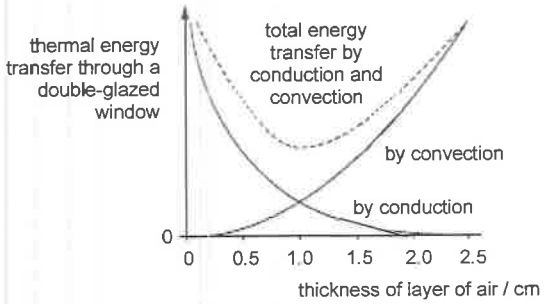
	potential energy	kinetic energy
A	increase	no change
B	increase	increase
C	no change	no change
D	no change	increase

8 Bubbles are seen forming rapidly in water and the temperature of the water remains constant. Which of the following statements best describes what happens to the particles of water?

A The particles of the water are moving faster.
B The particles of the water are moving further apart.
C The particles of the water are moving faster and further apart.
D The particles of the water are moving slower and closer together.

9 A double-glazed window has two sheets of glass separated by a layer of air.

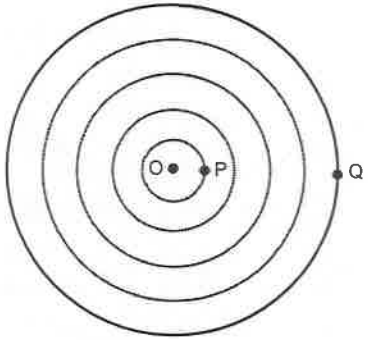
Therma energy is transferred through the layer of air by conduction and convection. The amount of conduction and convection varies with the thickness of the layer of air, as shown in the graph below.



Which thickness of air produces the smallest energy transfer, and why?

A 0.5 cm because there is little convection
B 1.0 cm because the total thermal energy transfer is least
C 1.5 cm because the total thermal energy transfer is small and conduction is low
D 2.0 cm because there is little conduction

10 The diagram below illustrates the circular wavefronts moving outward from a point source O.



The wavelength of the waves is 2 m. If the time taken for a wavefront to travel from P to Q is 10 s, what is the speed of the wave?

A 0.20 m/s **B** 0.40 m/s **C** 0.80 m/s **D** 1.25 m/s

11 A guitar player struck a guitar string to produce a sound. The same string is then struck harder to produce a second sound with the same pitch.

Which row about the speed and wavelength of the second sound compared with the first sound is correct?

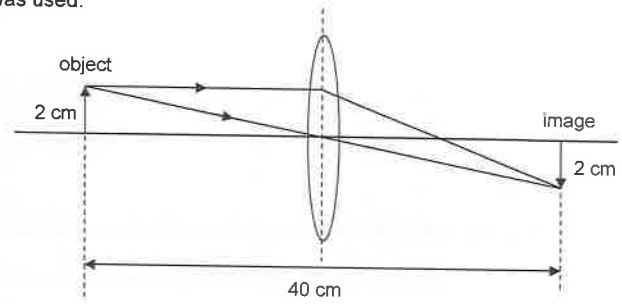
	speed	wavelength
A	same	same
B	same	different
C	different	same
D	different	different

12 The main components of the electromagnetic spectrum have many well-known uses.

What is a common application of ultraviolet radiation?

A alarms to detect intruders
B check metal pipes for cracks
C cancer treatment
D sterilization of medical equipment

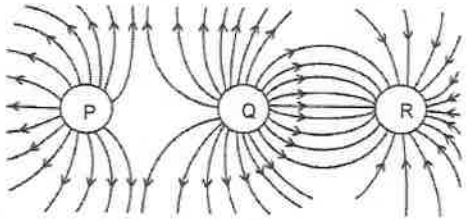
13 The ray diagram below shows the formation of an image when a thin converging lens was used.



If both the object and the image are 2 cm in height, what is the focal length of the lens?

A 2 cm **B** 10 cm **C** 30 cm **D** 40 cm

14 The figure below shows the pattern of electric field produced by three charged spheres.



Which of the following correctly shows the charge on each sphere?

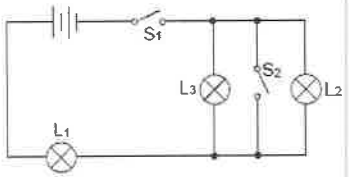
	P	Q	R
A	+	+	-
B	+	-	+
C	-	+	-
D	-	-	+

15 A wire of length 0.5 m and a cross-sectional area of 1.0×10^{-6} m^2 has a resistance of 2.0 Ω. Another wire of the same material has a length of 2.0 m and a cross-sectional area of 2.0×10^{-6} m^2.

What is the resistance of the longer wire?

A 0.5 Ω **B** 1.0 Ω **C** 2.0 Ω **D** 4.0 Ω

16 The diagram shows three identical lamps connected to a battery and two switches. With S_1 closed and S_2 opened, all three lamps light up.



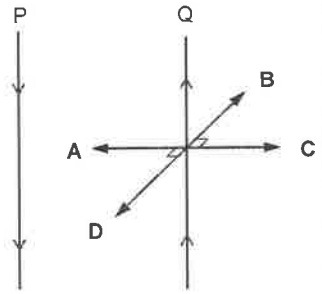
What happen to the lamps when both S_1 and S_2 are closed?

	L_1	L_2	L_3
A	dimmer	no light	no light
B	brighter	no light	no light
C	dimmer	no light	brighter
D	brighter	no light	dimmer

17 An electric heater of a given power rating is connected to a 240 V mains supply. The fuse rating for each electric heater is given. Which of the following is **incorrect**?

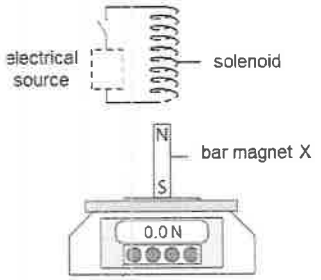
	power rating	fuse
A	1.1 kW	5 A
B	2.2 kW	10 A
C	3.2 kW	13 A
D	3.4 kW	15 A

18 Two parallel vertical wires P and Q are a small distance apart in air and both carry electric currents. The current in wire P is flowing downwards and the current in wire Q is flowing upwards. A force acts on Q due to the current in P. This force is perpendicular to the wire Q.



What is the direction of the force on Q?

19 An experiment to investigate magnetism is shown in the figure below.



The bar magnet X is placed on an electronic balance and the reading is zeroed. A solenoid is set up above bar magnet X and the electronic balance read 1.6 N when the switch is closed.

An unknown metal bar Y is placed in the solenoid and the reading increased to 2.8 N.

Which of the following shows the orientation of the electrical source and the material of Y?

	electrical source	material of Y
A		copper
B		iron
C		copper
D		iron

20 The half-life of a radioactive substance is 20 minutes.

How long does it take for the activity of the substance to reduce to $\frac{1}{8}$ of its initial activity?

A 100 minutes
B 80 minutes
C 60 minutes
D 40 minutes

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Paper 1

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

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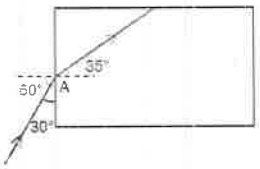
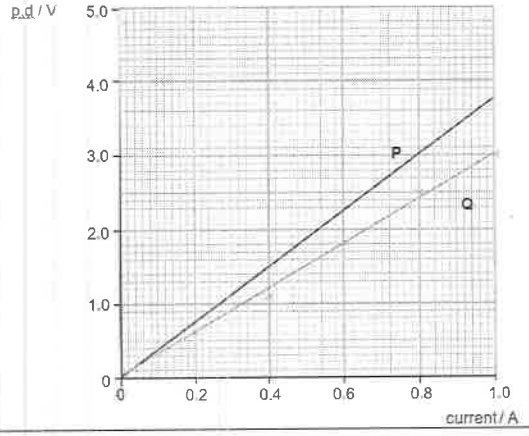
Paper 2

Section A

1(a)	$m = \frac{0.6}{1000}$ kg $m = 6.0 \times 10^{-4}$ kg or 0.006 kg W = m g $W = (6.0 \times 10^{-4})(10)$ $W = 6.0 \times 10^{-3}$ N	[1] [1]
(b)	$P = \frac{F}{A}$ $P = \frac{6 \times 10^{-3}}{0.4}$ $P = 0.015$ N/cm^2	[1] [1]
2 (a)	For a body in equilibrium, the sum of clockwise moments about any given point is equal to the sum of anticlockwise moments about the same point.	[1] [1]
(b)(i)	Taking moments about the pivot, sum of clockwise moments = sum of anticlockwise moments F x (75.0 − 20.0) + 0.8 x (100.0 − 75.0) = 2.0 x (75.0 − 50.0) F = 0.545 N	CW M [1] ACM [1] [1]
(b)(ii)	R + F = 2.0 + 0.8 R = 2.8 − 0.54545 = 2.25 N (Accept 2.26 N)	[1]
3 (a)	The energy from the chemical store of the battery is transferred electrically to the kinetic store of the scooter.	[1]
(b)	KE = ½ mv^2 = ½ x 70 x 4^2 = 560 J	[1] [1]
4 (a)	The lid prevents heat lost to the surrounding by convection and evaporation.	[1]

(b)	Plastic is a poor conductor of heat, and thus prevents heat loss to the surrounding by conduction.	[1]
(c)	It is less accurate because black is a good emitter of infrared radiation. This results in more heat being lost to the surrounding.	[1] [1]
(d)	• Internal kinetic energy increases • But internal potential energy remains unchanged / increases.	[1] [1]
5 (a)	low frequency … high frequency Radio waves | Micro waves | Infrared | Visible light | Ultra-violet | X -rays | gamma rays	[1]
(b)	Any one property: • EM waves travel at 3.0 x 10^8 m/s in vacuum • All EM waves are transverse waves • EM waves transfer energy (but not matter) • All EM waves obey wave equation v=fλ • All EM waves undergo reflection and refraction	[1]
(c)	Any one use of infra-red: • Infra-red remote controllers of electrical appliances • Intruder alarms • Thermal imaging equipment • Infra-red photography • Thermograms in medical field	[1]

6 (a)	$v = f\lambda$ $3.0 \times 10^8\ m/s = f \times 589 \times 10^{-9}\ m$ $f = 5.093 \times 10^{14}\ Hz$ $= 5.1 \times 10^{14}\ Hz$	[1] [1]
(b)(i)	$n = \frac{\sin i}{\sin r}$ $1.5 = \frac{\sin 60°}{\sin r}$ $r = 35°\ (to\ 2\ s.f.)$	 [1] [1]
(b)(ii)	 Normal, angle of incidence and angle of refraction must be labelled correctly.	[1]
7 (a)	• Correctly plotted graph with 3 data plots • Line of best-fit graph 	[1] [1]

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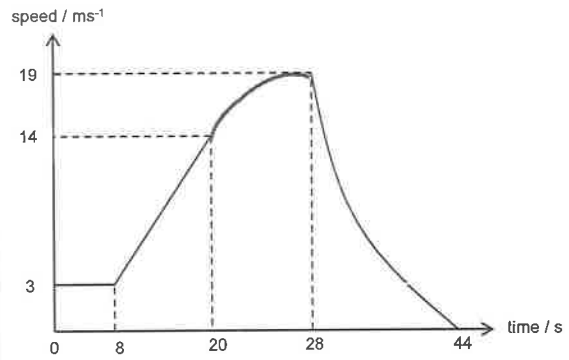
(b)	The gradient of the graph represents resistance. Since P is steeper, it has a higher resistance. (Must have correct explanation for the full mark)	[1]
(c)	Reading from graph, p.d. of P = 1.1 V p.d. of Q = 0.9 V p.d. across power supply = 1.1 + 0.9 = 2.0 V	[1] [1]
8 (a)(i)	The end near Y becomes a North pole, using Right-Hand Grip Rule.	[1]
(a)(ii)	The end of the iron bob nearer Y becomes an induced South pole. Since opposite poles attract, the bob swings towards Y.	[1] [1]
(b)	The pendulum bob swings towards Y.	[1]
(c)	Any one: • Increase the number of turns of coils in the solenoid • Use a larger current • Use a cell/battery/supply with a larger emf	[1]
9 (a)	Effective resistance = $1.0 + (1/2 + 1/4 + 1/8)^{-1}$ = 2.14 Ω	[1] [1]
(b)	For current flowing through 1.0 Ω, V = IR 10 = I (2.14) I = 4.67 A	[1]
(c)	The total effective resistance of the whole circuit increases. By V = IR, the current flowing through the ammeter decreases.	[1] [1]

10 (a)	technetium (–99)	[1]
(b)	Gamma radiation can be detected outside the body as it has strong penetration ability. Its half-life of 6 hours is short and less damage or loses radioactivity quickly.	[1] [1]
11 (a)(i)	Displacement of air particles is parallel to the direction of the ultrasound travel.	[1]
(a)(ii)	The transmitter vibrates and collides with the air particles nearby causing them to vibrate. These vibrating air particles collide with other neighbouring air particles to continue to transfer the energy. This process continues and the ultrasound wave travels and reaches the floor/vehicle in the form of a longitudinal wave. OR This process continues and forms alternating regions of compression and rarefaction in the air towards the floor/ vehicle.	[1] [1]
(a)(iii)	A louder sound only changes (increases) the amplitude of the sound, but its frequency is not adjusted and hence is still higher than the human audible range.	[1]
(b)(i)	170	[1]
(b)(ii)	1. Time interval between emitted and reflected signals is longer for vacant lots. (Explanation: as the signal travels a longer distance.) 2. Amplitude of reflected signal is smaller for vacant lots. (Explanation: there is greater energy loss by the ultrasound as it travels a longer distance.)	[1] [1]
(b) (iii)	Time interval emitted and reflected signal when there is a vehicle = (20×10^{-3}) s = 0.020 s Distance = 340 x 0.020 x ½ = 3.4 m	[1] [1] [1]

Section B

12 (a)	The cyclist moves with decreasing deceleration / speed decreases at a decreasing rate.	[1]
(b)		[1]
(c)(i)	70	[1]
(c)(ii)	a = (v – u) / t = (14 – 3) / (20 – 8) = 0.917 m/s^2	[1] [1]
(c)(iii)	F_R = ma F – 70 = 60 x 0.917 F = 125 N	[1] [1]
(d)	d = (2 x 3) + [½ x 12 x (3 + 14)] OR d = (14 x 3) + (½ x 12 x 11) d = 108 m	[1] [1]
(e)	He is most likely to fall **in front of** his bicycle.	[1]

13 (a)(i)	$P = VI$ $3000\ W = 240\ V \times I$ $I = 12.5\ A$	[1] [1]
(a)(ii)	13 A	[1]
(a)(iii)	$cost = Pt \times rate$ $= 3\ kW \times \frac{10}{60}\ h \times 30 \times \$0.2989$ $= \$4.48\ (to\ nearest\ cent)$	[1] [1]
(b)(i)	wire X: neutral wire Y: live wire Z: earth	[1] [1] [1]
(b)(ii)	The earth wire is **connected to the live terminal**. This causes the **metal casing to be live** and anybody who touches it can get an **electric shock**.	[1] [1]