Candidate Name

PEIRCE SECONDARY SCHOOL
PRELIMINARY EXAMINATION
SECONDARY 4 NORMAL (ACADEMIC)

SCIENCE (PHYSICS)   **5105/01**
Paper 1 Multiple Choice   **29 July 2022**
                                                Papers 1 and 2: 1 hour 15 minutes

Additional Materials: Multiple Choice Answer Sheet

INSTRUCTIONS TO CANDIDATES

Write your name, class and register number in the spaces provided at the top of this page.
Write in dark blue or black pen.
There are **twenty** questions 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 separate Multiple Choice 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.
You are advised to spend no longer than **30 minutes** on **Paper 1**.
You may proceed to answer Paper 2 as soon as you have completed Paper 1.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

Answers to Paper 1 and Paper 2 must be handed in separately.

Paper 1: [20 marks]
Answer all the questions in the OTAS provided.

1   Which statement about scalar and vector quantities is correct?

    A   Vector quantities have direction only.
    B   Scalar quantities have direction only.
    C   Vector quantities have magnitude, unit and direction.
    D   Scalar quantities have magnitude, unit and direction.

2   A student performed a pendulum experiment and he obtained a time of
    5.06 s for 10 oscillations. What is the period of the pendulum?

    A   0.506 s   **B**   5.06 s   **C**   15.06 s   **D**   50.60 s

3   The following are distance-time graphs.
    Which graph shows an object travelling at decreasing speed?
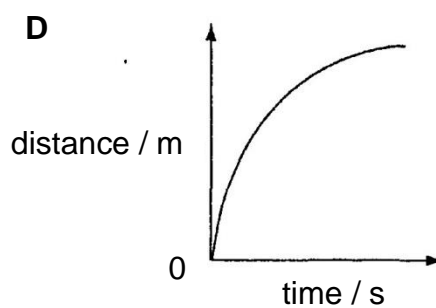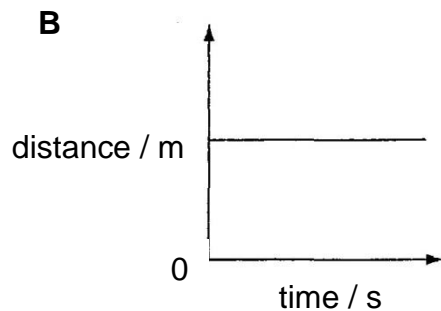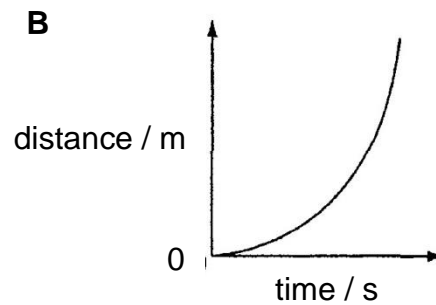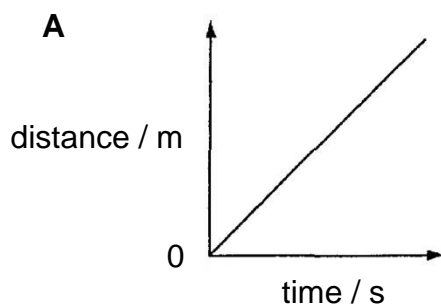
4   A body is accelerating at 5 m / s^2. What does it mean?

    A   The distance increases by 5 m every second.
    B   The velocity of a body increases by 5 m / s every second.
    C   The body increases its velocity and reaches constant velocity in 5 s.
   **D**   The velocity remains constant at 5 m / s.

5 A car accelerates along a straight road, moves at constant speed before finally decelerates and comes to a stop.
When are the forces acting on the car balanced?

A when it comes to a stop
B when it is accelerating and when it has constant speed
C when it has a constant speed and when it is decelerating
D when it has a constant speed and when it comes to a stop

6 A small piece of meteorite is transported from outer space back to Earth.
Which changes take place to the meteorite?

	change in mass	change in weight
A	no	increase
B	no	decrease
C	yes	increase
D	yes	decrease

**7** A load is to be moved using a wheelbarrow. The total weight of the load and the wheelbarrow is 800 N.
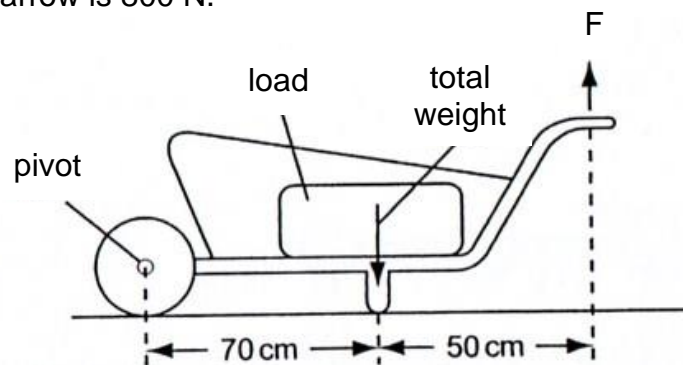
What is the size of the force F needed just to lift the loaded wheelbarrow?

A 333 N **B** 467 N **C** 571 N **D** 1120 N

8 What is the formula for gravitational potential energy, E_p, when an object has a weight w and is at a height h above the ground?

A $E_p = w \times h$
B $E_p = w \times 10$
C $E_p = w \times 10 \times h$
D $E_p = w \div 10 \times h$

9 A 300 N force is applied to a box in the direction XY in order to move it up a ramp as shown below.
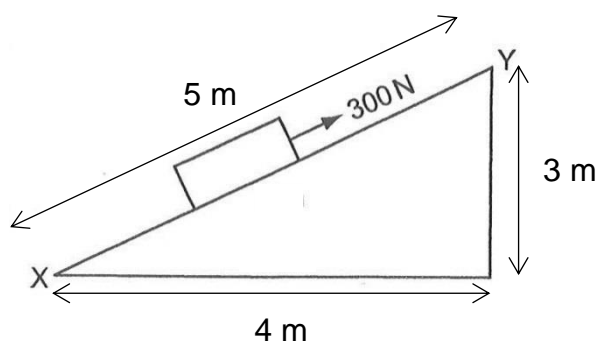
How much work is done when the box is moved from X to Y?

A 900 J **B** 1200 J **C** 1500 J **D** 3600 J

10 Under certain conditions, a solid can turn directly into a gas.
Which row shows the correct change in the movement of the molecules?

A The movement of the molecules changes from moving randomly at high speed to sliding against each other.

B The movement of the molecules changes from sliding against each other to moving randomly at high speed.

C The movement of the molecules changes from moving randomly at high speed to vibrating about fixed positions.

D The movement of the moelcules changes from vibrating about fixed positions to moving randomly at high speed.

**11** A teacher has a large beaker of water in which he wants to set up a convection current.
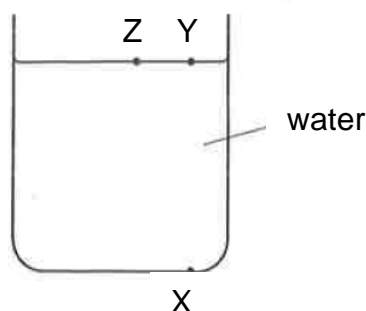
Which arrangement will set up a convection current?

A heating at Y
B heating at Z
C cooling at Y
D cooling at X

12 When a liquid is cooled at its freezing point, _____ .

    A its temperature decreases gradually
    B the size of the liquid molecules decreases
    C the total internal kinetic energy of the liquid molecules decreases
    D the total internal potential energy of the liquid molecule decreases

13 The diagram shows a dipper producing ripples in a ripple tank.
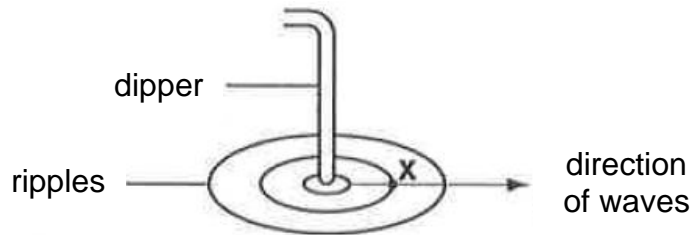
What does the ripples represent and which wave property describes the number of waves passing point X per second?

	what does the ripple represent	wave property
A	wavelength	period
B	wavelength	frequency
C	wavefront	period
D	wavefront	frequency

14 Which option correctly lists three components of the electromagnetic spectrum in order of decreasing frequency?

    A X-rays, microwaves, radio waves
    B visible light, radio waves, X-rays
    C X-rays, microwaves, visible light
    D radio waves, visible light, X-rays

15 A loud sound is made in front of a tall building.
An echo is heard 4 s after the sound is produced.
If the speed of sound in air is 320 m / s, how far away is the building?

    A 80 m   **B** 160 m   **C** 640 m   **D** 1280 m

16 The diagram shows a displacement-time graph produced by a sound wave of amplitude 2 units.
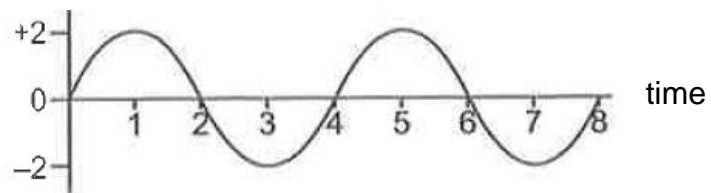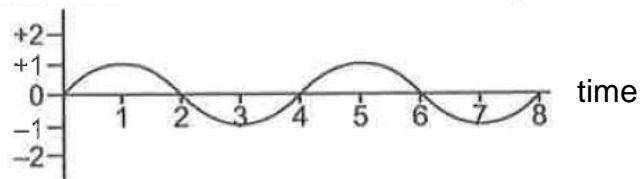

Which diagram shows a higher pitched sound being played more loudly?

A

B
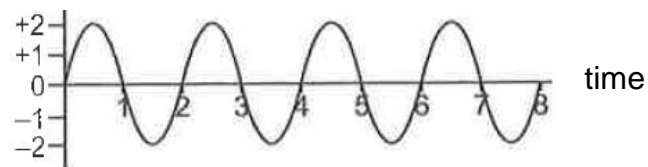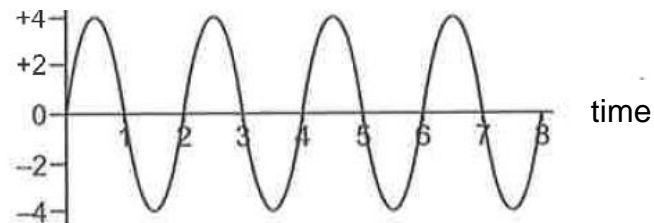

C

D
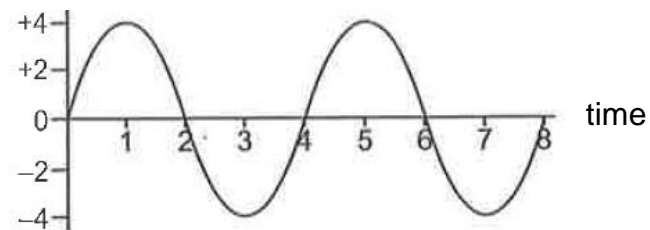
17 Which diagram shows the direction of conventional current and electron flow in a circuit?

A

electron
flow

conventional
current

B

conventional
current

electron
flow

C

electron
flow

conventional
current

D

conventional
current

electron
flow
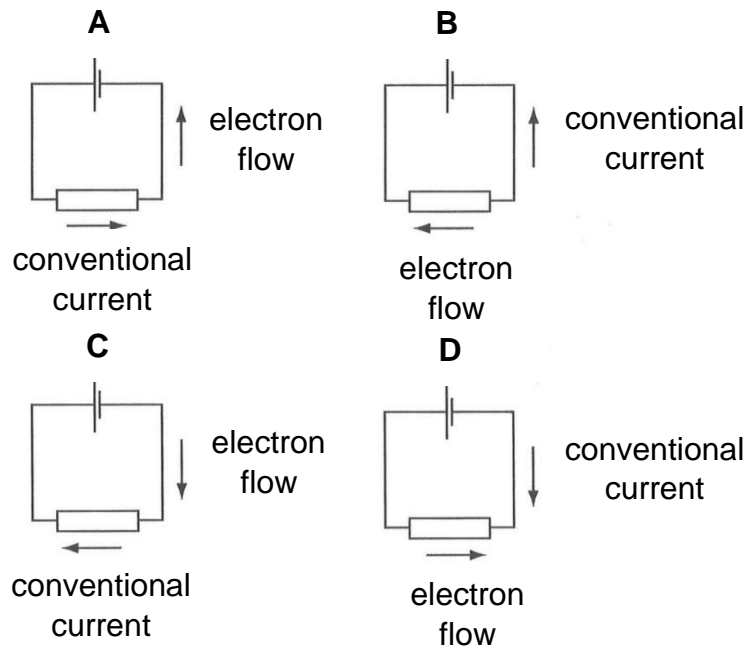
18 A conductor carries a current of 6.0 A. What is the time taken for 180 C of charge to flow through it?

A   0.0333 min   **B**   0.0333 s   **C**   30.0 min   **D**   30.0 s

Use the diagram below to answer Questions 19 and 20.

3 Ω

X

S_1

4.5 Ω

Y

3 Ω

S_2

S_3
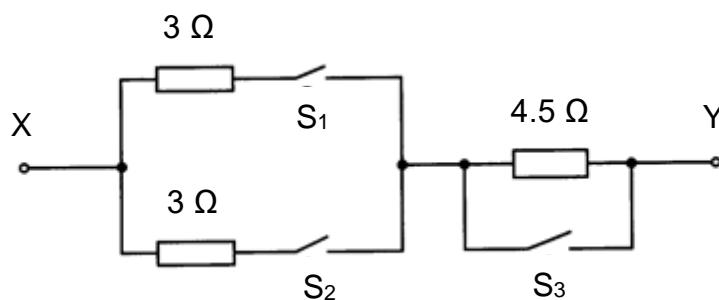
19 When switches S_1 & S_2 are closed, what is the effective resistance of the composite circuit?

A   10.5 Ω   **B**   6.0 Ω   **C**   1.5 Ω   **D**   0.67 Ω

20   Which switch positions would obtain a resistance of 3 Ω between X and Y?

	S₁	S₂	S₃
A	closed	open	closed
B	closed	closed	open
C	open	closed	open
D	open	open	open

End of Paper 1

Candidate Name _____

PEIRCE SECONDARY SCHOOL
PRELIMINARY EXAMINATION
SECONDARY 4 NORMAL (ACADEMIC)

SCIENCE (PHYSICS)   **5105/02**
Paper 2 Physics   **29 July 2022**
                                          Papers 1 and 2: 1 hour 15 minutes

Additional Materials:
Nil

INSTRUCTIONS TO CANDIDATES
Write your name, class and register number in the spaces provided at the top of this page.
Write in dark blue or black pen. You may use a soft pencil for any diagrams, graphs or rough working.

Section A [14 marks]
Answer **all** questions in this Section in the spaces provided.

Section B [16 marks]
Answer any **two** questions in this Section.
The use of an approved scientific calculator is expected, where appropriate.
In calculations, you should show all the steps in your working, giving your answer at each stage.
You are advised to spend no longer than **30 minutes** on **Paper 1**.
You may proceed to answer Paper 2 as soon as you have completed Paper 1.

At the end of the examination, hand in your answers to Paper 1 and Paper 2 separately.
The number of marks is given in brackets [ ] at the end of each question or part question.

**PARENT'S
SIGNATURE**

For Examiner's Use	
Section A	
Section B	
Total	30

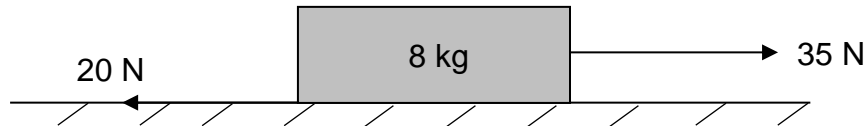This paper consists of **11** printed pages and **1** blank page.
Setter: Mr Clement Lee

Paper 2: Section A [14 marks]
Answer all the questions in the spaces provided.

1 A block of mass 8 kg, initially at rest, is pulled with a force of 35 N. The frictional force between the floor and the block is 20 N.

20 N   8 kg   → 35 N

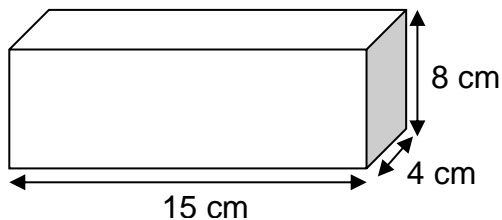**(a)** Calculate the resultant force acting on the block and state its direction.

resultant force = ……………….. N (to the ……….) [1]

(b) What will happen to the block as a result?

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

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

2 The diagram below shows a cuboid with dimensions 15 cm by 4 cm by 8 cm resting on the floor. The cuboid has a mass of 4.5 kg.

8 cm

4 cm

15 cm
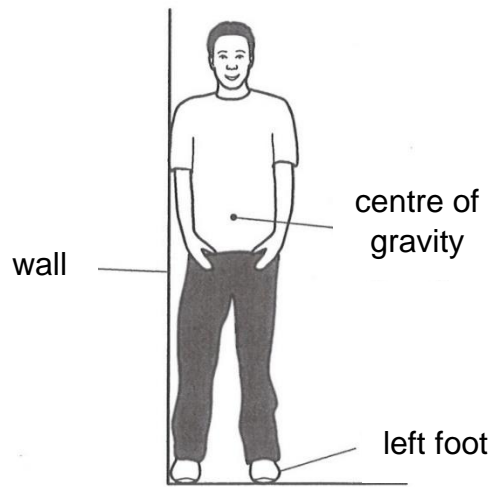
Given that g = 10 N / kg, calculate
(a) the weight of the cuboid,

weight = ……………….. N [1]

(b) the **greatest** pressure the cuboid will exert on the floor if it can rest on any of its faces.

greatest pressure = ……………….. N / cm^2 [1]

3 A boy stands with his right foot and right shoulder touching a wall as shown in the diagram below.
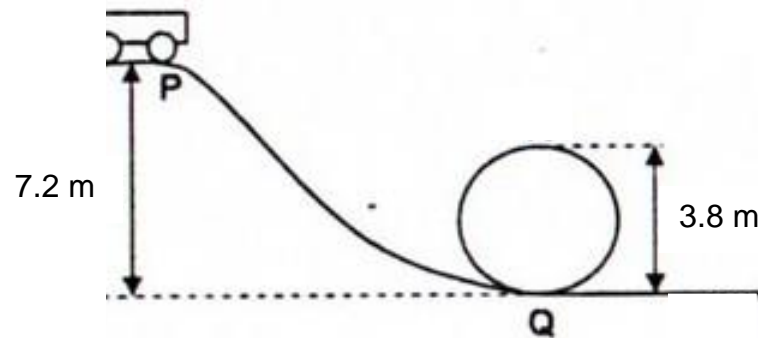

(a) Using the above diagram, add in the weight of the boy. [1]

(b) Explain why the boy cannot raise his left foot off the ground without losing his balance.

…………………………………………………………………………………………

…………………………………………………………………………………………

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

4 The diagram below shows a stationary roller coaster of mass 300 kg at the start of a frictionless roller coaster course at point P.


(a) Calculate the kinetic energy of the roller coaster if its speed at point Q is 12 m / s.

kinetic energy = ……………….. J [1]

(b) In reality, will the kinetic energy at Q be the same as the gravitational potential energy at P? Explain your answer.

………………………………………………………………………………………….

………………………………………………………………………………………….

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

5 The diagram shows an electric oven. The electric circuit is not shown. Air, in contact with the heating elements, is heated.
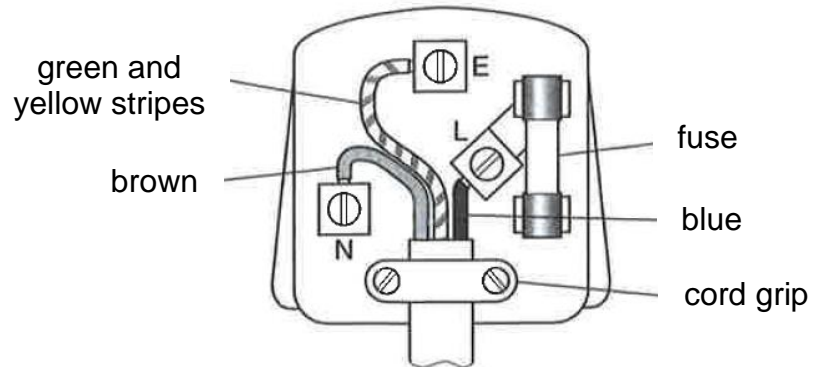

walls of oven

heating elements
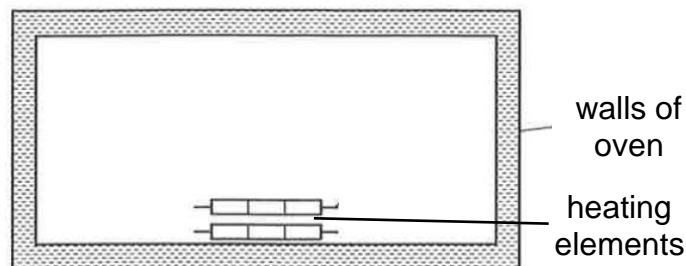
(a) Using the diagram, draw the convection current when the air is heated. [1]
(b) Describe how the air in the electric oven becomes hot.

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

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

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

6 The mains plug for a water heater has been wired wrongly and dangerously as shown in the diagram.

green and
yellow stripes

brown

E

L

fuse

blue

N

cord grip

(a) State in what way the mains plug has been wired wrongly.

....

.... [1]

(b) State why this wiring causes a hazard even when the switch on the water heater is switched off.

....

....

.... [1]
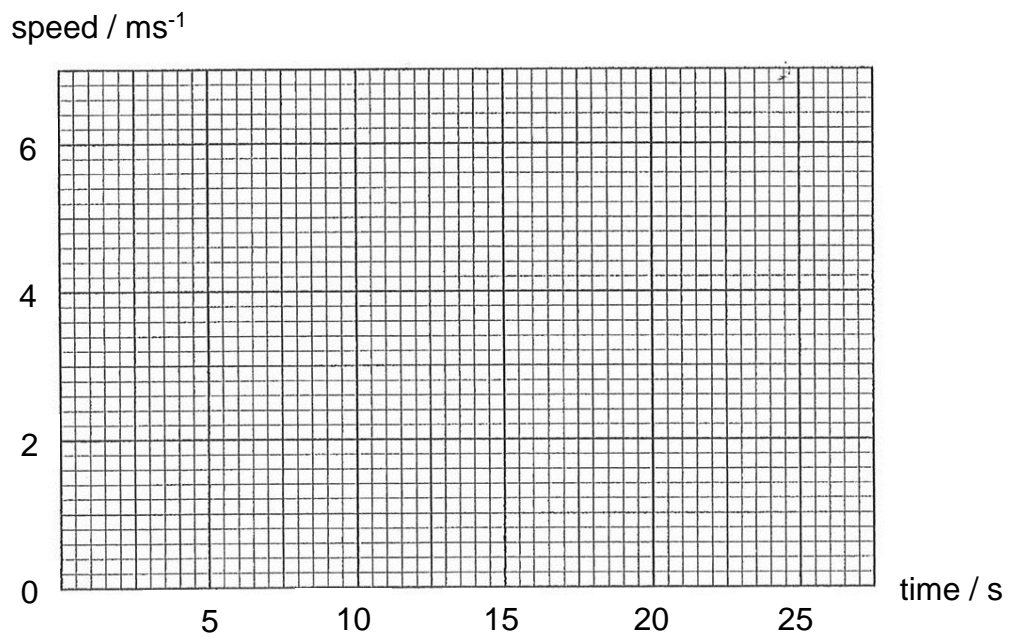
Paper 2: Section B [16 marks]
Answer any **two** questions in the spaces provided.

7   A student investigated the motion of a car at different times during a journey.
She measured the speed of the car every five seconds and the results are
shown in the table below.

time / s	speed / ms^{-1}
0	6
5	6
10	6
15	4
20	2
25	0

(a) Plot the speed-time graph of the car during this journey.   [2]

speed / ms^{-1}

(b) Describe the motion of the car during the whole journey.

……………………………………………………………………………………..

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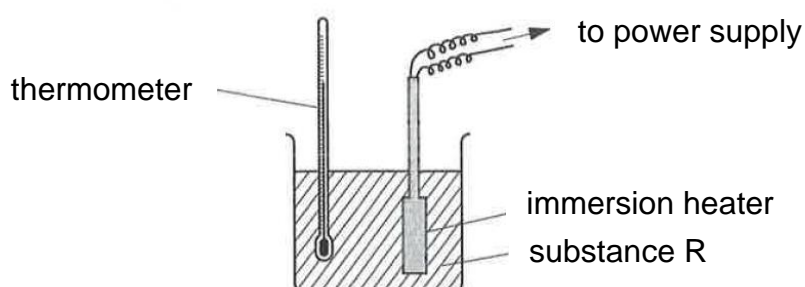
……………………………………………………………………………… [2]

(c) Calculate the deceleration of the car during the last 15 seconds.

deceleration = ……………….. m / s^2 [2]

(d) Calculate the average speed of the car.

average speed = ……………….. m / s [2]

8 **(a)** The diagram shows the apparatus used when some students investigated what happens to a solid substance R as it is heated. The solid is contained in a metal can. It is heated by an immersion heater.

The students measured the temperature of substance R at regular time intervals. The graph below shows what they have plotted.
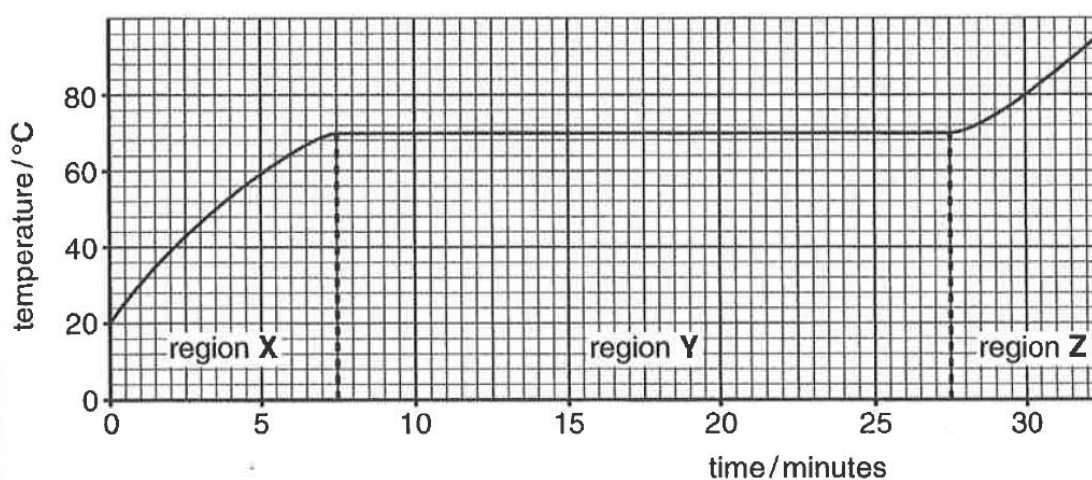
(i) State the process happening in region Y.

…………………………………………………………………………………… [1]

(ii) Give two reasons why there is no increase in temperature even though heat is supplied by the heater in region Y.
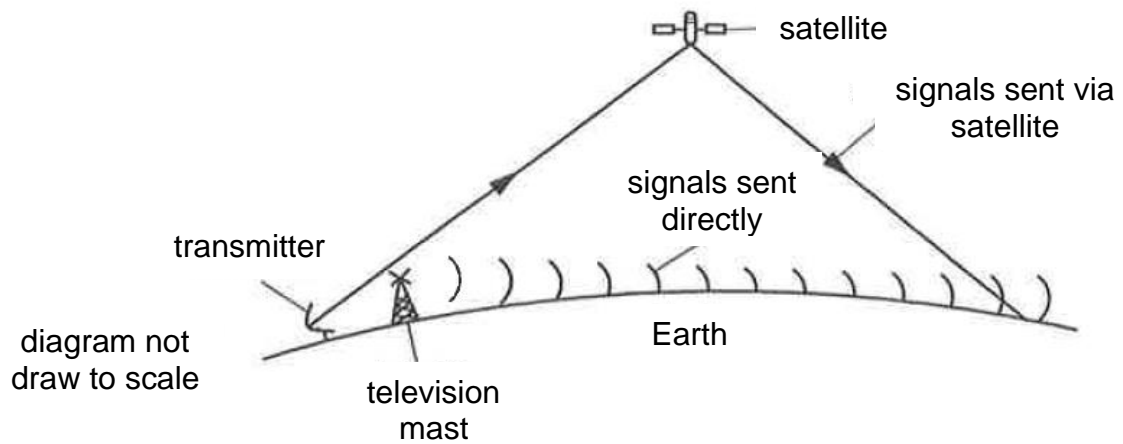
…………………………………………………………………………………....

…………………………………………………………………………………....

………………………………………………………………………………… [2]

(iii) State one difference between boiling and evaporation.

…………………………………………………………………………………....

………………………………………………………………………………… [1]

(b) Electromagnetic radiation can be used for sending television signals to different parts of the Earth. The diagram below shows two methods of sending television signals to different parts of the Earth's surface.

One method is to send the signals via a satellite in space.
**(i)** State the electromagnetic waves that is used in this method.

…………………………………………………………………………………. [1]

(ii) State the speed of the electromagnetic waves in a vacuum.

…………………………………………………………………………………. [1]

(iii) A transmitter on Earth sends out signals of frequency 6000 MHz. Hence, calculate the wavelength of the signal from the transmitter.

wavelength = ……………….. m [2]

9 The diagram below shows an experimental setup that can be used to determine the resistance of an unknown resistor.
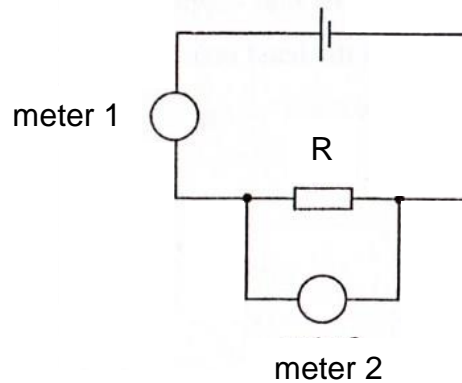
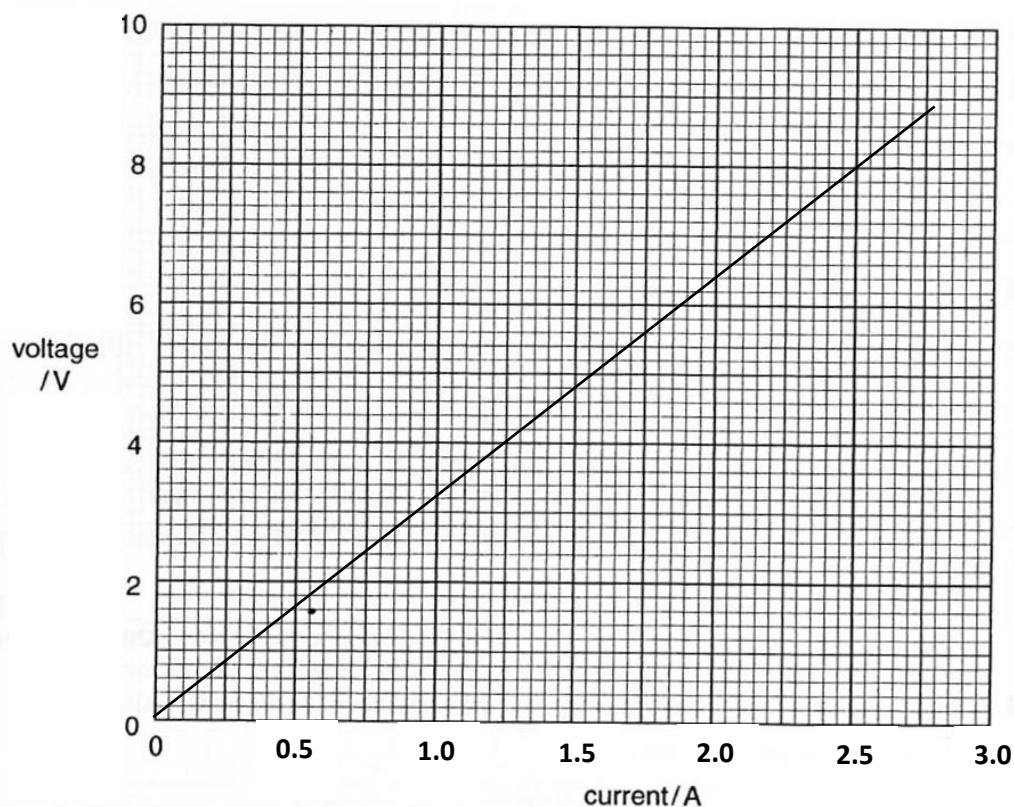**(a)** What is meter 1 and meter 2? [2]

meter 1: ……………….. meter 2: ………………..

(b) An important equipment is missing in the experimental setup shown in the above diagram. State the missing equipment and explain the purpose of this equipment.

……………………………………………………………………………………………

……………………………………………………………………………………………

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

(c) A student conducted the experiment to find the resistance of an unknown lamp and the results are plotted as shown below.

(i) What is the relationship between voltage and current for this unknown lamp?

....

.... [1]

(ii) State the potential difference across the lamp when the current is 1.5 A.

.... [1]
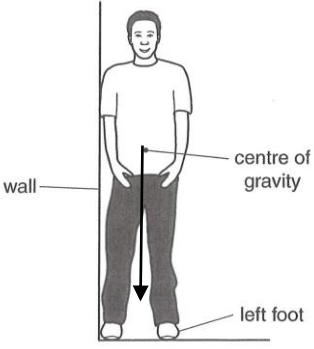
(iii) Using your answer in **(ii)**, calculate the power produced by the lamp when the current is 1.5 A.
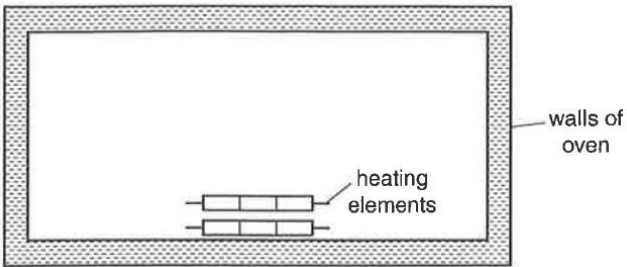
power = ……………….. W [2]

End of Paper 2

4A Science Physics Mark Scheme
Paper 1 [20 marks]

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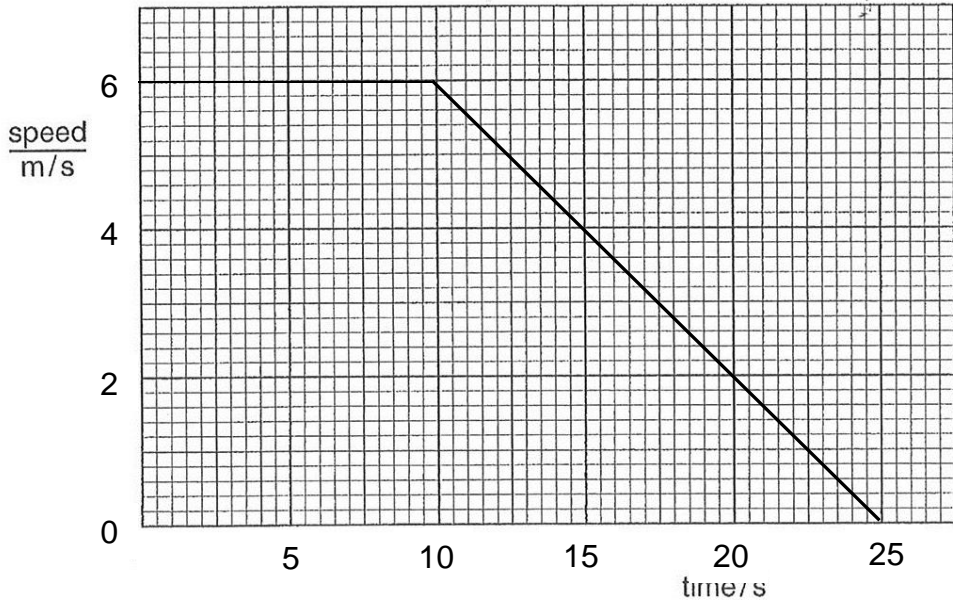
Paper 2 Section A [14 marks]

No.	Answer	Marks
1(a)	Resultant force = 35 – 20 $\qquad$ = <u>15 N (to the right)</u>	 A1
(b)	The block will accelerate to the right.	M1
2(a)	W = m x g = 4.5 x 10 $\qquad$ = <u>45 N</u>	 A1
(b)	P = F / A = 45 / 32 $\qquad$ = <u>1.41 N / cm^2 (to 3 sf)</u>	 A1
3(a)		M1
(b)	When the boy lifts his left foot, the weight of the boy now acts outside the base area. This will cause a resultant clockwise moment about his right foot which will cause him to lose his balance.	M1 M1
4(a)	E_k = ½ x m x v^2 = ½ x 300 x 12^2 $\qquad$ = <u>21 600 J</u>	 A1
(b)	No because some energy is lost through friction [1] causing the kinetic energy of the roller coaster to be lesser at Q.	M1

5(a)		M1
(b)	When the air is heated, it expands, become less dense and rises. The cold air, being denser, will sink. This will set up a convection current. <u>Note</u>: No mark is awarded if student only mention hot air rise & cold air sink.	M1 M1
6(a)	The live and neutral wires are switched/swapped with each other.	M1
(b)	The appliance will remain live/at high potential when the switch is opened OR The user may get an electric shock if there is an electrical fault.	M1

Paper 2 Section B [16 marks]

7(a)	 Correct plotting of points: 1 mark Correct graph: 1 mark	
(b)	For the first 10 seconds, the speed is constant or zero acceleration.	M1
	For the next15 seconds, the speed is decreasing uniformly or constant deceleration.	M1

(c)	$a = (v - u) / t = (0 - 6) / 15$ $\qquad = -0.4 \text{ m} / \text{s}^2$ deceleration = <u>0.4 m / s^2</u>	M1 A1
(d)	total distance = area under graph $\qquad = (1/2 \times 15 \times 6) + (10 \times 6)$ $\qquad = 105 \text{ m}$ average speed = total distance / total time $\qquad = 105 / 25$ $\qquad = \underline{4.2 \text{ m} / \text{s}}$	 M1 A1
8(a) (i)	Melting.	M1
(ii)	The heat is absorbed by the solid substance R to weaken the strong inte 7=-lkrmolecular bonds. The heat is also absorbed to increase the internal potential energy of the particles. There is no increase in the internal kinetic energy of molecules. <u>Note</u>: Accept any 2 points.	M1 M1
(iii)	<table><tr><th>Boiling</th><th>Evaporation</th></tr><tr><td>• Occurs at a particular temperature</td><td>• Occurs at any temperature</td></tr><tr><td>• Relatively fast</td><td>• Relatively slow</td></tr><tr><td>• Takes place throughout the liquid</td><td>• Takes place only at the liquid surface</td></tr><tr><td>• Bubbles are formed in the liquid</td><td>• No bubbles are formed in the liquid</td></tr><tr><td>• Temperature remains constant</td><td>• Temperature may change</td></tr><tr><td>• External thermal energy source needed</td><td>• External thermal energy source not needed</td></tr></table>	M1
(b) (i)	Microwaves	M1
(ii)	$3 \times 10^8 \text{ m} / \text{s}$	M1
(iii)	$\lambda = v / f = (3 \times 10^8) / (6000 \times 10^6)$ $\qquad = \underline{0.05 \text{ m}}$ <u>Note</u>: 1 mark is awarded if student used speed divided by frequency to find the wavelength.	M1 A1
9(a)	meter 1: Ammeter and meter 2: Voltmeter	M2
(b)	Variable resistor (rheostat) / switch. The rheostat is used to vary the resistance of the circuit so that the current flowing through the circuit can be varied / The switch is required to open the circuit to stop the current from flowing continuously.	M1 M1
(c) (i)	The voltage is directly proportional to the current / As current increases, the voltage also increases uniformly (linearly).	M1
(ii)	4.8 V	M1

(iii)	P = V x I = 4.8 x 1.5	M1
	= <u>7.2 W</u>	A1