Name	Class				Index Number		

BROADRICK SECONDARY SCHOOL

SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

PRELIMINARY EXAMINATION 2019

SCIENCE (PHYSICS/CHEMISTRY) 5076/01

Paper 1 Multiple Choice September 2019

Additional Materials: Multiple Choice Answer Sheet 1 hour

READ THESE INSTRUCTIONS FIRST

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

There are **forty** 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 OTAS answer sheet.

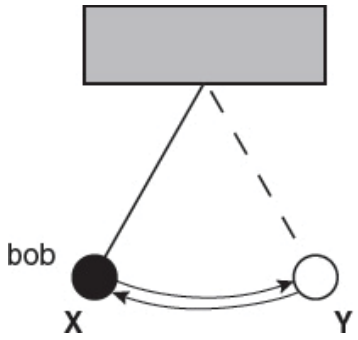
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

Setter: Mr Foo SK and Mrs Kerensa Chia

This question paper consists of **1X** printed pages including this page.

[Turn over

1 One oscillation of a swinging pendulum occurs when the bob moves from X to Y and back to X again.



Using a stopwatch, which would be the most accurate way to measure the time for one oscillation of the pendulum?

A Time 20 oscillations and divide by 20.

B Time 20 oscillations and multiply by 20.

C Time one oscillation.

D Time the motion from X to Y, and double it.

2 Which of the following is a vector quantity?

A a mass of 2.0 kg

B a temperature of –10 °C

C a weight of 15 N

D an average speed of 20 m/s

3 The circuit of a motor racing track is 3.0 km in length. In a race, a car goes 25 times round the circuit in 30 minutes.

What is the average speed of the car?

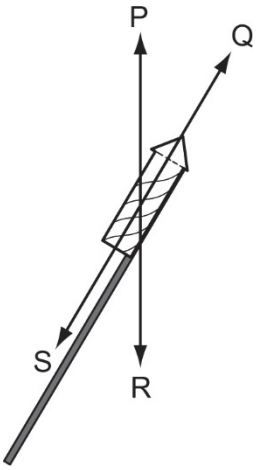
A 75 km / hour

B 90 km / hour

C 150 km / hour

D 750 km / hour

4 The diagram shows a firework rocket.



As the rocket flies through the air, three forces act on it. These forces are weight, thrust and air resistance.

What are the three forces?

	thrust	**air resistance**	**weight**
A	P	R	S
B	P	S	R
C	Q	R	S
D	Q	S	R

5 The mass and the volume of a bar made from metal **X** are measured.
The masses and volumes of four other bars are measured.

Which bar is made from a metal with a density that is double that of **X**?

	mass compared with **X**	volume compared with **X**
A	double	half
B	half	same
C	same	double
D	same	half

6 Which of the following statements about *inertia* is true?

A A body has inertia because of frictional forces acting on it.

B A body will have inertia even if placed in a vacuum.

C Inertia is a force that a body at rest will encounter that prevents it from starting to move.

D The inertia of a body keeps the body moving at constant velocity.

7 A body is suspended freely from a pivot.

Where can the centre of gravity of this body be found?

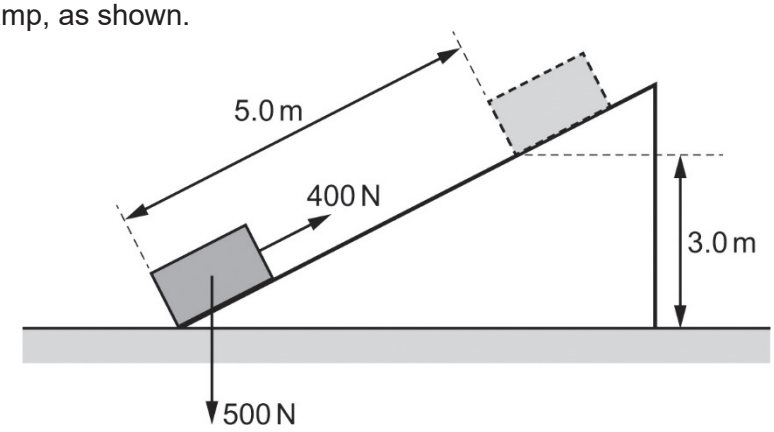
A at the left of pivot

B at the right of pivot

C vertically above the pivot

D vertically below the pivot

8 Work is done when a force of 400 N pulls a crate of weight 500 N at a constant speed along a ramp, as shown.



Part of the work done increases the gravitational potential energy ***E*** of the crate and the rest is work done ***W*** against friction.

What are the values of ***E*** and ***W***?

	E / J	**W** / J
A	1500	500
B	1500	2000
C	2000	2500
D	3500	500

9 Which of the following statements correctly explain why a balloon becomes smaller when it is kept in a freezer?

A The air molecules in the balloon are moving slower and colliding with each other less frequently.

B The air molecules in the balloon contract.

C The average distance between the air molecules in the balloon decreases.

D The number of air molecules in the balloon decreases.

10 A beaker of water is heated at its base.

Why does the water at the base rise?

A It contracts and becomes less dense.

B It contracts and becomes more dense.

C It expands and becomes less dense.

D It expands and becomes more dense.

11 Four beakers contain equal volumes of water at two different temperatures. The beakers are placed in the open air.

From which beaker does water evaporate the fastest?

	surface area of beaker / cm^2	temperature of water / ^oC
A	20	20
B	20	40
C	40	20
D	40	40

12 Which of the following statements about waves is true?

A The frequency of the waves always increases as its wavelength decreases.

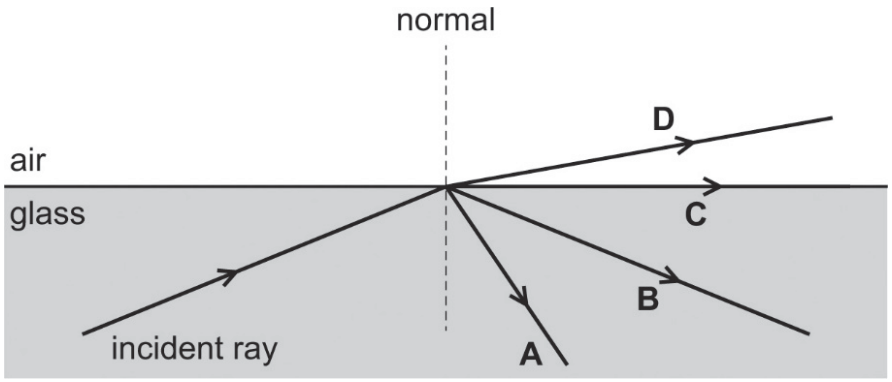
B The period of a wave is the time taken for the particles to travel from the maximum positive displacement to the maximum negative displacement.

C They transfer energy with the transfer of particles of matter.

D None of the above.

13 Light travelling in glass is incident on a glass-air boundary. The angle of incidence of the light is greater than the critical angle.

Which arrow shows the direction of the light after it is incident on the boundary?



14 Which statement about electromagnetic waves is correct?

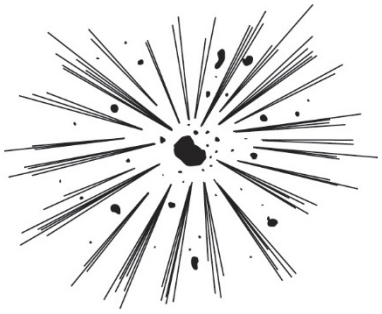
A All electromagnetic waves have speeds in air of approximately 3×10^8 m/s.

B In air, some electromagnetic waves travel faster than light.

C The electromagnetic waves with the largest wavelength are in the infra-red region.

D The electromagnetic waves with the smallest wavelength are in the X-ray region.

15 An explosion experiment is carried out on Earth. The experiment is repeated by an astronaut in space where there is no gas or air.



How does the explosion sound to the astronaut in space?

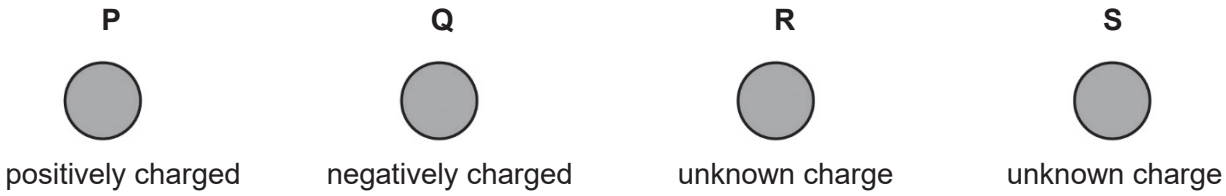
A completely silent

B slightly louder than on Earth

C slightly quieter than on Earth

D the same loudness as on Earth

16 The diagram shows four charged objects, **P**, **Q**, **R** and **S**.



It is found that P attracts R but repels S.

Which statement is correct?

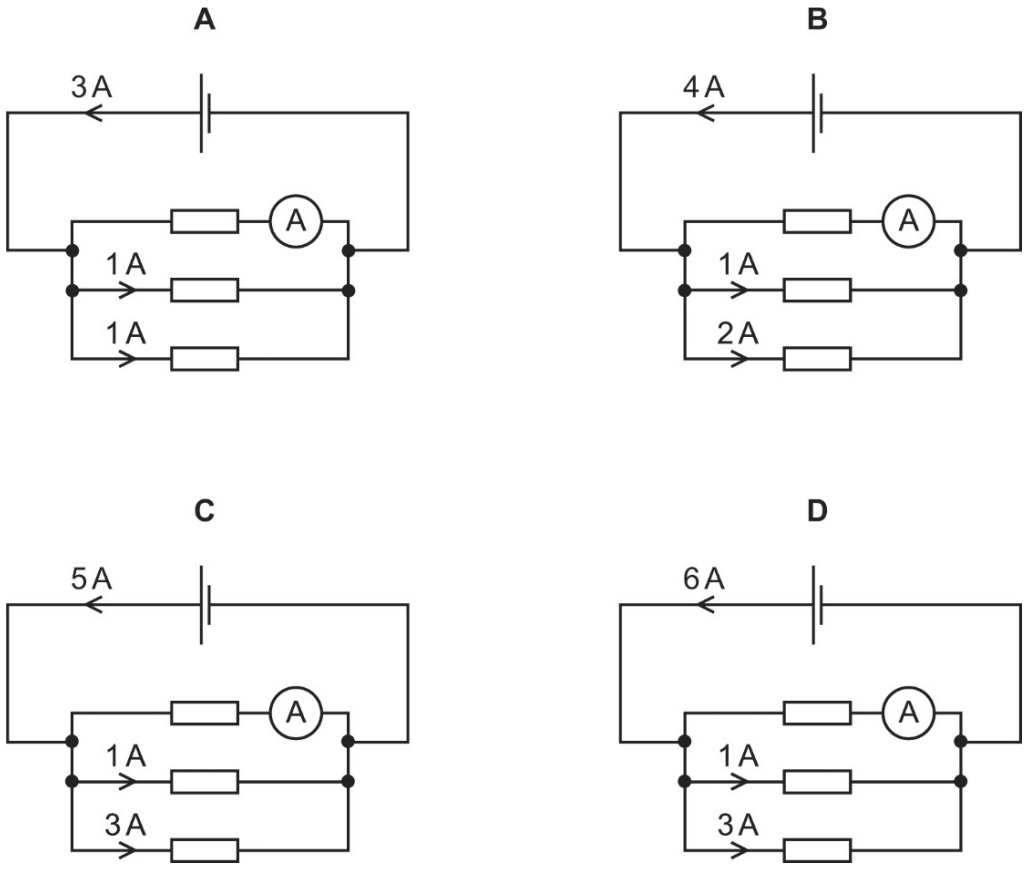
A Q attracts R.

B Q repels S.

C R attracts S.

D R repels S.

17 In which circuit does the ammeter read 2 A?



[Turn over

18 A metal wire has length l and cross-sectional area **A**.

Which of the following is proportional to the resistance?

A l + A

B l / A

C A × l

D A / l

19 The current in a hand dryer is 14 A. It is switched on for two minutes.

How much charge flows through the hand dryer?

A 0.14 C

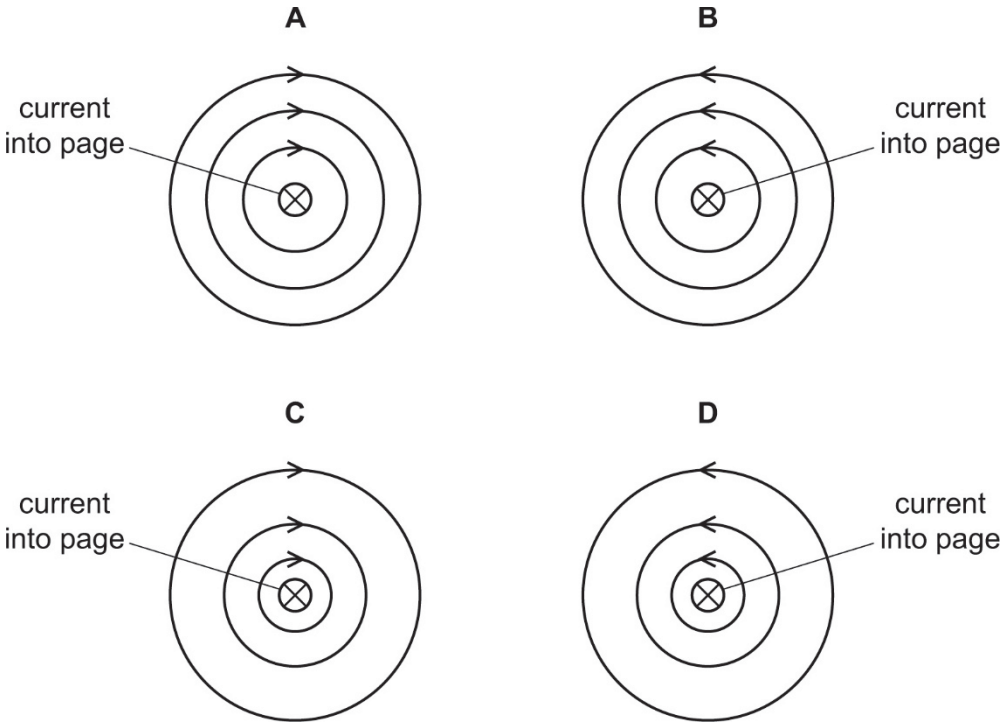
B 7 C

C 28 C

D 1680 C

20 An electric current in a wire is into the page.

Which diagram shows the shape and direction of the magnetic field around the wire?



21 – 40 Sci Chem

[Turn over

Name	Class				Index Number		

BROADRICK SECONDARY SCHOOL
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)
PRELIMINARY EXAMINATION 2019

SCIENCE(PHYSICS) 5076/02

Paper 2 September 2019

Candidates answer on the Question Paper 1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST
Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid. If working is needed for any question it must be shown with the answer. Omission of essential working will result in loss of marks. Calculators should be used where appropriate.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer any **two** questions.
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.
[Take g to be 10 m/s^2 or the weight of 1 kg to be 10 N]

Target Grade:
Actual Grade:
For Examiner's Use
65

Setter: Mr Foo SK

Section A (45 Marks)

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

1 A truck travelling along a road experiences air resistance and friction as shown below in Fig 1.1.

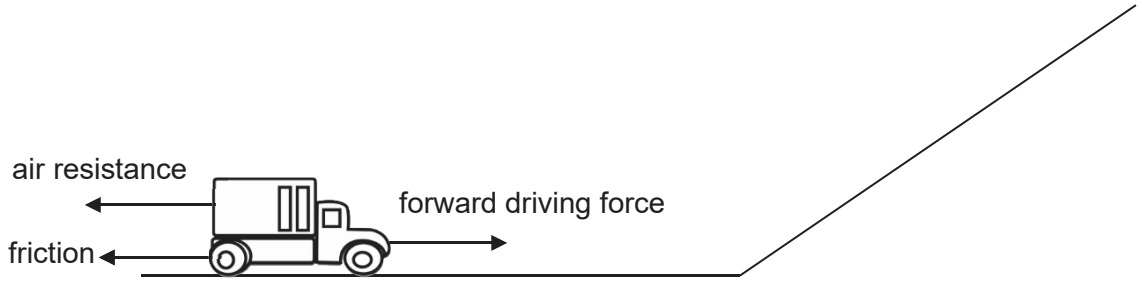
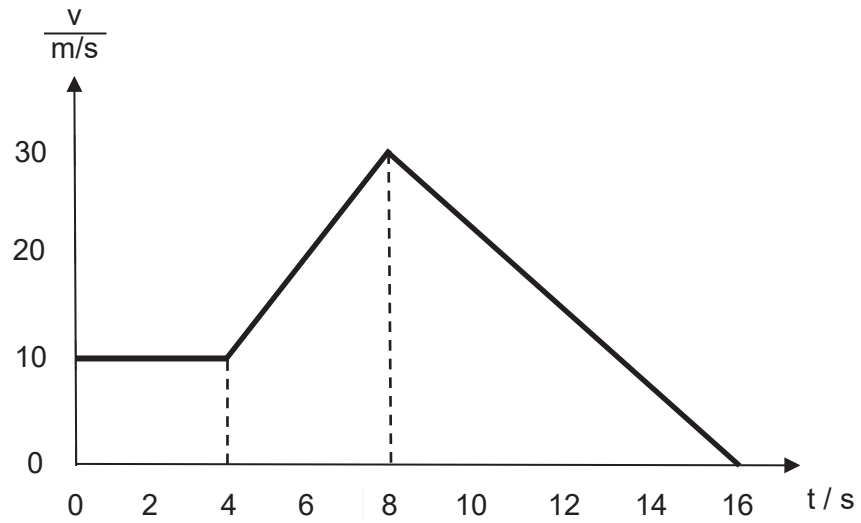


Fig 1.1

The graph below shows how the velocity of the truck varies with time.



The forward driving force by the engine is constant throughout the whole journey of 16 seconds.

(a) During which time interval are the forces on the truck balanced?

…… [1]

(b) The truck has a mass of 1500 kg.
Calculate the net force at t = 6 s.

force = …… N [2]

(c) At what time does the truck start to travel up the slope? Explain your answer.

……..

……..

……..

…… [2]

(d) Hence, or otherwise, calculate the length of the slope.

length = …… m [2]

2 **(a)** Define pressure and state its S.I. unit.

……..

……..…… [2]

(b) Sally weighs 480 N. The area of the heel of her shoes is 1 cm^2.

Calculate the pressure exerted by the heel on the ground.
Give your answer in its S.I. unit.

pressure = …… [2]

3 A builder needs to determine the density of a solid cube of wood.
He places the 50 cm mark of a uniform metre rule on a pivot, so that the rule balances.
He then places the cube on the rule with its centre of gravity directly above the 75 cm mark.

A mass of 0.050 kg is moved along the rule until balance is restored.
This is shown in Fig 3.1.

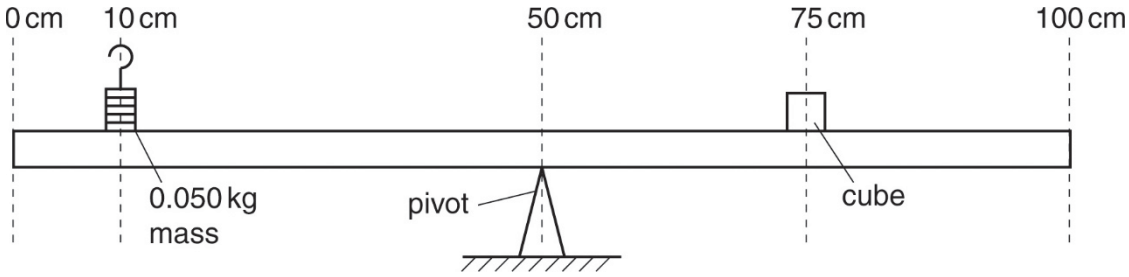


Fig 3.1 (not to scale)

The rule is balanced when the 0.050 kg mass is at the 10 cm mark.

(a) Explain why the rule originally balances when the pivot is placed at the 50 cm mark.

……

……

…… [2]

(b) Calculate the mass of the cube.

mass = …… kg [3]

(c) The cube has a volume of 1.6×10^{-4} m^3.
Determine the density of the wood.

density = …… kg/m^3 [2]

4 **(a)** The time required to bake large potatoes in an oven may be significantly reduced if a long steel spike was placed through the center of each potato before putting them in an oven.

Explain why this process reduces the cooking time.

……..

……..

……..

…… [2]

(b) Aluminium foil-coloured blankets can be used to keep mountaineers warm.

Explain this statement.

……..

……..

……..

…… [3]

5 A small quantity of crushed substance **X** was allowed to warm up from the temperature of −3°C using a 300 W heater. Fig 5.1 shows how the temperature of the substance varies with time.

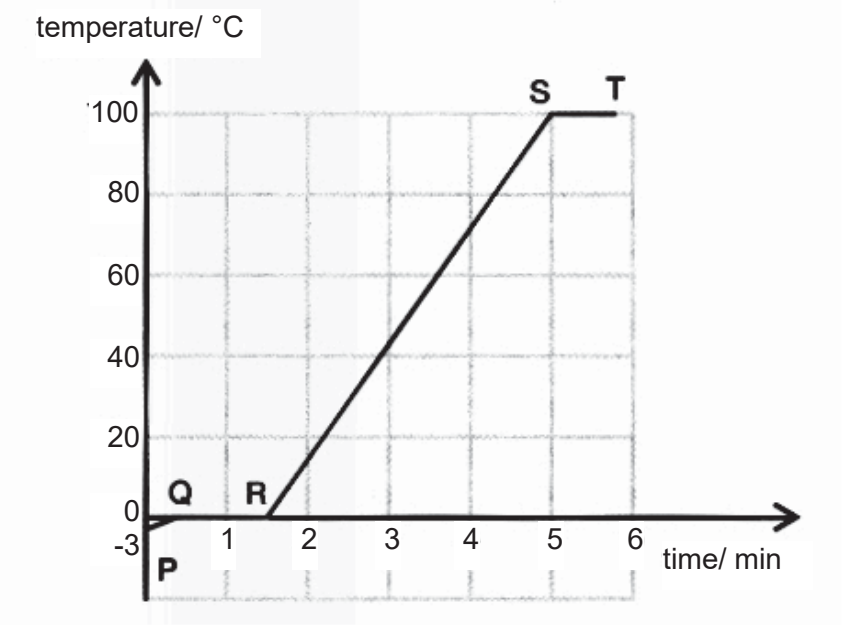


Fig 5.1

(a) What is the melting and boiling point of the substance **X**?

…… [2]

(b) Explain why the temperature remained constant for the period between **Q** and **R**.

……..

…… [1]

(c) If the 300 W heater in the above experiment is replaced by a 600 W heater, describe and explain the difference seen on the graph during the sections **QR** and **RS**.

……..

……..

……..

…… [3]

6 **(a)** In the swimming pool at a new leisure centre there is a 'wave machine' as shown in Fig 6.1.

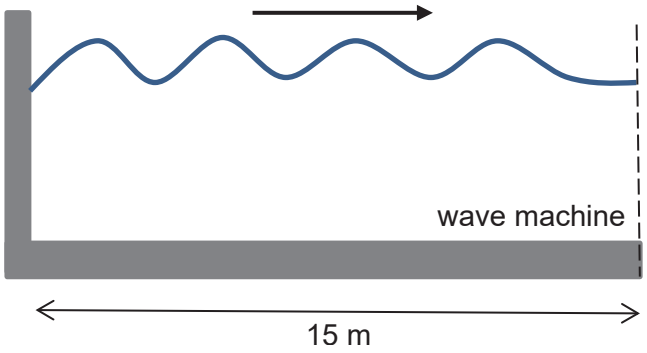


Fig 6.1

This machine makes waves in the water at one end of the pool at a frequency of 0.25 Hz. The waves take 12.0 s to travel 15 m along the pool.

(i) Define *transverse waves.*

……..

……... [1]

(ii) Calculate the wavelength of the waves.

wavelength = …… m [2]

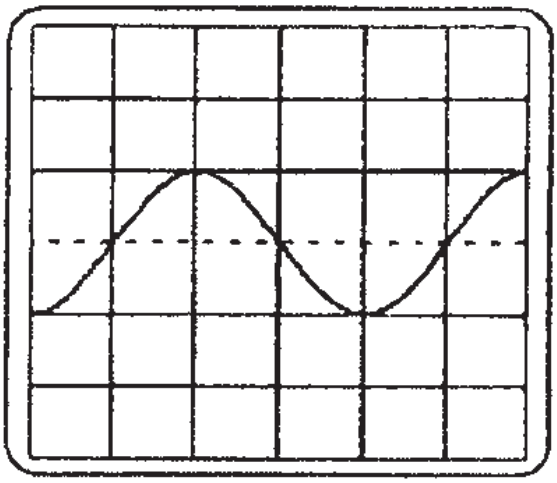
(iii) The swimming pool operator wants to reduce the speed of the waves.
He decided to reduce the frequency of the 'wave machine'.
Explain why he will be unsuccessful in this attempt?

……..

……..

…… [1]

(b) Fig 6.2 shows an oscilloscope trace for a sound with a frequency of 5000 Hz.



5000 Hz

Fig 6.2

On Fig 6.2, draw the trace for a louder sound with a frequency of 10 000 Hz. [2]

7 Fig 7.1 shows Dylan walking on a carpet and approaching a metal door, which is earthed.

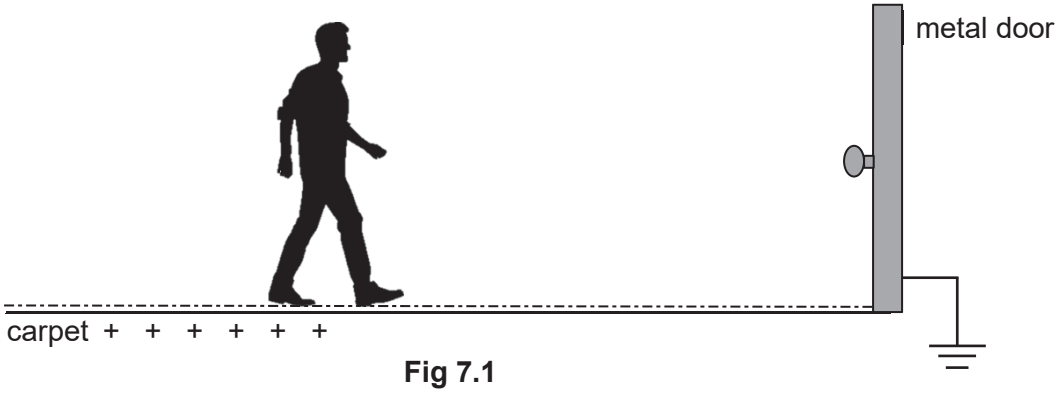


Fig 7.1

(a) It is found that the carpet on which Dylan has walked on carries positive charges. Explain how these charges are formed.

……..

……..

…… [2]

(b) Explain why Dylan gets a momentary electric shock when he is close to the metal door as shown in Fig 7.2.

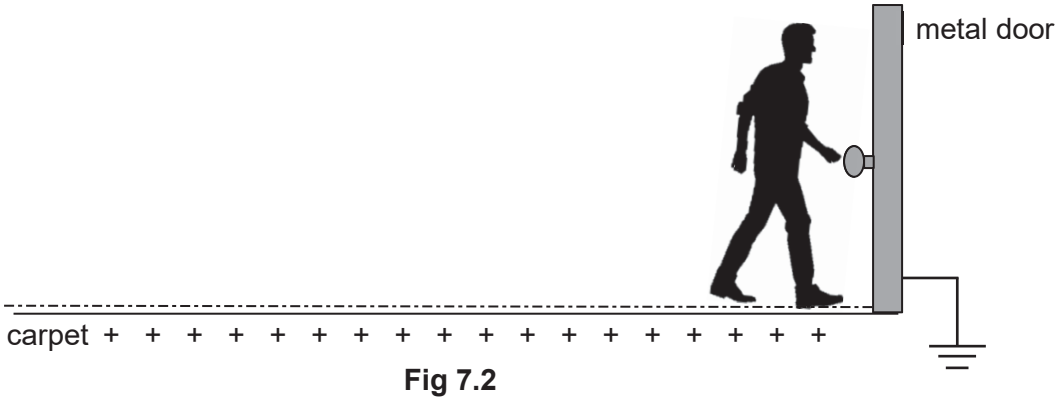


Fig 7.2

……..

……..

…… [2]

8 Fig 8.1 shows an electric circuit containing two identical lamps and a resistor. The lamps can operate at normal brightness when connected to a 6 V cell and resistor R.

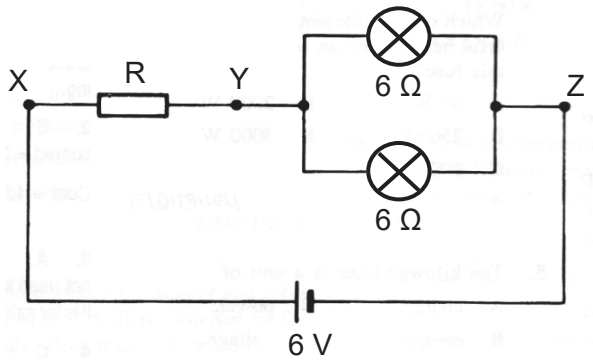


Fig 8.1

(a) Calculate the combined resistance of the two light bulbs.

resistance = …… Ω [2]

(b) The current flowing through the battery is 1.0 A.

Find the value of R.

R = …… Ω [2]

(c) Comment on the level of brightness of the remaining bulb if one of the light bulbs is removed. Explain your answer.

……..

……..

…… [2]

Section B (20 Marks)

Answer any **two** questions from this section.

Write your answers in the space provided.

9 Fig 9.1 shows a ray of blue light passing from air into a glass optical fibre and refracting at the surface.

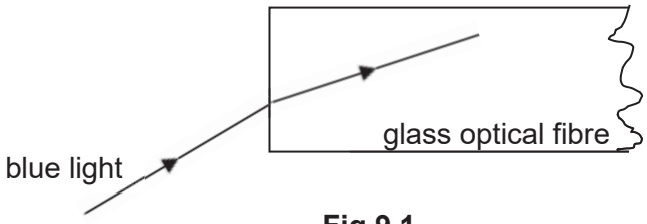


Fig 9.1

(a) Describe how the wavelength and the frequency of the blue light change after it entered the optical fibre.

……...……...

……...……...

…… [2]

(b) The refractive index of the optical fibre is 1.5.
Calculate the speed of the blue ray in the optical fibre.

speed = …… [2]

(c) Fig 9.2 shows the same blue ray travelling in the optical fibre. The ray strikes the wall of the fibre at *Q*. The angle between the ray and the wall of the fibre is 7°.

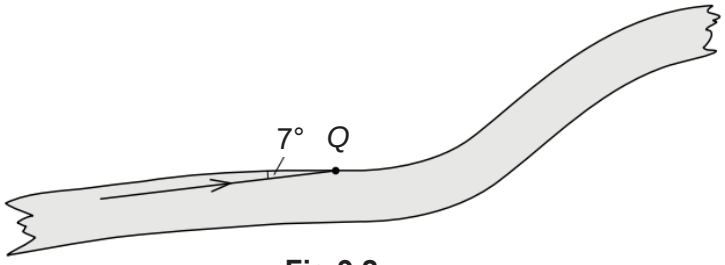


Fig 9.2

(i) Calculate the critical angle of the optical fibre.

critical angle = …… [2]

(ii) State and explain how the blue ray travels after hitting *Q*.

……...……...

……...……...

……...……...

…… [2]

(d) Explain why diamond, which has a refractive index higher than glass, is a more suitable material for the optical fibre, in terms of ensuring that light entering the optical fibre at one end will only leave the fibre at the other.

……...……...

……...……...

……...……...

…… [2]

10 An electric kettle has a power rating of 2.4 kW when it is connected to a 240 V power supply. To make a cup of tea the kettle is switched on for three minutes. During a morning it is used five times to make cups of tea.

(a) Sketch a circuit diagram to show how the kettle is connected to the 240 V power supply. In your diagram, show clearly how the live wire, the neutral wire, the earth wire, a switch and a fuse are connected. [3]

(b) If one unit of electricity costs 20 ¢, calculate the total cost of using the kettle in the morning.

cost = …… [2]

(c) The kettle is connected to the mains using a standard plug.

(i) Write down the equation which relates current, power and voltage.

…… [1]

(ii) Calculate the current used by the electric kettle when it is operating. Show clearly how you obtain your answer.

current = …… [1]

(iii) Should a 3 A fuse or a 13 A fuse be fitted?

…… [1]

(d) Explain the function of the earth wire.

……..……...

……..……...

……..……...

…… [2]

11 Fig 11.1 below shows an apparatus used to demonstrate the motor effect. *P* is a short length of bare copper wire resting on two other bare copper wires.

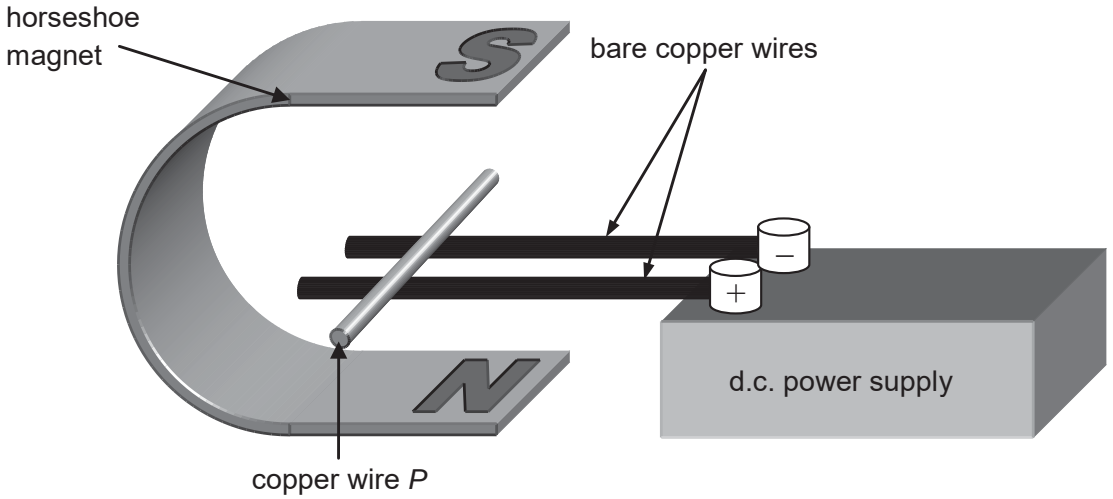


Fig 11.1

(a) State the direction the copper wire *P* would roll when the d.c. power supply is switched on.

…… [1]

(b) Explain the observation made in **(a)**.

……...……...

……...……...

…… [2]

(c) What difference would you notice if the following changes are made:

(i) the current is reversed,

…… [1]

(ii) the current is decreased,

…… [1]

(iii) the magnetic field is reversed.

…… [1]

(d) State and explain what is observed if the power supply is changed to an alternating current that has a low frequency.

……..……...

……..……...

……..……...

…… [2]

(e) Fig 11.2 below shows a positive charge moving into a magnetic field, the direction of which is perpendicular to and into the plane of the paper. Fig 11.3 shows a negative charge moving into a magnetic field, the direction of which is perpendicular to and out of the plane of the paper.

In the two figures below, draw the paths of the two charges in the respective magnetic fields. [2]

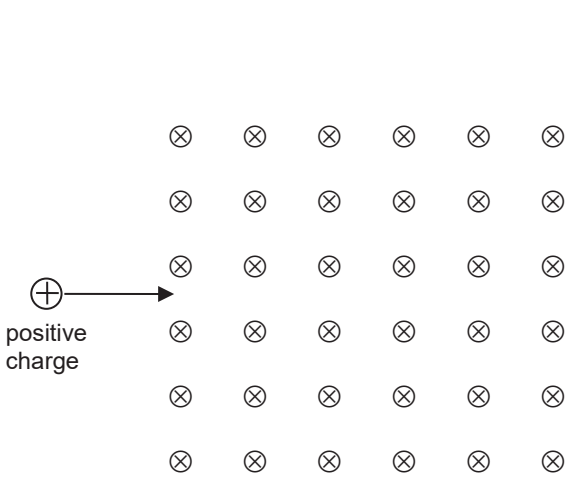


Fig 11.2

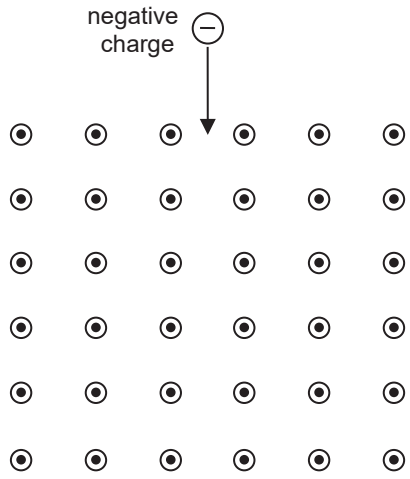


Fig 11.3

End of Paper

Paper 1 (20 Marks)

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

Paper 2 Section A (45 Marks)

1 **(a)** t = 0 s to t = 4 s. [1]

(b) gradient at t = 6 s = 5 m/s^2 [1]
F = m a = 1500 x 5 = 7500 N [1]

(c) The truck is traveling up the slope from t = 8.0 s. [1]
Part of the weight is acting against the motion thus deceleration will occur. [1]

(d) Distance travelled = area under graph from t = 8 s to 16 s [1]
= ½ x (16 – 8) (30) = 120 m [1]

2 **(a)** Pressure is force per unit area. [1]
SI unit is Pa (or N/m^2) [1]

(b) area = 1 cm^2 = 0.0001 m^2 [1]
P = F / A
= 480 / 0.0001 = 480 000 Pa [1]

3 **(a)** Uniform metre. CG in the middle (ie at the 50 cm mark), [1]
weight of rule through CG, no turning effect (moment) [1]
due to the weight of the rule. Thus the rule balances.

(b) sum of clockwise moments = sum of anticlockwise moments [1]
0.050 × (10) × 40 = m2 × (10) × 25 [1]
0.080 kg [1]

(c) ρ = m / V
0.08 / 1.6 × 10^{-4} [1]
= 500 kg/m^3 [1]

4 **(a)** Steel is a good conductor of heat. [1]
It conducts heat quickly from the oven to the inside of the potatoes, [1]
reducing cooking time.

(b) Aluminium is a shiny metal. [1]
thus it is a poor emitter of heat [1]
able to reduce the body heat from being lost. [1]

5 **(a)** The **melting point** of X is **0°C** and the **boiling point** of X is **100°C**. [2]

(b) During the period between Q and R, the **heat energy is absorbed to weaken the intermolecular forces**. [1]

(c) Since **thermal energy is supplied at a higher rate,** [1]
the length of **QR will be shorter** as the time taken for melting [1]
to complete will be lesser.
The slope of **RS will be steeper as the liquid will reach the boiling point faster**. [1]

6 **(a)** **(i)** Transverse waves are waves that **travel in a direction perpendicular to the direction of vibration.** [1]

(ii) v = 15 / 12
= 1.25 m/s [1]
λ = v / f = 1.25 / 0.25
= 5.00 m [1]

(iii) Since the **depth/medium of the pool remains unchanged**, the speed of the waves will not change. [1]

(b) Amplitude increased. [1]
Period halved. (showing 3 waves) [1]

7 **(a)** Electrons are transferred from the carpet to Dylan due to charging by friction. [1]
Since carpet has more positive charges than negative charges, [1]
carpet becomes positively charged.

(b) Dylan accumulates negative charges
and induces positive charges on the surface of the door knob/
door knob is positively charged. [1]

Since unlike charges attract,
negative charges from his body flows from his body to the metal door [1]
causing him to feel an electric shock.

8 **(a)** $1/R_t = 1/6 + 1/6 = 1/3$ [1]
$R_t = 3\Omega$ [1]

(b) R = (6−3) / 1 [1]
= 3 Ω [1]

(c) Remaining bulb is brighter. [1]
More current flows through this bulb now. [1]

Paper 2 Section B (20 Marks)

9 **(a)** The frequency remained unchanged. [1]
The wavelength decreases. [1]

(b) $n = c / v$
$v = 3.0 \times 10^8$ m/s / 1.5 [1]
$= 2.0 \times 10^8$ m/s [1]

(c) **(i)** $n = 1 / \sin c$
$c = \sin^{-1} 1 / 1.5$ [1]
$= 42°$ (41.8°) [1]

(ii) The blue ray will be totally internally reflected. [1]
This is because the angle of incidence at Q is greater than the critical angle. [1]

(d) Diamond will have a smaller critical angle [1]
and therefore a higher chance of undergoing total internal reflection. [1]

10 **(a)** Correct labelled diagram [3]

(b) Cost = 2.4 x (15 / 60) x 20 [1]
= 12 cents [1]

(c) **(i)** power = voltage x current [1]
reject answer if students did not state what the letters denote

(ii) 10 A [1]

(iii) 13 A [1]

(d) When the metal casing becomes 'live' due to a fault,
the excessive current will flow to the ground via the earth wire [1]
thus preventing anyone getting an electric shock by touching
the 'live' metal casing [1]

11 **(a)** Roll to the ***right*** (towards the d.c. power supply) [1]

(b) When the power supply is switched on,
current flows through wire *P* in a direction that is
into the plane of the ***page*** which is ***perpendicular*** to
the ***magnetic field*** direction (upward). [1]
By Fleming's Left-Hand-Rule, a ***force to the right*** acts on wire P. [1]

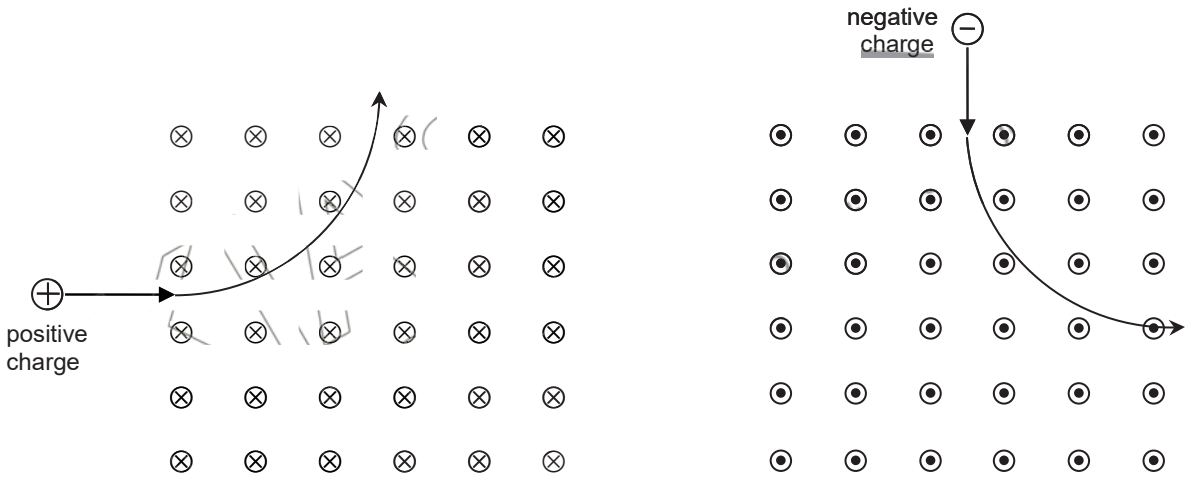
(c) **(i)** P rolls to the **left**. [1]

(ii) P rolls **more slowly**. [1]

(iii) P rolls to the **left**. [1]

(d) *P* will ***oscillate left and right repeatedly*** as long as the a.c. is supplied. [1]
The ***periodic change in direction of*** the ***current*** in wire *P*
will ***cause*** the ***force*** on the wire to
switch from left to right to left repeatedly. [1]

(e) [1] **[1]**



End of Paper