Bukit Batok Secondary School

PRELIMINARY EXAMINATIONS 2018

SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

SCIENCE (PHYSICS / CHEMISTRY)

Paper 1 Multiple Choice

5076 / 01
24 August 2018
0745 – 0845
1 hour

Additional materials: Multiple Choice Answer Sheet

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 Answer Sheet in the spaces provided.

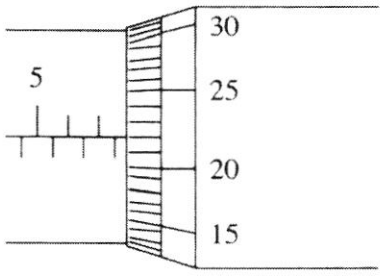
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D.**
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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.

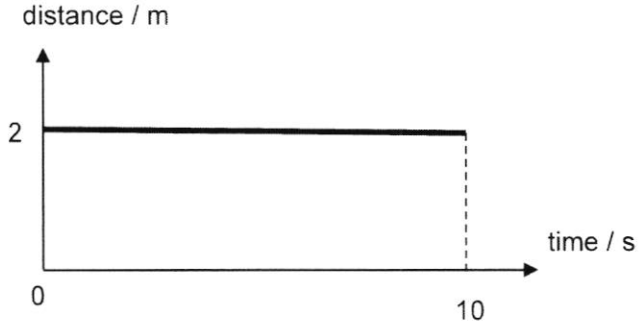
Electronic calculators may be used.
A copy of the Data Sheet is printed on page 15.
A copy of the Periodic Table is given at the end of the paper.

1 What is the reading shown by the micrometer screw gauge?



A 5.272 mm
B 5.72 mm
C 7.22 mm
D 7.72 mm

2 Which of the following best describes the distance-time graph below?

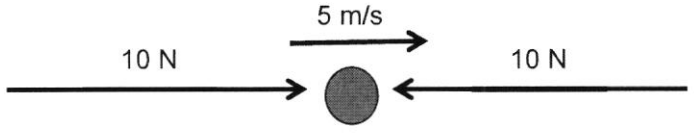


A An object at rest.
B An object moving with a constant speed of 2.0 m/s.
C An object moving with a constant velocity of 2.0 m/s.
D An object moving with a constant acceleration of 2.0 m/s^2.

3 Which of the following consist of only vector quantities?

A mass, distance, time
B friction, velocity, electromotive force
C tension, speed, energy
D weight, displacement, electrostatic force

4 A particle moving at constant speed of 5 m/s is being acted on by two 10 N forces as shown.



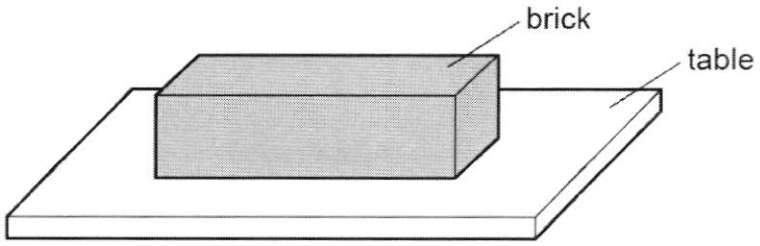
The particle will

A continue to move at 5 m/s in a straight line.
B increase its speed gradually.
C slow down gradually and stop.
D stop immediately.

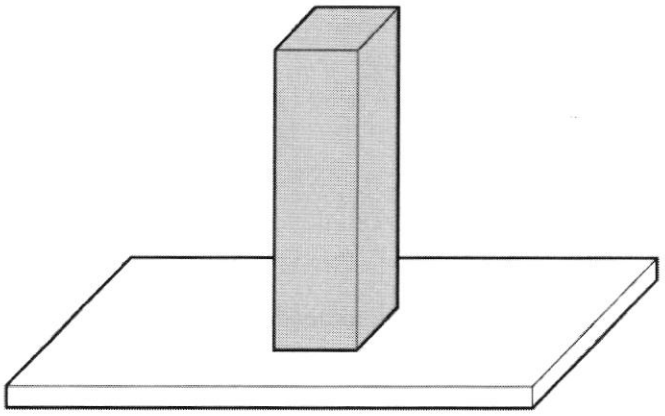
2

Apply past knowledge to new situations

5 A brick with flat, rectangular sides rests on a table.



The brick is now turned so that it rests on the table on its smallest face.



How has this affected the force and the pressure exerted by the brick on the table?

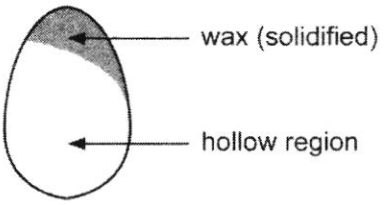
	force	pressure
A	increased	increased
B	increased	unchanged
C	unchanged	increased
D	unchanged	unchanged

6 When solid A of mass 15 g is immersed in a displacement can filled with water, it displaced the same volume of water as solid B of mass 10 g. Which of the following best describes the densities of solid A and solid B?

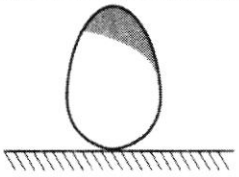
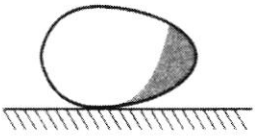
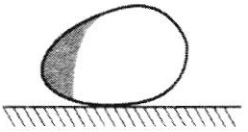
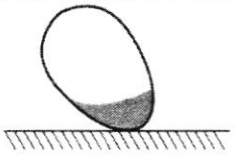
A Solid A and solid B have the same density.
B Density of solid A is 0.667 times the density of solid B.
C Density of solid A is 1.5 times the density of solid B.
D Density of solid A is 5 times the density of solid B.

Apply past knowledge to new situations

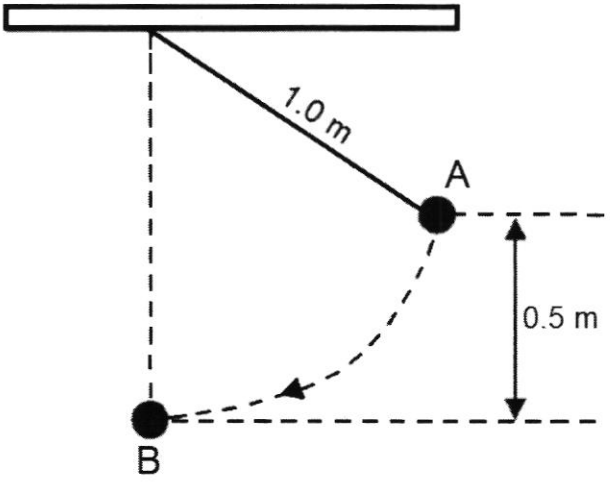
7 An empty egg shell has molten wax solidified inside it as shown in the figure below.



In which position is the egg shell most stable when placed on a flat, horizontal surface?

A	B	C	D
			

8 A pendulum with length of 1.0 m is displaced to position A and released as shown.



Ignoring air resistance, what is the speed of the pendulum bob as it passes its lowest point B?

A 1.5 m/s
B 2.3 m/s
C 3.2 m/s
D 4.1 m/s

9 A cube of ice is heated to water, then to steam.
Which of the following is true?

A The molecules expand as ice changes to steam.
B The molecules move slower as ice changes to steam.
C The molecules move further apart as the ice changes to steam.
D The molecules move closer to one another as ice changes to steam.

Apply past knowledge to new situations

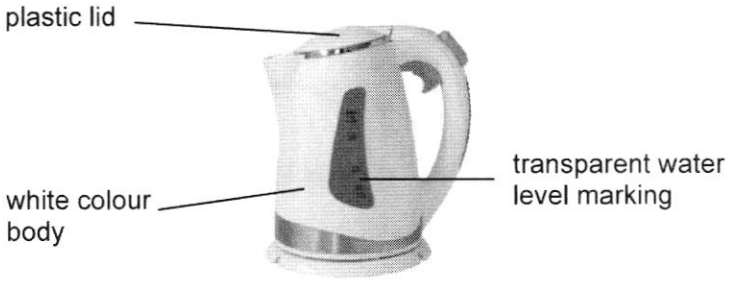
10 A beaker of water is heated at the bottom to form a convection current in the water.
An explanation on how convection occurs contains four statements.

1 Density of expanded water decreases.
2 Warm water that is less dense rises and cold water moves in to replace it.
3 Water at the bottom gains heat and becomes warmer.
4 Water expands.

What is the correct order of these four statements?

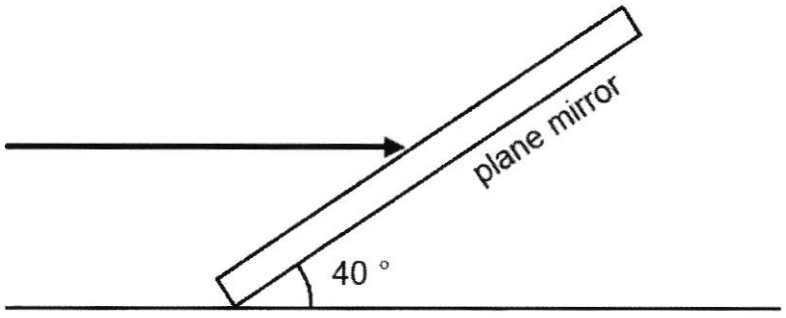
A 3 → 1 → 2 → 4
B 3 → 2 → 4 → 1
C 3 → 4 → 1 → 2
D 3 → 4 → 2 → 1

11 The diagram shows an electric flask.
Which of the following statement is true?



A The plastic lid is a good conductor of heat.
B The plastic lid increases heat loss through convection.
C The white colour exterior reduces rate of heat loss by radiation.
D The transparent water level marking increases heat loss by radiation.

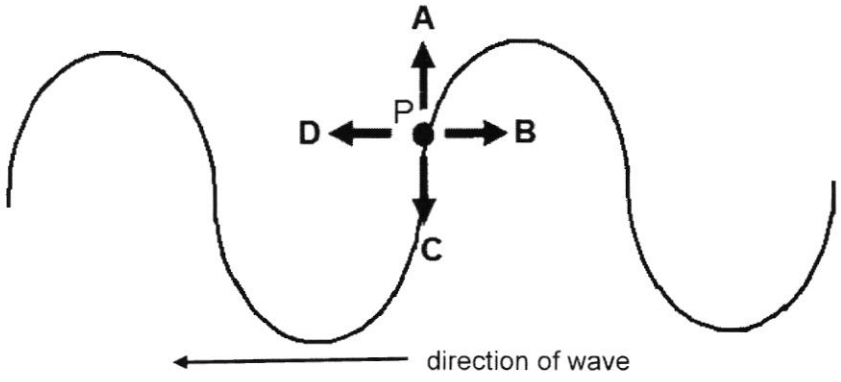
12 A light ray is parallel to the floor and strikes a plane mirror as shown.



What is the angle of incidence?

A 40°
B 50°
C 90°
D 140°

13 A rope is set to oscillate up-and-down to create a transverse wave that moves to the left. At the particular instant below, what is the direction of movement of point P?



14 What is the speed of X-rays in a vacuum?

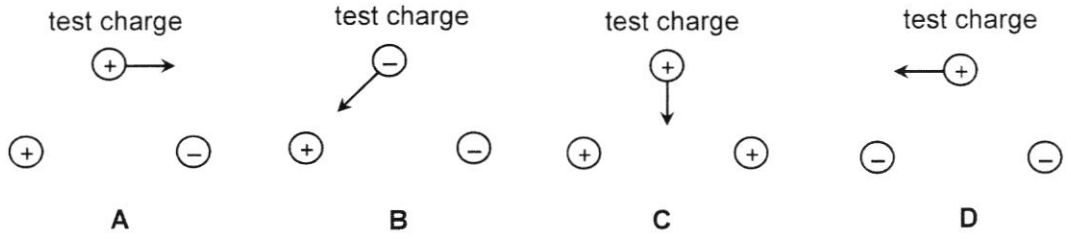
A 380 m/s
B 3.0×10^8 m/s
C Slightly less than 3.0×10^8 m/s
D Slightly more than 3.0×10^8 m/s

15 Which of the following is **not** an application of gamma rays?

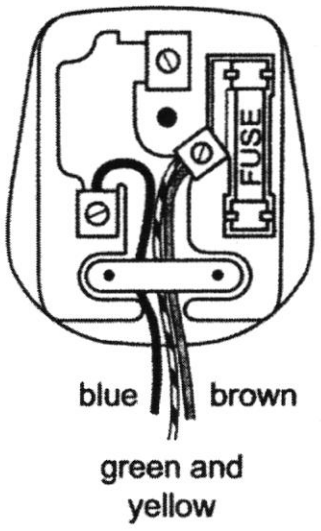
A checking welds
B intruder alarm
C sterilizing equipment
D treatment of cancer

Apply past knowledge to new situations

16 Which of the following diagrams correctly shows the direction of the resultant electrostatic force acting on a small test charge?



17 The plug of the vacuum cleaner is wrongly wired as shown.



What is the effect of using the plug wired this way?

A The fuse in the plug blows.
B The metal case becomes live.
C The vacuum cleaner catches fire.
D The vacuum cleaner does not work.

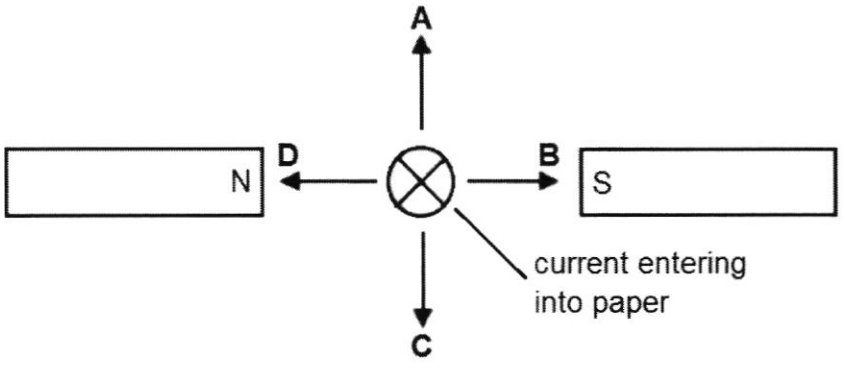
18 Which material is used to make the needle of a plotting compass?

A aluminium
B brass
C iron
D steel

19 One kilowatt-hour of electricity costs $0.20.
How much does it cost to switch on a heater marked "120 V, 3 A" for 90 minutes.

A $0.11
B $2.70
C $64.80
D $108.00

20 The figure below shows a current-carrying conductor between two magnets.
Which of the arrows indicates the direction of the force acting on the conductor?



Name:..... Class register no..... Class:.....

Bukit Batok Secondary School

PRELIMINARY EXAMINATIONS 2018

SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

SCIENCE (PHYSICS / CHEMISTRY) 5076/02

Paper 2 Physics

17 August 2018
0745 – 0900
1 hour 15 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces provided at the top of this page.
Write in dark blue or black pen
You may use a pencil for any diagrams, graphs or rough working
Do not use staples, paper clips, highlighters, 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 in the spaces provided.
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.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
.....	
.....	
Total	

This document consists of **17** printed pages (including cover page).

SECTION A [45 MARKS]
Answer all the questions in the spaces provided.

1 Fig.1.1 below shows the velocity-time graph of a 900 kg car travelling on a straight horizontal road for the first sixty seconds of its journey.

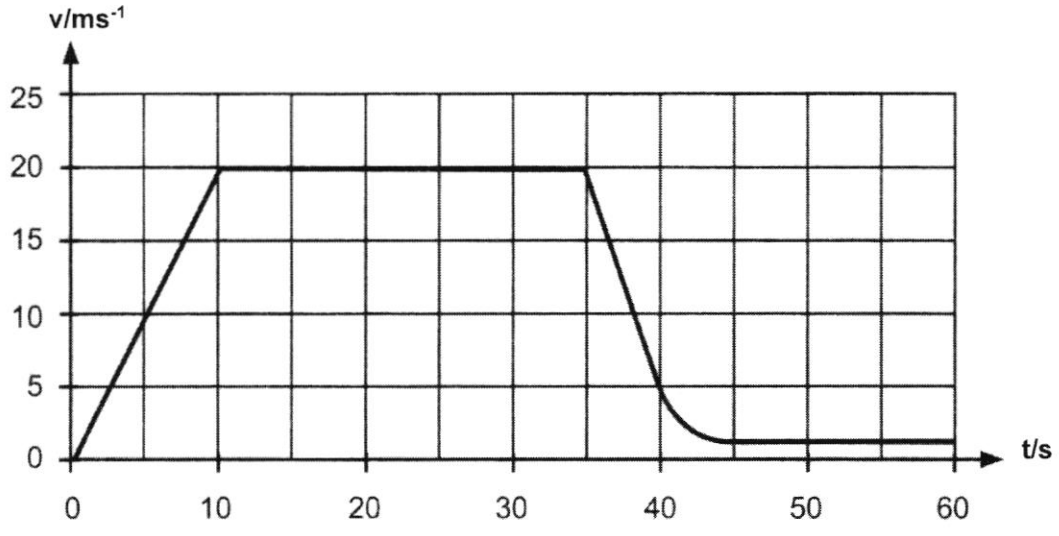


Fig 1.1

(a) Calculate, for the first 10 seconds,

(i) the acceleration of the car,

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

(ii) the resultant force acting on the car.

resultant force = ... N [2]

Apply past knowledge to new situations

(b) State how the braking force relates to the forward driving force,

(i) from t = 35 s to t = 45 s and

.....

.....

(ii) between t = 45 s to t = 60 s.

.....

..... [2]

(c) Determine the total distance travelled by the car during the first 30 s of its journey.

total distance = ... m [2]

2 Fig. 2.1 shows a stone supported by two strings that hang from a rod. The tensions in the two strings are 1.3 N and 2.0 N.

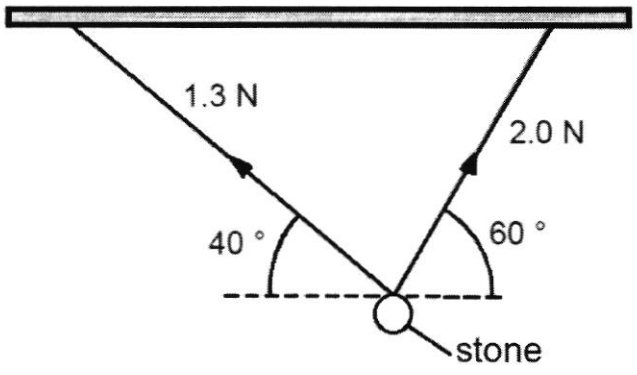


Fig. 2.1 (not drawn to scale)

In the space below, draw a labelled diagram to show the resultant force of the two tensions. Determine the size of the resultant force and the angle between the resultant force and the horizontal.

scale = 1 cm to ..... N

resultant force = ... N

angle = ... [5]

Apply past knowledge to new situations

3 Fig 3.1 shows a barrier found in most carparks. The barrier is in equilibrium. The weight of the pole is 450 N and the centre of gravity of the pole is 1.30 m away from the pivot.

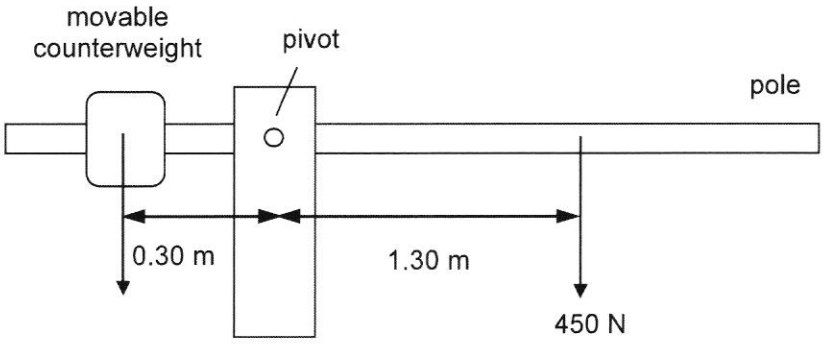


Fig. 3.1

(a) The centre of gravity of the movable counterweight is 0.30 m away from the pivot.

(i) Calculate the weight of the counterweight.

weight of counterweight = ... N [2]

(ii) Hence, calculate the mass of the counterweight.

mass of counterweight = ... kg [1]

(b) Calculate the amount of force acting on the pivot.

force on pivot = ... N [1]

(c) Describe and explain how the gate can be opened.

.....

.....

.....

..... [2]

4 Fig. 4.1 shows a toy car of mass 1.00 kg on a smooth track.
The toy car which is given a slight push starts to move with an initial speed of 2.00 m/s down a smooth track.

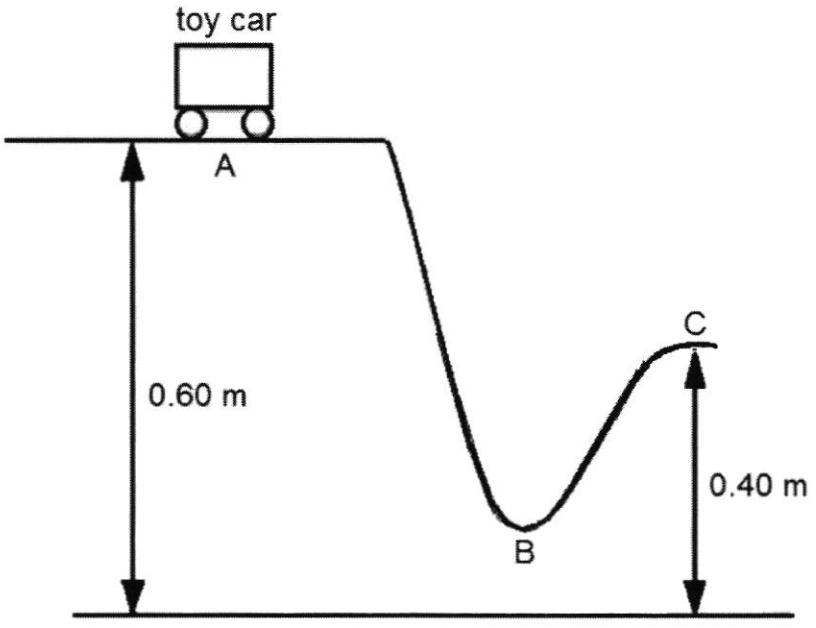


Fig 4.1

(a) State the Principle of Conservation of Energy.

.....

.....

.....

..... [2]

(b) State and explain at which point on the track would the speed of the toy car be at its maximum.

.....

.....

.....

..... [2]

(c) (i) Calculate the gravitational potential energy of the toy car at point **C**.

gravitational potential energy = ... J [1]

(ii) Hence, determine the speed of the toy car at **C**.

speed = ... m/s [2]

5 **(a)** Fig. 5.1 shows how the temperature of an unknown solid substance varies when heated over a Bunsen flame.

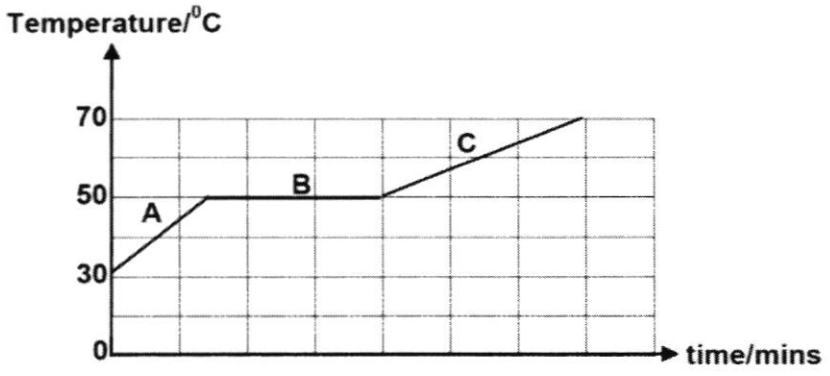


Fig. 5.1

(i) Name the process taking place during stage **B**.

.....[1]

(ii) Describe the movement of the particles at stage **C**.

.....

.....[1]

(iii) Describe the arrangement of the particles at stage **A**.

.....

.....[1]

(b) Explain why a pot of water boils faster with a covered lid.

.....

.....

.....

.....[2]

6 Fig. 6.1 shows a rectangular glass block, **PQRS**, with a refractive index of 1.50. A light ray is incident on the side **PS** of the glass block as shown.

(a) What is meant by the phrase *refractive index of 1.50*?

.....

..... [1]

(b) A ray of light is incident on the side **PS** at 75° and is refracted into the glass block at 40°.

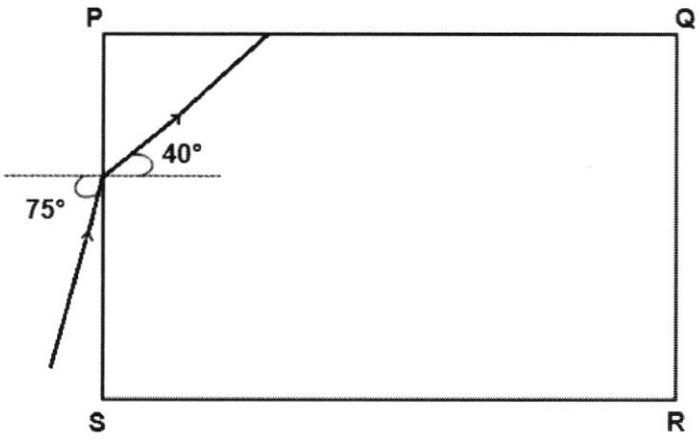


Fig. 5.1

(i) Show that the refractive index of the glass block is 1.50. [1]

(ii) Calculate the critical angle of the glass block.

critical angle = ... ° [2]

(iii) Complete the path of the light ray until it emerges into the air again.
Label all the angles clearly. [2]

7 **(a)** A beam of light is travelling parallel to the axis of a thin lens, as shown in Fig. 7.1. Point **F** is the focal point of the lens.

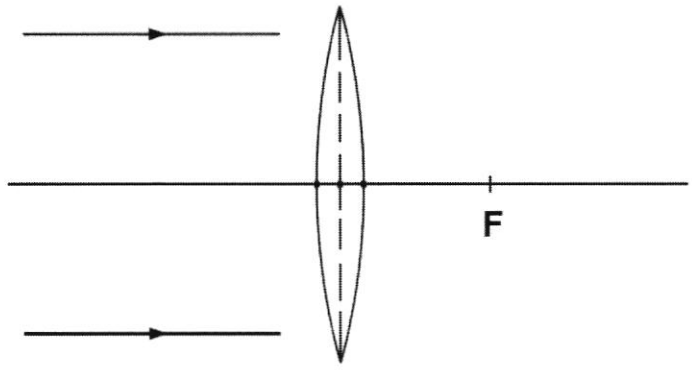


Fig. 7.1

On Fig. 7.1, complete the paths of the two rays after passing through the lens. [2]

(b) In this part of the question, you are required to draw an accurate ray diagram using the grid on Fig. 7.2 for the lens in part **(a)**.

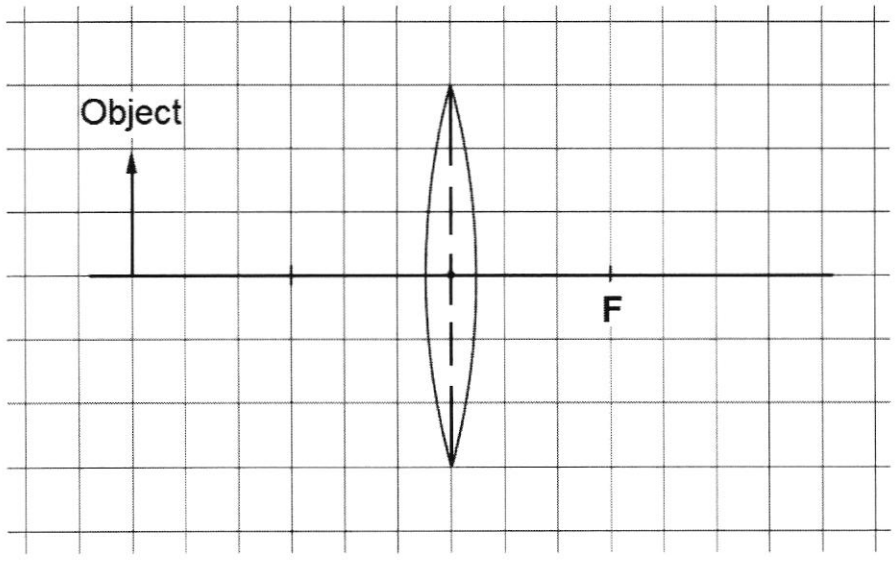


Fig. 7.2

(i) On the diagram, draw two rays from the top of the object through the lens to locate the position of the image. Label the image "I" beside it. [2]

(ii) From your diagram, state **one** similarity about the image and the object.

.....

..... [1]

8 Fig. 8.1 shows an arrangement that is used to remove dust particles from the smoke in a factory chimney.

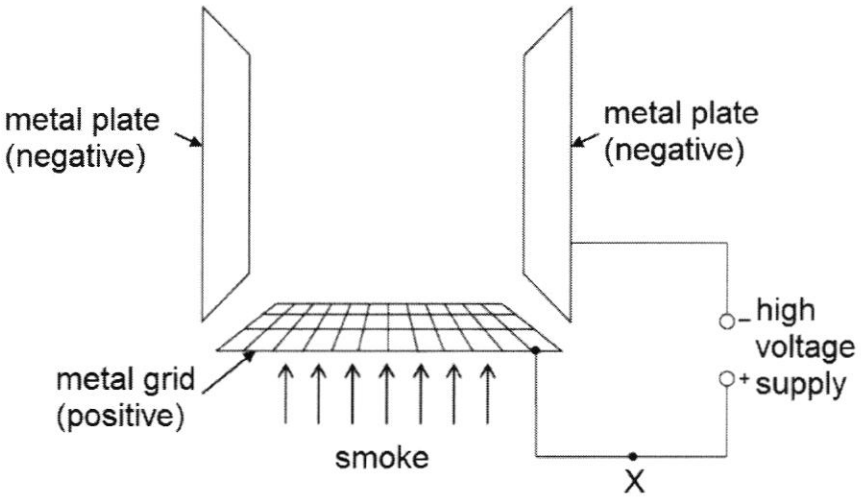


Fig. 8.1

When smoke passes through the metal grid, this results in the dust particles having a net positive charge.

(a) Explain what happened to the dust particles as they pass through the metal grid.

.....

.....

.....

..... [2]

(b) If 6.0 C of charges flow past point **X** in 1.0 minute, calculate the current flowing through **X**.

current = ... A [1]

SECTION B [20 MARKS]

Answer **ANY TWO** questions from this section.

9 Fig. 9.1 shows a metal cylinder which contains 0.000 46 m^3 of oil. The total mass of the cylinder and the oil is 1.2 kg. The mass of the cylinder is 0.800 kg and the space above the oil is air. The gravitational field strength is 10 N/kg.

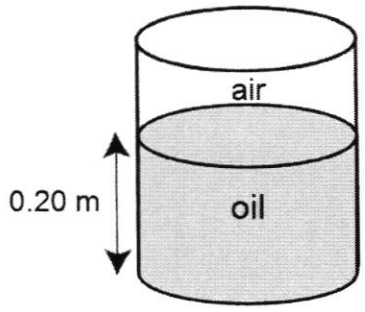


Fig. 9.1

(a) State **two** differences between the mass and the weight of a substance.

Difference 1: .....

.....

Difference 2: .....

.....

[2]

(b) Calculate the weight of the oil.

weight = ... [1]

(c) Calculate the density of the oil in SI unit.

density = ... [2]

(d) Calculate the pressure exerted by the oil on the base of the cylinder in SI unit.

pressure = ... [2]

(e) State and explain how the values of each of the following quantities would change when the cylinder and the oil is brought to the Moon, where the gravitational field strength is reduced.

(i) density of oil.

.....

..... [1]

(ii) pressure exerted by the oil on the base of the cylinder.

.....

.....

..... [2]

10 (a) A boy holds the loose end of a long rope which is fixed to a pole.
He moves it up and down at a rate of 20 complete oscillations in every 50 seconds.
Fig. 10.1 shows a section of the wave moving along the rope.

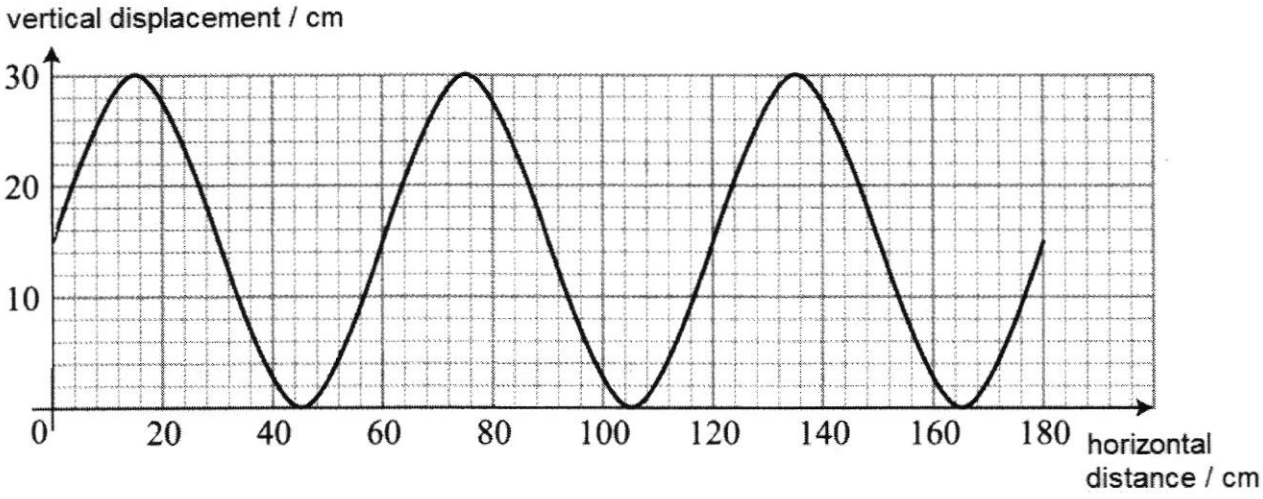


Fig. 10.1

(i) State the value of the amplitude of the wave.

amplitude = ... [1]

(ii) Calculate the frequency of the wave.

frequency = ... [2]

(iii) Calculate the speed of the wave.

speed = ... [2]

(b) Fig. 10.2 shows the cone of a loudspeaker that is producing sound waves in air.
At any given moment, a series of compressions and rarefactions exist along the line **PQ**.

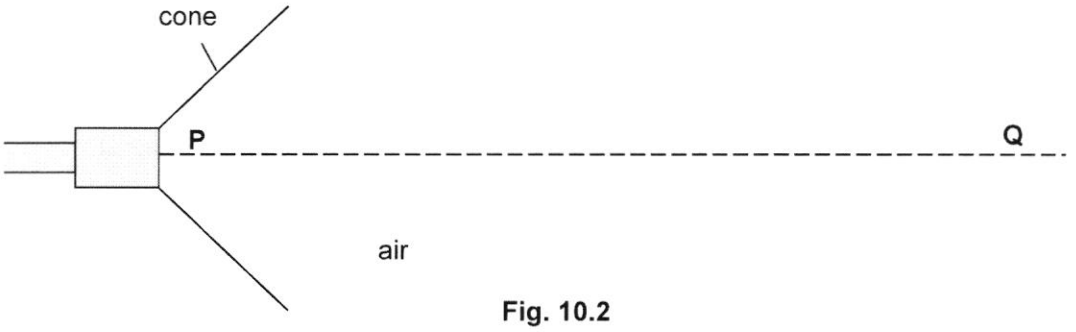


Fig. 10.2

The sound wave experience a rarefaction at **P**.

(i) On Fig 10.2, draw the wave lines to represent **two** wavelengths of compressions and rarefactions between **P** and **Q**.
Use the letter **C** to mark **two** compressions and the letter **R** to mark **two** rarefactions along **PQ**. [2]

(ii) With reference to the sound wave travelling along **PQ** in Fig. 10.2, explain what is meant by a *longitudinal* wave.

.....

..... [1]

(iii) To the right of **Q**, there is a large vertical wall 50 m in front of the loudspeaker.
The speed of sound in air is 340 m/s.
Calculate the time taken for the echo to return to **P**.

time taken = ... [2]

11 (a) Fig. 11.1 below shows an electrical circuit with a lamp and two resistors

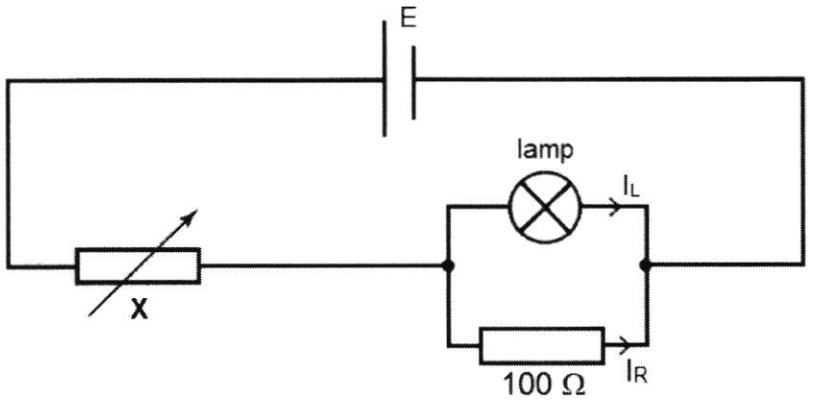


Fig. 11.1

(i) Name the component **X**.

..... [1]

Fig. 11.2 shows the graph of current against potential difference for the lamp **alone**. The potential difference across the lamp is 4.0 V.

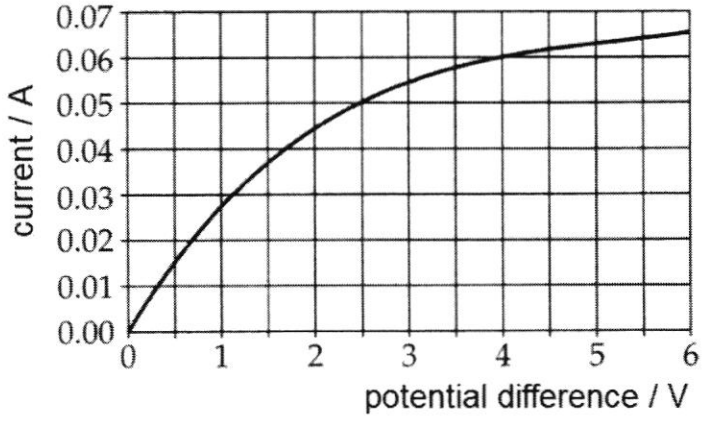


Fig. 11.2

Determine

(ii) the current in the lamp, I_L.

I_L = ... [1]

(iii) the current in the 100 Ω resistor, I_R.

I_R = ... [2]

(iv) the current in component **X**.

current through **X** = ... [1]

(b) Fig. 11.3 shows a type of electromagnetic lock in a door.

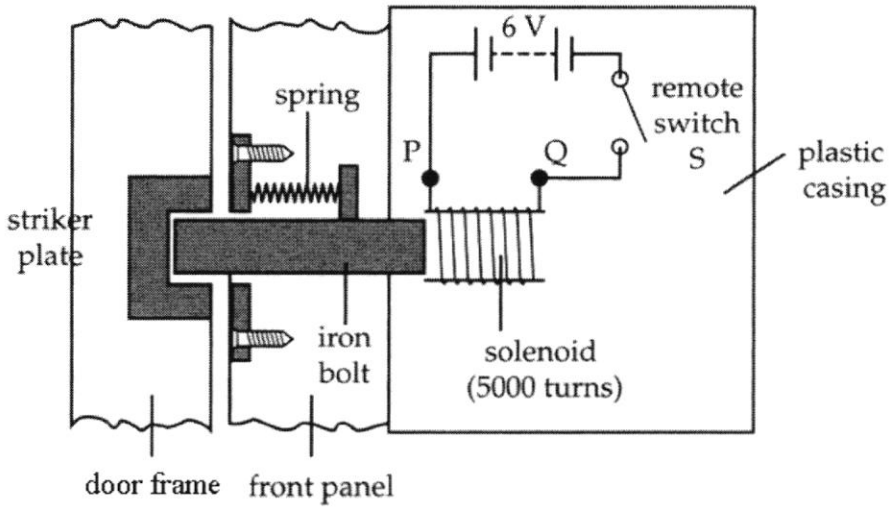


Fig. 11.3

When switch S is closed, the iron bolt moves to the right and out of the striker plate, allowing the door to be opened.

(i) Explain why the iron bolt moves to the right and into the solenoid when the switch is closed.

.....

.....

.....

.....

.....

..... [3]

(ii) After using the electric lock for a year, the 6 V battery goes "flat" and its e.m.f. drops to 4 V.
Why the electromagnetic lock does **not** work now?

.....

.....

.....

..... [2]

****** END OF PAPER 2 ******

2018 Preliminary Examination Marking Scheme
[Sec. 4 Express / 5 Normal (Academic) 5076 Science Physics Paper 2]

SECTION A [45 MARKS]

1 (a) (i) acceleration, $a = \frac{v-u}{t} = \frac{20-0}{10}$ [1 for working]

$= \underline{\mathbf{2.0\ m/s^2}}$ [1 for ans]

(ii) resultant force, $F_R = ma = (900)(2.0)$ [1 for working]

$= \underline{\mathbf{1\ 800\ N}}$ [1 for ans]

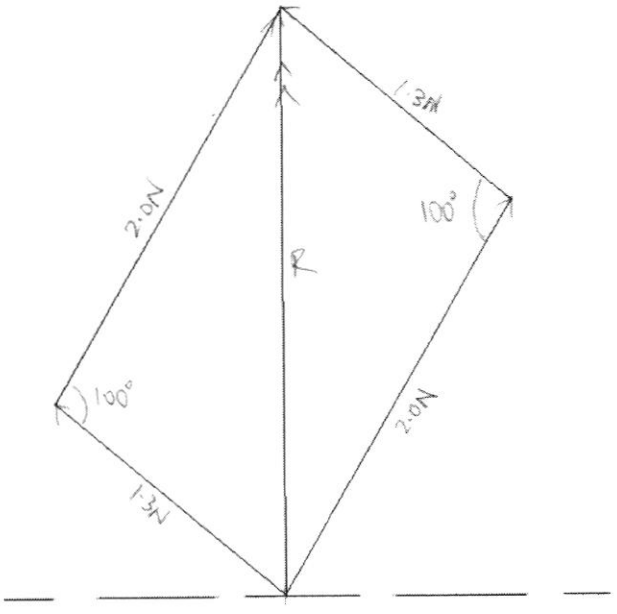
(b) (i) From t = 35 s to t = 45 s, the **braking force is greater than the forward driving force**. [1]

(ii) Between t = 45 s to t = 60 s, **the braking force is equal to the forward driving force**. [1]

(c) Total distance = ½ (10)(20) + (20)(20)
= 100 + 400 [1 for working]
= **500 m** [1 for ans]

2 [**Maximum = 2** for correct length of arrows]
[To deduct 1 mark for lack of arrows or wrong arrow]
[To deduct 1 mark for lack of angles or wrong angle between arrows]

Suitable scale = **1 cm to 0.2 N** [1]
resultant force = **2.56 ± 0.02 N** [1 for value within range]
angle of resultant with horizontal = **90° ± 1°** [1 for angle within range]



3 **(a)** Using Principle of Moments,

(i) W x 0.30 m = 450 N x 1.30 m [1 for working]

$$W = \frac{450 \times 1{,}30}{0.30}$$

= **1950 N** [1 for ans]

(ii) Using W = mg

$$m = \frac{W}{g}$$

$$= \frac{1950}{10}$$

= **195 kg** [1 for working & ans]

(b) Force on pivot = 1950 N + 450 N

= **2400 N** [1 for working & ans]

(c) The gate can be opened by **shifting the counterweight further away from the pivot**. **(OR shift to the left)**. [1]

so the **counterclockwise moment** produced by the force of the counterweight is **larger than** the **clockwise moment** produced by the weight of the pole. [1]

4 **(a)** Energy cannot be created or destroyed.
It can only be converted from one form to another; [1]
the total energy of an isolated system is constant. [1]

(b) At **point B**. [1]
At this point the **change in height of the toy car is the greatest** and the largest amount of GPE would have been converted to KE and thus the car would be at the greatest speed. [1]

(c) **(i)** GPE at point **C** = mgh
= (1.00)(10)(0.40) = **4.0 J** [1 for working & ans]

(ii) Total energy at point **A** = KE at point **A** + GPE at point **A**
= ½ mv^2 + mgh
= ½ (1.00) $(2.00)^2$ + (1.00)(10)(0.60)
= 2.0 + 6.0 = **8.0 J** [1 for working & ans]

Total energy at point **A** = GPE at point **C** + KE at point **C**
8.0 = mgh + ½ mv^2
8.0 = (1.00)(10)(0.40) + ½ mv^2
8.0 – 4.0 = ½ (1.00) v^2
$v = (\sqrt{8.0})$
= **2.83 m/s** [1 for ans & unit]

[allow ecf from **(c)(i)**]

5 (a) (i) melting [1]

(ii) During stage **C,** the molecules are **sliding past one another**. [1]

(iii) The molecules at stage **A** are **closely packed together**. [1]

(b) With a covered lid, it reduces heat loss to the surroundings by:

- **prevents convection current from forming**.
- reducing **evaporation from the water surface**,
- **reducing conduction through the layer of trapped air** between the water and the lid.

[any TWO answers, 1 mark each, max = 2]

6 (a) "*refractive index of 1.50*" shows that
the **ratio** of the **sine of the incident angle** to the **sine of the refracted angle is 1.50** OR
Ratio of the **speed of light in vacuum** to the **speed on light in the medium is 1.50**. [1]

(b) (i) Refractive index, $n = \frac{\sin i}{\sin r} = \frac{\sin 75°}{\sin 40°}$

= 1.50 (shown) [1 for working]

(ii) $n = \frac{1}{\sin c}$

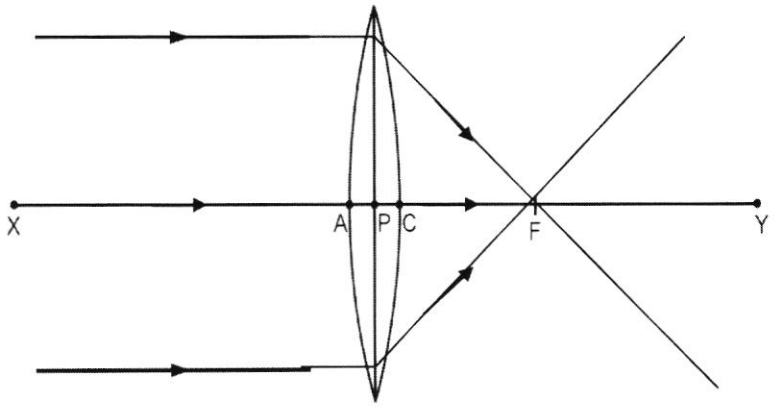
$1.50 = \frac{1}{\sin c}$ [1 for working]

$c = \sin^{-1}\left(\frac{1}{1.50}\right)$

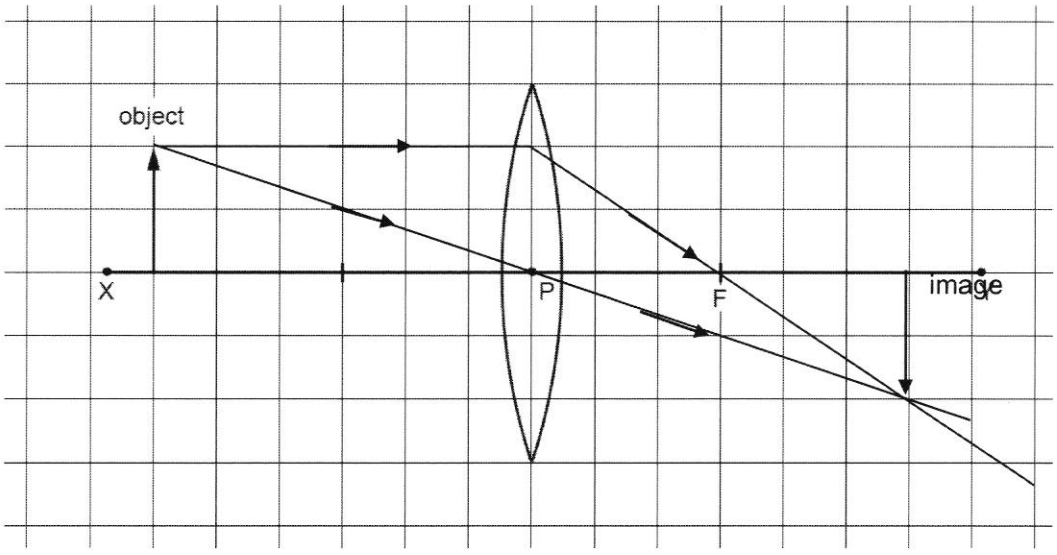
= **41.8 °** [1 for ans]

(b) (iii) [1 for Total Internally Reflected ray, angle 50°, at side **PQ**]
[1 for emergent ray at side **QR**, angle = 75°]

7 (a) [1 mark for each ray converging onto F on the right after passing through the lens]
[max = 2 marks]



(b) (i) [1 mark for each ray, **max = 2 marks**]



(ii) The **object distance is the same as the image distance**. OR
The **size of the image is the same as the size of the object**. [1]

8 (a) When the dust particles come into contact with the grid, they **lose electrons to the grid** [1]. Thus the particles will have less negative charges than positive charges and end up with a net positive charge and this cause it to be **attracted to the metal plate**. [1]

(b) Using I = Q / t
= 6.0 / (1 x 60) = **0.10 A** [1 for working & ans]

SECTION B [2 X 10 = 20 MARKS]

9 (a) [**Any TWO** answers. 1 mark each. **Maximum = 2**]

Mass	Weight
A measure of the amount of matter in an object.	The force of gravitational attraction on an object.
SI unit: kilogram (kg)	SI unit: newton (N)
Measured with a beam balance.	Measured with a spring balance.
Mass remains unchanged when it is moved to another place with different gravitational attraction.	Weight changes when it is moved to another place with different gravitational attraction.

(b) Using W = mg
= (1.2 – 0.800)(10)
= **4.0 N** [1 for working, ans & unit]

(c) Using density $= \frac{m}{V} = \frac{0.400}{0.00046}$ [1 for working]
= **870 kg/m^3** [1 for ans & unit]

(d) Using $P = \frac{F}{A} = \frac{4.0}{\left(\frac{0.00046}{0.20}\right)}$ [1 for working]
= **1740 Pa** [1 for ans & unit]

(e) (i) Density **does not change**. Since **Density = Mass / Volume**, both the **mass and volume of the liquid does not change**. [1]

(ii) Pressure will be **reduced**. [1]
According to **P = F/A**, **weight W (= F) of the liquid is smaller on Moon with base area remains constant**. [1]

10 (a) (i) amplitude = **15.0 cm** [1]

(ii) frequency, f = no of oscillations / time
= 20 / 50 [1 for working]
= **0.40 Hz** [1 for ans & unit]

(iii) Using v = f λ
v = 0.40 x 60 [1 for working]
= **24 cm /s or 0.24 m/s** [1 for ans & unit]
[allow ecf from **(a)(ii)** for value of frequency]

(b) (i) lines = 1 mark
Labelling of **C** and **R** = 1 mark

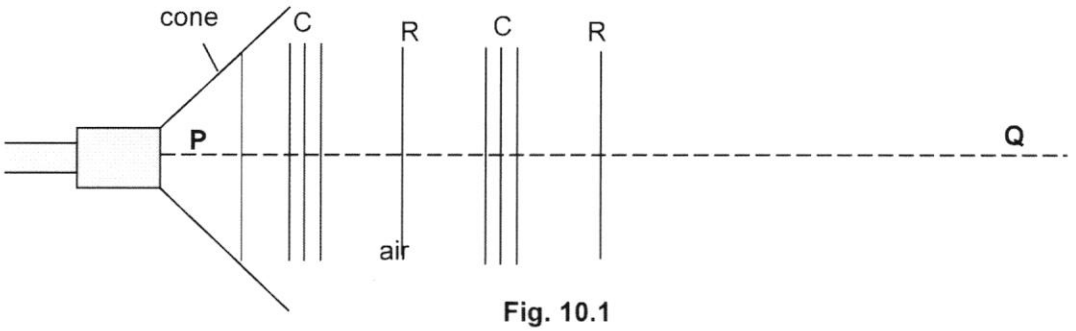


Fig. 10.1

(ii) The sound wave **travels in the direction** (along PQ)
parallel to the direction of the vibration of the air molecules. (along PQ). [1]

(iv) Time = $\frac{2 \times \text{distance}}{\text{speed}} = \left(\frac{2 \times 50}{340}\right)$ [1 for working]

= **0.29 s (accept 0.294 s)** [1 for ans & unit]

11 (a) (i) Rheostat or variable resistor [1]

(ii) (From the graph) current I_L = **0.060 A** [1 for ans & unit]

(iii) Using V = IR

current $I_R = \frac{V}{R} = \frac{4.0}{100}$ [1 for working]

= **0.040 A** [1 for ans & unit]

(iv) current I_X = 0.06 + 0.04

= **0.10 A** [1 for ans & unit]

(b) (i) When the switch is closed, the **solenoid becomes an electromagnet**. [1]
The iron bolt is then **attracted to the solenoid due to magnetic induction**. [1]
This **strong attractive force will overcome the force of the spring** and cause the lock to be unlocked. [1]

(ii) At 4 V, there is **little current flowing through the solenoid**. [1]
Therefore **the magnetic field strength of the solenoid is too weak to attract the iron bolt**. [1]