HILLGROVE SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2017

Secondary 4 Express / 5 Normal Academic

SCIENCE (PHYSICS) 5076 / 01

Paper 1

Date: 23 August 2017

Time: 7.50 a.m. – 8.50 a.m.

Duration: 1 hour
for Science (Physics, Chemistry)

Additional material: Multiple Choice Answer Sheet

INSTRUCTIONS TO STUDENTS:

1. Write in soft pencil
2. Do not use staples, paper clips, glue or correction fluid.
3. Write your name, class and register number on the Answer Sheet in the spaces provided.

There are **twenty** 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. Should you wish to change your answer, make sure that you have completely erased the wrong oval.

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.
Usage of calculators is permitted in this examination.

At the end of the examination hand in the Multiple Choice Answer Sheet and the question paper separately. **Label the Multiple Choice Answer Sheet as Science (Physics)**

Name of Student: _____ ( )

Class: _____ Subject Teacher: Mrs Peng / Mdm Teo / Mr Chia / Mr Chow

Parent's Signature: _____

Setter: Mrs Jennifer Peng

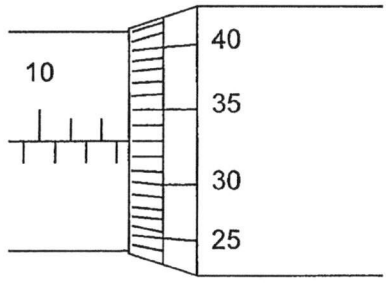
This question paper consists of 6 printed pages including the cover page.

[Turn over

SECTION A (20 Marks)
Multiple Choice Questions

Answer all questions on the Answer Sheet provided.
Label the Multiple Choice Answer Sheet as Science (Physics)

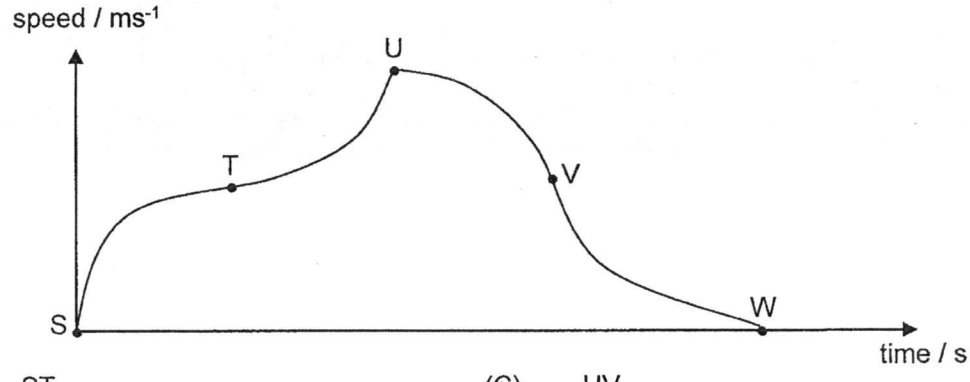
1. A student used a micrometer screw gauge to measure the thickness of a metal sheet. The diagram below shows part of the micrometer.



What is the thickness of the metal sheet?

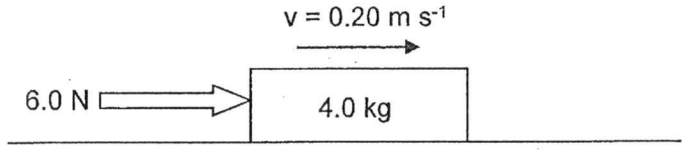
(A) 10.33 mm
(B) 12.33 mm
(C) 12.83 mm
(D) 15.33 mm

2. The figure shows the speed-time of an object. In which region is the object undergoing increasing deceleration?



(A) ST
(B) TU
(C) UV
(D) VW

3. A box of mass 4.0 kg moves with a constant speed of 0.20 m s^{-1} when a force of 6.0 N is applied.



What are the frictional force and the resultant force acting on the box?

	resultant force	frictional force
(A)	0.0	6.0
(B)	0.8	5.2
(C)	5.2	0.8
(D)	6.0	0.0

4. Two forces of 5 N and 6 N act on an object at the same time. Which of the following cannot be the resultant force that is acting on the object?

(A) 3 N
(B) 5 N
(C) 11 N
(D) 12 N

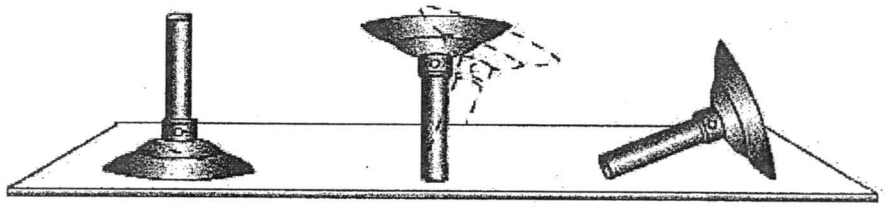
5. An 80 N rock from the moon which has a gravity of 1.6 m/s^2, is brought to the Earth. What is the weight of the rock on the Earth? Take g = 10 m/s^2 on Earth.

(A) 50 N
(B) 80 N
(C) 500 N
(D) 800 N

6. What are the apparatuses needed to determine the density of a regularly-shaped block?

(A) a balance and a ruler
(B) a balance and a weighing scale
(C) a measuring cylinder and a ruler
(D) a measuring cylinder and a beaker

7. The following diagrams show the initial positions of three identical Bunsen burners. Which row best describes the states of equilibrium of the objects?



(A)	neutral	stable	unstable
(B)	neutral	unstable	stable
(C)	stable	unstable	neutral
(D)	stable	neutral	unstable

8. A worker is lifting boxes of identical weight from the ground onto a moving belt. At first, it takes him 2 s to lift each box. Later in the day, it takes him 3 s. Which statement is correct?

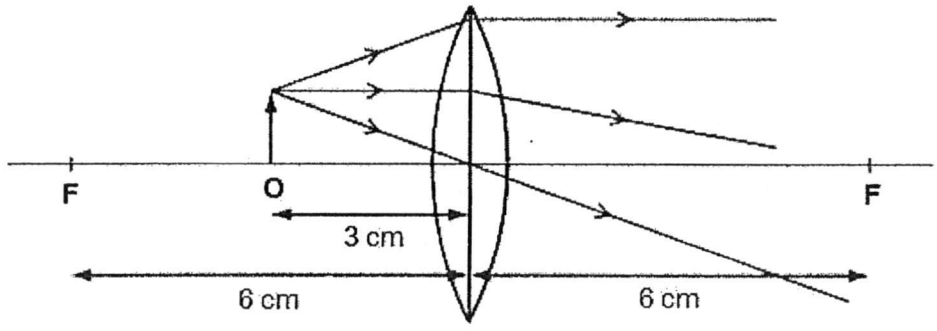
(A) Later in the day, less work is done in lifting each box.
(B) Later in the day, more work is done in lifting each box.
(C) Later in the day, less power is developed in lifting each box.
(D) Later in the day, more power is developed in lifting each box.

9. A metal rod is heated at one end. Which statement best describes the conduction of heat through the metal rod?

(A) Atoms vibrate and hit atoms at the cold end.
(B) Atoms move from the hot end and hit electrons at the cold end.
(C) Free electrons move from the hot end and hit atoms further along the rod.
(D) Free electrons vibrate and pass energy to free electrons further along the rod.

10. Bubbles are seen forming rapidly in water and the temperature of the water remains constant. Which statements best describes what is happening?
    (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.

11. The figure shows an object **O** placed 3 cm away from a converging lens that has a focal length of 6 cm.



What type of image is produced?
    (A) real, upright and diminished
    (B) real, inverted and magnified
    (C) virtual, upright and magnified
    (D) virtual, inverted and diminished

12. Which row correctly describes the natures of sound, light and radio waves?

	sound	light	radio
(A)	longitudinal	transverse	longitudinal
(B)	longitudinal	transverse	transverse
(C)	transverse	longitudinal	longitudinal
(D)	transverse	longitudinal	transverse

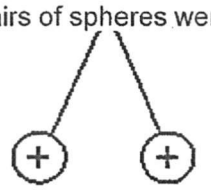
13. Which group of electromagnetic waves is in the order of increasing wavelength?
    (A) Gamma ray → Ultra-violet → Radio wave
    (B) Gamma ray → Visible light → Ultra-violet
    (C) Microwave → Ultra-violet → X-ray
    (D) Visible light → Infra-red → X-ray

14. Which row correctly shows the increasing order of the speed of sound in different mediums?

	slowest ⟶		fastest
(A)	air	steel	water
(B)	air	water	steel
(C)	steel	water	air
(D)	steel	air	water

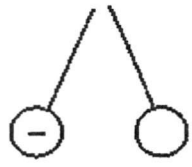
15. Four pairs of spheres were placed near one another. Which pair is incorrect?

(A)



(C)

(B)



(D)

Legend:

⊕ Positively charged sphere

⊖ Negatively charged sphere

○ Electrically neutral sphere

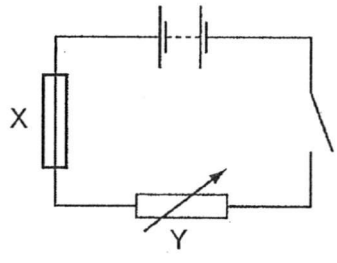
16. How could the unit of potential difference, the volt, also be written?

(A) A/s
(B) C/J
(C) C/A
(D) J/C

17. A student uses a length of wire as a resistor. He discovers that the resistance of the wire is too small. What changes to the length and thickness can be made to the wire to make the resistance of the wire higher?

	length	thickness
(A)	longer	thicker
(B)	longer	thinner
(C)	shorter	thicker
(D)	shorter	thinner

18. Kevin sets up the circuit as shown below.



What is the purpose of component X and Y?

	component X	component Y
(A)	to prevent excessive current	to change the resistance depending on temperature
(B)	to prevent excessive current	to vary the current in the circuit
(C)	to switch the current on/off	to change the resistance depending on temperature
(D)	to switch the current on/off	to vary the current in the circuit

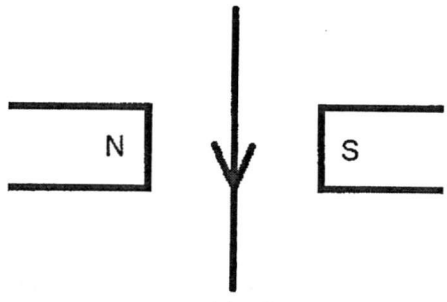
19. Consider the following actions:

1 pull the steel bar slowly out of the solenoid
2 connect direct current to the solenoid
3 connect alternating current to the solenoid
4 place the magnetised steel bar into the solenoid
5 switch off the current supply
6 set up the solenoid in the east-west direction
7 set up the solenoid in the north-south direction

Which sequence is correct to effectively demagnetise a steel bar using electrical method?

(A) $7 \rightarrow 4 \rightarrow 2 \rightarrow 5$
(B) $7 \rightarrow 2 \rightarrow 4 \rightarrow 1$
(C) $6 \rightarrow 4 \rightarrow 3 \rightarrow 1$
(D) $6 \rightarrow 3 \rightarrow 4 \rightarrow 5$

20. The diagram shows current-carrying conductor placed in a magnetic field.



conductor

What is the direction of the force acting on the current-carrying conductor?

(A) into the page
(B) out of the page
(C) towards the top of the page
(D) towards the bottom of the page

*** END OF PAPER 1 ***

HILLGROVE SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2017

Secondary 4 Express / 5 Normal Academic

Science (Physics)

5076 / 02

Paper 2

Date: 18 August 2017

Time: 10.30 am – 11.45 am Duration: 1 hour 15 minutes

INFORMATION TO CANDIDATES
Write your name, class and register number on the work you hand in.
You may use HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of 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.
Write your answers in the spaced provided on the question paper.

SECTION B
Answer any **two** questions.
Write your answers in the spaced 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.

Name of Student: _____ ( )

Class: Secondary _____

Subject Teacher: Mrs Peng / Mdm Teo
Mr Chia / Mr Chow

Parent's Signature: _____

Setter: Mrs Jennifer Peng

Section	Marks
A	/ 45
B	/ 20
Total	**/ 65**

This question paper consists of **15** printed pages, including cover page.

Section A

Answer **all** questions in the spaces provided on the question paper.

1. A car of mass 1.5×10^3 kg accelerates uniformly from rest to 20 m/s in 8.0 s.

   (a) Calculate the resultant force on the car.

   resultant force = _____ N [2]

   (b) Calculate the distance travelled by the car.

   distance = _____ m [2]

   (c) Calculate the work done on the car by the resultant force in (a).

   work done = _____ J [2]

2. A student wanted to find the density of an unknown liquid using a bottle and obtained the measurements as shown in **Fig. 2**.
   Calculate the density of the unknown liquid, given that the density of coconut oil is 0.924 g/cm^3.

Fig. 2

density = _____ g/cm^3 [3]

3. **Fig. 3.1** and **Fig. 3.2** show two ways in which a retort stand can be balanced.

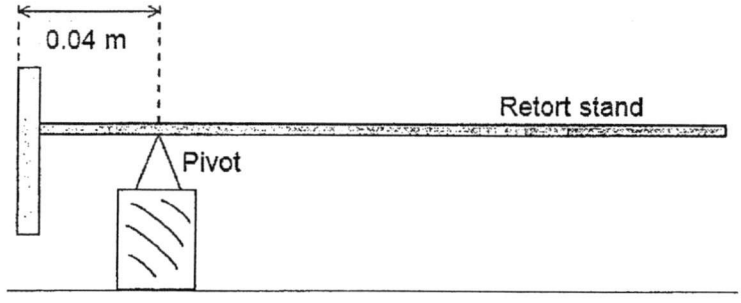


Fig. 3.1

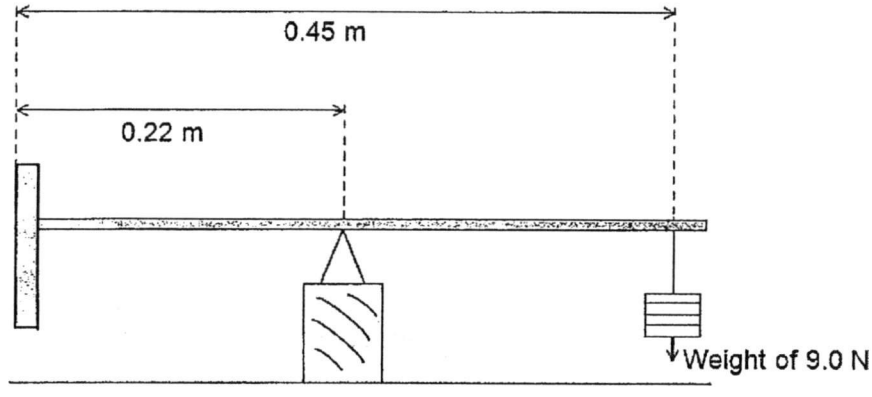


Fig. 3.2

(a) On **Fig. 3.1**, indicate with the symbol "X", the centre of gravity of the retort stand. [1]

(b) Calculate the weight of the retort stand.

weight = _____ N [3]

4. **Fig. 4** shows the dimensions of a metal block whose mass is 100 g. Take g = 10 ms^{-2}. Calculate the maximum pressure the metal block can exert on a table.

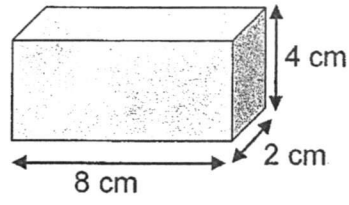


Fig. 4

maximum pressure = _____ N/cm^2 [3]

5. (a) Describe what happens to the molecules in water as its temperature rises. [2]

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(b) By considering the molecules in ice and in water, suggest why the density of ice is less than the density of water. [2]

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6. **Fig. 6.1** shows three waves A, B and C. They travel 12.0 meters in 2.0 s through the same medium.

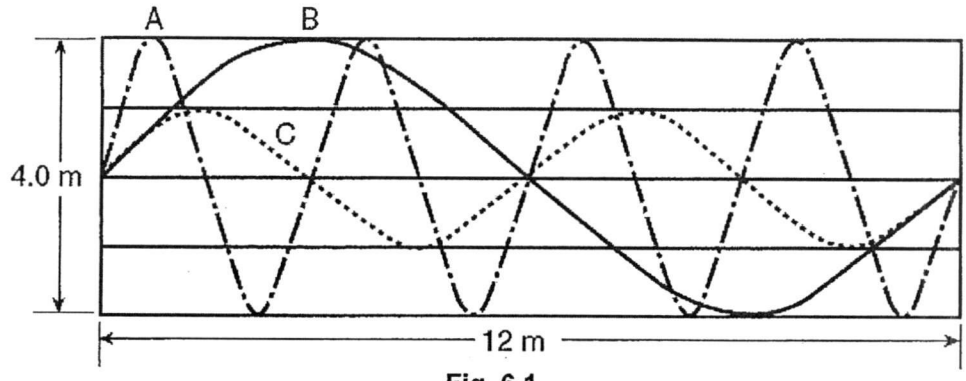

Fig. 6.1

(a) Calculate the wavelength of wave A.

wavelength = _____ m [1]

(b) Determine the period of wave B.

period = _____ s [1]

(c) Calculate the speed of wave C.

speed = _____ ms^{-1} [1]

7. **Fig. 7.1** represents the different components in the electromagnetic spectrum. The electromagnetic waves are arranged in order.

Gamma	X-rays	**P**	Visible light	**Q**	Microwave	Radio

Fig. 7.1

(a) Name the two radiations P and Q. [1]

P is .....

Q is .....

(b) State **one** property of radiation P which differs from those of radio waves. [1]

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(c) State **two** properties which are common to all forms of electromagnetic spectrum.[2]

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8. A siren is located at some distance from a large building, as shown in **Fig. 8.1.**

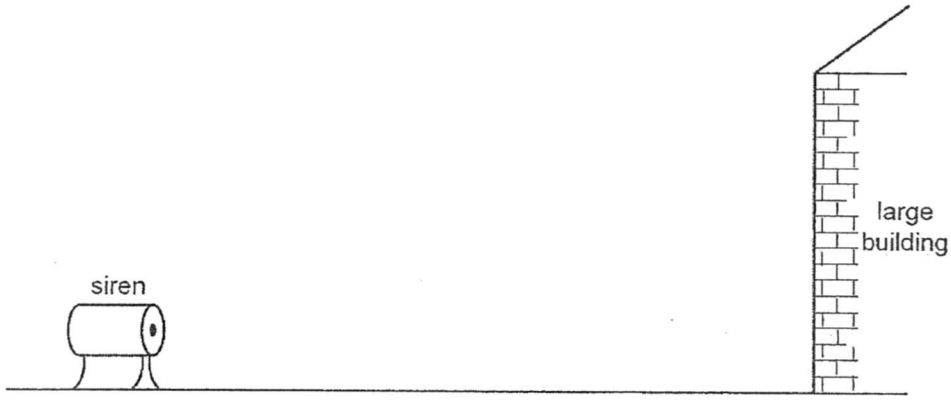

Fig. 8.1.

The siren is sounded once briefly. A short while later, an observer standing near the siren hears the sound again.

(a) (i) Describe why the second sound is heard by the observer. [1]

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(ii) Given that the speed of sound in air is 330 m/s and that the second sound is heard 1.6 s later, calculate the distance between the siren and the large building.

distance = _____ m [2]

(b) A microphone connected near the siren picks up the following signal when the siren was first sounded.

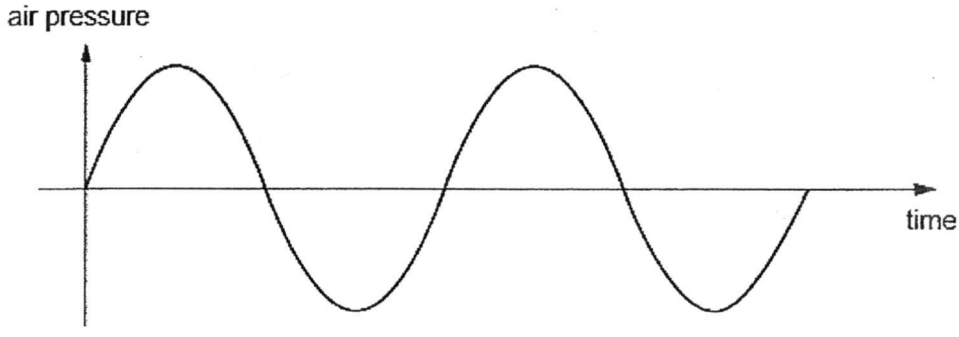

Fig. 8.2

(i) On **Fig. 8.2**, draw how the signal for the second sound would look like. [1]

(ii) Explain the difference(s) in the signal for the second sound that you have drawn in (b)(i). [2]

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9. **Fig. 9.1** shows a part of a device called a gold leaf electroscope. The plate, rod and leaf are all made of metal. **Fig. 9.2** shows what happens to the gold leaf when a positively charged strip is held close to the plate.

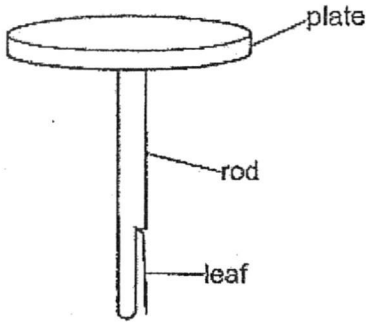

Fig. 9.1

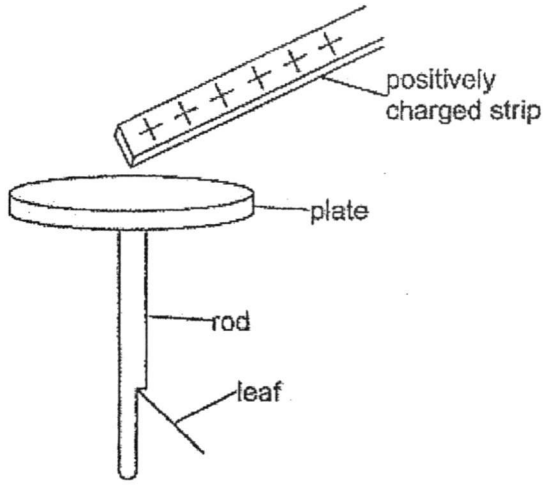

Fig. 9.2

(a) State the nature of the charge at the plate in **Fig. 9.2.** [1]

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(b) Explain why the leaf moves away from the rod in **Fig. 9.2.** [3]

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10. **Fig. 10** shows two 6 Ω resistors and a lamp of resistance 3 Ω, connected to a 12 V cell.

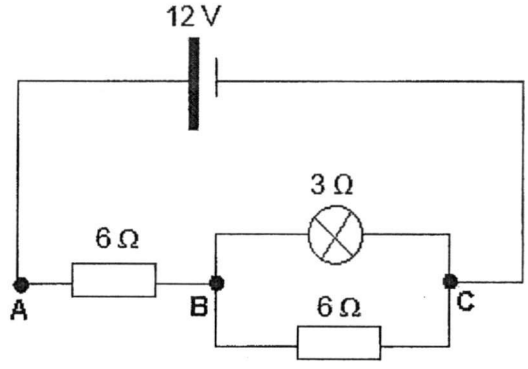

Fig. 10

(a) Calculate

(i) the total resistance of the circuit,

resistance = _____ Ω [2]

(ii) the potential difference across **B** and **C**.

potential difference = _____ V [2]

(b) Given that the power dissipated in the lamp is 3 W, calculate the cost of using the lamp for 12 hours per day for a week if it costs $0.20 per unit of electricity.

cost = $ _____ [2]

(c) Another lamp of resistance 3 Ω is connected across BC. State and explain what will happen to the current flowing through the battery. [2]

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Section B

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

Write your answers in the spaces provided.

11. A pendulum consists of a metal sphere attached to a thin thread, as shown in **Fig. 11.1**

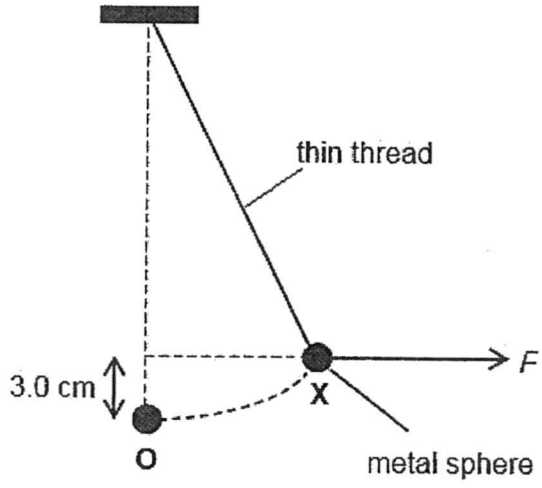

Fig. 11.1

When the thread is vertical, the metal sphere is at **O**. The metal sphere is moved from **O** to **X** and held in position **X** by a horizontal force *F*.

(a) Draw a free-body diagram to show the forces acting on the metal sphere when it is at **X**. [2]

(b) The metal sphere is now released so that the pendulum is free to swing. Explain why the metal sphere begins to move and why it continues to move past **O**. [2]

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(c) The mass of the metal sphere is 200 g. When the sphere is moved from **O** to **X**, it is raised through a vertical height of 3.0 cm. The gravitational field strength is 10 N/kg.

(i) Calculate the work done to raise the sphere.

work done = _____ [2]

(ii) Calculate the maximum speed of the sphere after it has been released, assuming air resistance is negligible.

maximum speed = _____ [2]

(d) A student determines the time for one complete swing of the pendulum. She uses two methods.

In the first method, she measures the time for one complete swing.
In the second method, she measures the time for 20 complete swings and divides the total time by 20.

Explain why the second method gives a more accurate result than the first method. [2]

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12. A student investigates the refraction of light when it travels from medium A to air. **Fig. 12.1** shows the arrangement of the apparatus.

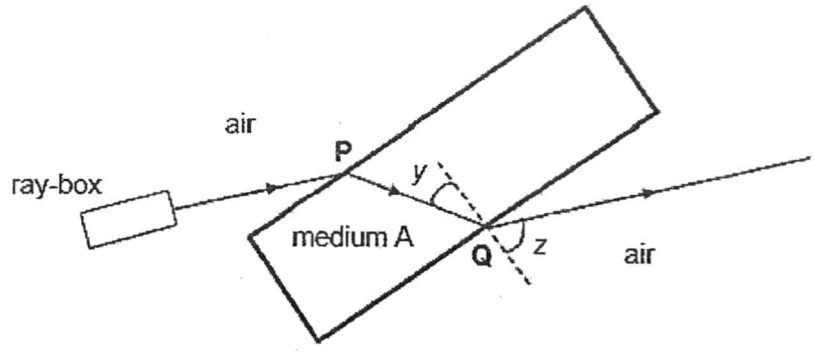

Fig. 12.1

The student uses a ray-box to direct a ray of light towards the boundary between the air and medium **A** at **P** so that it emerges through the other side at **Q**. After tracing the light rays, the student measures the angle *y* in medium A and the angle *z* in the air. He then changes the direction of the light ray at the boundary and measures the new angle y in medium A.

The table below shows his results.

Angle *y* in medium A	Angle *z* in the air
35 °	54 °
22 °	

Table 12.2

(a) Explain why the direction of light changes as it passes from glass into air. [2]

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(b) Using the data in **Table 12.2**, calculate the missing value for the angle *z* in the air.

angle *z* == _____ [2]

(c) Calculate the minimum angle *y* at which total internal reflection would occur. Give the value of the minimum angle *y* to the nearest degree.

minimum angle *y* = _____ [2]

(d) Hence, describe how the direction of the light at the boundary **Q** changes as angle y increases from 20 ° to 60 °. [4]

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(b) The iron rod is removed and the bar magnet is attached to a cone of paper to make a simple loudspeaker, as shown in **Fig. 13.3**

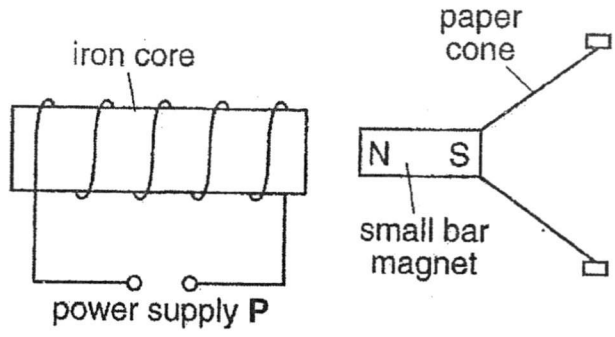

Fig. 13.3

The magnet causes the paper cone to vibrate, producing a sound wave in the air. Use **Fig. 13.1** on pg 14 to calculate the frequency of the sound wave.

frequency = _____ [1]

(c) Power supply **P** is now replaced with a second power supply that causes the speaker to produce a sound wave of frequency 240 Hz.

(i) The speed of sound in air is 330 m/s. Calculate the wavelength of this new sound wave.

wavelength = _____ [3]

(ii) The new current in the coil is smaller than when power supply **P** was used and is of a different frequency.

Describe and explain how the sound produced with the second power supply is different from that produced by power supply **P**. [2]

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*** END OF PAPER 2 ***

13. The voltage of a power supply P varies with time as shown in **Fig. 13.1**

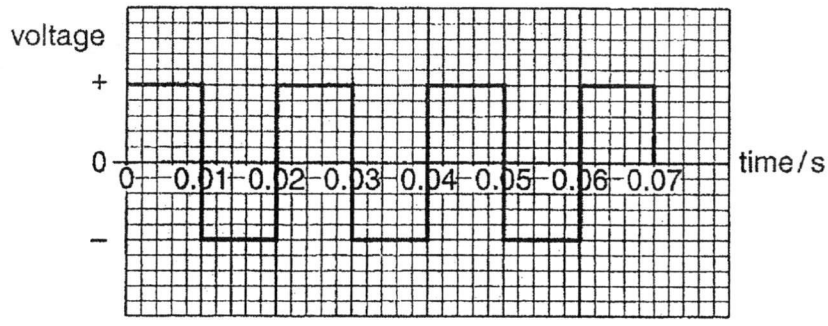

Fig. 13.1

The direction of the voltage changes with 0.01 s.

A coil of wire is wrapped around an iron core and connected to power supply P.
An iron rod is suspended close to one end of the core and a small bar magnet is suspended close to the other end as shown in **Fig. 13.2**

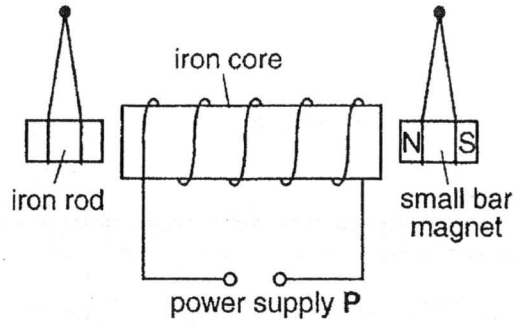

Fig. 13.2

(a) Power supply **P** is switched on. Explain why the iron rod is always attracted to the iron core but the force on the bar magnet varies. [4]

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(b) The iron rod is removed and the bar magnet is attached to a cone of paper to make a simple loudspeaker, as shown in **Fig. 13.3**

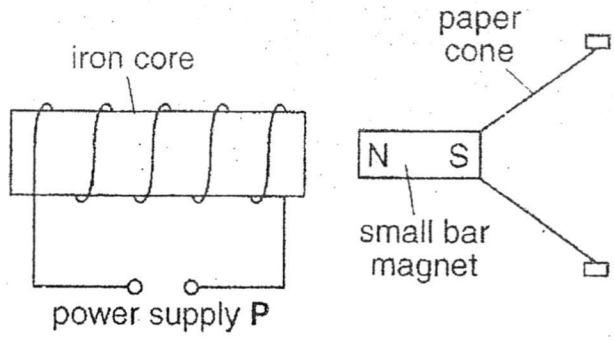


Fig. 13.3

The magnet causes the paper cone to vibrate, producing a sound wave in the air. Use **Fig. 13.1** on pg 14 to calculate the frequency of the sound wave.

frequency = 1 / T
= 1 / 0.02
= **50 Hz** [A1: minus 1 mark for wrong or missing unit]

frequency = _____ [1]

(c) Power supply **P** is now replaced with a second power supply that causes the speaker to produce a sound wave of frequency 240 Hz.

(i) The speed of sound in air is 330 m/s. Calculate the wavelength of this new sound wave.

$v = f\lambda$
$330 = 240\,\lambda$ [C1]
$\lambda = 330 / 240$
$\lambda = 1.375$ [C1]
$\lambda \approx$ **1.38 m or 1.4 m** [A1: minus 1 mark for wrong or missing unit]

wavelength = _____ [3]

(ii) The new current in the coil is smaller than when power supply **P** was used and is of a different frequency.

Describe and explain how the sound produced with the second power supply is different from that produced by power supply **P**. [2]

As the new current in the coil is smaller, the attractive and repulsive **force is lesser**, the paper cone will vibrate with a **lower amplitude** and the sound produced will be **softer**. [B1]

The **increase in frequency** will cause the paper cone to vibrate with a higher frequency and the sound produced will be **higher in pitch**. [B1]

*** END OF PAPER 2 ***

13. The voltage of a power supply P varies with time as shown in **Fig. 13.1**

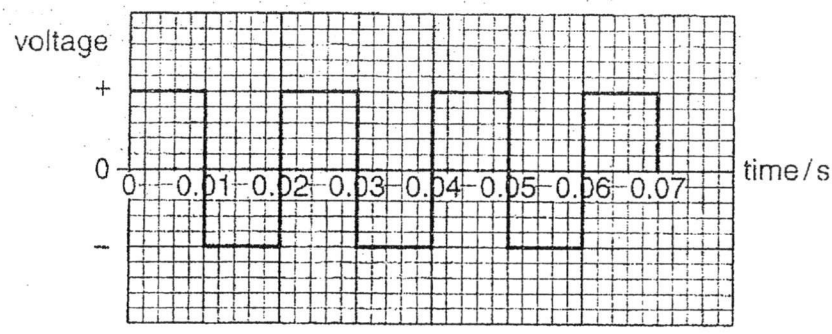


Fig. 13.1

The direction of the voltage changes with 0.01 s.

A coil of wire is wrapped around an iron core and connected to power supply P.
An iron rod is suspended close to one end of the core and a small bar magnet is suspended close to the other end as shown in **Fig. 13.2**

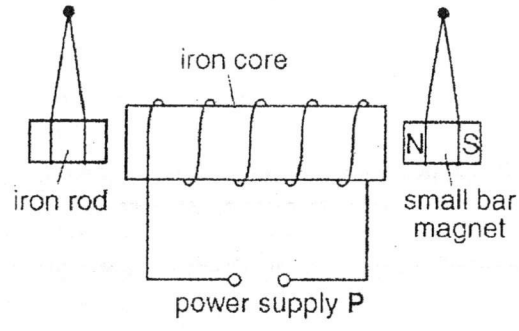


Fig. 13.2

(a) Power supply **P** is switched on. Explain why the iron rod is always attracted to the iron core but the force on the bar magnet varies. [4]

The power supply P is switched on, the iron core will be magnetized. As the power supply is an alternating current supply, the **iron core will be magnetized with poles** [B1] alternating every 0.1 s.

The iron rod is always attracted to the iron core by **magnetic induction,** [B1] when the poles of the iron core changes, the **surface of the iron rod nearest to the iron core will be induced with an opposite polarity, unlike poles attract** [B1] and the iron rod will be attracted to the iron core.

The force on the bar magnet varies as the small bar magnet will alternate between being **attracted and repelled** by the iron core depending on the pole formed at the end of the iron core closer to it as the direction of the current changes. [B1]

(c) Calculate the minimum angle *y* at which total internal reflection would occur.
Give the value of the minimum angle *y* to the nearest degree.

$c = \sin^{-1}(1 / n)$
$= \sin^{-1}(1 / 1.41)$
$= 45.2°$ [ECF1: student used the n calculated in (b)]
minimum angle $y \approx$ **46 °** [A1: minus 1 mark for wrong or missing unit]

minimum angle *y* = _____ [2]

(d) Hence, describe how the direction of the light at the boundary **Q** changes as angle y is increases from 20 ° to 60 °. [4]

20 ° ≤ y < 46 °: light undergoes **refraction** [B1], with some light undergoing **partial reflection**. As y increases, z increases.

y = 46 ° (critical angle): **light travels along the glass-air boundary, angle of refraction = 90°** [B1]

46 °< y ≤ 60°: light undergoes **total internal reflection**[B1], **light is reflected back into the glass, where angle of incidence is equal to angle of reflection** [B1]

12. A student investigates the refraction of light when it travels from medium A to air. **Fig. 12.1** shows the arrangement of the apparatus.

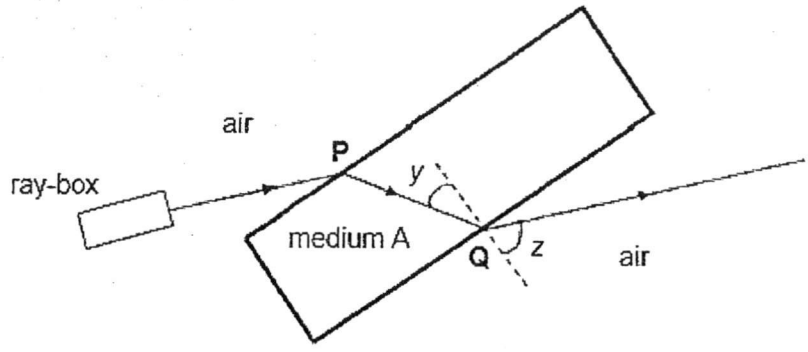


Fig. 12.1

The student uses a ray-box to direct a ray of light towards the boundary between the air and medium **A** at **P** so that it emerges through the other side at **Q**. After tracing the light rays, the student measures the angle *y* in medium A and the angle *z* in the air. He then changes the direction of the light ray at the boundary and measures the new angle y in medium A.

The table below shows his results.

Angle *y* in medium A	Angle *z* in the air
35 °	54 °
22 °	

Table 12.2

(a) Explain why the direction of light changes as it passes from glass into air. [2]

Speed of light increases as it passes from glass into air, which is optically denser. [B1: do not award marks if students mention that glass is denser, instead of optically denser] As **the light is entering the glass block at an angle** [B1], the path of light undergoes refraction and bends

(b) Using the data in **Table 12.2**, calculate the missing value for the angle *z* in the air.

n = sin i / sin r
= sin 54° / sin 35°
= 1.41 [M1]

n = sin z / sin r
1.41 = sin z / sin 22 °
z = **31.9 °**

[A1: answer to be given to 1 decimal place, minus 1 mark for wrong or missing unit]

angle z = _____ [2]

(b) The metal sphere is now released so that the pendulum is free to swing. Explain why the metal sphere begins to move and why it continues to move past **O**. [2]

At X, all three forces are balanced and the metal sphere does not move. When F is removed, a **resultant force (due to weight of metal sphere and tension in thread)** acts on the metal sphere, causing the metal sphere to move. [M1]

As the metal sphere moves from X to O, **GPE is converted to kinetic energy.**

At O, KE is maximum, thus the metal sphere continue to move pass O.

[B1: Do not give marks, if candidate only gave descriptions of energy changes without answering the question]

(c) The mass of the metal sphere is 200 g. When the sphere is moved from **O** to **X**, it is raised through a vertical height of 3.0 cm. The gravitational field strength is 10 N/kg.

(i) Calculate the work done to raise the sphere.

Work done = gain in GPE = mgh

$= \frac{200}{1000}(10)\frac{3}{100}$ [M1: convert mass and height correctly]

= **0.06 J** [A1: minus 1 mark for wrong or missing unit]

work done = _____ [2]

(ii) Calculate the maximum speed of the sphere after it has been released, assuming air resistance is negligible.

GPE at X = KE at O

0.06 = ½ (0.2) v^2

v^2 = 0.6 [M1]

v = $\sqrt{0.6}$ = **0.775 m/s** (3 sf)

[A1: also accept 0.78 m/s minus 1 mark for wrong or missing unit]

maximum speed = _____ [2]

(d) A student determines the time for one complete swing of the pendulum. She uses two methods.

In the first method, she measures the time for one complete swing.
In the second method, she measures the time for 20 complete swings and divides the total time by 20.

Explain why the second method gives a more accurate result than the first method. [2]

The main source of error is the **reaction time** of the student. [B1]

By taking average of 20 complete swings, the **error is divided between the 20** swings. [B1: refer to textbook pg 14. Do not award marks, if students just mention as obtaining more accurate timing without explaining why.]

Section B

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

Write your answers in the spaces provided.

11. A pendulum consists of a metal sphere attached to a thin thread, as shown in **Fig. 11.1**

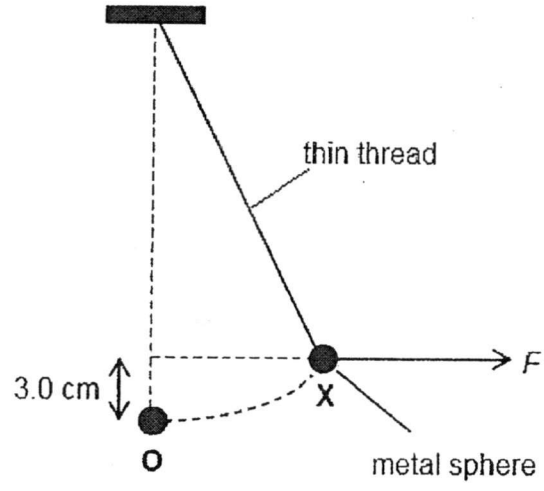
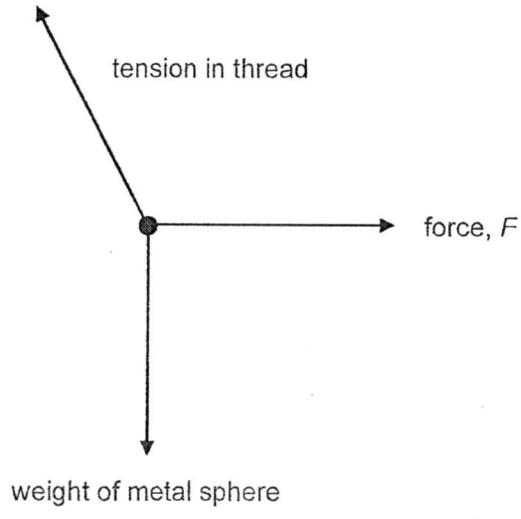


Fig. 11.1

When the thread is vertical, the metal sphere is at **O**. The metal sphere is moved from **O** to **X** and held in position **X** by a horizontal force *F*.

(a) Draw a free-body diagram to show the forces acting on the metal sphere when it is at **X**. [2]



[2 marks: all 3 forces correctly labelled, with direction of force correctly indicated.]
[1 mark: at least 1 force correctly labelled, with direction of force correctly indicated.]

10. **Fig. 10** shows two 6 Ω resistors and a lamp of resistance 3 Ω, connected to a 12 V cell.

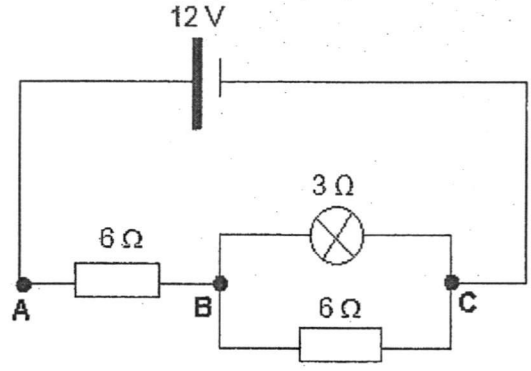


Fig. 10

(a) Calculate

(i) the total resistance of the circuit,

$\frac{1}{R} = \frac{1}{R^1} + \frac{1}{R^2}$ $\frac{1}{R} = \frac{1}{3} + \frac{1}{6} = \frac{1}{2}$

R = 2 Ω [M1]

R_T = 6 + 2

= **8.0 Ω** [A1]

resistance = _____ Ω [2]

(ii) the potential difference across **B** and **C**.

Current through the circuit, I = V / R

= 12 / 8

= 1.5 A [M1]

V_{BC} = IR

= (1.5) (2)

= **3.0 V** [A1]

potential difference = _____ V [2]

(b) Given that the power dissipated in the lamp is 3 W, calculate the cost of using the lamp for 12 hours per day for a week if it costs $0.20 per unit of electricity.

E = Pt

$= (\frac{3}{1000})$ (12 x 7)

= 0.252 kWh [M1]

Cost = 0.252 x 0.20

= **$0.05** [A1: minus 1 mark for wrong / missing units]

cost = $ _____ [2]

(c) Another lamp of resistance 3 Ω is connected across BC. State and explain what will happen to the current flowing through the battery. [2]

The **current will increase** [B1]

as the **total resistance of the circuit decreases**, as I = V/R. [B1]

9. **Fig. 9.1** shows a part of a device called a gold leaf electroscope. The plate, rod and leaf are all made of metal. **Fig. 9.2** shows what happens to the gold leaf when a positively charged strip is held close to the plate.

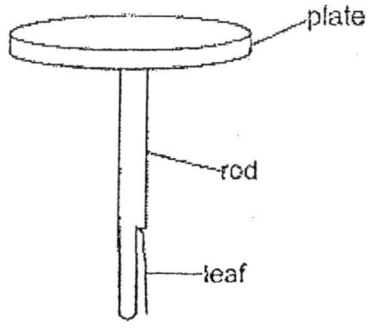


Fig. 9.1

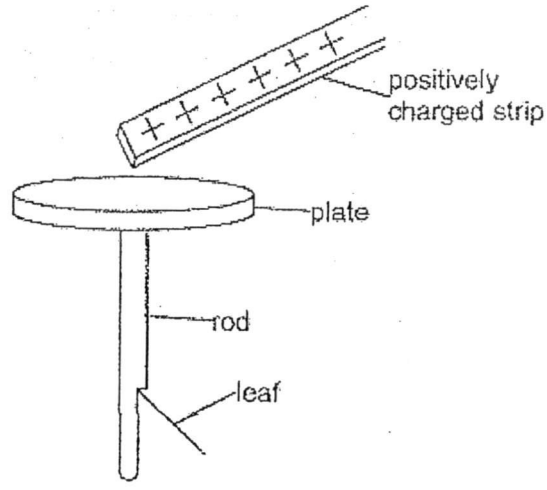


Fig. 9.2

(a) State the nature of the charge at the plate in **Fig. 9.2.** [1]

Negative / Negatively charged [B1]

(b) Explain why the leaf moves away from the rod in **Fig. 9.2.** [3]

Electrons are attracted to the positively charged rod and **moves to the top** towards the positively charged rod [B1], leaving both the **bottom end of the rod and the leaf positively charged** [B1]. Since bottom end of rod and leaf are both positively charged, **like charges repel** [B1] and the leaf moves away from the rod.

Note: positive charges do NOT move

(a) (i) Describe why the second sound is heard by the observer. [1]

The **sound wave was reflected off the large building** back to the position of the siren, the second sound heard is the echo. [B1]

(ii) Given that the speed of sound in air is 330 m/s and that the second sound is heard 1.6 s later, calculate the distance between the siren and the large building.

speed = distance / time

330 = (distance x 2) / 1.6 [M1]

distance = $\frac{330 \times 1.6}{2}$ = **264 m** [A1]

distance = _____ m [2]

(b) A microphone connected near the siren picks up the following signal when the siren was first sounded.

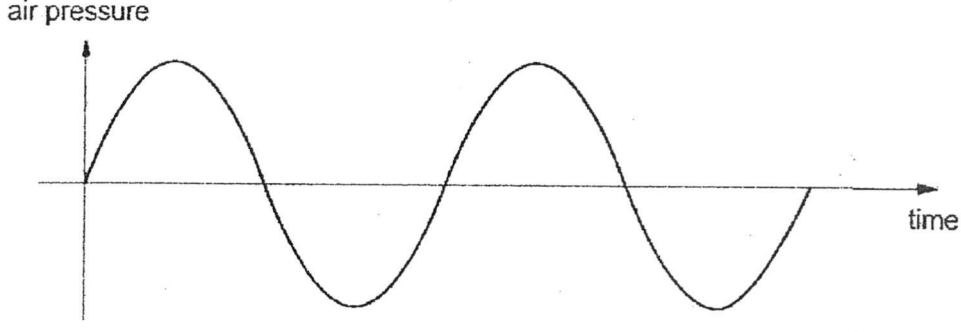
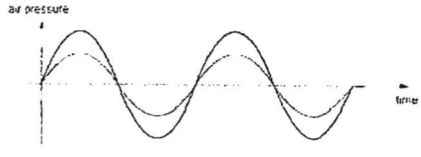


Fig. 8.2

(i) On **Fig. 8.2**, draw how the signal for the second sound would look like. [1]



[B1]

- Smaller applitude
- Same period

(ii) Explain the difference(s) in the signal for the second sound that you have drawn in (b)(i). [2]

The second sound would be softer, as some energy is transferred to the surrounding. As such, the **amplitude of the sound wave is smaller as the sound is softer** [B1]. There should be **no change to the frequency / period** [B1] of the sound as the pitch remains unchanged

Note: students must explain in terms of the signal / graph

7. **Fig. 7.1** represents the different components in the electromagnetic spectrum. The electromagnetic waves are arranged in order.

Gamma	X-rays	**P**	Visible light	**Q**	Microwave	Radio

Fig. 7.1

(a) Name the two radiations P and Q. [1]

P is **Ultra-violet** Q is **Infra-red**
[B1: Both must be correct to get 1 mark. 0 marks for incorrect spelling]

(b) State **one** property of radiation P which differs from those of radio waves. [1]

Ultra-violet waves have **shorter wavelength** than radio waves.

Ultra-violet waves have **higher frequency** than radio waves.

[B1: any one of the two reasons, verse vice is accepted]

(c) State **two** properties which are common to all forms of electromagnetic spectrum.[2]

- They transfer energy from one place to another.

- They are transverse waves.

- They travel through vacuum at 3×10^8 ms^{-1}

- They obey wave equation $v = f\lambda$ - They show wave properties

[B1: any two properties, 1 mark for each correct property]

8. A siren is located at some distance from a large building, as shown in **Fig. 8.1.**

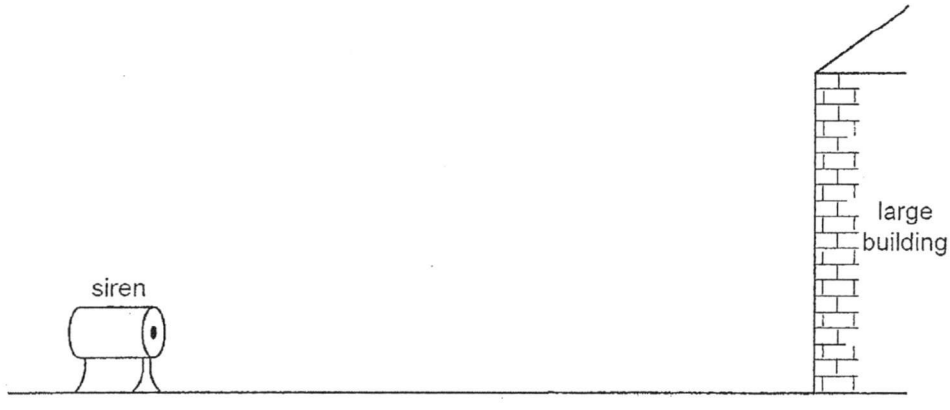


Fig. 8.1.

The siren is sounded once briefly. A short while later, an observer standing near the siren hears the sound again.

6. **Fig. 6.1** shows three waves A, B and C. They travel 12.0 meters in 2.0 s through the same medium.

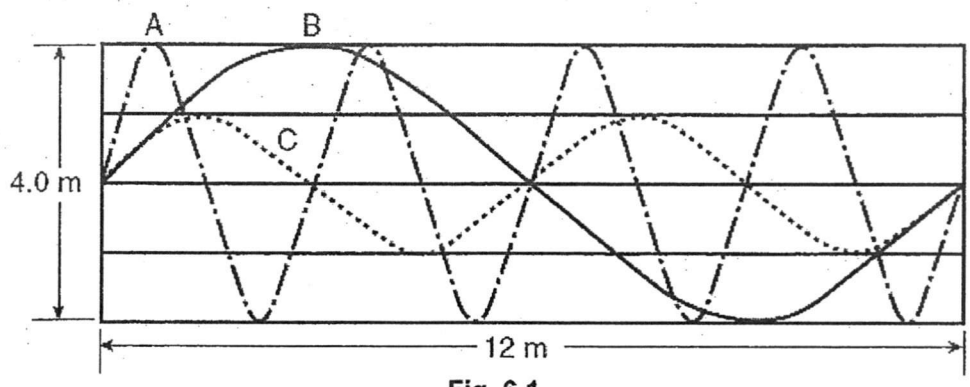


Fig. 6.1

(a) Calculate the wavelength of wave A.

wavelength of A = 12 / 4
= **3.0 m** [A1]

wavelength = _____ m [1]

(b) Determine the period of wave B.

Period of B = **2.0 s** [A1]

period = _____ s [1]

(c) Calculate the speed of wave C.

Speed of C = d / t
= 12.0 / 2.0
= 6.0 m/s [A1]

speed = _____ ms^{-1} [1]

4. **Fig. 4** shows the dimensions of a metal block whose mass is 100 g. Take g = 10 ms^{-2}.
Calculate the maximum pressure the metal block can exert on a table.

Weight = mg = 0.1 x 10 Convert mass to kg, 100 g = 0.1 kg
= **1 N** [M1]

Maximum Pressure
= Force / Minimum Area
= 1 / (2 x 4) [M1: use the correct minimum area]
= **0.125 N/cm^2** [ECF1: weight from top is used]

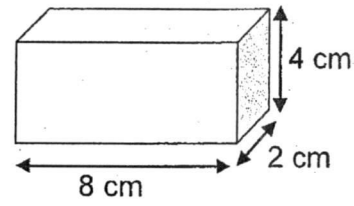


Fig. 4

maximum pressure = _____ N/cm^2 [3]

5. (a) Describe what happens to the molecules in water as its temperature rises. [2]

As the temperature rises, the water molecules **gain thermal energy which is converted to kinetic energy**, [B1] the **average speed of the water molecules increases**, molecules will **move faster**. [B1: 0 marks if the students used "vibrate" or if they only use fast]

(b) By considering the molecules in ice and in water, suggest why the density of ice is less than the density of water. [2]

The **distance between the molecules in ice is further apart** [B1: award 0 if student write far apart] from one another as compared to the arrangement of the molecules in water. **Given the same volume, number of molecules of ice will be lesser** [B1: must compare number of molecules based on per unit volume] as compared to that of water, resulting in ice being less dense than water.

3. **Fig. 3.1** and **Fig. 3.2** show two ways in which a retort stand can be balanced.

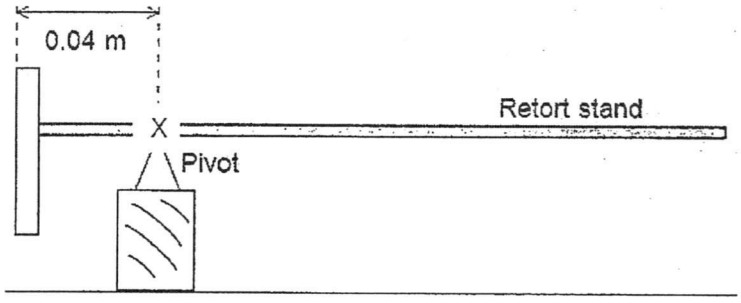


Fig. 3.1

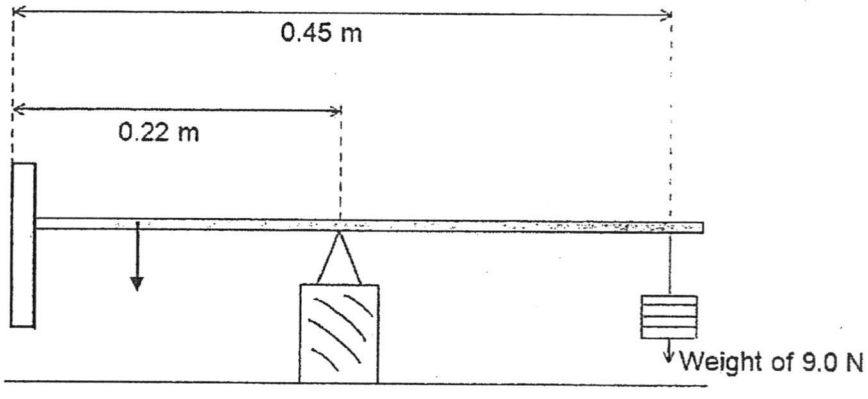


Fig. 3.2

(a) On **Fig. 3.1**, indicate with the symbol "X", the centre of gravity of the retort stand. [1]
Only X is required for 1 mark

(b) Calculate the weight of the retort stand.
Taking moments about the pivot,
W x (0.22 – 0.04) = 9.0 x (0.45 – 0.22) [C1: W x (0.22 – 0.04)] [C1: 9.0 x (0.45 – 0.22)]
W x 0.18 = 9.0 x 0.23
W = **11.5 N** [A1: minus 1 mark for wrong or missing unit]

weight = _____ N [3]

Section A

Answer **all** questions in the spaces provided on the question paper.

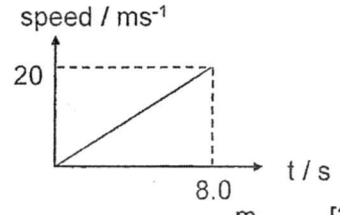
1. A car of mass 1.5 x 10^3 kg accelerates uniformly from rest to 20 m/s in 8.0 s.

(a) Calculate the resultant force on the car.

a = (v-u) / t
= (20 – 0) / 8
= 2.5 m/s^2 [M1]
F = ma
= 1.5 x 10^3 x 2.5
= **3750 N** [A1]

resultant force = _____ N [2]

(b) Calculate the distance travelled by the car.



distance = area under the speed-time graph
= ½ (v) (t)
= ½ x 20 x 8 [M1]
= **80 m** [A1]

distance = _____ m [2]

(c) Calculate the work done on the car by the resultant force in (a).

work done, W = force x distance
= 3750 x 80 [M1: force is from (a) / distance is from (b)]
= **300 000 J** [ECF1]

work done = _____ J [2]

2. A student wanted to find the density of an unknown liquid using a bottle and obtained the measurements as shown in **Fig. 2**.
Calculate the density of the unknown liquid, given that the density of coconut oil is 0.924 g/cm^3.

Fig. 2

Mass of coconut oil = 101.9 – 32.6 = 69.3 g
Mass of the unknown liquid = 92.6 – 32.6 = 60 g [M1]
Volume of unknown liquid = volume of coconut oil
= Mass / Density = 69.3 / 0.924
= 75 cm^3 [M1]
Density of unknown liquid = Mass / Volume = 60 / 75
= **0.80 g/cm^3** [A1]

density = _____ g/cm^3 [3]

HILLGROVE
SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2017

Secondary 4 Express / 5 Normal Academic

Science (Physics)

5076 / 02

Paper 2

Date: 18 August 2017

Time: 10.30 am – 11.45 am Duration: 1 hour 15 minutes

INFORMATION TO CANDIDATES
Write your name, class and register number on the work you hand in.
You may use HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of 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.
Write your answers in the spaced provided on the question paper.

SECTION B
Answer any **two** questions.
Write your answers in the spaced 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.

Name of Student: _____ ( )

Class: Secondary _____

Subject Teacher: Mrs Peng / Mdm Teo
Mr Chia / Mr Chow

Parent's Signature: _____

Setter: Mrs Jennifer Peng

Section	Marks
A	/ 45
B	/ 20
Total	**/ 65**

This question paper consists of 15 printed pages, including cover page.

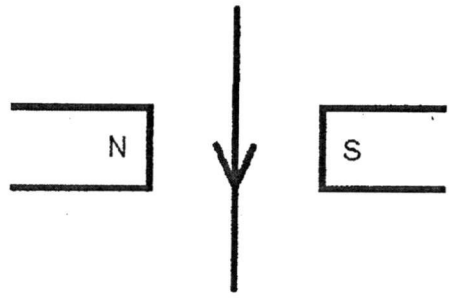
20. Consider the following actions:

1 pull the steel bar slowly out of the solenoid
2 connect direct current to the solenoid
3 connect alternating current to the solenoid
4 place the magnetised steel bar into the solenoid
5 switch off the current supply
6 set up the solenoid in the east-west direction
7 set up the solenoid in the north-south direction

Which sequence is correct to effectively demagnetise a steel bar using electrical method?

(A) $7 \rightarrow 4 \rightarrow 2 \rightarrow 5$
(B) $7 \rightarrow 2 \rightarrow 4 \rightarrow 1$
(C) $6 \rightarrow 4 \rightarrow 3 \rightarrow 1$
(D) $6 \rightarrow 3 \rightarrow 4 \rightarrow 5$

21. The diagram shows current-carrying conductor placed in a magnetic field.



conductor

What is the direction of the force acting on the current-carrying conductor?

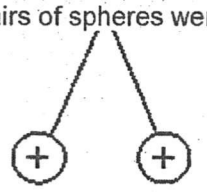
(A) into the page
(B) out of the page
(C) towards the top of the page
(D) towards the bottom of the page

Use Fleming's Left Hand rule.

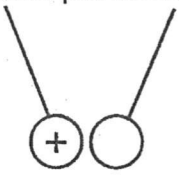
*** END OF PAPER 1 ***

16. Four pairs of spheres were placed near one another. Which pair is incorrect?

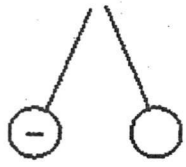
(A)



(C)



(B)



(D)

Legend:

⊕ Positively charged sphere ⊖ Negatively charged sphere ○ Electrically neutral sphere

(A) Like poles repel (C) Attracted by Electrostatic Induction (D) Unlike poles attract

17. How could the unit of potential difference, the volt, also be written?

(A) A/s (C) C/A
(B) C/J (D) J/C

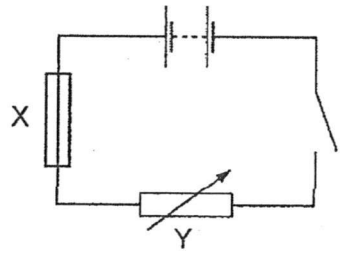
V = W/Q

18. A student uses a length of wire as a resistor. He discovers that the resistance of the wire is too small. What changes to the length and thickness can be made to the wire to make the resistance of the wire higher?

	length	thickness
(A)	longer	thicker
(B)	longer	thinner
(C)	shorter	thicker
(D)	shorter	thinner

A longer and thinner wire has a higher resistance.

19. Kevin sets up the circuit as shown below.



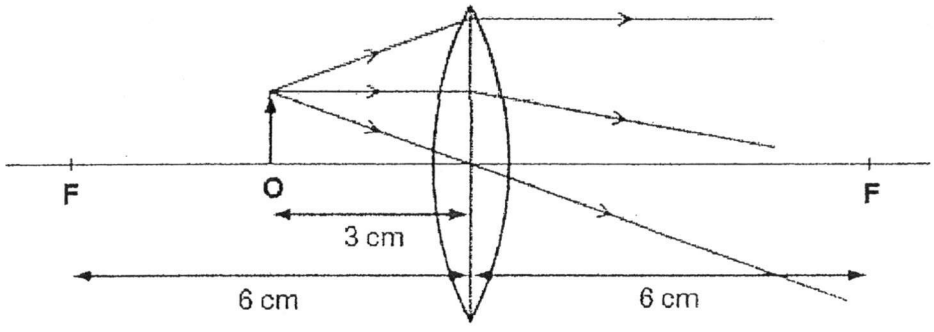
What is the purpose of component X and Y?

	component X	component Y
(A)	to prevent excessive current	to change the resistance depending on temperature
(B)	to prevent excessive current	to vary the current in the circuit
(C)	to switch the current on/off	to change the resistance depending on temperature
(D)	to switch the current on/off	to vary the current in the circuit

X is a fuse, which melts and breaks the circuit when there is excessive current.
Y is a rheostat, which changes the resistance in the circuit, to vary the current in the circuit.

11. Bubbles are seen forming rapidly in water and the temperature of the water remains constant.
Which statements best describes what is happening?
(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.
The process is called boiling. The average speed of the particles does not change as the temperature of the water remains constant. There is a change of state and the water particles are being water vapor.

12. The figure shows an object **O** placed 3 cm away from a converging lens that has a focal length of 6 cm.



What type of image is produced?
(A) real, upright and diminished
(B) real, inverted and magnified
(C) virtual, upright and magnified
(D) virtual, inverted and diminished
Uses: magnifying glass

13. Which row correctly describes the natures of sound, light and radio waves?

	sound	light	radio
(A)	longitudinal	transverse	longitudinal
(B)	longitudinal	transverse	transverse
(C)	transverse	longitudinal	longitudinal
(D)	transverse	longitudinal	transverse

Sound is longitudinal wave. Light and radio (both are part of the electromagnetic waves) are transverse waves.

14. Which group of electromagnetic waves is in the order of increasing wavelength?
(A) Gamma ray → Ultra-violet → Radio wave
(B) Gamma ray → Visible light → Ultra-violet
(C) Microwave → Ultra-violet → X-ray
(D) Visible light → Infra-red → X-ray
Gamma, X-ray, Ultra-violet, Light, Infrared, Microwave, Radio

15. Which row correctly shows the increasing order of the speed of sound in different mediums?

	slowest	→	fastest
(A)	air	steel	water
(B)	air	water	steel
(C)	steel	water	air
(D)	steel	air	water

Speed of sound is fastest in solid, followed by liquid then slowest in air.

4. Two forces of 5 N and 6 N act on an object at the same time. Which of the following cannot be the resultant force that is acting on the object?

(A) 3 N (C) 11 N
(B) 5 N (D) 12 N

minimum resultant force = 6 - 5 = 1 N maximum resultant force = 5 + 6 = 11 N

5. An 80 N rock from the moon which has a gravity of 1.6 m/s^2, is brought to the Earth. What is the weight of the rock on the Earth? Take g = 10 m/s^2 on Earth.

(A) 50 N (C) 500 N
(B) 80 N (D) 800 N

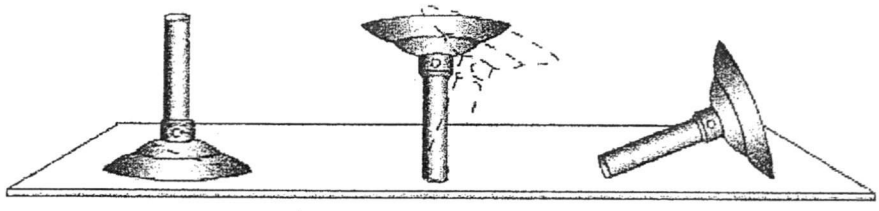
Moon: W = mg 80 = m (1.6) m = 50 kg Earth: W = mg W = 50 (10) W = 500 N

6. What are the apparatuses needed to determine the density of a regularly-shaped block?

(A) a balance and a ruler
(B) a balance and a weighing scale
(C) a measuring cylinder and a ruler
(D) a measuring cylinder and a beaker

A balance will provide the mass. The ruler can be used to measure the dimensions of the block. The volume of the block can be calculated using mathematical formulae.

7. The following diagrams show the initial positions of three identical Bunsen burners. Which row best describes the states of equilibrium of the objects?



(A)	neutral	stable	unstable
(B)	neutral	unstable	stable
(C)	stable	unstable	neutral
(D)	stable	neutral	unstable

8.

9. A worker is lifting boxes of identical weight from the ground onto a moving belt. At first, it takes him 2 s to lift each box. Later in the day, it takes him 3 s. Which statement is correct?

(A) Later in the day, less work is done in lifting each box.
(B) Later in the day, more work is done in lifting each box.
(C) Later in the day, less power is developed in lifting each box.
(D) Later in the day, more power is developed in lifting each box.

Work done is the same as the boxes are of identical weight, lifted to the same height. Later in the day, time taken increases to 3 s, power = work done / time, thus power is reduced

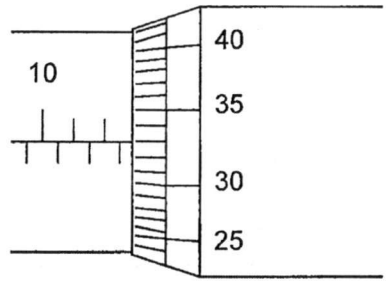
10. A metal rod is heated at one end. Which statement best describes the conduction of heat through the metal rod?

(A) Atoms vibrate and hit atoms at the cold end.
(B) Atoms move from the hot end and hit electrons at the cold end.
(C) Free electrons move from the hot end and hit atoms further along the rod.
(D) Free electrons vibrate and pass energy to free electrons further along the rod.

SECTION A (20 Marks)
Multiple Choice Questions

Answer all questions on the Answer Sheet provided.
Label the Multiple Choice Answer Sheet as Science (Physics)

1. A student used a micrometer screw gauge to measure the thickness of a metal sheet. The diagram below shows part of the micrometer.

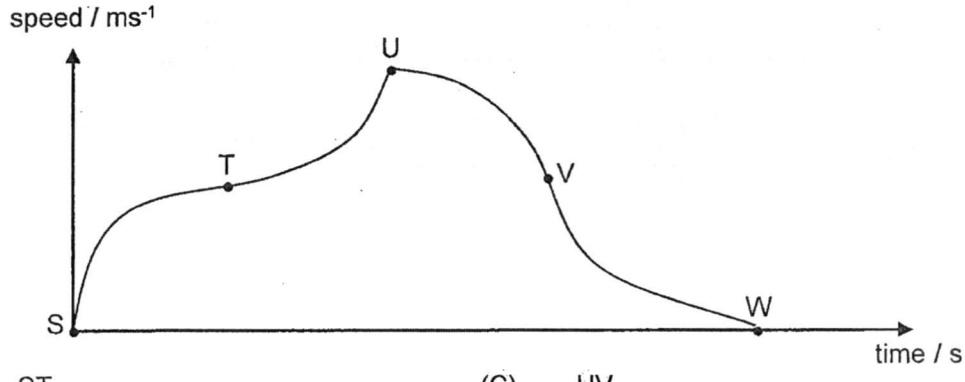


What is the thickness of the metal sheet?

(A) 10.33 mm
(B) 12.33 mm
(C) 12.83 mm
(D) 15.33 mm

12.5 + 0.33 = 12.83

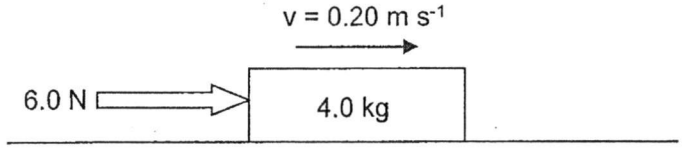
2. The figure shows the speed-time of an object. In which region is the object undergoing increasing deceleration?



(A) ST
(B) TU
(C) UV
(D) VW

ST: decreasing acceleration TU: increasing acceleration VW: decreasing deceleration

3. A box of mass 4.0 kg moves with a constant speed of 0.20 m s^{-1} when a force of 6.0 N is applied.



What are the frictional force and the resultant force acting on the box?

	resultant force	frictional force
(A)	0.0	6.0
(B)	0.8	5.2
(C)	5.2	0.8
(D)	6.0	0.0

resultant force = 0 as acceleration is 0 frictional force = applied force = 6 N

HILLGROVE SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2017

Secondary 4 Express / 5 Normal Academic

SCIENCE (PHYSICS) 5076 / 01

Paper 1

Date: 23 August 2017

Time: 7.50 a.m. – 8.50 a.m.

Duration: 1 hour
for Science (Physics, Chemistry)

Additional material: Multiple Choice Answer Sheet

INSTRUCTIONS TO STUDENTS:

1. Write in soft pencil
2. Do not use staples, paper clips, glue or correction fluid.
3. Write your name, class and register number on the Answer Sheet in the spaces provided.

There are **twenty** 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. Should you wish to change your answer, make sure that you have completely erased the wrong oval.

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.
Usage of calculators is permitted in this examination.

At the end of the examination hand in the Multiple Choice Answer Sheet and the question paper separately. **Label the Multiple Choice Answer Sheet as Science (Physics)**

Name of Student: _____ ( )

Class: _____ Subject Teacher: Mrs Peng / Mdm Teo / Mr Chia / Mr Chow

Parent's Signature: _____

Setter: Mrs Jennifer Peng

This question paper consists of 6 printed pages including the cover page.

[Turn over