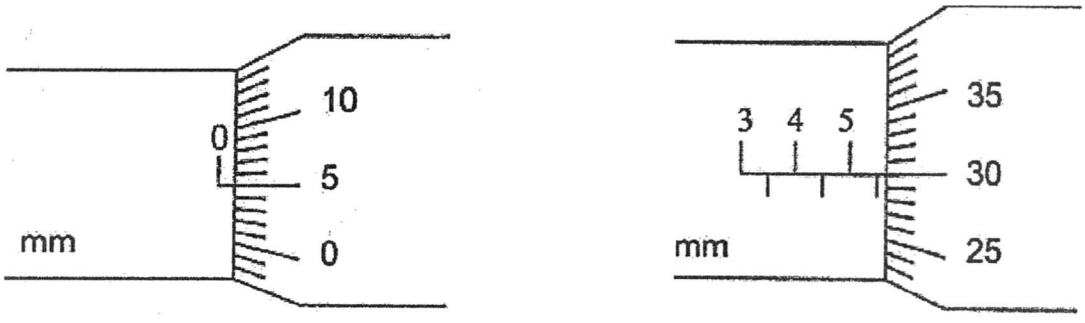
Answer **all** questions.

1 The diagram on the left shows the micrometer reading when the jaws are closed with no ball-bearing. The diagram on the right shows the micrometer reading when the jaws are closed around the ball bearing.



The diameter of the ball bearing is _____.

A 5.85 mm **B** 5.75 mm **C** 2.93 mm **D** 2.88 mm

2 Three pendulums P, Q and R have the same length. The mass of pendulum P is 1.0 kg, pendulum Q is 10 kg and pendulum R is 100 kg.

Given that the effect of air resistance is negligible, which of the following statements is true?

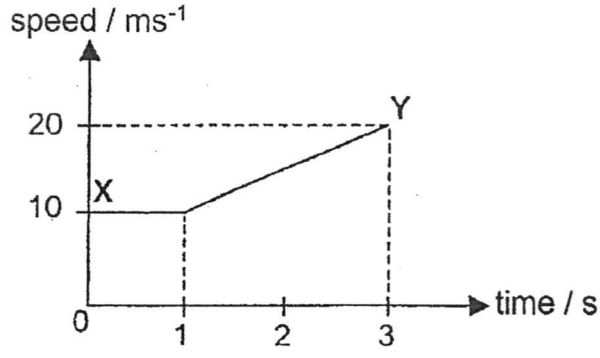
A They will have the same period.

B Pendulum P will oscillate the fastest.

C Pendulum R will oscillate the fastest.

D All three pendulums will oscillate at different periods.

3 The figure shows a speed-time graph.

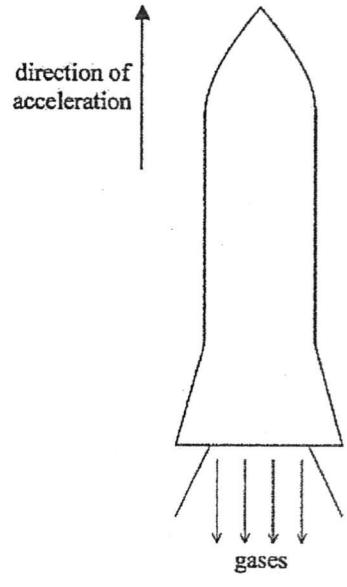


The average speed between X and Y is _____.

A 6.7 ms^{-1} **B** 13.3 ms^{-1} **C** 15 ms^{-1} **D** 20 ms^{-1}

4 A rocket accelerates vertically upwards by ejecting high-speed gases vertically downwards as shown in the diagram.

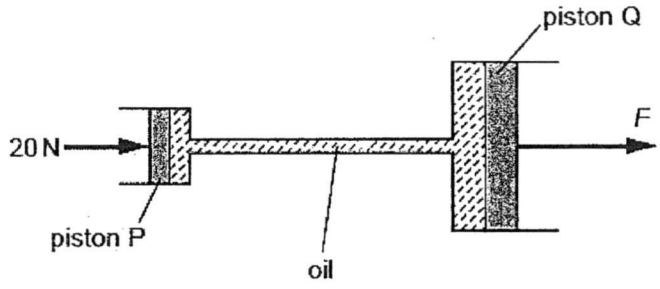
At the instant shown, the weight of the rocket is W and the magnitude of the force the rocket exerts on the gases is T.



What is the magnitude of the net force on the rocket?

A W **B** T **C** $T + W$ **D** $T - W$

5 The diagram shows a simple model of the braking system of a car. A force of 20 N is applied to piston P. As a result, there is a force *F* acting on piston Q.



Piston P has an area of 5.0 cm^2 and piston Q has an area of 25 cm^2.

What is the force *F*?

A 4.0 N **B** 20 N **C** 100 N **D** 500 N

6 A crane lifts a load of 600 kg through a vertical distance of 15 m in 0.5 min.

Taking gravitational field strength as 10 N/kg, what is the average useful power during this operation?

A 200 W **B** 400 W **C** 3 000 W **D** 12 000 W

7 Under the microscope, pollen grains suspended in a liquid are observed to be in continuous random motion.

This is due to _____.

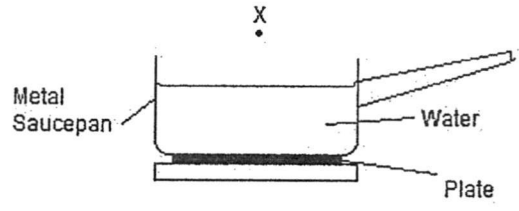
A convection current in the liquid

B the movement of the wind

C the pollen grains absorbing the liquid molecules

D the liquid molecules colliding with the pollen grains

8 The diagram shows a metal saucepan containing water and placed on a hot plate. After some time, the air at point X also becomes hot.



What are the main ways by which heat travels from the hot plate through the base of the metal saucepan, through the water and through the air to point X?

	through the base of the saucepan	through the water	through the air
A	conduction	convection	conduction
B	conduction	radiation	convection
C	convection	convection	radiation
D	conduction	convection	convection

9 When a metal is heated, which of the following will occur?

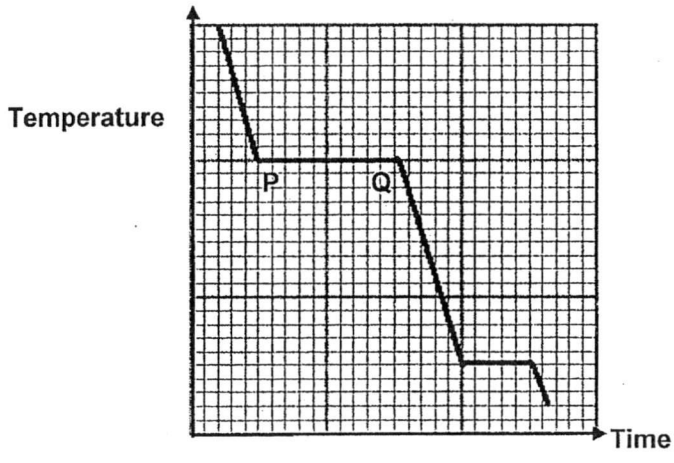
1 The atoms can move freely.

2 The atoms have a larger amplitude of vibration.

3 The average kinetic energy of the atoms is increased.

A 1 and 2 only **B** 2 and 3 only **C** 1 and 3 only **D** 1, 2 and 3

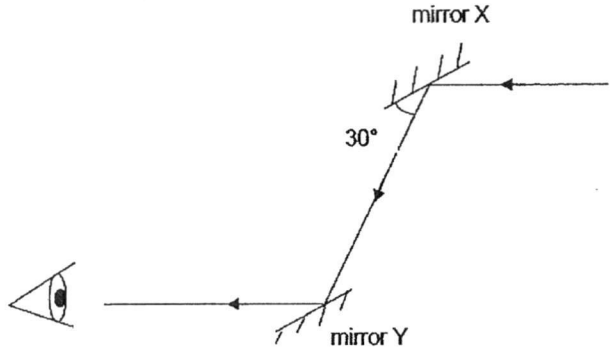
10 A substance is heated in an enclosed space until it becomes a gas.
After the heater is removed, the temperature is recorded at regular intervals.
The graph shows temperature plotted against time.



Which process occurs during the time interval PQ?

A boiling **B** Melting **C** solidification **D** condensation

11 A ray of light is reflected by two parallel plane mirrors X and Y.



Which of the following statements is correct?

A The angle of incidence at mirror Y is 60°.

B The angle of incidence at mirror X is 30°.

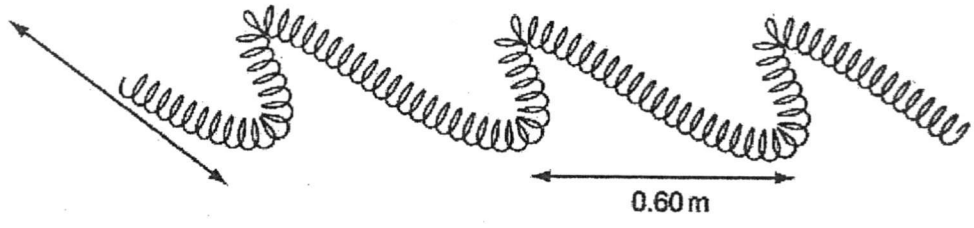
C The angle of reflection at mirror Y is 0°.

D The angle of reflection at mirror X is 120°.

12 Which of the following shows the correct uses of X-rays, microwaves and infra-red radiation?

	X-rays	microwaves	infra-red radiation
A	body check	communication	burglar alarm
B	Radiotherapy	radar	checking banknotes
C	cutting of metal	sunbed	sterilization of water
D	Radiotherapy	fluorescence	cooking

13 The diagram shows part of a spring that is shaken from side to side to produce a wave.

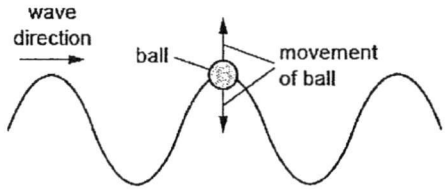


The distance between successive peaks is 0.60 m and the frequency is 2.5 Hz.

How long does it take for a wave to travel 3.0 m along the spring?

A 0.20 s **B** 0.50 s **C** 2.0 s **D** 5.0 s

14 A ball floating in a ripple tank begins to move vertically up and down as a wave passes beneath it. The ball does not move horizontally.



Which of the following statements is correct?

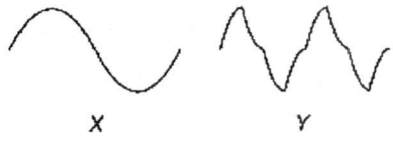
A Both energy and water are transferred in the wave direction.

B Neither energy nor water is transferred in the wave direction.

C Energy is not transferred in the wave direction but water is.

D Energy is transferred in the wave direction but water is not.

15 The figure shows the traces of two musical notes *X* and *Y* on a cathode ray oscilloscope (CRO).



1 *Y* has a higher pitch than *X*.

2 The loudness of *Y* is greater than that of *X*.

3 *X* and *Y* are transverse waves.

Which of the following is true?

A 1 only **B** 2 only **C** 1 and 3 only **D** 1, 2 and 3

16 A plastic rod is rubbed with a cloth. At the end of the process, the rod is found to be positively charged and the cloth is found to be negatively charged.

This involves the movement of _____.

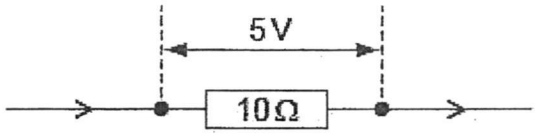
A positive charge from the cloth to the rod

B positive charge from rod to the cloth

C negative charge from the rod to the cloth

D negative charge from cloth to the rod

17 The potential difference (p.d.) across a 10 Ω resistor is 5 V.



How much charge passes through the 10 Ω resistor in 30 seconds?

A 2.0 C **B** 15 C **C** 60 C **D** 1 500 C

18 The cable to an electric fan is worn out. The live wire makes contact with the metal casing which is earthed. The 3-pin plug to the fan contains a 5 A fuse. When the fan is working normally, a current of 4 A flows.

Which of the following scenarios will happen when the switch is closed?

A The metal case heats up to a very high temperature.

B The fuse will melt and disconnect the fan from the mains supply.

C The metal case will become live and dangerous.

D The current will flow to earth and the fuse will not be affected.

19 One end T of a metal rod attracts the S-pole of a bar magnet.

Which of the following deductions about the metal rod is correct?

A It is a magnet with a S-pole at T.

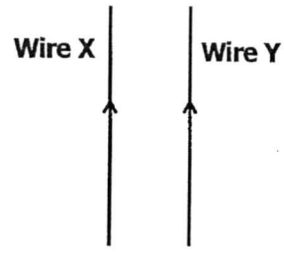
B It is a steel rod which is either unmagnetised or a magnet with a N-pole at T.

C It is a steel rod which is either unmagnetised or a magnet with a S-pole at T.

D It is an aluminium rod.

20 Two current-carrying wires are arranged in parallel as shown.

What is the direction of the electromagnetic force acting on each wire?



	Wire X	Wire Y
A	To the left	To the right
B	To the left	To the left
C	To the right	To the left
D	To the right	To the right

O Level Centre/ Index Number /	Class	Name

新加坡海星中学

MARIS STELLA HIGH SCHOOL

PRELIMINARY EXAMINATION TWO

SECONDARY FOUR

SCIENCE (PHYSICS) **5076/2**

Paper 2 **22 August 2017**

1 hours 15 minutes

(for both Sections A and B)

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

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

This is Section A of the paper.
Answer **all** questions in the spaces provided.
Take gravitational field strength, g = 10 N/kg.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 65.

At the end of the examination, hand in the following separately:
(1) Section A
(2) Section B

For Examiner's Use	
Section A	45
Section B	20
Total	65

This document consists of **13** printed pages inclusive of this cover page.

Section A

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

1 In an experiment, two beakers, each containing sugar solutions A and B are provided.

Fig. 1.1 shows part of the information provided.

(a) You are to complete the missing information in the blanks in Fig.1.1.

	sugar solution A	sugar solution B
volume	200 cm^3	300 cm^3
density	1 200 kg/m^3	_____ g/cm^3
mass	_____ g	330 g

Fig. 1.1

[2]

(b) Both beakers of sugar solutions are then mixed.

Find the density of the mixture in g/cm^3.

density = ...g/cm^3 [2]

2 Fig. 2.1 shows the speed-time graph for the first 120 s of the journey of a lorry.

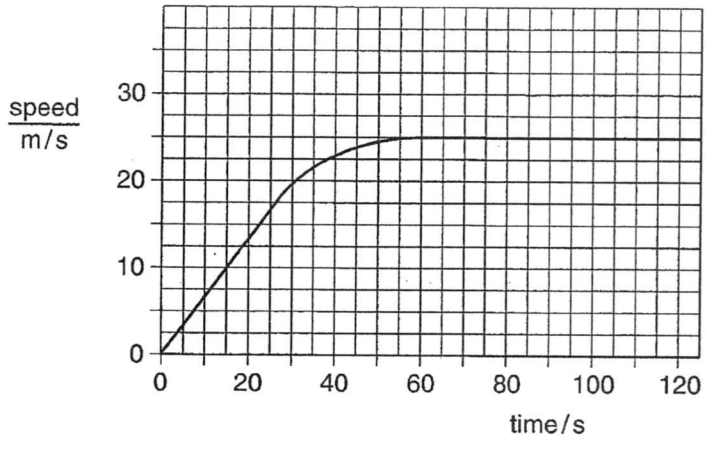


Fig. 2.1

(a) Describe the acceleration of the lorry during this period.

.....

.....

.....[2]

(b) The mass of the lorry is 5 000 kg. Calculate the resultant force on the lorry during the first 15 s.

resultant force = ... [2]

3 A car of mass 1000 kg is moving at 20 m/s along a straight horizontal road.

(a) Calculate the kinetic energy of the car.

kinetic energy = ...[1]

(b) The car is stopped by a constant braking force in a distance of 40 m.

Calculate the size of this braking force, stating clearly how you arrive at your answer.

braking force = ... [3]

4 Fig. 4.1 shows the rest position and Fig. 4.2, the displaced position of a weighted toy. **G** is its centre of gravity. The toy weighs 5.0 N.

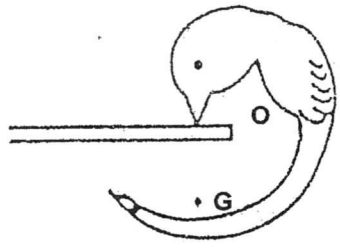


Fig. 4.1

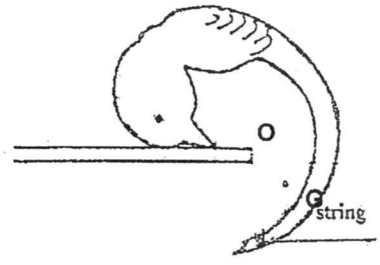


Fig. 4.2

(a) Explain why **G** has to be vertically below the pivot **O** for the toy to remain at rest position as shown in Fig. 4.1.

.....

.....

.....

.....

.....[2]

(b) Fig. 4.2 shows the toy in its slightly displaced position using a string.

State and explain what happens to the toy when the string is cut.

.....

.....

.....

.....

.....[2]

5 A student slowly heats a sample of solid wax in a test-tube.
Fig. 5.1 shows how the temperature of the wax varies with time *t*.

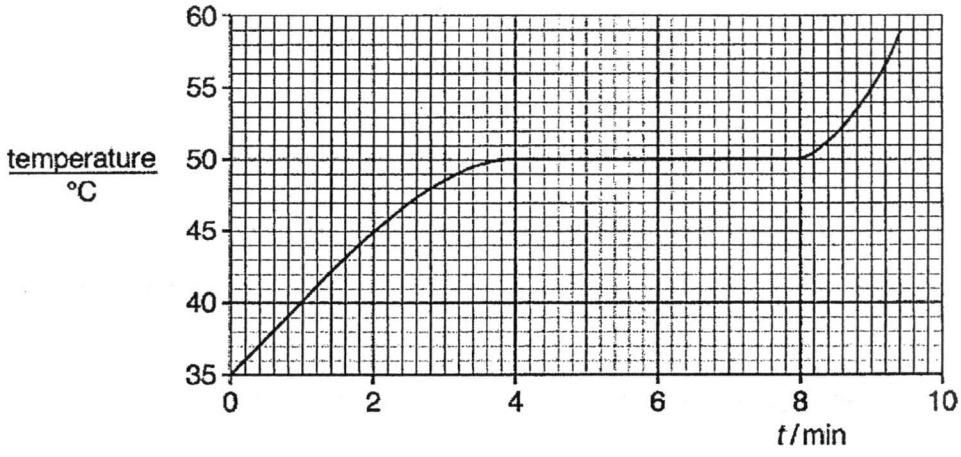


Fig. 5.1

(a) State the melting point of the wax.

.....[1]

(b) Name the physical states of the wax at the following times:

(i) 2 min.....

(ii) 6 min.....

(iii) 9 min.....
[2]

(c) State whether the kinetic energy and the potential energy of the molecules *increases*, *decreases* or *does not change* during the time interval of 4 min to 8 min.

kinetic energy.....

potential energy.....
[1]

6(a) Optic fibres are used to transmit data.

Fig. 6.1 shows a ray of light entering and passing along an optical fibre.

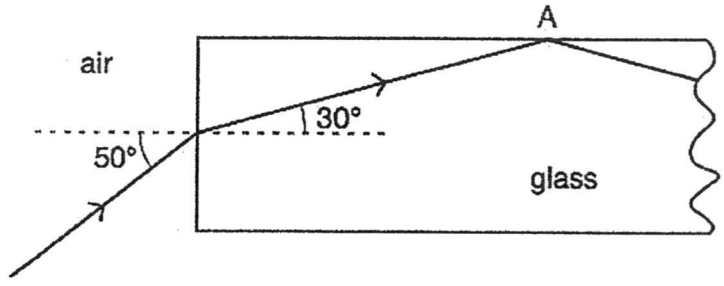


Fig. 6.1 (not to scale)

(i) Calculate the refractive index of the glass in the optical fibre.

refractive index = ... [1]

(ii) Hence, find the critical angle.

critical angle = ... [1]

(iii) Explain why the ray of light is totally internally reflected at A.

.....

.....

.....

.....[2]

6(b) Fig. 6.2 shows the virtual image **I** formed by a magnifying glass which is represented by a straight dotted arrow. The focal point of the lens is represented by **F**.

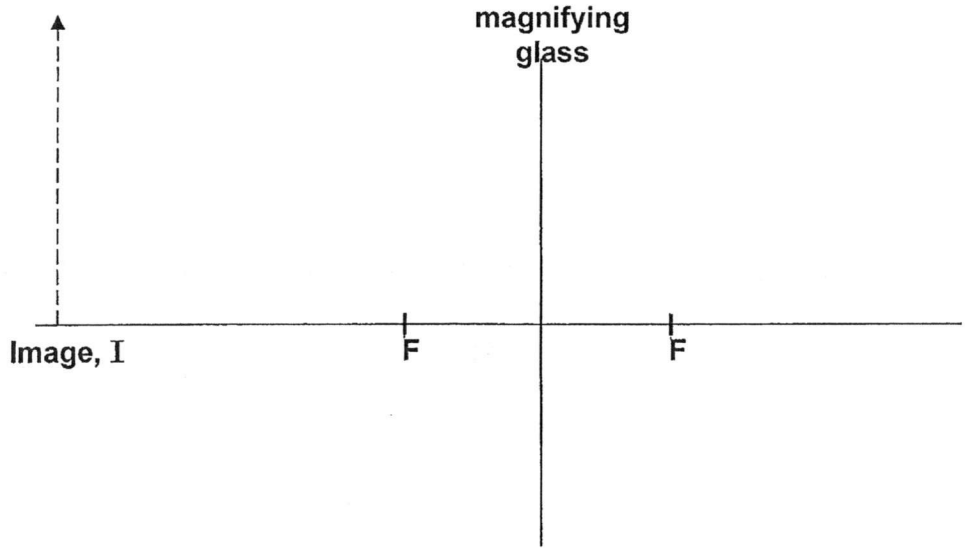


Fig. 6.2 (not to scale)

(i) By means of a ray diagram, complete Fig. 6.2 to determine the position of the object and label it as **O**. [3]

(ii) State all 4 characteristics of the image formed if the object is **moved away** from the lens to a position between F and 2F.

.....

.....[2]

7 Fig. 7.1 shows the displacement-time graph of a wave.

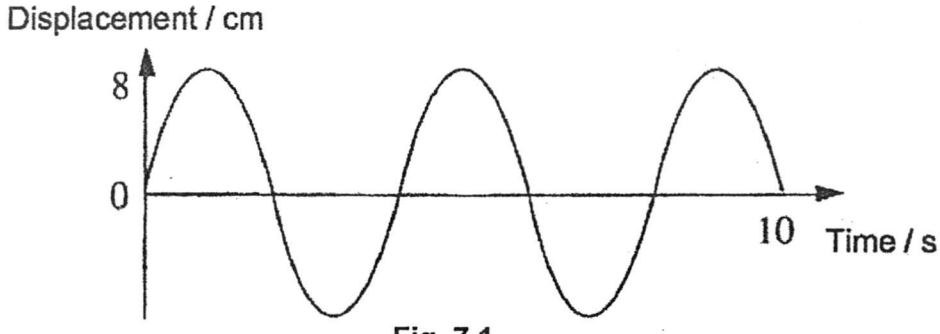


Fig. 7.1

Determine

(a) the frequency of the wave, and

frequency = ... [2]

(b) the speed of the wave if the wavelength is 6.0 m.

speed = ... [1]

8 Electrostatic charges can be placed on objects by rubbing them together.

(a) State the name of the charged particle that is transferred from one object to the other in this process.

.....[1]

(b) Fig. 8.1 shows petrol being pumped into a container.

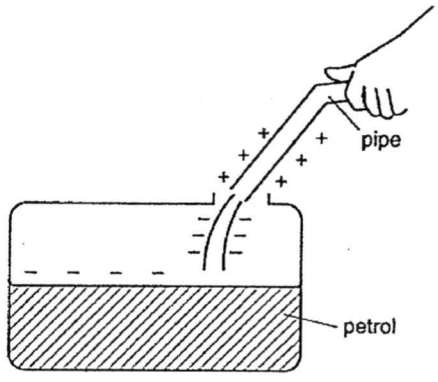


Fig. 8.1

Electrostatic charges build up on the petrol and the pipe as shown in Fig.8.1.

Explain why this is dangerous.

.....

.....

.....

.....[2]

9 Fig. 9.1 shows an electric circuit in which the internal resistance of the battery is negligible. When a filament lamp is connected to the battery of e.m.f of 4.0 V, the current in the circuit is 2.0 A.

The energy dissipated in the filament lamp is 64 J. The resistance of the filament lamp is 2.0 Ω.

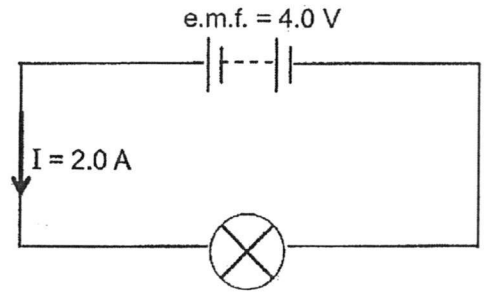


Fig. 9.1

(a) Explain what is meant by *e.m.f.*.

.....

.....[1]

(b) Calculate the amount of charge flowing through the filament lamp.

charge = ... [1]

(c) An identical filament lamp is connected in parallel to the filament lamp.

Calculate

(i) the effective resistance of the circuit,

resistance = ... [1]

(ii) the current drawn from the battery,

current = ... [1]

(iii) the total power dissipated from the lamps.

power = ... [1]

10 An electric iron is rated at 960 W 240 V. The iron is used continuously for 30 minutes.

(a) Calculate the electrical energy used during the period of 30 minutes in

(i) kilowatt-hours

electrical energy = ...kWh [2]

(ii) joules

electrical energy = ... J [2]

(b) Determine the cost if the cost per unit of electricity is $0.30.

cost = ... [1]

End of Section A

O Level Centre/ Index Number /	Class	Name

新加坡海星中学

MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION TWO
SECONDARY FOUR

SCIENCE (PHYSICS) **5076/2**
Paper 2 **22 August 2017**
1 hours 15 minutes
(for both Sections A and B)

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

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

This is Section B of the paper.
Answer **any** two questions. Write your answers in the spaces provided on the question paper.

Take gravitational field strength, g = 10 N/kg.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 65.

For Examiner's Use	
Section B	20

This document consists of **7** printed pages inclusive of this cover page.

Section B

This section starts with question 11.

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

Write your answers in the spaces provided.

11 Fig. 11.1 shows a person P crossing a uniform bridge supported at **AB**. The length of the bridge is 6.0 m and its weight is 2 000 N. The person is 4.0 m away from **B**.

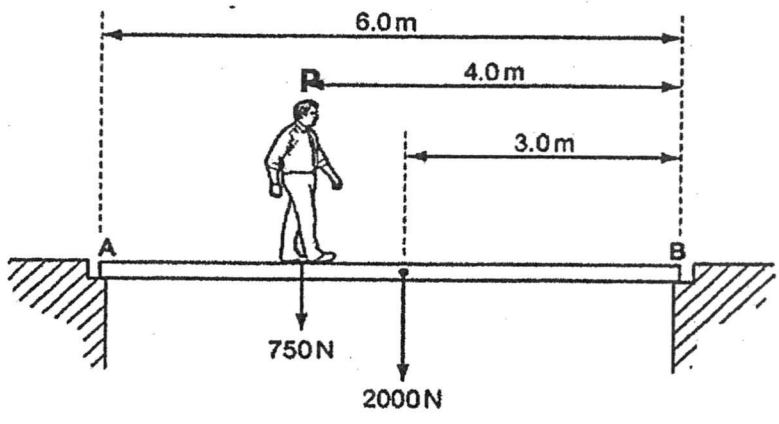


Fig. 11.1 (not to scale)

By taking moments about **B**, calculate

(a) the moment of the weight of the bridge.

moment = ... [2]

(b) the moment of the weight of the person.

moment = ... [2]

(c) On Fig. 11.1, draw clearly the reaction forces acting on the bridge by the supports at A and at B. Label the forces $\mathbf{F_A}$ and $\mathbf{F_B}$ respectively. [2]

(d) Hence, calculate

(i) $\mathbf{F_A}$, the force exerted by the support on the bridge at **A**.

force = ... [2]

(ii) $\mathbf{F_B}$, the force exerted by the support on the bridge at **B**.

force = ... [2]

12(a) An object of mass 2.0 kg is acted upon by two forces 5.0 N and 6.0 N. The angle between these forces is 60°.

(i) By means of an appropriate scaled diagram, determine

1. the magnitude and
2. the direction of the resultant force acting on the object.

Scale: 1 cm rep _____

1. magnitude = ...

2. direction = ...

[4]

(ii) Hence, find the acceleration of the object.

acceleration = ...[1]

12(b) Fig. 12.1 shows the top view of a large hall, 100 m long, which has sound-absorbent sidewalls and a smooth hard wall at each end.

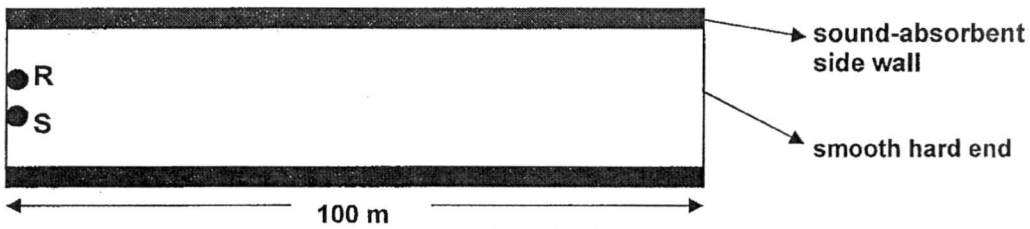


Fig. 12.1

A source of sound at S emits a short single blast.

(i) Explain the observation that "***several echoes of decreasing loudness*** are heard by an observer at R".

.....

.....

.....[2]

(ii) By expressing your answers in 2 decimal places, calculate the time it takes for the **first** and **second echoes** to be heard at R respectively, given that the speed of sound in air is 340 ms^{-1}.

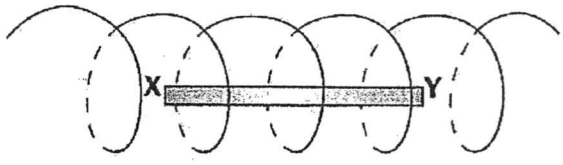
time for 1st echo = ...

time for 2nd echo = ...

[3]

13(a) Fig. 13.1 shows a steel rod XY placed inside a solenoid. In order to magnetise the steel rod, the solenoid needs to be connected to a circuit.

Fig. 13.1



(i) On Fig. 13.1,

1. draw the circuit diagram needed to magnetise the steel rod. Include a power supply and any other apparatus needed. [2]

2. mark the direction of the current flow **on the circuit** and state clearly the corresponding magnetic pole at the end labelled Y. [2]

(ii) State one factor in this method that will affect the strength of the magnet produced.

.....[1]

13(b) Fig. 13.2 and Fig. 13.3 show a small bar magnet hanging on a thread **near** the end of a solenoid (coil) carrying a steady current.

Fig 13.2

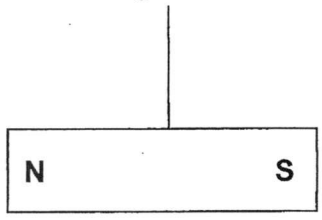
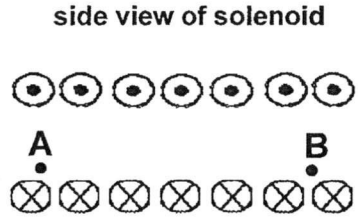


Fig. 13.3



key

current out of page ⊙

current into page ⊗

The current in the solenoid creates a magnetic field.

(i) A magnetic field line passes through **A** and **B**.
On Fig 13.3, draw this magnetic field line both **inside and outside** the solenoid that passes through **A** and **B.** Indicate the **direction** of the magnetic field on the line you have drawn with an arrow. [2]

(ii) An iron core is inserted into the solenoid in Fig. 13.3.
State and explain what will happen to the solenoid and the bar magnet.

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.....

.....[3]

End of Section B

Paper 1

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

Paper 2
Sect A

1a Mass of A = 240 g
Density of B = 1.10 g/cm^3

1b Density of mixture = Mass of mixture / Volume of mixture
= (240 + 330) g / (200 + 300) cm^3
= **1.14 gcm^{-3}**

2a Uniform/ constant acceleration at first and it decreases to zero

2b a = (v-u)/t
= 10/ 15
= 0.667 m/s^2 or 0.67 m/s^2

F = ma
= 5 000 x 0.67
= 3 330 N or 3 300 N

Accept 3 350 N or 3 340 N

3a KE = ½ mv^2
= ½ x 1000 kg x (20 m/s)^2
= **200 kJ**

3b Work done by braking force on the car = KE of the car
F x 40 m = 200 000J
Braking force = 200 000J / 40m
= **5 000 N**

4a The toy which is at rest is in equilibrium and thus there is no (resultant) moment. When G is directly under the pivot O, the perpendicular distance from the pivot to the line of action of the force (or weight) is zero.

4b When the string is cut, the toy starts to oscillates about O / moves to the left first and then to the right. This is due to the moment of the weight of the toy. The toy comes to rest eventually at the position shown in Fig 4.1.

5a 50 °C

5b 1. solid
2. mixture of solid and liquid
3. liquid

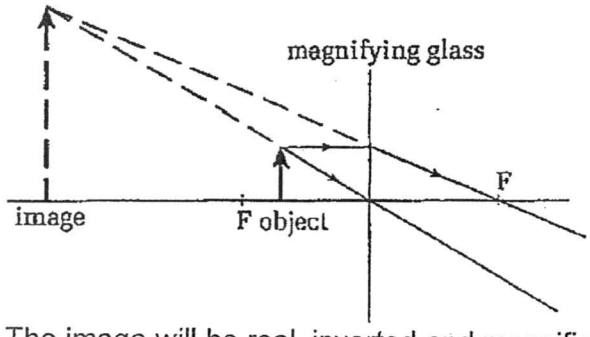
5c KE does not change, PE increases

6ai n = sin i/sin r
= sin 50° /sin 30°
= 1.5(3)

6aii $c = \sin^{-1} 1/n$
$= \sin^{-1} 1/1.5(3)$
$= 41°$

6aiii - moving from optically more dense to less dense medium [or moving to lower refractive index (air)
- angle of incidence is greater than the critical angle (of glass)

6bi



- correct dotted and solid lines
- 2 arrows before and 2 after lens:
- Ray passing through F and centre of lens
- solid arrow labeled O

6bii The image will be real, inverted and magnified. On the other side of the lens.

7a $f = 1/T$
$= 1/ 4.0$
$= \underline{0.25 \text{ Hz}}$

7b $v = f\lambda$
$= 0.25 \text{ Hz} \times 6.0 \text{ m}$
$= \underline{1.5 \text{ ms}^{-1}}$

8a Electron

8b The petrol will explode/ catch fire/combustion
Opposite/ unlike charges attract
<u>cause movement of electrons</u>/ <u>current/ discharge</u> or <u>sparks will occur</u> (in air)

9a e.m.f. is the work done by a source in driving a unit charge around a complete circuit (or the energy released per unit charge)

9b $Q = E/V$ or W/V
$= 64 /4.0$
$= \underline{16 \text{ C}}$

9ci $1/ R = 1/2 + 1/2$
$R = \underline{1.0 \ \Omega}$

9cii $I = V/ R$
$= 4.0 / 1.0$
$= \underline{4.0 \text{ A}}$

9ciii $P = I^2R$
$= (4.0)^2 \times 1$

= 16 W

10a Electrical energy = Pt
= 960/1000 kW x 30/60h
= 0.48kWh

10b Electrical energy = Pt
= 960 W x (30 x 60)s
= 1 730 000 J or 1.73 x 10^6 J

10c Cost of electricity = 0.48kWh x $0.30
= 14 cents or $0.14

Section B

11a Moment of weight of the bridge about B = F x d
= 2 000 x 3.0
= 6 000 Nm

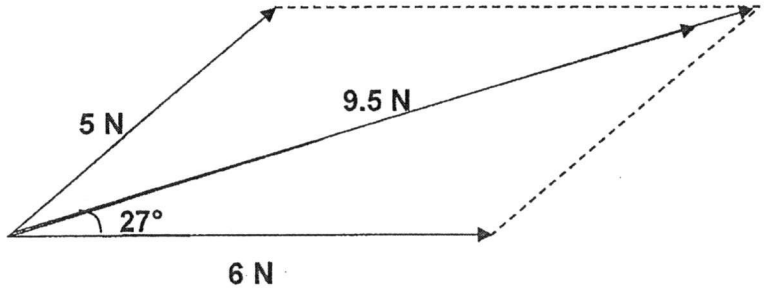
11b Moment of weight of person about B = F x d
= 750 x 4.0
= 3 000 Nm

11c F_A and F_B and arrows at correct positions

11d In equilibrium, taking moments about B,
clockwise moments = anti-clockwise moments
F_A x 6.0 = 6 000 + 3 000
F_A = 9 000/6.0
= 1 500 N

11e In equilibrium, sum of upward forces = sum of downward forces
$F_A + F_B$ = 2 000 + 750
F_B = 2 750 – 1 500
= 1 250 N

12ai



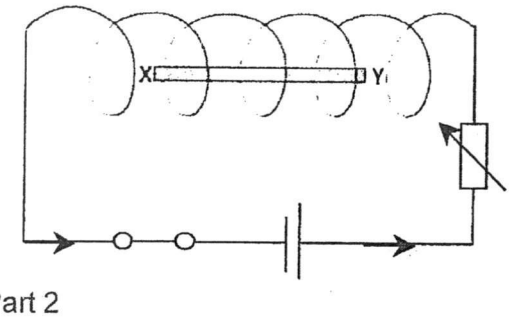
(1) Magnitude of net force = 9.5 N (9.4 N to 9.7 N)
(2) Direction = 27° (± 1°) to the 6.0 N force (or 33° to the 5.0 N force)

12aii a = F/m = part (i)/2.0 = 4.8 ms^{-2} ans based on given range in 12ai.

12bi Several echoes: due to repeated reflections of sound from the walls at both ends.
Decreasing loudness: part of the sound energy is absorbed by / lost to the sound absorbent walls.

12bii 1st echo
time = 2x distance/time (t = 2d/v or 2s/v)
= (2x100) /340
= 0.588 s = 0.59 s
2nd echo
time = distance/time
= (4x100) /340
= 1.176 s = 1.18 s
Both answer in 2 d.p.

13ai



Part 2
Correct current direction and corresponding magnetic pole at end Y or next to right end of solenoid, in symbol or spelt

13aii - (Magnitude) of current flowing in the solenoid or
- Number of turns (per unit length) of the solenoid

13bi One closed loop passing through A and B enclosing all "X"
Direction of magnetic field is clockwise

13bii The **solenoid** becomes a **stronger electromagnet** with a South pole/ S pole on the left / facing the bar magnet.

Explanation: When **iron core** is inserted the **magnetic field strength** of the electromagnet is greatly **increased.**

Since **like poles repel**, the **bar magnet** will be **repelled more strongly** by the solenoid / **move away more** from the solenoid.