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SERANGOON SECONDARY SCHOOL
PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

CANDIDATE NAME	( )	CLASS	
CENTRE NUMBER	S	INDEX NUMBER	

SCIENCE (PHYSICS, CHEMISTRY)

Paper 1

5076/01
26 August 2022
1 hour

Additional Materials: Multiple Choice Answer Sheet

Setter(s):

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staplers, paper clips, glue or correction fluid.
Write your Centre number, index number and name on the Multiple Choice Answer Sheet.
DO **NOT** WRITE IN ANY BARCODES.

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.

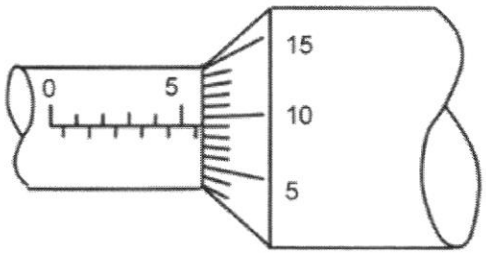
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Data Sheet is printed on page X.
A copy of the Periodic Table is printed on page X.
The use of an approved scientific calculator is expected, where appropriate.

This paper consists of **?** printed pages, including this **cover** page.

1 Which list contains **only** scalar quantities?

A acceleration, distance, kinetic energy, length
B distance, temperature, volume, weight
C mass, deceleration, density, kinetic energy
D mass, speed, kinetic energy, volume

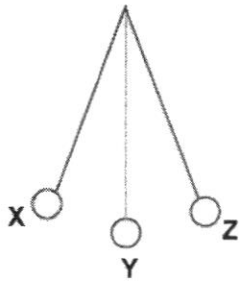
2 A micrometer screw gauge is used to measure the diameter of a copper wire.



What is the diameter of the wire?

A 5.45 mm **B** 5.59 mm
C 5.73 mm **D** 6.23 mm

3 The diagram shows a simple pendulum oscillating between positions **X** and **Z**.



Which sequence should be timed to measure the period of the pendulum?

A **X → Y** **B** **X → Z**
C **X → Z → Y** **D** **X → Z → X**

4 An object falls from rest through a great height in air. Which row describes the acceleration and the velocity of the object before it reaches terminal velocity?

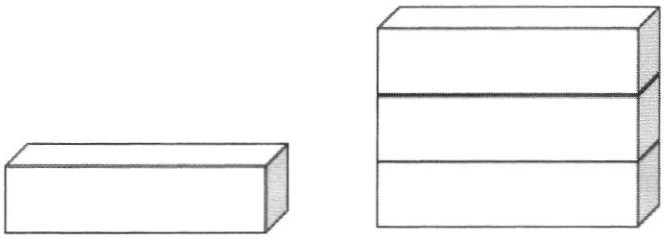
	acceleration	velocity
A	constant	constant
B	constant	increasing
C	decreasing	increasing
D	decreasing	decreasing

5 A force is applied to an object on a frictionless surface. It produces an acceleration of 3.5 m/s².

What are possible values for the applied force and for the mass of the object?

	force / N	mass / kg
A	2.0	1.5
B	2.0	7.0
C	7.0	0.5
D	7.0	2.0

6 The diagram shows a single brick and a pile of three bricks. All the bricks are identical.



Which statement about the bricks is correct?

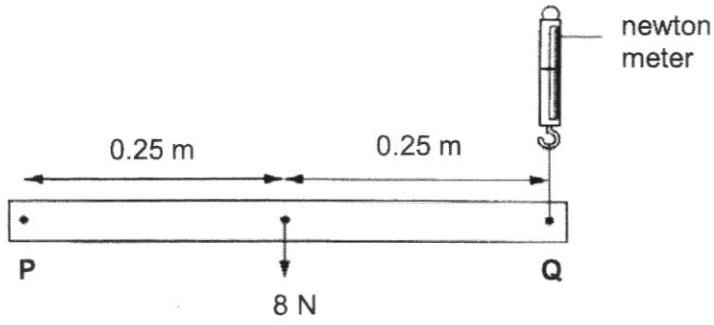
A The pile of bricks has the same density as the single brick, but three times the volume and mass.

B The pile of bricks has the same mass as the single brick, but three times the density and volume.

C The pile of bricks has the same volume as the single brick, but three times the density and mass.

D The pile of bricks has three times the mass, volume and density compared to the single brick.

7 A metal bar, PQ, has a weight of 8 N and is pivoted at P. It is prevented from turning by a newton meter acting at Q.

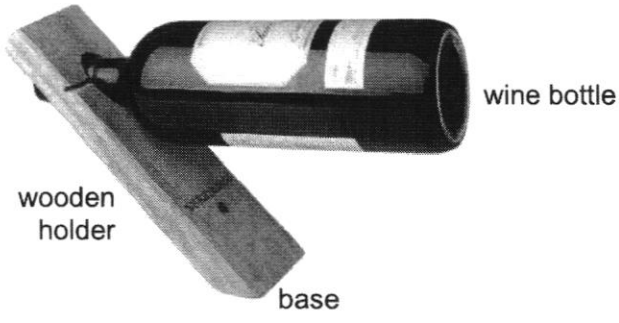


What is the reading on the newton meter?

A 4.0 N **B** 8.0 N

C 12.8 N **D** 16 N

8 The diagram shows a wine bottle placed in a wooden holder. The bottle and the holder are in equilibrium.



Which statement is true about the set-up?

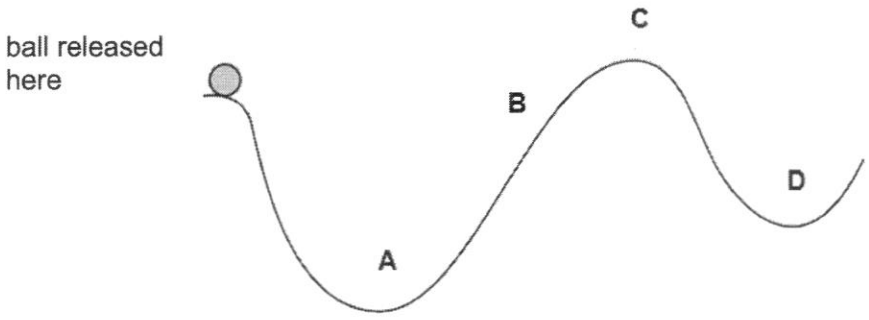
A The centre of gravity of the bottle is directly above the base of the wooden holder.

B The centre of gravity of the bottle and that of the wooden holder are at the same point.

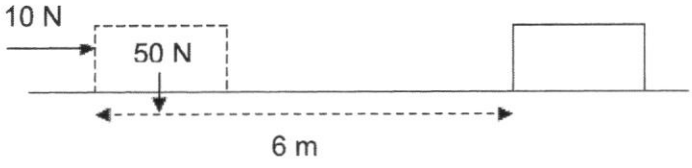
C The centre of gravity of the wooden holder is directly above the base of the wooden holder.

D The centre of gravity of the bottle and the wooden holder is directly above the base of the wooden holder.

9 A ball is released from rest and rolls down a track from the position shown.
What is the furthest position the ball could possibly reach?



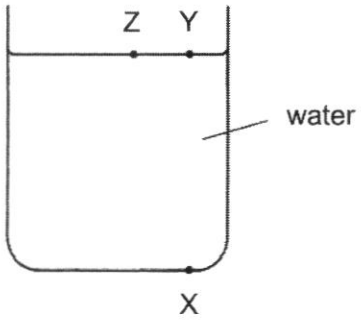
10 A box weighing 50 N is being pushed horizontally on a smooth surface by a 10 N force for 6 m in 3 s.



What is the average power?

A 20 W
B 60 W
C 100 W
D 300 W

11 A student has a large tank of water in which he wants to set up a convection current.



Which position is the most suitable to setup a convection current?

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

12 Liquid evaporates from a beaker.
What happens to the temperature of the remaining liquid and how does this temperature change affect the rate of evaporation?

	temperature	rate of evaporation
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

13 It takes 0.20 s to generate one complete wave in a ripple tank. The wavelength of each wave produced is 4.0 cm.

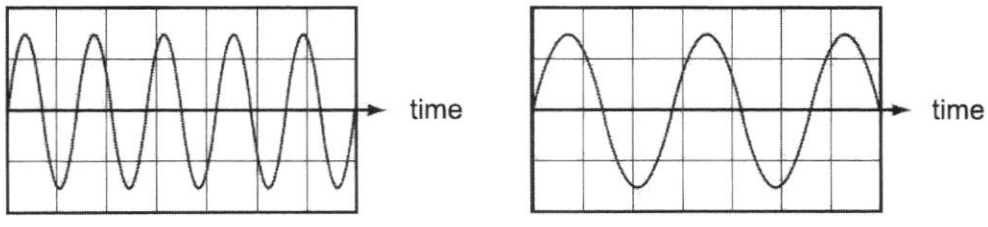
What is the speed of the wave?

A 0.80 cm/s
B 1.3 cm/s
C 5.0 cm/s
D 20 cm/s

14 Which of the following sets of electromagnetic waves have higher wavelengths than visible light?

A radio waves, infrared radiation, ultraviolet radiation
B radio waves, microwaves, infrared radiation
C X-rays, gamma rays, ultraviolet radiation
D X-rays, microwaves, infrared radiation

15 The diagrams show the wave shapes of two different sounds. The scales are the same in each diagram.

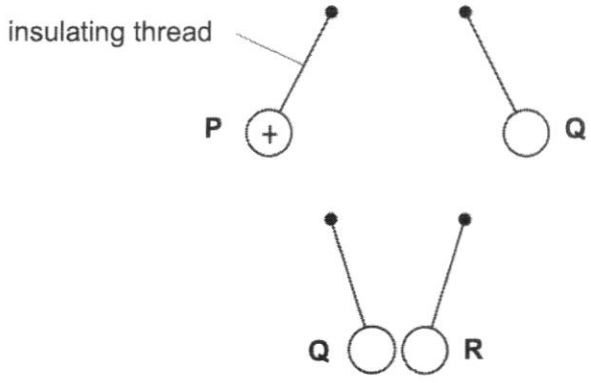


sound 1 sound 2

How does sound 2 compare with sound 1?

A Sound 2 is louder than sound 1.
B Sound 2 is quieter than sound 1.
C Sound 2 has a lower pitch than sound 1.
D Sound 2 has a higher pitch than sound 1.

16 Three charged balls, **P**, **Q** and **R**, are suspended by insulated threads. Ball **P** is positively charged.



What are the charges on **Q** and **R**?

	charge on **Q**	charge on **R**
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

17 An electric oven is connected to the mains supply using insulated copper wires. The wires become very warm.

What can be done to reduce the resistance in the insulated copper wires?

A use thicker copper wires

B use thicker insulation

C use thinner copper wires

D use thinner insulation

18 Which statement describes an example of induced magnetism?

A A bar magnet attracts another bar magnet.

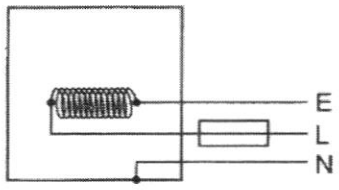
B A bar magnet, swinging freely, comes to rest pointing North-South.

C A bar magnet attracts a steel ball bearing.

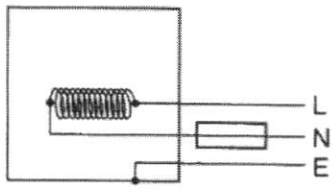
D A compass needle points to S-pole of a bar magnet.

19 The diagrams show the wiring to a heating element in a toaster oven. Which one shows the correct arrangement of wires?

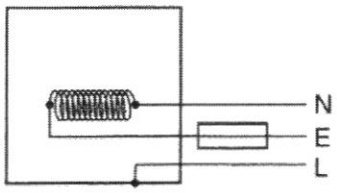
A



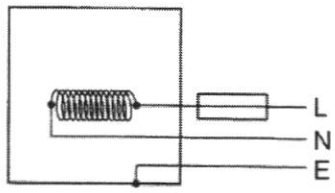
C



B

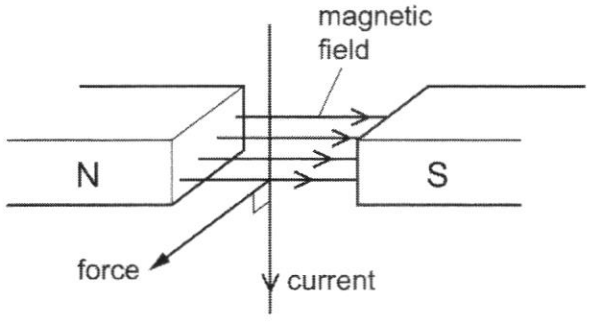


D



20 A wire in a magnetic field carries a current. The wire experiences a force due to the magnetic field.

The diagram shows the directions of the magnetic field, the current and the force.



The direction of the current and the direction of the magnetic field are both reversed. In which direction does the force act now?

A in the opposite direction from before the change

B in the same direction as before the change

C towards the north pole

D towards the south pole

END OF PAPER

SERANGOON SECONDARY SCHOOL
PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS AND 5 NORMAL ACADEMIC

CANDIDATE NAME	( )	CLASS	
CENTRE NUMBER	S	INDEX NUMBER	

SCIENCE PHYSICS

Paper 2 **(Section A)**

5076/02
23 Aug 2022
1 hour 15 minutes

Candidates answer on the Question Paper.

Setter(s):

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number 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 or graphs.
Do not use staplers, 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.

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

The number of marks is given in brackets [ ] at the end of each question or part question.

For examiner's use	
Section A	45

This question paper consists of **17** printed pages, including this **cover** page.

Section A [45 marks]

Answer **all** questions.

1 Fig. 1.1 (not drawn to scale) shows a load held in position by two wires A and B. There is a tension of 50 N in each wire, with an angle of 160° between them.

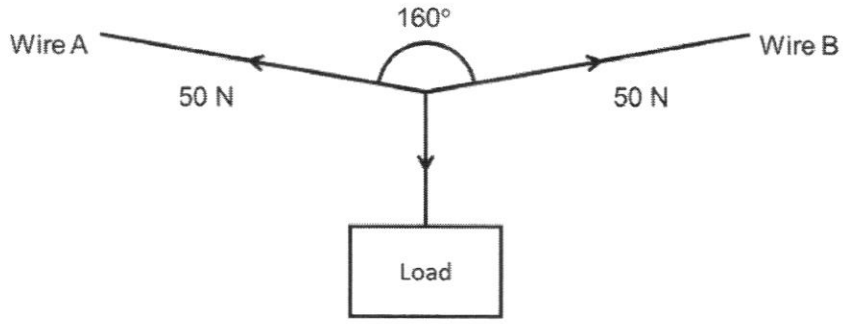


Fig. 1.1

(a) Using an appropriate scale, draw a vector diagram in the space below to determine the weight of the load.

weight = ... N [2]

(b) Calculate the mass of the load. [g = 10 N/kg]

mass = ... g [2]

2 A cyclist was travelling along a straight path. Fig. 2.1 shows the distance travelled by the cyclist with respect to time.

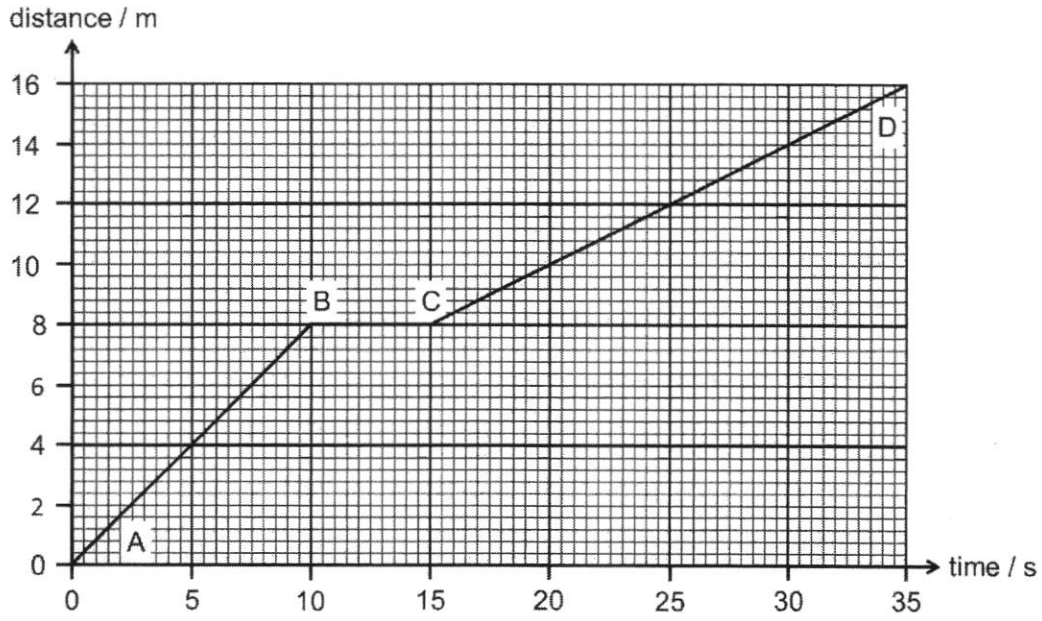


Fig. 2.1

(a) Calculate the speed of the cyclist from $t = 0$ s to $t = 10$ s.

speed = ... m/s [2]

(b) Describe the motion of the cyclist from $t = 10$ s to $t = 35$ s.

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..... [2]

3 Fig. 3.1 shows a digger used to remove 3000 N of soil from the ground.

The centre of gravity of the soil has a perpendicular distance of 2.0 m away from the front edge A of the tracks in contact with the ground. The gravitational field strength on Earth is 10 N/kg.

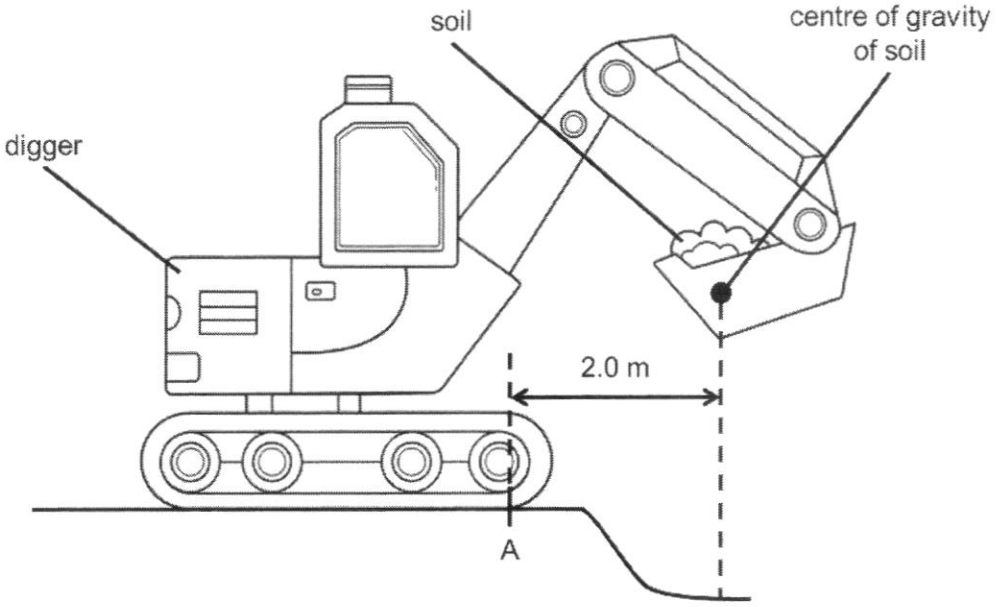

Fig. 3.1

(a) Calculate the moment of the weight of the soil about A.

moment of the weight of soil = ... Nm [1]

(b) The digger is moved forward such that the centre of gravity of the digger is directly above point B. Fig. 3.2 shows the digger at rest in that position without falling over.

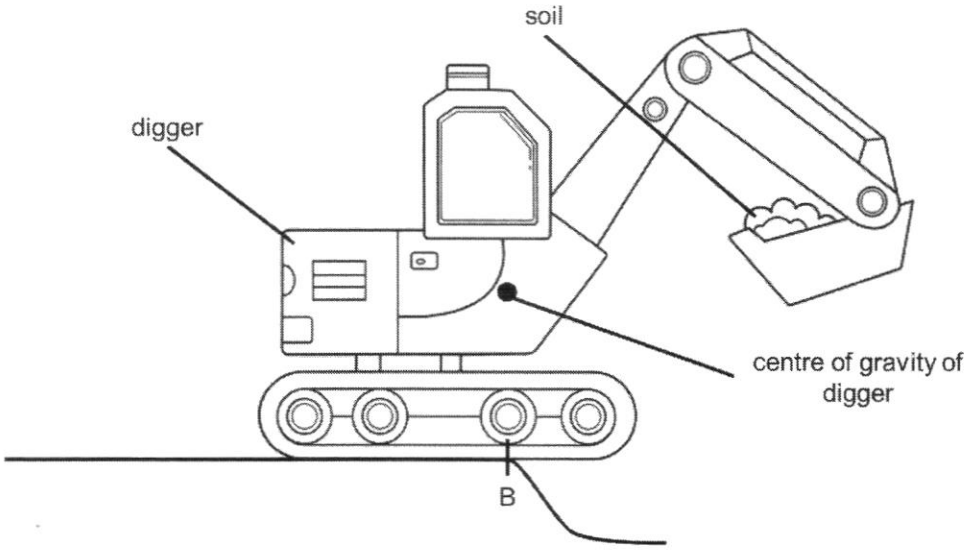

Fig. 3.2

Explain why the digger will fall over if it continues to move forward any further.

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.....

.....

..... [2]

4 Fig. 4.1 shows a gymnast on a trampoline at point A with stretched springs on the side. The gymnast starts to rise and passes through point B. Fig. 4.2 shows the maximum height attained by the gymnast at point C.

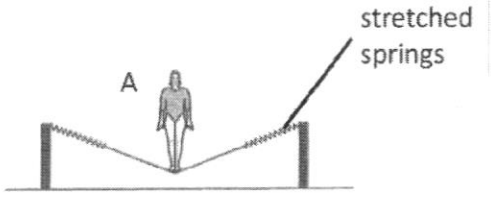

Fig. 4.1

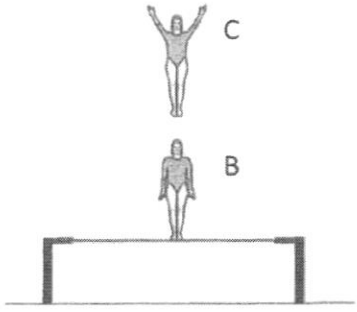

Fig. 4.2

(a) The gymnast has a mass of 50 kg and travelled 0.50 m from point A to B.

Calculate the amount of work done against gravity as the gymnast travelled from point A to B. [g = 10 N/kg]

work done = ... J [2]

(b) State the type of energy gained by the gymnast when rising from point B to C.

.....

..... [1]

(c) When the gymnast is at point B, there is a total kinetic energy of 1750 J.

Ignoring the effects of resistive forces, calculate the maximum height that the gymnast can reach.

maximum height = ... m [2]

5 Fig. 5.1 shows two identical glass cylinders containing equal volumes of water at the same initial temperature of 30°C. Two identical electric heaters were placed in the cylinders, one near the top in cylinder **A** and the other near the bottom in cylinder **B**.

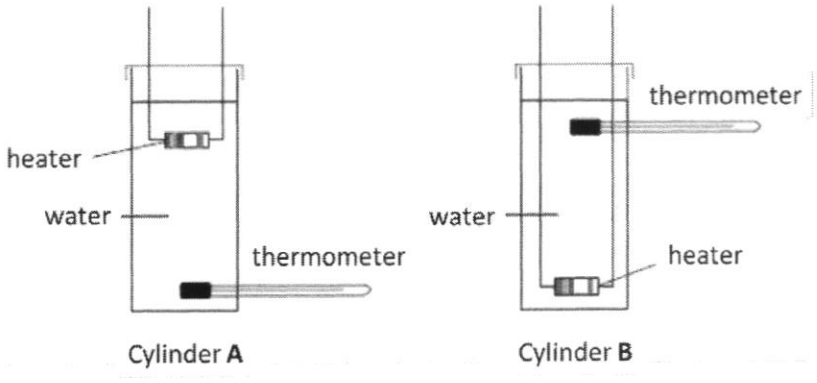

Fig. 5.1

(a) State the method(s) of transfer of thermal energy present in both cylinders.

..... [1]

(b) Describe the main method of heat transfer in which all the water is heated up in cylinder **B**.

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..... [3]

(c) Both heaters are switched on at the same time. Explain why the thermometer reading in cylinder **A** increases much slower than the one in cylinder **B**.

.....

..... [1]

6 Fig. 6.1 shows the cooling curve of substance X. The temperature of substance X was brought down from an initial temperature of 45 °C using a cooling unit with a power rating of 800 W.

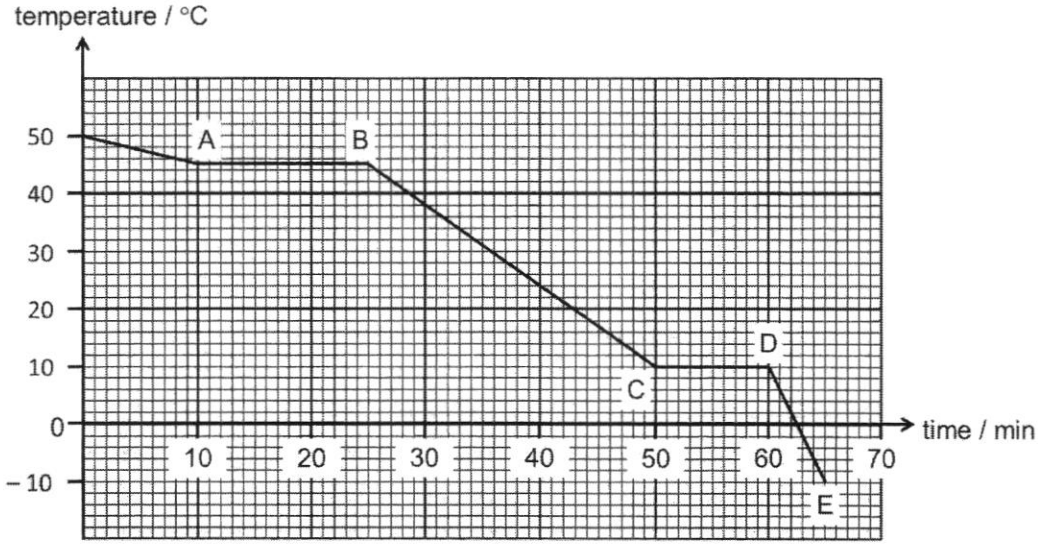

Fig. 6.1

(a) Calculate the amount of energy consumed by the cooling unit to change substance X from liquid to solid state.

amount of energy = ... J [2]

(b) Explain why the temperature of substance X remains constant from point A to B.

.....

.....

.....

.....

..... [2]

(c) Calculate the resistance of the cooling unit given that the normal operating current is 4.0 A.

resistance = ... Ω [2]

7 Fig. 7.1 shows a light ray incident on an air-to-glass boundary at an angle of 75°. The light ray is then reflected from the surface of a plane mirror, placed below the glass layer. The refractive index of the glass is 1.50.

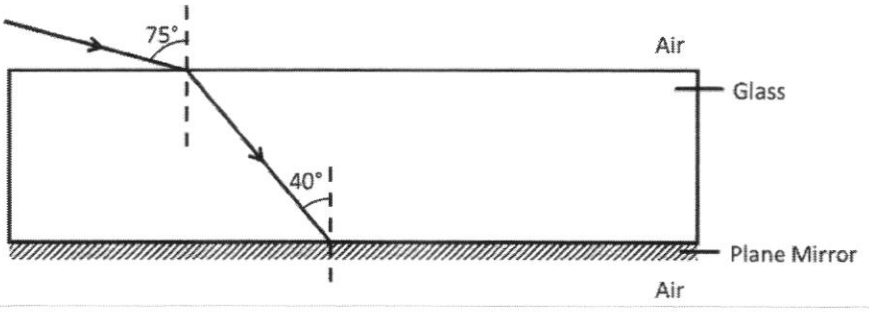

Fig. 7.1

(a) In the space above, complete the ray diagram as the light ray emerges from the glass layer back into the air. [1]

(b) **(i)** Calculate the critical angle of the glass if its refractive index is increased to 1.60.

critical angle = ...° [1]

(ii) Hence, explain what would happen to the light ray if the plane mirror is removed and the refractive index of the glass layer is increased to 1.60.

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..... [2]

8 **(a)** Fig. 8.1 shows some short metal threads attached to a metal ball. The metal ball is supported by an insulating stand. The metal ball and threads contain negative charges that are free to move throughout the metal surface and positive charges that are not free to move. The metal ball and threads have no overall charge.

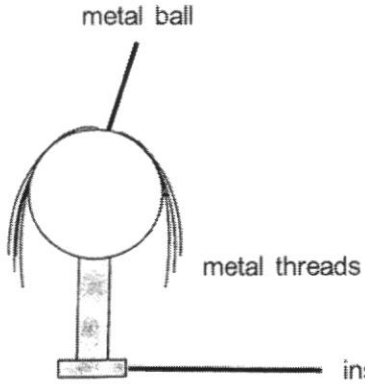

Fig. 8.1

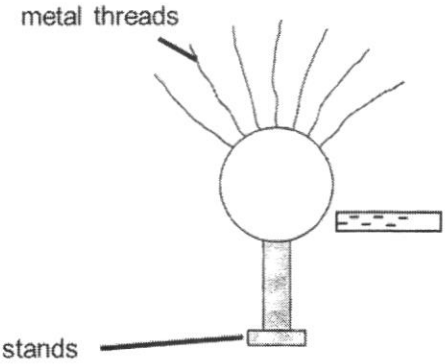

Fig. 8.2

Fig. 8.2 shows a negatively charged rod placed near the right side of the metal ball and the metal threads start to "stand" and move away from one another.

Explain why the metal threads would "stand" and move away from one another in Fig. 8.2.

.....

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..... [2]

(b) Fig. 8.3 shows an electrical circuit which consists of a 9 V cell, a 4.0 Ω resistor and 3 light bulbs of the same resistance. The potential difference across lamp Z is measured to be 3 V.

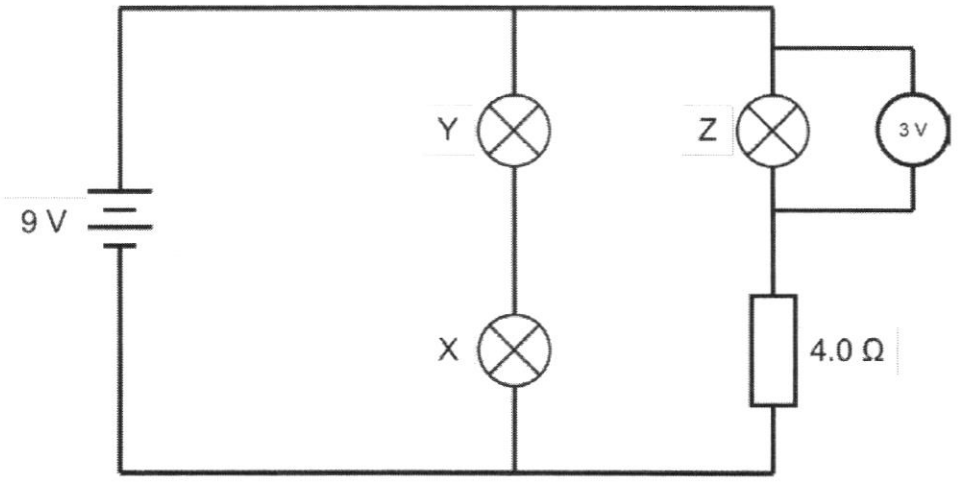

Fig. 8.3

(i) Calculate the current flowing in the 4.0 Ω resistor.

current = ... A [2]

(ii) Calculate the resistance of lamp Z.

resistance = ... Ω [1]

(iii) Calculate the total resistance of the circuit.

resistance = ... Ω [2]

9 **(a)** Fig. 9.1 shows two identical rods A and B placed in a solenoid which is placed on a horizontal flat surface and is connected to some batteries and switch S. Both rods are made of iron.

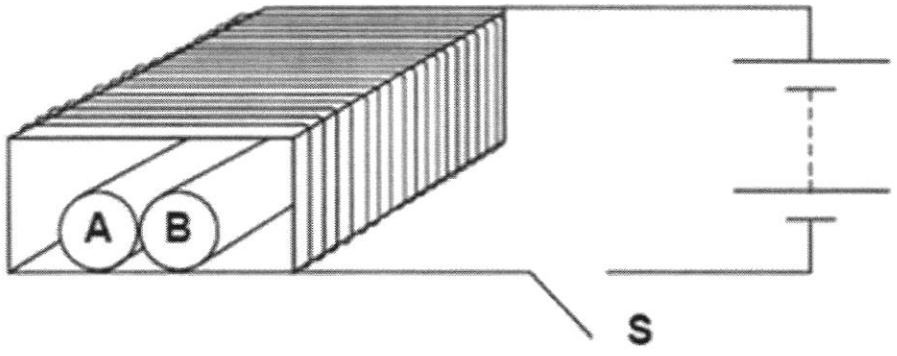

Fig. 9.1

(i) When switch S is closed, explain why the iron rods will roll away from each other.

.....

.....

.....

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..... [2]

(ii) Switch S is then opened after some time. Explain why the rods will roll towards each other if rod A is made of iron while rod B is made of steel.

.....

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..... [2]

(b) Fig. 9.2 shows a rigid wire held between the poles of a U-shaped magnet. When the switch is closed, there is an upward force on the wire as indicated.

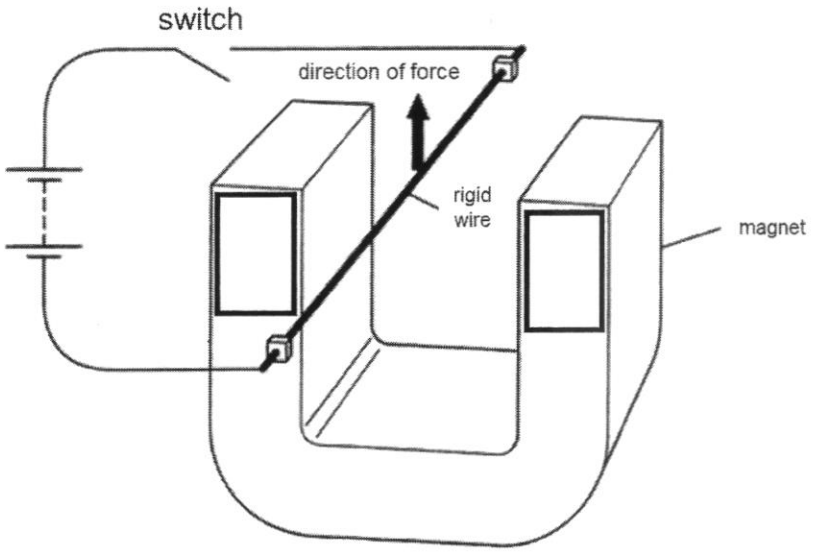

Fig. 9.2

(i) In the boxes provided in Fig. 9.2, label the north pole "N" and south pole "S" of the U-shaped magnet. [1]

(ii) State the changes that can be made to the set-up to cause a bigger downward force to act on the wire.

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..... [2]

SERANGOON SECONDARY SCHOOL
PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS AND 5 NORMAL ACADEMIC

CANDIDATE NAME	( )	CLASS	
CENTRE NUMBER	S	INDEX NUMBER	

SCIENCE PHYSICS

Paper 2 **(Section B)**

5076/02
23 Aug 2022
1 hour 15 minutes

Candidates answer on the Question Paper.

Setter(s):

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number 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 or graphs.
Do not use staplers, 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.

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

The number of marks is given in brackets [ ] at the end of each question or part question.

For examiner's use	
Section B	
Total	20

This question paper consists of **10** printed pages, including this **cover** page.

Section B [20 marks]
Answer any **two** questions from this section.

10 **(a)** Fig. 10.1 shows how the speed of a moving car varies with respect to time.

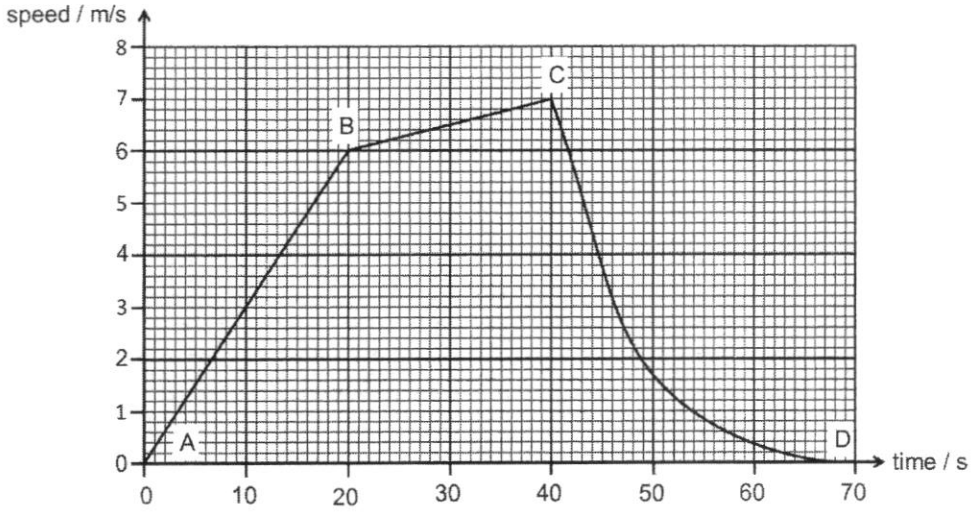


Fig. 10.1

(i) Calculate the average speed of the car for the first 40 seconds.

average speed = ... [2]

(ii) Assuming that the engine force remains constant throughout the whole journey, state whether the car was subject to any change in resistive forces between C and D. Explain your answer.

.....

.....

..... [2]

(b) Fig. 10.2 shows a uniform box held in equilibrium about the pivot P by a force F. The mass of the box is 4.0 kg. [g = 10 N/kg]

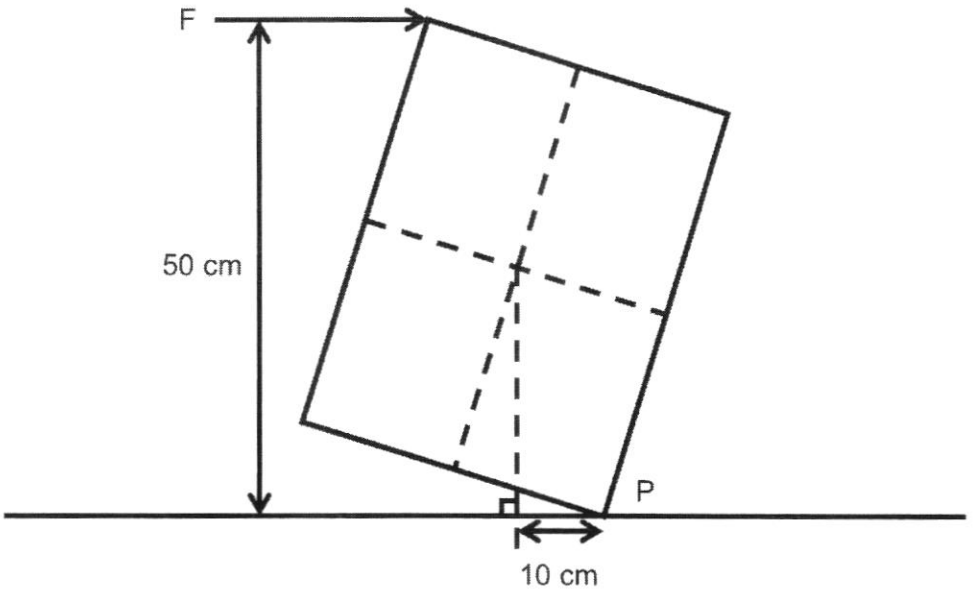


Fig. 10.2

(i) Calculate the weight of the box.

weight = ... [2]

(ii) Calculate the moment due to the weight of the box about point P.

moment = ... [2]

(iii) Hence, calculate the magnitude of force F.

force F = ... [2]

11 **(a)** Fig. 11.1 shows part of a hydraulic braking system of a motor car which uses oil as the brake fluid. When a force is applied on the brake pedal, pressure is exerted on the piston in the master cylinder. The exerted pressure is constant throughout the entire brake fluid which causes the piston in the slave cylinder to move up.

The contact area of the piston in the master cylinder is 20.0 cm^2 and the contact area of the piston in the slave cylinder is 5.0 cm^2.

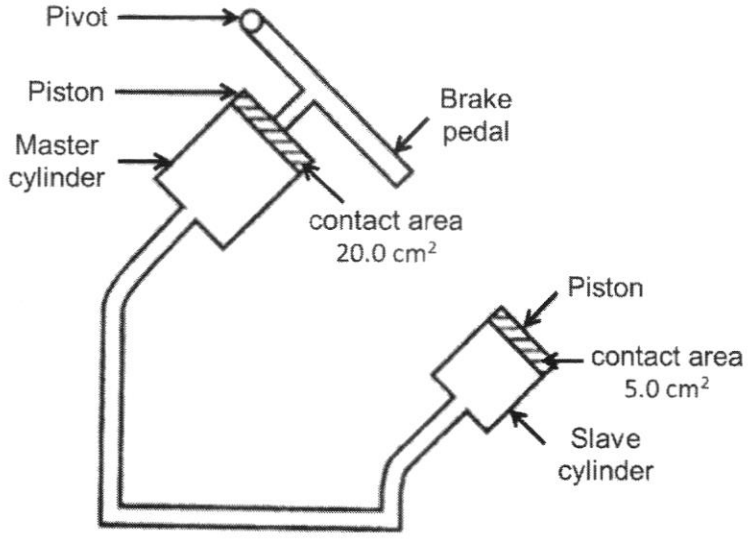


Fig. 11.1

(i) Calculate the pressure exerted on the brake fluid when a 250 N force is applied on the brake pedal.

pressure = ... [2]

(ii) Hence, calculate the force exerted on the piston in the slave cylinder.

force = ... [2]

(iii) Explain why oil is used as the brake fluid instead of air.

.....

.....

..... [2]

(b) The depth of the seabed can be measured by emitting sound waves and measuring the time taken for the reflected sound to return.

Fig. 11.2 shows the displacement-distance graph of the sound waves emitted. The sound waves travel at a speed of 1500 m/s in water.

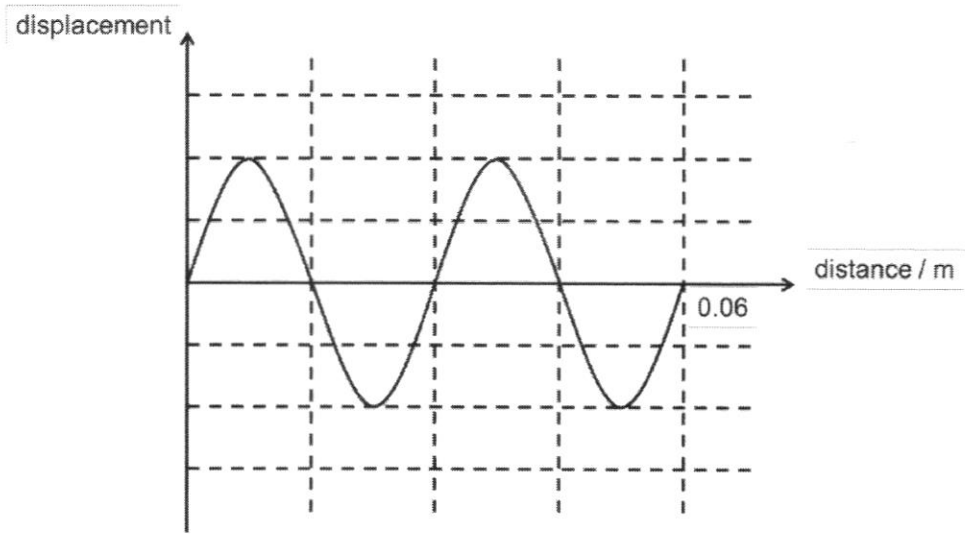


Fig. 11.2

(i) Calculate the frequency of the sound waves in water.

frequency = ... [2]

(ii) In the space above, draw the graph of a new sound wave that has half the loudness and double the pitch of the original sound wave. [2]

12 **(a)** Fig. 12.1 shows an electrical circuit of some household appliances. The whole circuit is protected by fuse Z and has a supply voltage of 240 V.

Two identical lamps A and B, marked '60 W 240 V', are connected to the live wire through fuse X.

An electric kettle, marked '1500 W 240 V', is connected to the live wire through fuse Y. It has a metal case which is connected to the Earth wire.

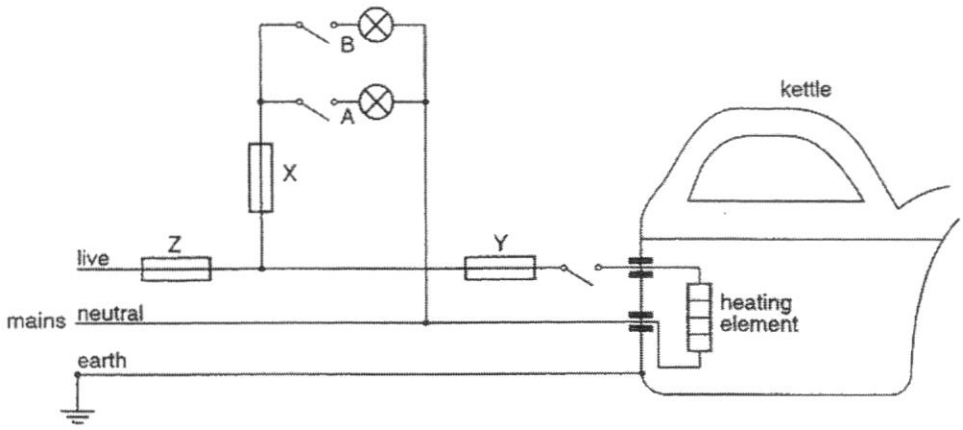


Fig. 12.1

When all the switches are closed,

(i) calculate the current in the electric kettle, and

current in electric kettle = ... [1]

(ii) calculate the total current of the circuit.

total current of circuit = ... [3]

(iii) All three appliances are used for 10 min daily. Calculate the total energy consumption of all three appliances for a month of 30 days. Leave your answer in kWh.

total energy consumption = ... [2]

(iv) Given that 1 kWh of energy costs 20 cents, calculate the total cost of using all three appliances for a month of 30 days.

total cost = ... [2]

(b) Fig. 12.2 shows the circuit of a simple electrical circuit breaker.

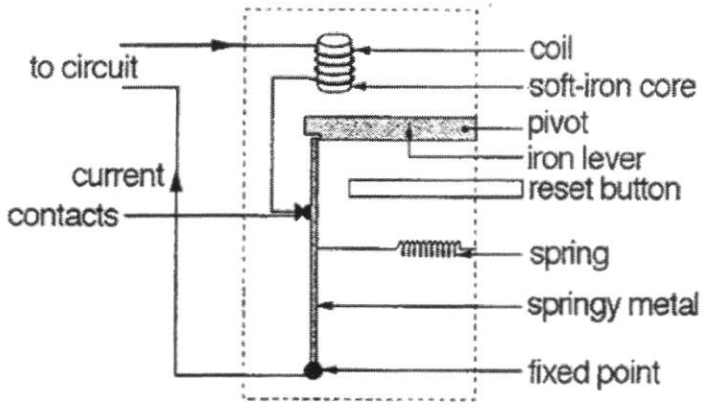


Fig. 12.2

In the event of an electrical fault, the current in the circuit will become very high and the circuit breaker will be activated.

Describe what happens to the soft-iron core, iron lever, spring and contacts in the circuit breaker when it is in operation.

.....

.....

..... [2]

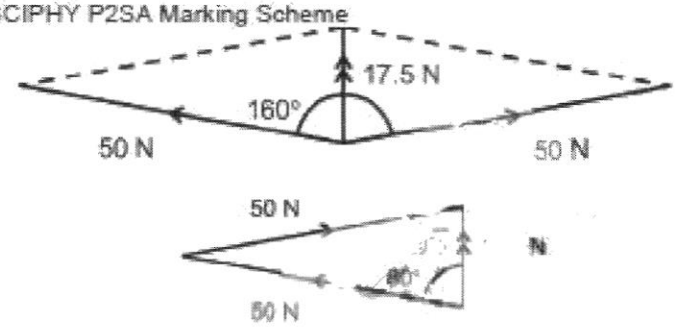
END OF PAPER

SSS 2022 4E5N Sci Physics Prelim Paper 1 Mark Scheme [20 marks]

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

2022 SSS 4E5N Prelim SCIPHY P2SA Marking Scheme

1 (a)



OR

1m — correct parallelogram / tip to tail method with resultant force shown
1m — W = 17.5 N (accept 16.0 N to 19.0 N)

Deduct 1m if no / inappropriate scale written: 1 cm to 5N
Deduct 1m if no / wrong arrowheads / wrong arrowhead direction (1 arrowhead for tension & 2 arrowheads for resultant force) [2]

(b) W = mg

$m = \frac{W}{g} = \frac{17.5}{10}$ — M1

$m = 1.75\ kg = 1750\ g$ — A1

ECF given for "(a) divide by 10" [2]

2 (a) $speed = \frac{distance}{time} = \frac{8}{10-0}$ (gradient of d-t graph) — M1

$speed = 0.80$ m/s — A1 [2]

(b) 1m — From t = 10 s to t = 15 s, the cyclist was <u>stationary / not moving</u>.
1m — From t = 15 s to t = 35 s, the cyclist was travelling at a <u>constant speed of 0.40 m/s</u>. ($\frac{8}{20} = 0.40$) [2]

3 (a) M = F x d = 3000 x 2.0 = 6000 Nm — B1 [1]

(b) 1m — If the digger moves forward any further, the <u>line of action of the weight of the digger will lie outside the base area</u> of the digger.
DNA: "line of action of centre of gravity" / "centre of gravity or weight lie outside the base area"

1m — This will result in a <u>resultant clockwise moment about point B (the clockwise moment about point B will be more than the anticlockwise moment about point B)</u>, causing the digger to fall over.
DNA: "sum of CWM not equal to sum of ACWM" [2]

4 (a) WD = F x d = (50)(10)(0.50) — M1
WD = 250 J — A1 [2]

(b) 1m — Gravitational potential energy [1]

(c) KE loss = GPE gain
1750 = mgh = (50)(10)(h)

$h = \frac{1750}{(50)(10)}$ — M1

h = 3.5 m — A1 [2]

5 **(a)** 1m – conduction and convection [1]

(b) 1m – The heater will heat up the **water at the bottom** of cylinder B and cause it to expand, **becomes less dense and rise**.

1m – The **cooler and denser water at the top** of the cylinder **will sink** to replace the water at the bottom.

1m – This cycle will repeat to **form convection currents** until all the water is heated up in cylinder B. [3]

(c) 1m – water is a **poor conductor of heat** / **convection currents are near the top and take a longer time** to reach the thermometer. [1]

6 **(a)** E = P x t = (800)(10 x 60) --- M1
E = 480000 J --- A1 [2]

(b) Substance X is changing from gaseous state to liquid state / undergoing condensation.
1m --- The particles are **losing internal potential energy as the intermolecular forces become stronger / the particles become closer together**.
1m --- Since there is **no change in the internal kinetic energy**, there is no change in temperature / temperature remains constant. [2]

(c)

Method 1:	Method 2:
$P = I^2R$	$P = IV$
$R = \frac{P}{I^2} = \frac{800}{4.0^2}$ --- M1	$V = \frac{P}{I} = \frac{800}{4.0} = 200$ V --- M1
$R = 50\ \Omega$ --- A1	$R = \frac{V}{I} = \frac{200}{4.0} = 50\ \Omega$ --- A1

[2]

7 **(a)**

1m for correct light rays (1 in glass layer, 1 in air with normal)
-1m for missing arrowheads / wrong direction
-1m for wrong angle of reflection at mirror (40°) / angle of refraction in air (75°)
-1m for missing / wrong normal [1]

(b) **(i)** $\sin c = \frac{1}{n} = \frac{1}{1.6}$

$c = \sin^{-1}\frac{1}{1.6} = 38.682° = 38.7°$ (1 d.p.) --- 1m [1]

(ii) 1m – The light ray will **undergo total internal reflection** as
1m – the **angle of incidence (40°) is more than the critical angle (38.7°)** and it is **travelling from an optically denser medium to an optically less dense medium**. [2]

8 **(a)** 1m --- When the negatively charged rod is brought near the right side of the metal ball, **the free moving negative charges in the metal ball will be repelled and move to the other end of the metal threads**.
1m --- Since the other end of the metal threads are negatively charged, they will move away from one another as **like charges repel**. [2]

(b) **(i)** V = I x R
$I = \frac{V}{R} = \frac{6}{4}$ --- M1
I = 1.50 A (3 s.f.) --- A1 [2]

(ii) $R = \frac{V}{I} = \frac{3}{1.5} = 2.00\ \Omega$ (3 s.f.) --- B1

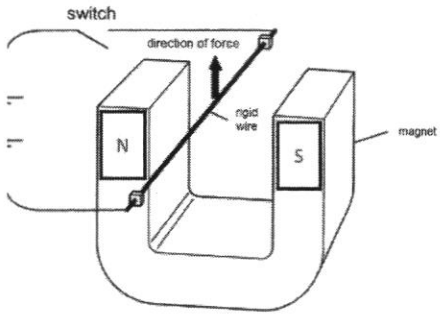
ECF given for "3 / (i)" [1]

(iii) $R_T = \left(\frac{1}{R_{X+Y}} + \frac{1}{R_{Z+10}}\right)^{-1} = \left(\frac{1}{2+2} + \frac{1}{2+4}\right)^{-1} = \left(\frac{1}{4} + \frac{1}{6}\right)^{-1}$ --- M1
$R_T = 2.40\ \Omega$ (3 s.f.) --- A1 [2]

9 **(a)** **(i)** 1m --- When switch S is closed, both **iron rods will be magnetized by direct current / become induced magnets / become electromagnets**.
1m --- The **same end of the rods will be induced with the same poles. Since like poles repel, the rods will roll away from each other.** [2]

(ii) 1m --- When switch S is opened, the **iron rod will lose its magnetism** as it is a soft magnetic material, and the **steel rod will retain its magnetism** as it is a hard magnetic material.
1m --- The **iron rod will be magnetized by induction / become an induced magnet by the steel rod with unlike poles next to the steel rod. Since unlike poles attract, the rods will move towards each other.** [2]

(b) **(i)**



[1]

(ii) 1m --- For a bigger force: **increase the current** flowing through the wire / **use a stronger magnet** / **increase magnetic field strength**
DNA: "add more batteries" without mentioning "increase current"

1m --- For downward force: **reverse the direction of flow of current** / **polarity of the magnet** [2]

2022 SSS 4E5N Prelim SCIPHY P2SB Marking Scheme

10 (a) (i) Average speed

$= \frac{total\ distance}{total\ time}$

$= \frac{\left(\frac{1}{2}\times 6\times 20\right)+\left(\frac{1}{2}(6+7)20\right)}{40}$ --- M1 for finding correct total distance

$= \frac{190}{40}$

= 4.75 m/s --- A1 for finding correct average speed [2]

(ii) 1m --- There is an **increase in the resistive forces**.

1m --- The **acceleration** (of the moving car between C and D) **is decreasing**. Hence, the **resultant force is decreasing**.

$$F_R(decrease) = F_{engine}(constant) - f(increase)$$ [2]

(b) (i) W = mg = (4.0)(10) --- M1

W = 40 N --- A1 [2]

(ii) M = F x d = (40)(0.1) --- M1

M = 4.0 Nm --- A1 [2]

(iii) About P,

Sum of clockwise moments = Sum of anticlockwise moments

F x 0.5 = 4 --- M1

F = 8.0 N --- A1 [2]

11 (a) (i) $P = \frac{F}{A} = \frac{250}{20\times 10^{-4}}$ --- M1

P = 125000 Pa or 1.25 x 10^5 Pa --- A1 [2]

(ii) F = P x A = 125000 x (5 x 10^{-4}) --- M1

F = 62.5 N --- A1 [2]

(iii) 1m --- Oil is not compressible / air can be compressed.

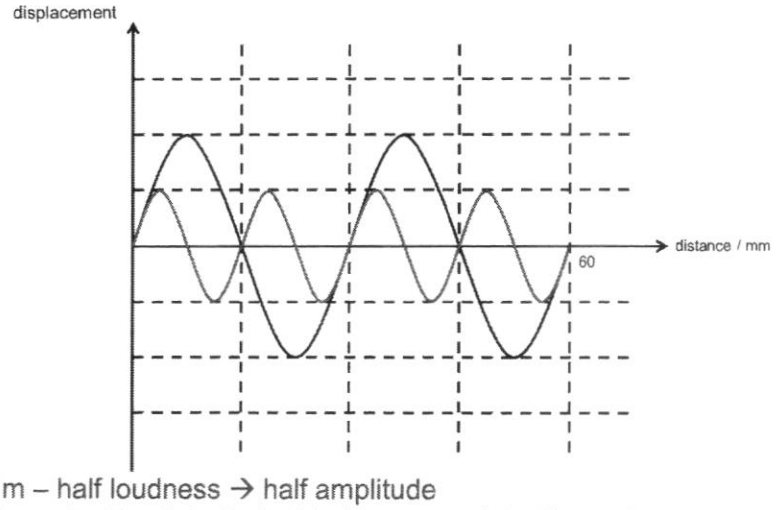
1m --- This maintains the **pressure to be constant throughout the whole brake fluid.** (Higher efficiency of transmission of pressure through the fluid) [2]

(b) (i) $v = f\lambda$ (wavelength value taken from graph)

$f = \frac{v}{\lambda} = \frac{1500}{30\times 10^{-3}}$ --- M1

f = 50000 Hz --- A1 [2]

(ii)



1m – half loudness → half amplitude

1m – double pitch → double frequency → half wavelength [2]

12 **(a)** **(i)** $P = IV$

$I = \frac{P}{V} = \frac{1500}{240} = 6.25$ A --- B1 [1]

(ii) Current in each lamp = $\frac{60}{240} = 0.25$ A --- M1

Current in both lamps = current in each lamp x 2

$I = 0.25 \times 2$ --- M1

$I = 0.5$ A

Total current of circuit = 0.5 + 6.25 = 6.75 A --- A1 [3]

(iii) $E = Pt = \left(\frac{60+60+1500}{1000}\right)\left(\frac{10}{60} \times 30\right)$ --- M1

$E = (1.62)(5) = 8.1$ kWh --- A1 [2]

(iv) Total cost = 8.1 x \$0.20 --- M1

= \$1.62 --- A1 [2]

(b) 1m --- When the current is very high, the **soft-iron core will be magnetized** and become strong enough to **attract the iron lever upwards**.

1m --- Without the iron lever to hold the springy metal in place, **the spring will pull the springy metal to the right and the contacts will be broken, thus breaking the circuit**. [2]