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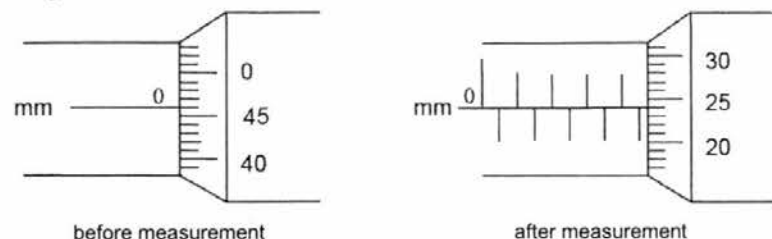
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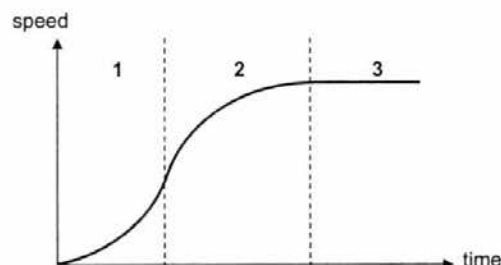
XINMIN SECONDARY SCHOOL
新民中学
SEKOLAH MENENGAH XINMIN

- 1 The thickness of a wire is measured using a micrometer screw gauge. The diagrams below show the readings of the micrometer screw gauge before and after measuring the thickness of the wire.



What is the thickness of the wire?

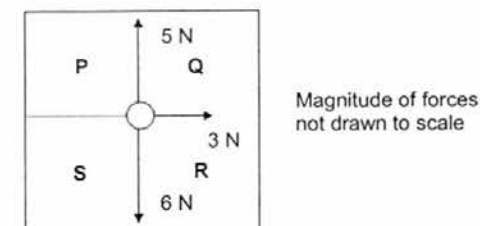
- A 4.70 mm B 4.74 mm C 4.76 mm D 4.78 mm
- 2 The graph below shows how the speed of an object changes with time for intervals 1, 2 and 3.



Which of the following correctly describes the acceleration for the respective intervals?

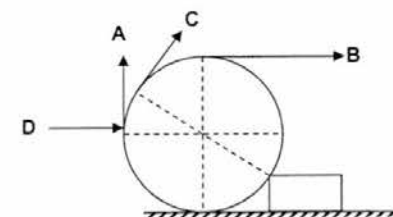
	1	2	3
A	increasing	decreasing	zero
B	decreasing	increasing	zero
C	increasing	decreasing	constant
D	decreasing	increasing	constant

- 3 The diagram below shows the top view of a field separated into four sectors P, Q, R and S. A cart tied to three ropes is placed in the middle of the field. Three bulls start to pull the ropes with forces indicated in the figure below at the same time. In which sector will the cart start to move initially?

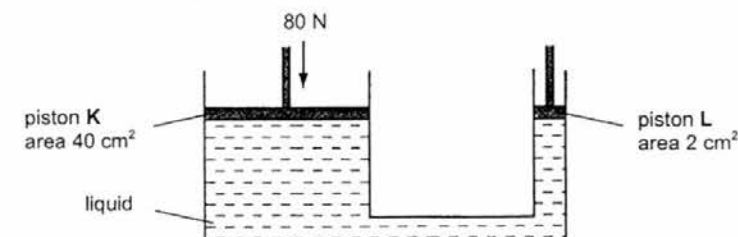


- A Sector P B Sector Q C Sector R D Sector S

- 4 Which of the following forces A, B, C or D would be the smallest force required to be exerted in order to push the ball up the step?



- 5 The system shown in the diagram contains an incompressible liquid.

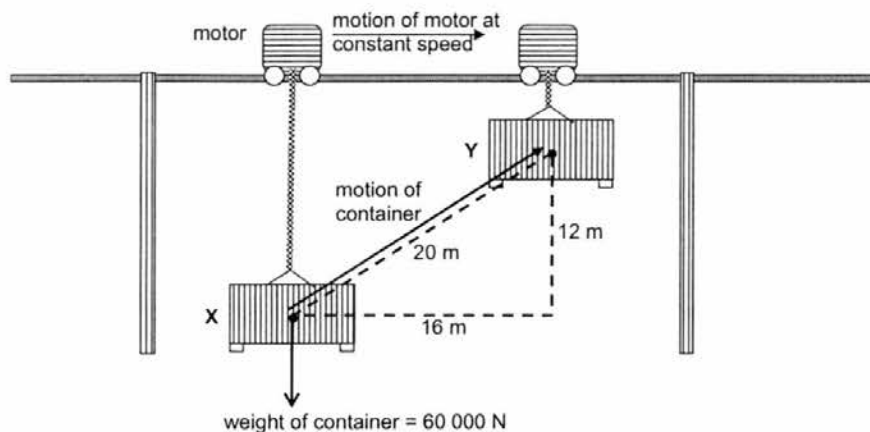


A downward force of 80 N is exerted on piston K.

What is the upward force on piston L?

- A 1 N B 4 N C 80 N D 1600 N

- 6 In an energy transformation sequence, which of the following produces kinetic energy from gravitational potential energy as part of the sequence?
- A burning fuel in a power station
- B generating hydroelectric energy
- C generating energy in a nuclear power station
- D generating energy in a geothermal power station
- 7 At the Port of Singapore Authority, a motor runs on a horizontal rail at a constant speed while raising up a 60 000 N container from X to Y as shown in the diagram.



The container is raised at a constant speed from X to Y.
What is the work done by the motor in pulling up the container?

- A 0 kJ B 720 kJ C 960 kJ D 1200 kJ

- 8 According to the kinetic model of matter, all matter is made up of very small particles which are in continuous motion.

Which row best describes the particle behavior in the gaseous state?

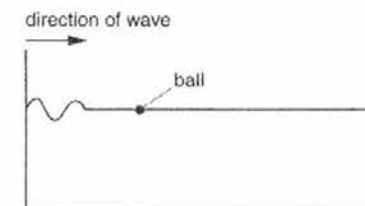
	forces between particles	arrangement of particles
A	strong	close but packing is more disorderly than in a liquid
B	strong	far apart in a disorderly arrangement
C	weak	close but packing is more disorderly than in a liquid
D	weak	far apart in a disorderly arrangement

- 9 In solids, thermal energy is transferred by conduction.

What is the cause of conduction?

- A change in density
- B expansion
- C infra-red radiation
- D vibration of atoms or molecules

- 10 The diagram shows a ball floating in a tank of water.

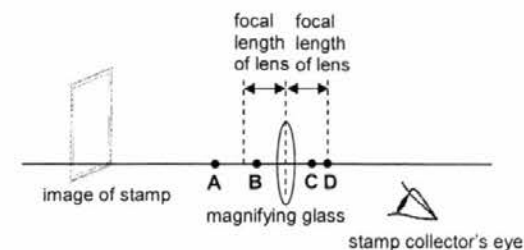


Which diagram shows the movement of the ball when the wave passes?



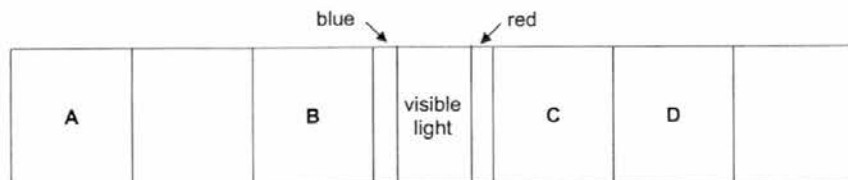
- 11 A stamp collector is using a magnifying glass to see a stamp more clearly.

Where is the stamp placed?



- 12 The diagram below shows the electromagnetic spectrum, with the blue end and red end of the visible spectrum marked.

Which section of the spectrum has waves which have a long wavelength and is used for satellite television?

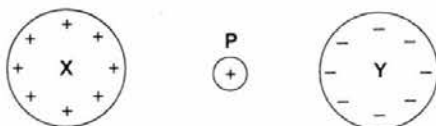


- 13 Two students play a trumpet and a flute each. The note from the flute is softer and has a higher pitch than the note from the trumpet.

How do the amplitude and frequency of the sound from the flute compare to the amplitude and frequency from the trumpet?

	flute's amplitude	flute's frequency
A	larger	higher
B	larger	lower
C	smaller	higher
D	smaller	lower

- 14 Sphere X is positively charged and sphere Y is negatively charged. They are placed a short distance apart and a small positive charge P is placed between them.



In which direction does P move and what is the force between X and Y?

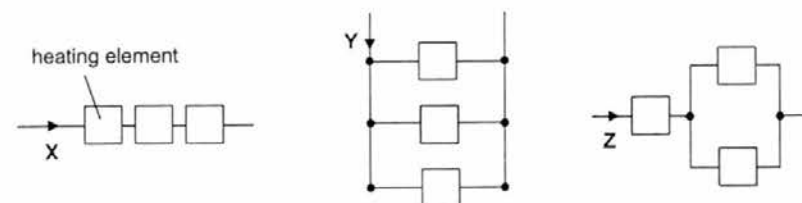
	movement of P	force between X and Y
A	towards X	attraction
B	towards Y	attraction
C	towards X	repulsion
D	towards Y	repulsion

- 15 A milliammeter shows a reading of 30 mA.

How much electrical charge flows through the milliammeter in 10 seconds?

- A 0.3 C B 3.0 C C 30 C D 300 C

- 16 Three identical heating elements are wired up to the mains in the three ways shown.



Which of the following shows the current drawn from the mains supply of these arrangements in **decreasing** order?

	current drawn from mains supply		
	highest		lowest
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Y	X	Z

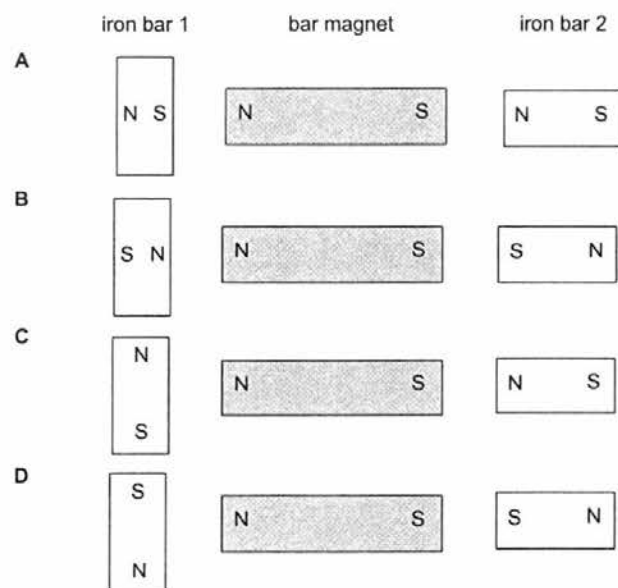
- 17 A house-owner replaced a failed fuse for the lights of the house. When the lights were switched on, the new fuse also failed. The house-owner then used another fuse with a higher rating than the previous two.

Why was this not a sensible thing to do?

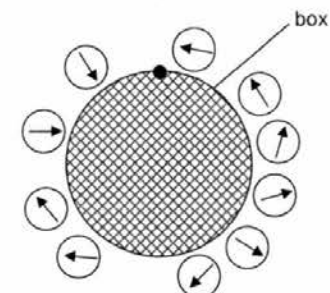
- A A circuit will only work if the fuse rating is lower than the value of current in the circuit.
 B The fuse has already melted because the rating was too high.
 C Using a fuse with too high a rating would cause electric shocks.
 D A fuse with a higher rating might allow the circuit to work, but the fault would not be corrected.

- 18 A bar magnet is placed between two iron bars.

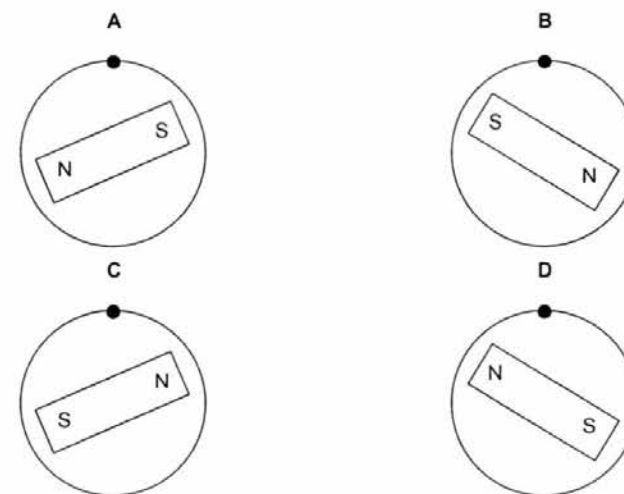
Which diagram correctly shows the poles induced in both iron bars?



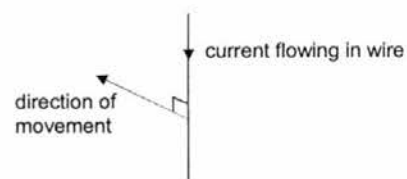
- 19 The diagram shows a box which has a bar magnet hidden inside it. Compasses are placed around the outside and their needles point as shown.



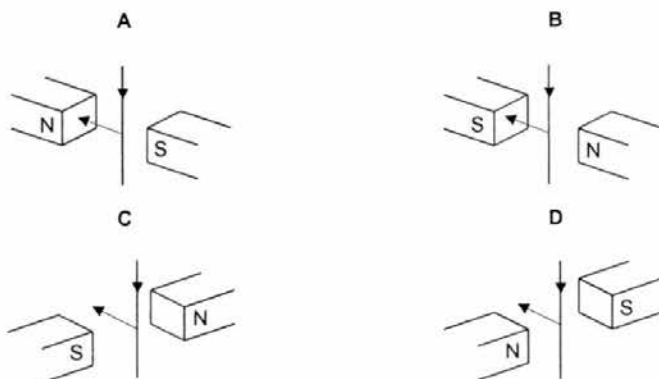
Which diagram shows the position of the magnet inside the box?



- 20 A current flows in a wire hanging between the poles of a magnet. The wire starts to move in the direction shown.



Which diagram shows the position and the polarity of the magnet?



*****End of Paper*****

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white



XINMIN SECONDARY SCHOOL
新民中学
SEKOLAH MENENGAH XINMIN

Preliminary Examination 2016

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE (PHYSICS)

5076/02

Paper 2

23 August 2016

Secondary 4E5N

1 hour 15 minutes

Setter: Ms Pang Hui Chin
Vetter: Mr Tee Seow Hong

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

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on the work you hand in.
You may use an 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 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.

Section B

Answer any **two** questions.

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

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

Section A

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

- 1 A student checks the purity of a small, uniform bar of gold by measuring its density.

He measures the dimensions of the bar. The values are shown in Fig. 1.

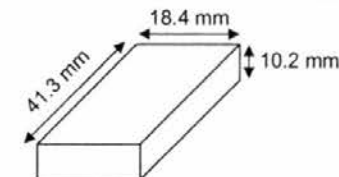


Fig. 1

He measures the mass of the bar as 176.8 g and the weight of the bar as 1.80 N.

- (a) Suggest the name of an instrument that could be used to measure the dimensions of the bar.

[1]

gravitational field strength = N/kg [2]

- (ii) Calculate the density of the bar.

density = g/cm³ [2]

- (c) The density of pure gold is 19.281 g/cm³.
State and explain whether the bar is made of pure gold.

[1]

- 2 A car of mass 950 kg is travelling on a straight road at a constant speed of 20.0 m/s for 5.0 s. It accelerates at a uniform rate of 1.25 m/s^2 for 4.0 s and then decelerates uniformly to rest in 8.0 s by a constant braking force.

- (a) Complete Fig. 2 to show how the speed of the car varies with time for the whole journey. [3]

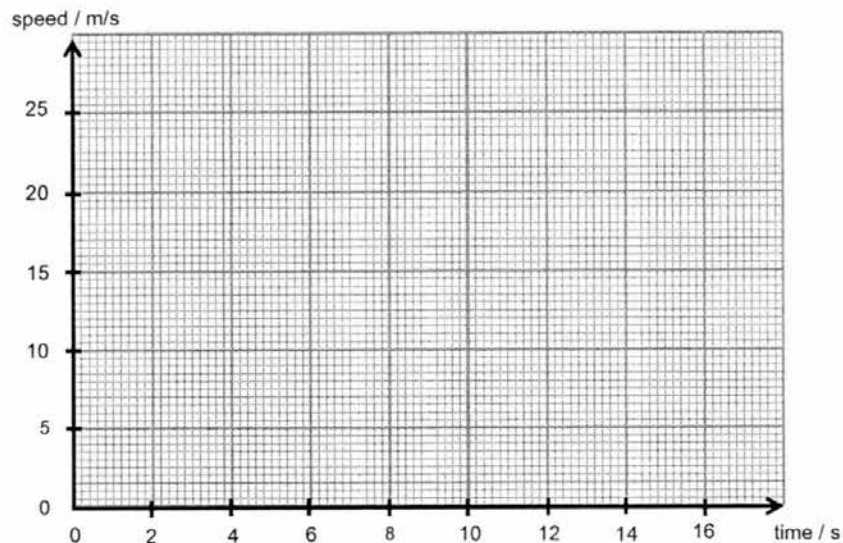


Fig. 2

- (b) Use your graph in Fig. 2 to determine the distance travelled between $t = 5.0 \text{ s}$ and $t = 9.0 \text{ s}$.

distance = m [2]

- (c) Calculate the magnitude of the resultant braking force on the car as it is brought to rest.

force = N [3]

- 3 Mrs Lee bought a device shown in Fig. 3 to squeeze the juice out of oranges easily for her son.

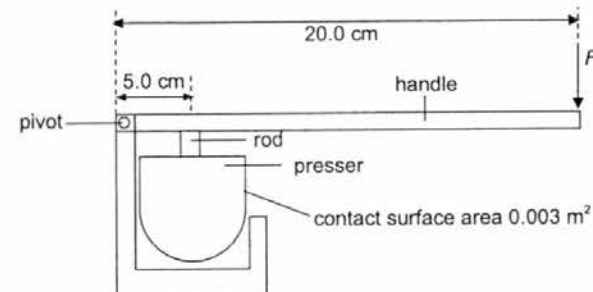


Fig. 3

When a force F is applied at the end of the handle, the presser squeezes the juice out of the orange.

The area of the presser in contact with the orange is 0.003 m^2 . The perpendicular distance from the pivot to the rod holding the presser is 5.0 cm. A force F is applied normal to the handle at a distance 20.0 cm from the pivot. A minimum pressure of 4000 N/m^2 is needed to squeeze the juice out of the orange.

- (a) Calculate the minimum force F that is required at the end of the handle to exert a pressure of 4000 N/m^2 on the orange.

force = N [4]

- (b) Mrs Lee's son offered to help squeeze the oranges using the device. He exerts a force directly above the rod holding the presser. Explain why it is inefficient for him to apply a force at that position.

.....

[2]

- 4 Fig. 4 shows a refraction of light at the boundary between air and glass.

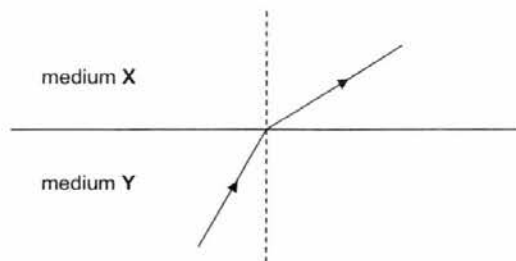


Fig. 4 (not to scale)

- (a) State, with a reason, which medium, X or Y, represents the glass.

.....

[2]

- (b) The light travels at 3.0×10^8 m/s in air and 2.1×10^8 m/s in the glass.

Calculate the refractive index of the glass.

refractive index = [2]

- (c) Using your answer to (b), calculate the critical angle for glass.

critical angle =° [2]

- 5 Fig. 5 shows an object placed in front of a thin converging lens. The positions of the focal points are marked F.

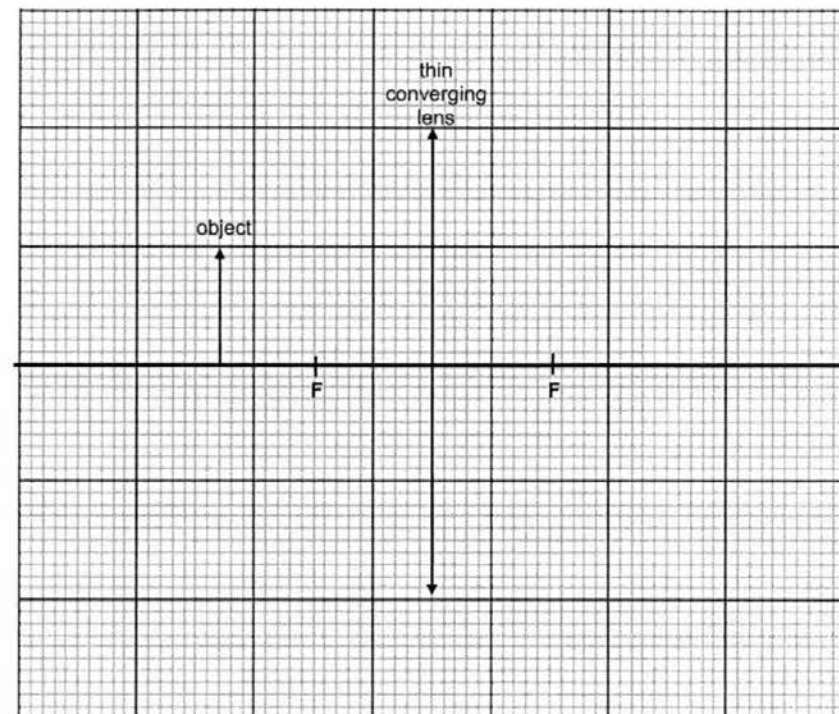


Fig. 5

- (a) On Fig. 5, draw rays from the top of the object to determine the position of the top of the image. Mark the position, I, of the top of the image. [3]
- (b) Name an optical instrument that uses this arrangement of lens and object. [1]
- (c) The object is moved to between F and the lens. State two changes that this causes to the image. [2]

1.

 2.
 [2]

- 6 The wavelength of X-rays is roughly the size of an atom.

(a) Estimate the wavelength of X-rays.

..... [1]

(b) Calculate the frequency of the X-rays in (a), assuming that the speed of X-ray is 3×10^8 m/s.

frequency = [2]

- 7 Fig. 7.1 shows a light metal ball suspended at the end of an insulating thread. The metal ball contains negative charges that are free to move throughout the metal and positive charges that are not free to move. The metal ball has no overall charge. A negatively charged rod is held close to the suspended ball. The ball moves towards the rod as shown in Fig. 7.2.

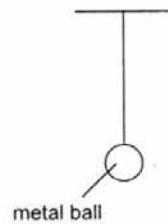


Fig. 7.1

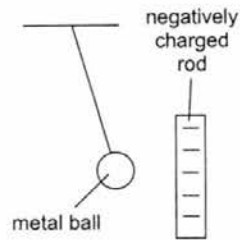


Fig. 7.2

Explain why the metal ball moves towards the rod.

.....

 [2]

For
Examiner's
Use

- 8 Fig. 8 shows a circuit consisting of a battery of e.m.f. 6.0 V and two pairs of 3.0Ω resistors in series. Each of these pairs of resistors are connected in parallel.

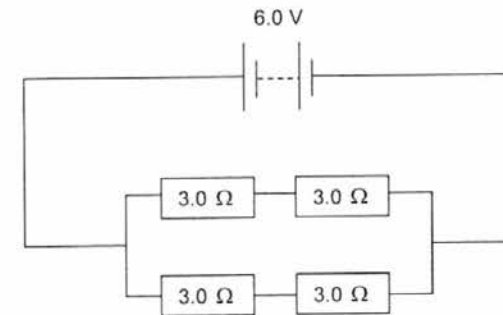


Fig. 8

Calculate

(a) the total resistance of the circuit,

resistance = Ω [3]

(b) the current through the battery,

current = A [1]

(c) the power developed in the battery.

power = W [1]

For
Examiner's
Use

- 9 Fig. 9 shows a stiff copper rod suspended between two magnetic poles. The copper rod is freely hinged at the top.

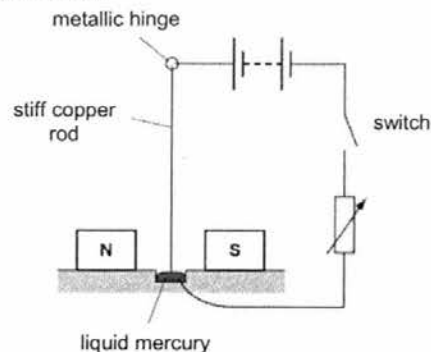


Fig. 9

- (a) Draw the magnetic field between the poles.
(b) State and explain what will be observed when the switch is closed.

[1]

[2]

For
Examiner's
Use

Section B

Answer any **two** questions in this section.
Write your answers in the spaces provided.

For
Examiner's
Use

- 10 A heat pipe is a device that transmits thermal energy along its length. Fig. 10 shows a heat pipe attached to black metal fins. The fins absorb energy from the Sun. The sealed pipe transmits this energy along its length into a tank of cold water.

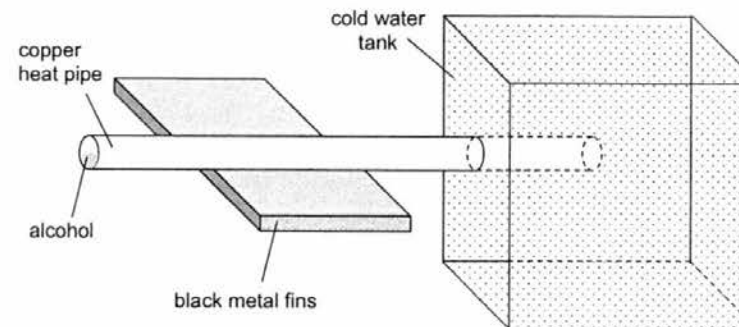


Fig. 10

Thermal energy from the fins is conducted through the walls of the copper pipe and causes the alcohol to boil. At the end of the copper pipe which is in contact with cold water, the alcohol condenses. The liquid alcohol runs along the pipe to be boiled again. There is little change in the temperature of the alcohol.

- (a) Describe how molecules in the copper conduct energy to the alcohol.

[1]

- (b) Explain how boiling and condensation within the heat pipe cause the transfer of energy.

[2]

- (c) Another company has the metal fins painted in silver. Suggest why it is a disadvantage to the device.

[1]

- (d) (i) Describe how the water in the tank above the heat pipe is heated.

.....

.....

.....

.....

.....

.....

[3]

- (ii) The temperature of the water in the tank above the heat pipe was measured to be higher than that below the heat pipe. Explain why there is a difference in the temperature.

.....

.....

.....

.....

.....

[2]

- (iii) State one change that could be made so that the water in the tank could be heated up more efficiently.

.....

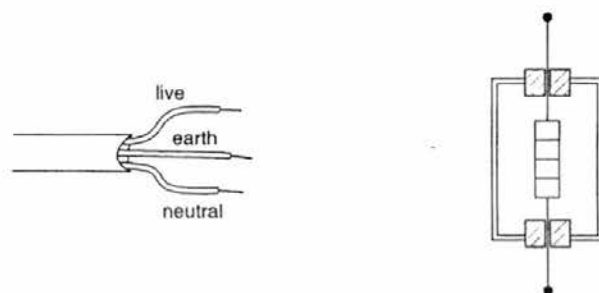
.....

[1]

- 11 (a) (i) A mains cable has three conductors in it: the live, the neutral wire and the earth wire.

The cable is to be connected to an electrical heater which is enclosed in a metal case. The circuit is to **include** a switch and a fuse.

On Fig. 11, complete the circuit diagram.



[4]

Fig. 11

For
Examiner's
Use

The company that manufactures the electrical heater decided to double insulate it instead of enclosing it in a metal case.

- (ii) State which wire, earth, live or neutral, is not needed in the cable for the electrical heater.

..... [1]

- (iii) Explain what it means to "double insulate" and why the heater is safe to use even though it has only two wires.

.....

.....

.....

.....

..... [2]

- (b) The power rating of the electrical heater is 1000 W, 230 V.

- (i) State a suitable fuse rating, 3 A, 5 A or 13 A, for the electrical heater. Explain your answer with suitable calculations.

.....

.....

..... [2]

- (ii) The electrical heater is switched on for 2 minutes. One unit of electricity costs 20 cents. Calculate the cost of switching on the electrical heater.

cost = [1]

For
Examiner
Use

- 12 (a) Describe, with the aid of a diagram, how to demagnetise a magnet.

.....

 [3]

- (b) Two ends, end X and end Y, of a soft iron core are each wrapped by a coil of wire. The wire is connected to a battery as shown in Fig. 12. A bar magnet is placed in between the two ends.

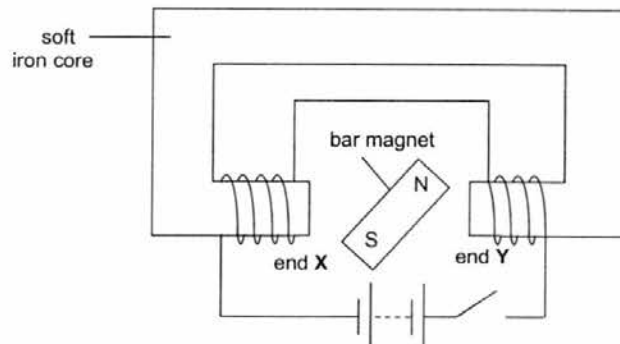


Fig. 12

The current is switched on.

- (i) State the polarity of the iron core at

end X
 end Y [2]

For
Examiner's
Use

- (ii) State and explain what will happen to the bar magnet.

.....

 [2]

- (iii) The connections to the battery are reversed. State what now happens to the bar magnet when the switch is closed.

..... [1]

- (iv) State two differences between soft iron and steel.

.....

 [2]

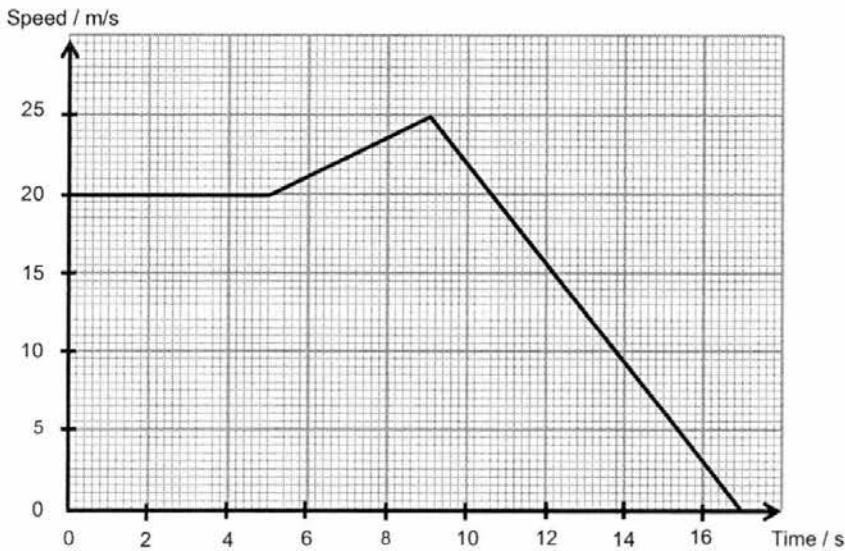
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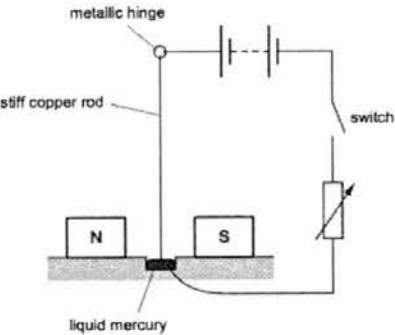
PAPER 1

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

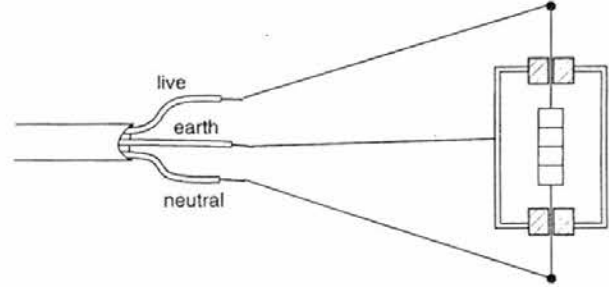
PAPER 2 / SECTION A

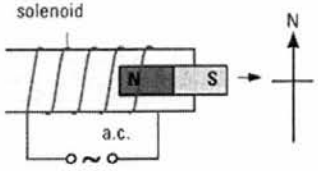
Qn	Answer	Marks / Remarks
1a	Vernier calipers	B1
1bi	g = $1.80 \div (176.8 \div 1000)$ = 10.2 N/kg	M1 A1
1bii	density = $176.8 \text{ g} \div (4.13 \text{ cm} \times 1.84 \text{ cm} \times 1.02 \text{ cm})$ = 22.8 g/cm^3	M1 A1
1c	No, it is not made of pure gold as the density of the bar is greater than 19.281 g/cm^3 .	B1
2a	 B1 – constant speed of 20.0 m/s for 5.0 s B1 – accelerates at uniform rate of 1.25 m/s^2 for 4.0 s (includes correct speed of 25 m/s at $t = 9.0 \text{ s}$) B1 – decelerates uniformly to rest in 8.0 s	
2b	distance = $0.5 \times (20 + 25) \times 4$ = 90 m	M1 (allow ecf for 25 m/s from (a)) A1

2c	deceleration $= \frac{25-0}{8}$ $= 3.125 \text{ m/s}^2$ resultant braking force $= 950 \times 3.125$ $= 2968.75$ $= 2970 \text{ N (3sf)}$	M1 M1 A1
3a	force at presser $= 4000 \times 0.003$ $= 12 \text{ N}$ moment by force at presser = moment of F $12 \times 5.0 = F \times 20.0$ $F = 12 \times 5.0 \div 20.0$ $= 3 \text{ N}$	M1 M1 M1 A1
3b	When he exerts a force directly above the rod holding the presser, the perpendicular distance from the force to the pivot is shorter than when the force is exerted at the end of the handle. As such, for the same moment, the force required by the son would be larger than the value F .	B1 B1
4a	Medium Y represents the glass. That is because the light bends away from the normal when it passes from Y to X. OR The angle of incidence is smaller than the angle of refraction because glass is optically denser than air.	B1 B1
4b	$n = \frac{c}{v}$ $= \frac{3 \times 10^8}{2.1 \times 10^8}$ $= 1.43$	M1 A1
4c	$\sin c = \frac{1}{n}$ $= \frac{1}{1.428}$ $c = \sin^{-1} \frac{1}{1.428}$ $= 44.4^\circ$	M1 allow ecf or use 1.43 A1
5a	See appendix B1 – for each light ray from top of object, with arrows (maximum B2) B1 – image with labelling I at the top of image	penalize 1 mark from question if lack of arrow
5b	Projector / Objective lens of microscope	B1
5c	1. The image becomes virtual. 2. The image is upright.	B1 do not accept: B1 image becomes larger

6a	$1 \times 10^{-9} \text{ m}$ or 1 nm .	B1
6b	$f = \frac{v}{\lambda}$ $= (3 \times 10^8) \div (1 \times 10^{-9})$ $= 3 \times 10^{17} \text{ Hz}$	M1 (using 6a ans) A1 (with units)
7	It is because the <u>free moving negative charges in the ball are repelled by the negatively charged rod as like charges repel and move away from the side near the rod.</u> As such <u>the side near the rod is induced with a positive charge and gets attracted to the negatively charged rod as unlike charges attract.</u>	B1 (do not accept: positive charges moving) B1
8a	$\frac{1}{R_E} = \frac{1}{3+3} + \frac{1}{3+3} = \frac{1}{3}$ $R_E = 3 \Omega$	M1 – for parallel M1 – for series (denominator) A1
8b	$I = V / R = 6 / 3 = 2 \text{ A}$	A1 (allow ecf)
8c	$P = VI = 6 \times 2 = 12 \text{ W}$	A1 (allow ecf)
9a		B1
9b	The stiff copper rod will <u>move out of the paper.</u> This is because of the <u>combined magnetic field from the current flowing through the rod and the magnets.</u> The <u>unbalanced fields on both sides of the rod produce the force that is exerted on the wire.</u>	B1 B1

PAPER 2 / SECTION B

Qn	Answer	Marks / Remarks
10a	When the copper pipe gets heated, the <u>molecules will vibrate vigorously and collide with its neighbouring molecules, making them vibrate too</u> , thus energy is transferred via conduction to the alcohol.	B1
10b	When boiling occurs, <u>thermal energy is taken in</u> and a change of state from liquid to gas occurs. The gaseous alcohol molecules travel along the pipe and condense. <u>During condensation, the thermal energy is released.</u>	B1 B1
10c	It is because <u>silver is a poor absorber of heat.</u>	B1
10di	The <u>water around the heat pipe in the water tank gets heated up, expands and becomes less dense.</u> The warm water rises up to the tank while <u>the cooler water at the top being denser will sink.</u> As a result, <u>the difference in density sets up a convection current</u> and the water in the tank above the heat pipe is heated.	B1 B1 B1
10dii	<u>Water at the bottom of the heat pipe is heated up by conduction only while the water at the top is heated up by convection and conduction.</u> Since <u>water is a poor conductor of heat</u>, the water at the top will have a higher temperature than the water at the bottom.	B1 B1
10diii	The heat pipe could be placed at the bottom of the water tank.	B1
11ai		B1 each for correct connection of live, neutral and earth wires B1 for drawing switch and fuse in live wire
11aii	Earth wire	B1
11aiii	Double insulation means the electric heater is <u>insulated externally and internally.</u> <u>When the live wire breaks and touches the casing, which is an insulator of electricity</u>, no current will be able to flow in the casing, thus even if a person touches it, he will not get an electric shock.	B1 B1
11bi	$I = 1000 \div 230 = 4.35 \text{ A}$ A suitable fuse rating will be 5 A.	B1 B1
11bii	$\text{cost} = 1 \text{ kW} \times (2 \div 60) \text{ h} \times 20 \text{ cents} = 0.67 \text{ cents}$	B1 no mark if no unit

12a	 Place the bar magnet <u>in the East-West direction</u> in the middle of a <u>solenoid carrying an alternating current</u>. With the alternating current flowing, <u>pull the magnet out of the solenoid slowly</u>.	B1 (diagram) B1 B1
12bi	End X: South End Y: North	B1 B1
12bii	The bar magnet will rotate anticlockwise to a position such that the <u>North pole will face end X</u> and the <u>South pole will face end Y</u> . This is because <u>unlike poles attract</u> and <u>like poles repel</u> .	B1 (accept either) B1 (accept either)
12biii	The bar magnet will rotate clockwise to a position such that the <u>North pole will face end Y</u> and the <u>South pole will face end X</u> .	B1 (accept either)
12biv	Soft iron can be easily magnetized while steel is difficult to magnetize. Soft iron can be easily demagnetized while steel is difficult to demagnetize.	B1 B1