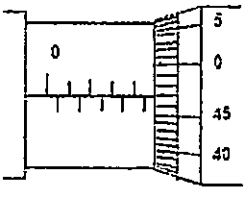
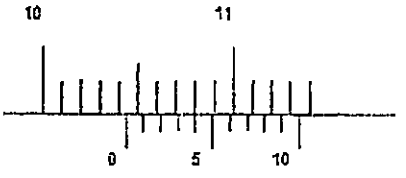
1. The diagrams show parts of a micrometer screw gauge and a vernier calipers



micrometer screw gauge

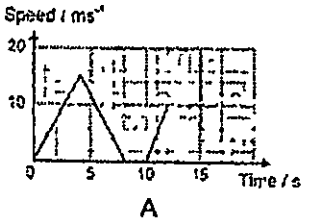


vernier calipers

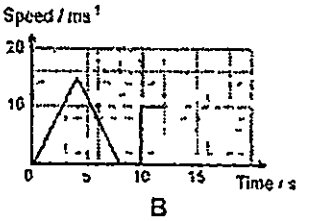
What are the readings shown?

	micrometer screw gauge (mm)	vernier calipers (cm)
A	4 47	10.44
B	4 47	14 40
C	4 97	10 44
D	4 97	14 40

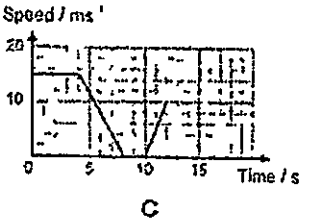
2 A bus travels at a constant speed of 15 m/s for 4 0 s The driver applies the brakes to bring the bus to rest with uniform retardation in a distance of 30 m It remains stationary for 2 s and then accelerates uniformly to reach a speed of 10 m/s in 2 s Which of the following speed-time graphs correctly represents the entire motion of the bus?



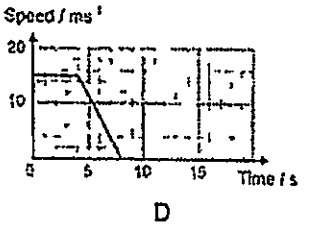
A



B



C



D

3 Which of the following has the greatest inertia?

A a car of mass 1500 kg

B a girl running a 100 m race in 10 s

C a football moving at a speed of 10 m/s

D a trolley of mass 2 kg moving down a slope

4. When a force of 4 N is used to pull an object of mass 2 kg, the object moves with a constant velocity of 2 m/s What is the acceleration of the object if a force of 10 N is now used to pull it?

A 2 0 m/s^2 B 3 0 m/s^2

C 4.0 m/s^2 D 5 0 m/s^2

5 A 2 kW electric motor is used to operate a winding machine If it raises the load vertically up by 10 m in 2 s, what is the weight of the load?

A 200 N B 400 N C 20 000 N D 40 000 N

6 Jane tries to walk across a muddy field by putting a piece of light plank on the muddy field before stepping on it What effect does the light plank have on the force and the pressure exerted by Jane on the mud?

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

7 In a Brownian motion experiment involving smoke particles in air, heavy particles settle quickly but the small smoke particles remain suspended for long period of time Which statement explains why the smoke particles do not settle?

A Air pressure has a greater effect on small particles

B The smoke particles have the same density as the air

C The Earth's gravitational field does not act on small particles

D Random molecular bombardment by air molecules keeps the smoke particles suspended

8. Illuminated smoke particles, suspended in air, are viewed with a microscope They are seen to move randomly This is because the smoke particles are

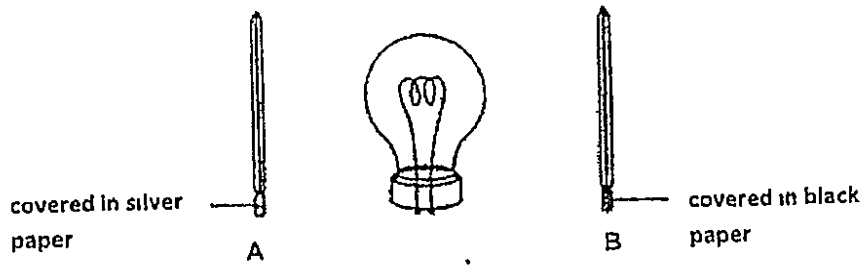
A bombarded continually by air molecules

B moved about by convection currents

C shaken by the vibrations of the molecules within them

D supplied with energy by the light illuminating them

The diagram shows two thermometers A and B placed at equal distance from a light bulb The light bulb is switched on After two minutes, the thermometers show an increase in temperature Thermometer B shows a greater increase in temperature



Which of the following are true statements about this experiment?

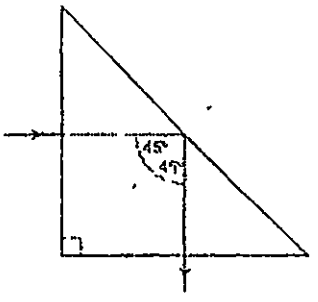
(1) Heat is transferred to the thermometers mainly by radiation
(2) The black paper is a better absorber of radiation
(3) The silver paper is a better reflector of radiation

A (2) only
B (1) and (2) only
C (2) and (3) only
D (1), (2) and (3)

0 Which of the following statements is not true about all electromagnetic waves?

A They are transverse waves
B They can travel in vacuum
C They carry with them energy
D They travel at the same speed in liquids

11 The diagram shows a right-angled prism being used to turn a ray of light through 90



What is the critical angle of the glass prism?

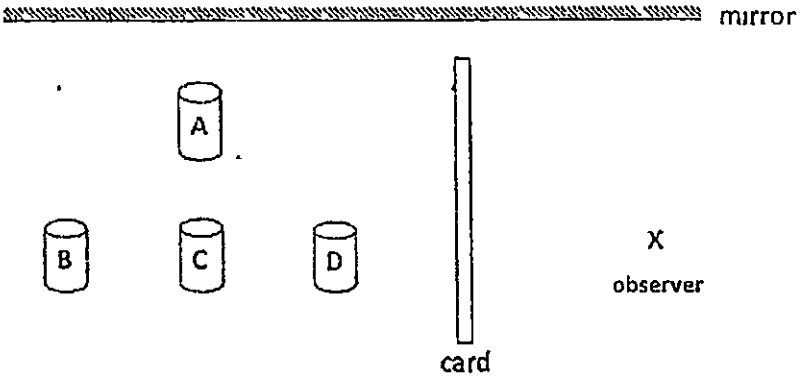
A less than 45°

B equal to 45°

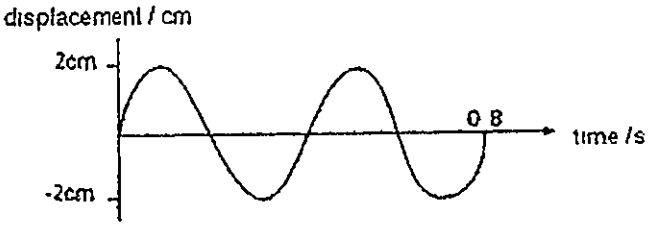
C greater than 45°

D equal to 90

12 The diagram shows four cylinders placed in front of a plane mirror The card prevents the observer at X from seeing the cylinders directly However, the image of one cylinder can be seen in the mirror Which image, A, B, C and D can be seen in the mirror?



13 The figure below shows the displacement-time graph of a particle in a water wave



What is the amplitude and frequency of the water wave?

	amplitude (cm)	frequency (Hz)
A	2	1 25
B	2	2 50
C	4	1 25
D	4	2 50

14. A bat emits an ultrasonic wave of frequency 33 kHz and receives an echo 100 ms later. If the speed of sound in air is 330 m/s, what is the distance of the bat from the object producing the echo?

A 10 0 m B 16 5 m C 33 0 m D 66 0 m

15. An ebonite rod is rubbed with fur and the fur becomes positively charged What could have caused the fur to become positively charged?

A The fur has lost some electrons to the rod
B The rod has lost some electrons to the fur
C The fur has gained some protons from the rod
D The rod has gained some protons from the fur

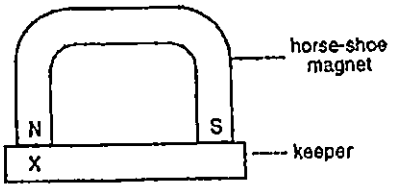
16 An electrical quantity is defined as 'the work done to drive a unit charge through an electrical component.' What is this quantity called?

A current
B power
C potential difference
D electromotive force

17. An electric kettle is plugged in and switched on The fuse in the plug blows immediately Which fault could cause this?

A The wire connected to the plug is too thin.
B The earth wire is not connected to the kettle.
C The live wire touches the metal case of the kettle
D The live wire and neutral wire connected in the plug are swapped around

18. The diagram illustrates a permanent horseshoe magnet and a keeper The keeper, which is easily magnetised, is placed across and in contact with the poles of the magnet when the magnet is not used



Which combination below correctly gives the material which should be used for the magnet and keeper, and the polarity of end X of the keeper when it is placed as shown in the figure?

	magnet	keeper	polarity of X
A	soft iron	soft iron	north
B	soft iron	steel	south
C	steel	soft iron	north
D	steel	soft iron	south

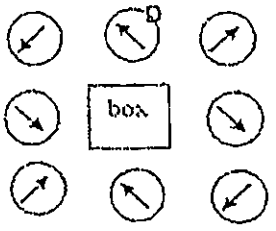
A B

9

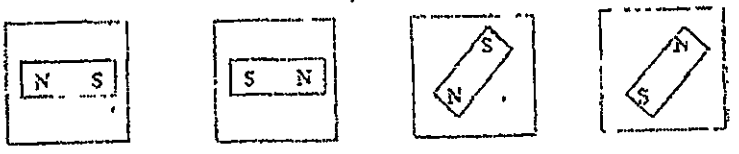
A B C D

The diagram below shows a box which has a magnet hidden inside it Compasses are placed around the box and the needles point in the directions shown

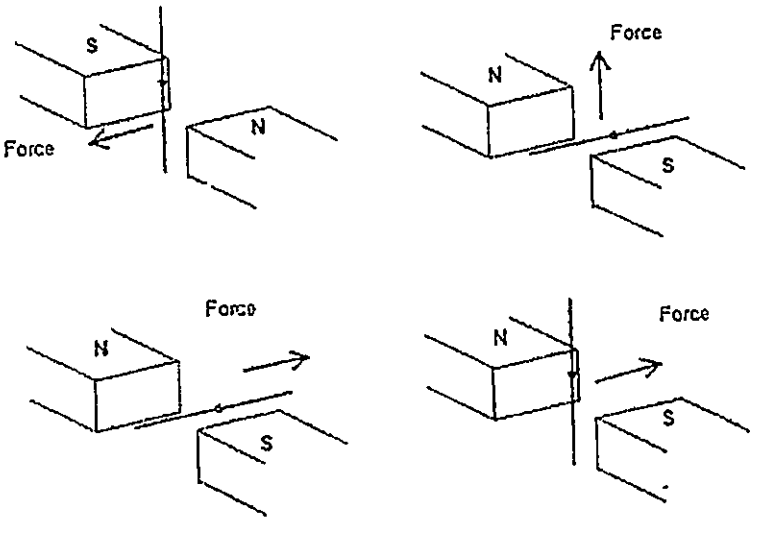
C



Which diagram shows how the magnet is placed inside the box?



0 Four current carrying wires are placed between two magnets as shown in the diagrams below Which of the following diagrams shows the correct direction of the force experienced by the wire?



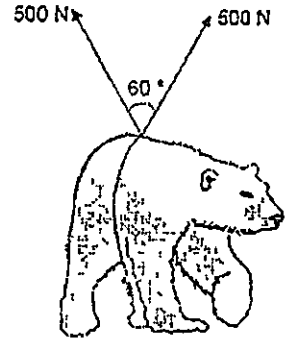
End of Paper

Setter. Mrs Lau Swee Kheng

Section A (45 marks)

Answer all questions in the spaces provided

1 The diagram shows a polar bear being lifted by two ropes The diagram is not drawn to scale The tension in each rope is 500 N and the angle between the ropes is 60°



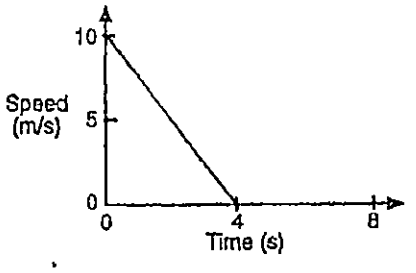
Draw a vector diagram in the space below to determine the weight of the polar bear
State the scale used

[4]

scale = ..

weight =

2. The graph below shows how the speed of a ball changes for the first four seconds after it was rolled up a hill with an initial speed of 10 ms ^{1}



(a) At what time did the ball reach its highest point on the hill? [1]

(b) Calculate the greatest distance of the ball from its starting point [2]

distance =

(c) Calculate the deceleration of the ball as it moved up the slope [2]

deceleration =

(d) At what time would the ball return to the starting point? [1]

3 Packaging companies purchase corrugated cardboard boxes to pack their goods These boxes are flattened when they are delivered, as shown in Fig 3 1 below

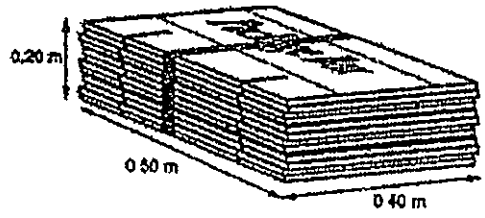


Fig 3 1

(a) A bundle of these boxes measures 0 50 m × 0 40 m × 0.20 m and has a mass of 5 2 kg Calculate the density of the corrugated cardboard [2]

density = .

(b) Corrugated cardboard is made up of three sheets of thick paper stuck together Fig 3 2 shows an enlarged view of the edge of a sheet of corrugated cardboard.

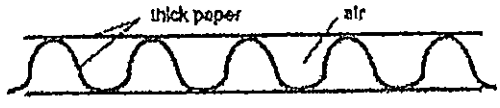


Fig 3.2

(i) What can you say about the density of the thick paper compared to the value calculated in (a)? [1]

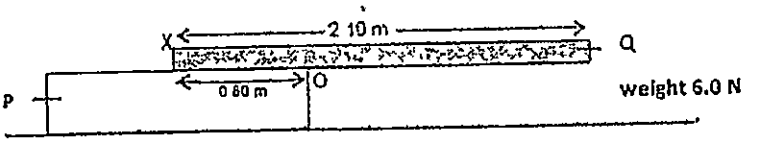
(ii) Explain your answer in (i) [1]

_____

_____

_____

4. The diagram shows two uniform wooden blocks P and Q. Block Q weighs 6.0 N and is placed on top of block P



(a) Explain briefly what the term *centre of gravity* means [1]

_____

_____

(b) On the diagram above, indicate the weight of the block Q with an arrow labelled "W" [1]

(c) Predict and explain using moments, what will happen to block Q when it is placed on block P [2]

_____

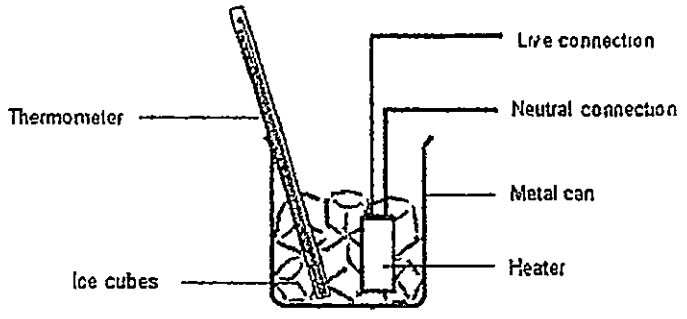
_____

_____

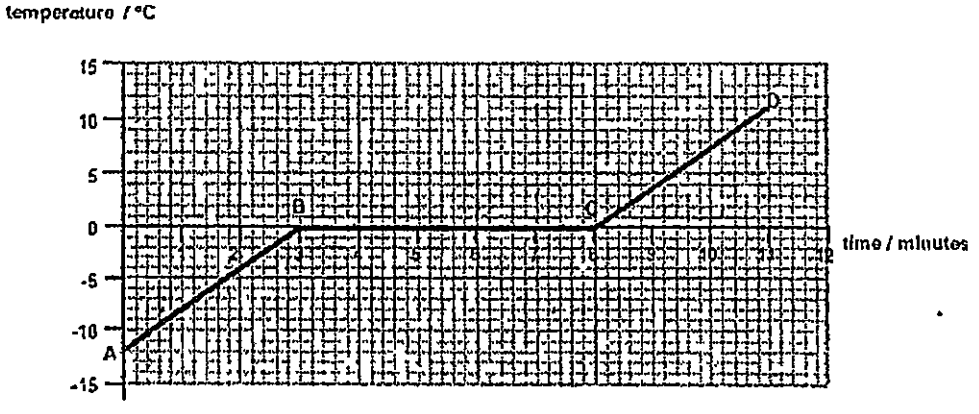
(d) Given that the gravitational field strength on Earth and Mars are 10 N/kg and 3.75 N/kg respectively, calculate the weight of Q on Mars [2]

weight =

5 The diagram shows the apparatus used by some students to investigate what happens to ice cubes as it is heated The solid is contained in a metal can It is heated by an immersion heater



The students measure the temperature of the ice cubes, at regular time intervals The graph below shows the results obtained

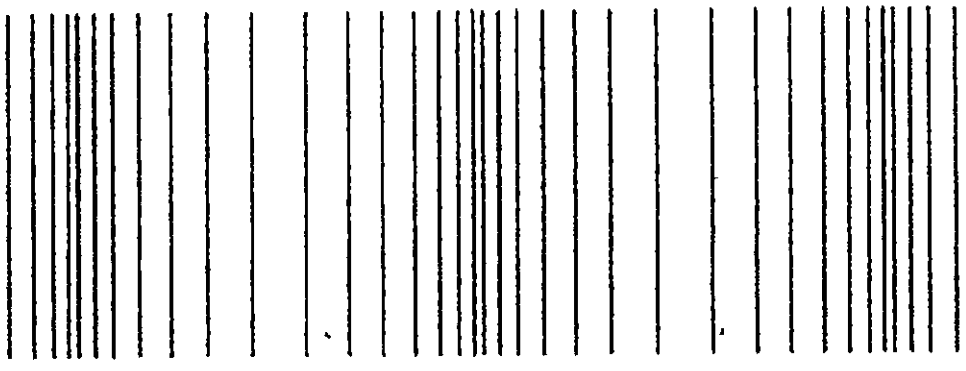


(a) Describe the difference between the motion of the particles of the ice at AB and at BC. [2]

(b) The power rating of the heater is 3000 W Given that the cost of 1 kWh of electricity is 23 cents, calculate the cost of operating the heater for 12 minutes [2]

cost =

6. A microphone produces a sound in air A full scale diagram representing the sound wave of frequency 5 2 kHz is shown below



(a) Explain how sound is transmitted in air [2]

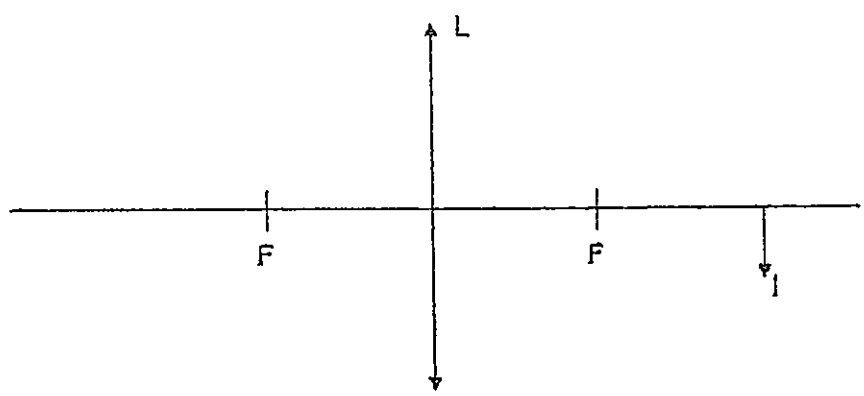
(b) On the diagram above, mark the position of the centre of a compression with a 'C' and the centre of a rarefaction with a 'R' [1]

(c) State the wavelength of the sound wave [1]

(d) Hence, calculate the speed of sound in air [2]

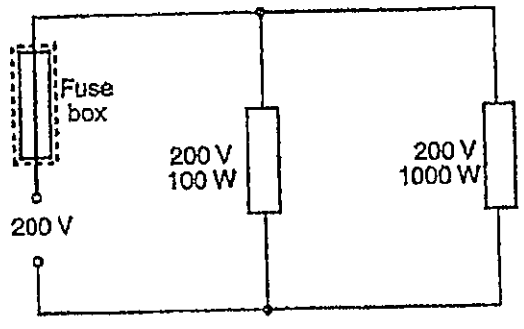
speed of sound = .

7 The diagram below shows an image I formed from an object O placed near a converging lens L with principal foci F. On the diagram below, draw two light rays to find the location of the object. Label the object, O [2]



A B

The diagram below shows a household electric circuit that consists of a heating unit and a lighting unit connected to the mains of 200 V



(a) Which is the heating unit, A or B? Explain [1]

(b) Calculate the maximum current drawn from the mains [2]

maximum current=

(c) Calculate the resistance of A [2]

resistance =

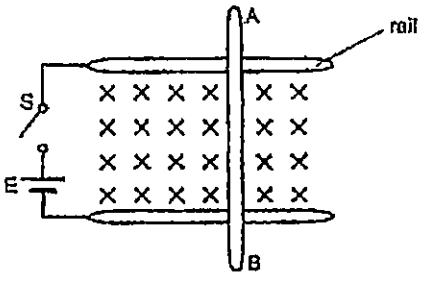
(d) Why is it not advisable to use thin wire in the heating unit? [1]

_____

_____

_____

9. (a) A metal rod AB is placed on two smooth horizontal metal rails as shown in the diagram below The set of crosses represents a uniform magnetic field pointing into the paper



(i) State and explain what would happen when the switch is closed [2]

_____

_____

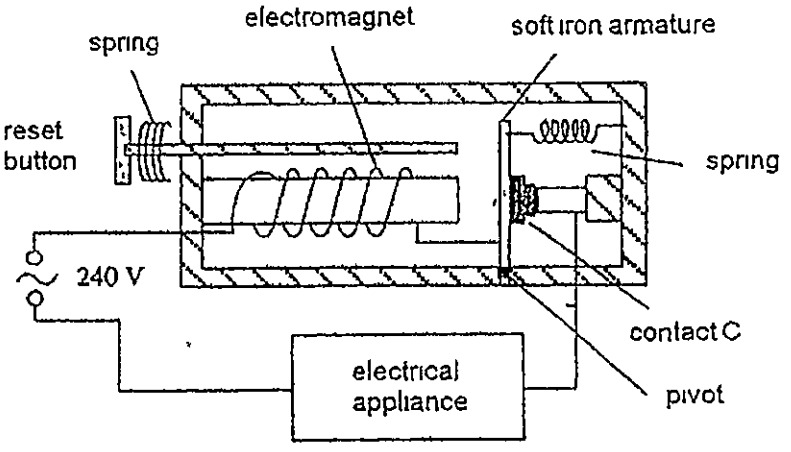
(ii) Explain the effects on the motion of the rod AB when the magnetic field strength is increased [1]

_____

_____

_____

(b) The diagram shows a circuit breaker that could be used in household circuits

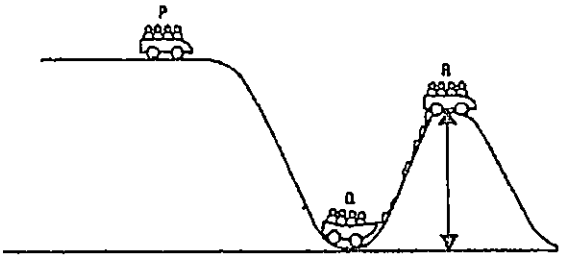


Explain how this circuit breaker works when there is a large current flowing through the electrical appliance and how it can be reset [4]

Section B (20 marks)

Answer any two questions in the spaces provided

10. (a) The diagram below shows the side view of a roller coaster track A stationary cart of mass 600 kg is released from position P. It moves to positions Q and R Between P and Q, the track is considered to be frictionless From Q to R, there is substantial energy loss due to friction Take acceleration due to gravity to be 10 N/kg



The gravitational potential energy of the car at P is 192 000 J

(i) Calculate the height at P [2]

height =

(ii) Calculate the velocity at Q. [2]

velocity =

(iii) When the cart reaches R, it has a velocity of 13 m/s Calculate the energy loss due to friction [2]

energy loss =

(iv) The total length of track between Q and R is 500 m Calculate the frictional force along the track [1]

frictional force =

(v) State an assumption made when calculating the answer to (iv) [1]

_____

_____

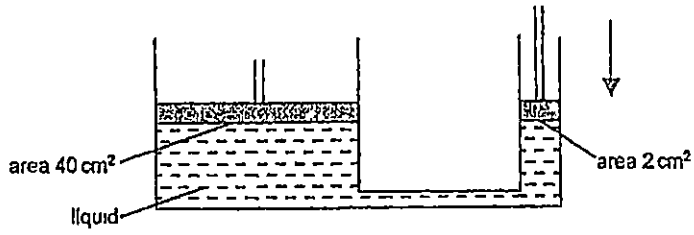
_____

piston K

80 N

piston L

(b) The hydraulic system shown in the diagram below contains a liquid

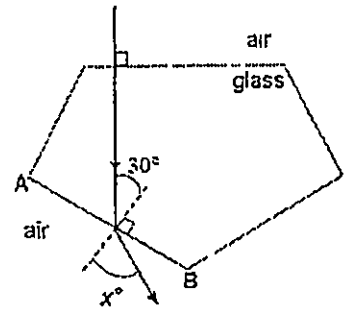


A downward force of 80 N exerted on piston L causes a pressure The liquid transmits this pressure to piston K which then causes a force to be exerted on piston K. Calculate the upward force exerted by the liquid on piston K [2]

upward force =

Fig 11.1

11 (a) Fig 11 1 shows a cross-section of a piece of glass which has a refractive index of 1.5
A ray of light is incident normally at the top surface as shown



(i) Find the angle of refraction of the ray, $x°$, at the boundary AB. [2]

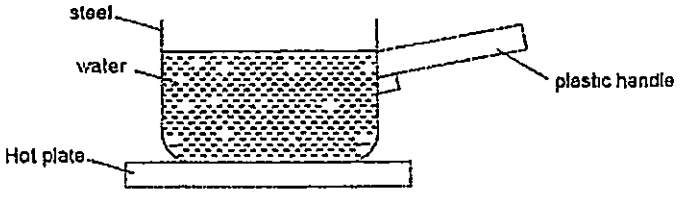
angle of refraction =

(ii) A piece of diamond of refractive index 2 4 is cut to the same shape as the glass shown in the diagram Find the critical angle of the diamond [2]

critical angle =

(iii) By considering light entering the diamond from the top surface as shown in Fig 11.1, explain why a piece of diamond sparkles [2]

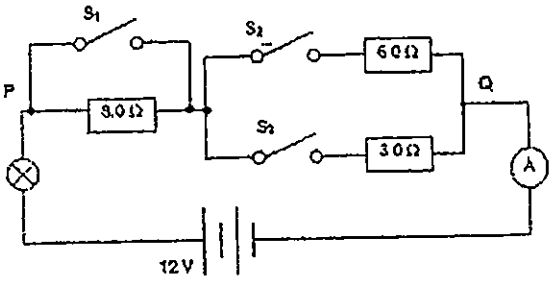
(b) The diagram shows a saucepan containing water placed on a hot plate After sometime, the water becomes hot



(i) Describe how heat from the hot plate is transferred to the base of the saucepan [2]

(ii) Describe and explain how heat is distributed in the water [2]

2 The diagram below shows a circuit in which all the switches S_1, S_2 and S_3 are opened



(a) Calculate the effective resistance between points P and Q when S_1, S_2 and S_3 are closed [2]

resistance =

(b) If the ammeter reading is 2.0 A, what is the resistance of the lamp when S_1, S_2 and S_3 are closed? [2]

resistance =

(c) What is the energy dissipated by the lamp in 1 minute when the current in the circuit is 2.0 A? [2]

energy =

(d) When switches S_1, S_2 and S_3 are closed, the lamp lights up with certain brightness If switch S_1 is now opened, explain how this will affect the brightness of the lamp [2]

(e) Calculate the effective resistance of the circuit when only S_1 is opened [2]

resistance =

End of Paper 2

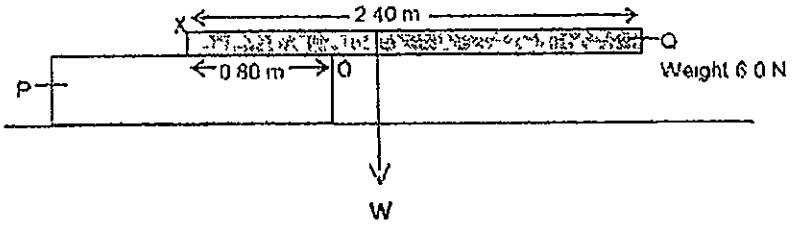
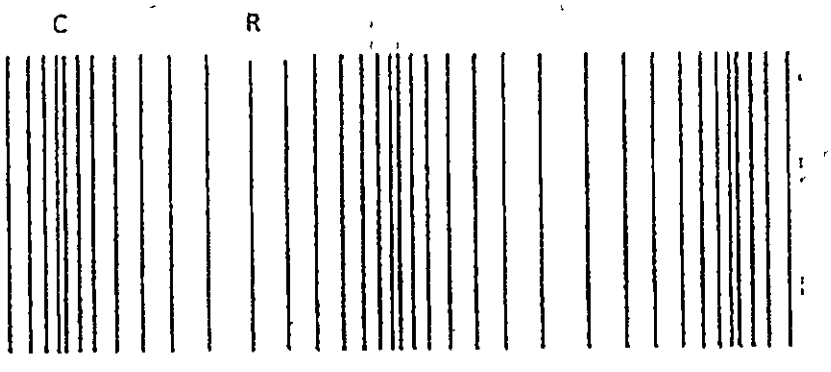
Setter: Mrs Lau Swee Kheng

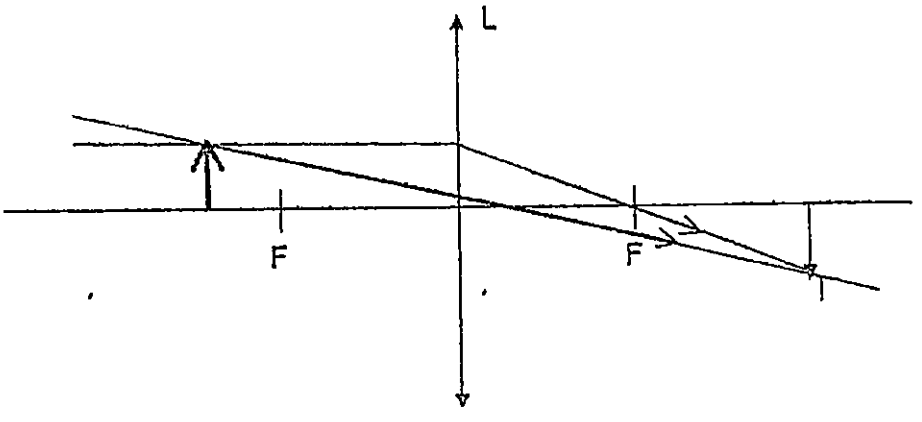
Secondary Five Normal (Academic) Sc(Physics) Prelim

Answer Scheme

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

Section A		
1	Appropriate scale Forces of 500 N and 60° represented accurately Resultant force found correctly using parallelogram / tip tail method Resultant force between 860 N to 880 N	[1] [1] [1] [1]
2a	4s	[1]
2b	Distance = area under speed-time graph = ½ (10 x 4) = 20 m	 [1] [1]
2c	Deceleration = $\frac{\text{initial speed final speed}}{\text{time}}$ $= \frac{10}{4}$ = 2.5 m/s²	 [1] [1]
2d	8s	[1]
3a	$D = \frac{M}{V}$ $= \frac{52}{02 \times 05 \times 04}$ = 130 kg/m³	 [1] [1]
3bi	Density of the thick paper is higher.	[1]
3bii	The cardboard is made up of mostly air which is of low density.	[1]

4a	Point at which weight acts	[1]
4b		[1]
4c	The weight of Q creates a clockwise moment about pivot O. Hence Q will topple over	[1] [1]
4d	$W_{earth} = mg$ $6 = m(10)$ $m = 0\ 6$ kg $W_{mars} = 0\ 6 \times 3.75 = 2.25$ N	[1] [1]
5a	At AB, the particles are vibrating about fixed positions [1] while at BC, the particles are starting to slide over one another [1]	[2]
5b	Cost = no of kW x no of hr x 23 cents $= 3 \times \frac{12}{60} \times 23$ = 13 8 cents	[1] [1]
6a	The air particles vibrate in a direction parallel to the direction of the sound wave A series of compressions and rarefactions are set up.	[1] [1]
6b	 Accept any possible answer	[1]

6c	6 cm (+/-0 1 cm)	[1]
6d	$v = f\lambda$ $= 5200 \times 0\ 06$ $= 312\ m/s$	[1] [1]
7	 [1] for two light rays with arrows [1] for correct drawing of object	[2]
8a	A. It has a higher power rating.	[1]
8b	$P = VI$ $1100 = 200\ I$ $I = 5\ 5\ A$	[1] [1]
8c	$P = \frac{V^2}{R}$ $100 = \frac{200 \times 200}{R}$ $R = 400\ \Omega$	[1] [1]
8d	A thin wire has <u>high resistance</u> and hence will create a lot of <u>heat</u>.	[1]
9ai	The metal rod will move away from the battery. This is because a current carrying conductor experiences a force when a magnetic field acts perpendicularly to it.	[1] [1]
9aii	The metal rod moves further away from the battery because the force acting on the conductor now is stronger.	[1]

9b	When a large current flows through the solenoid, the electromagnet becomes strong enough to attract the soft iron armature. The soft iron armature moves to the left, breaking contact with C The circuit breaker can be reset by pushing the reset button inwards so that the iron armature can resume contact with C	[1] [1] [1] [1]
	Section B	
10ai	PE = mgh 192 000 = 600 (10)h h = 32 m	[1] [1]
10aii	E = ½ mv² 192 000 = ½ (300)v² v = 25 3 m/s	[1] [1]
10aiii	Energy loss = Total energy – energy at R = 192 000 – [(600 x 10 x 5) - (½ x 600 x 13²) = 111 000 J	[1] [1]
10aiv	Work done = F x d 111 000 = F x 500 F =223 N	[1]
10av	All the energy loss is used to overcome friction	[1]
10b	Pressure at L = Pressure at K $\frac{80}{2} = \frac{F}{40}$ F = 1600 N	[1] [1]
11ai	$n = \frac{\sin i}{\sin r}$ $1\,5 = \frac{\sin x}{\sin 30}$ x = 48 6°	[1] [1]
11aii	$\sin c = \frac{1}{n}$ $c = \sin^{-1}(\frac{1}{2\,4})$ = 24 6°	[1] [1]
11aiii	As the angle of incidence is greater than critical angle [1], total internal reflection occurs [1] Hence light will escape from the diamond at the surface.	[2]

10bi	Particles at the hot plate vibrate faster They collide with particles at the base of the saucepan to transfer the heat energy from the hot plate to the saucepan	[1] [1]
10bii	Hot water at the bottom rises due to its low density/Cold water at the top sinks due to its high density Convection currents are formed in the water	[1] [1]
12a	$R_{PQ} = (\frac{1}{6} + \frac{1}{3})^{-1}$ $= 2\,\Omega$	[1] [1]
12b	$R_T = \frac{12}{2} = 6\,\Omega$ $R_{lamp} = 6 - 2 = 4\,\Omega$	[1] [1]
12c	$E = I^2Rt$ $= 2^2 \times 4 \times 60$ $= 960\ J$	 [1] [1]
12d	Brightness of the lamp decreases The total resistance of the circuit increases, resulting in a smaller current flowing through the lamp.	[1] [1]
12e	$R_T = (\frac{1}{6} + \frac{1}{3})^{-1} + 8 + 4$ $= 14\,\Omega$	[1] [1]