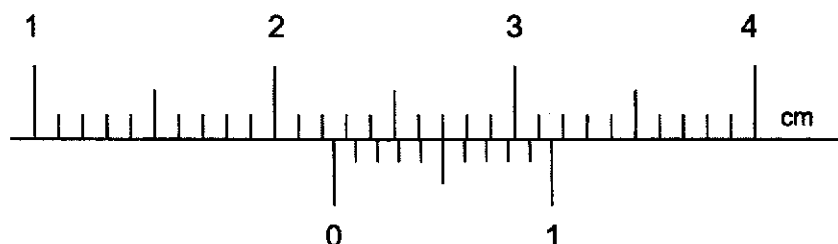


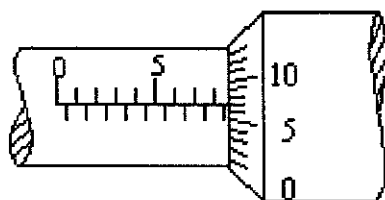
Answer all questions on the Optical Mark Sheet provided.

- 1 A student used a pair of vernier calipers to measure the diameter of a wooden cylinder. The diagram shows an enlargement of the caliper scales.



What reading was recorded?

- A 0.25 cm    B 0.57 cm    C 2.25 cm    D 2.27 cm
- 2 The diagram shows a micrometer scale.



What reading is shown?

- A 5.07 mm    B 5.37 mm    C 8.07 mm    D 8.57 mm
- 3 Which of the following actions will decrease the period of a pendulum?
- A decrease the angle of oscillation  
B shorten the length of the pendulum  
C decrease the mass of the pendulum bob  
D conduct the experiment on the top of a mountain
- 4 Which of the following lists contains only base quantities?
- A length, time, weight, current  
B density, length, mass, volume  
C weight, area, force, acceleration  
D time, mass, length, temperature

- 5 A light ping pong ball has low inertia.

How difficult is it to start moving it and to stop it from moving?

	to start	to stop
<b>A</b>	easy	easy
<b>B</b>	difficult	easy
<b>C</b>	easy	difficult
<b>D</b>	difficult	difficult

- 6 Cooking oil floats on water but mercury does not.

If water has a density of  $1000 \text{ kg/m}^3$ , which of the following shows the correct densities of cooking oil and mercury?

	density of cooking oil / ( $\text{kg/m}^3$ )	density of mercury / ( $\text{kg/m}^3$ )
<b>A</b>	900	13 600
<b>B</b>	1200	1500
<b>C</b>	13 600	900
<b>D</b>	900	700

- 7 Liquids usually expand more than solids when heated through the same rise in temperature.

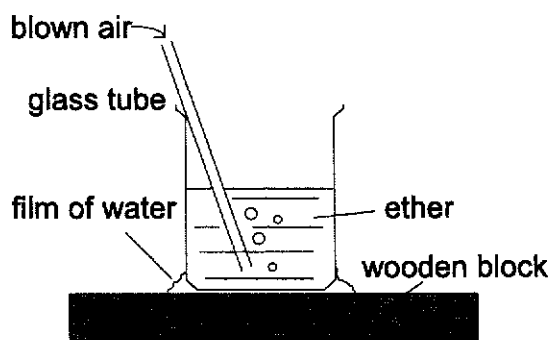
Which of the following best explains this?

- A** Liquid molecules are bigger than solid molecules.
- B** Liquid molecules move faster than solid molecules.
- C** Liquid molecules expand more than solid molecules.
- D** The forces between liquid molecules are weaker than the forces between solid molecules.
- 8 Some oxygen gas is in a sealed container that has a constant volume.

What will happen to the oxygen molecules when the gas is heated?

- A** They will expand.
- B** They will become denser.
- C** They will move more quickly.
- D** They will become further apart.

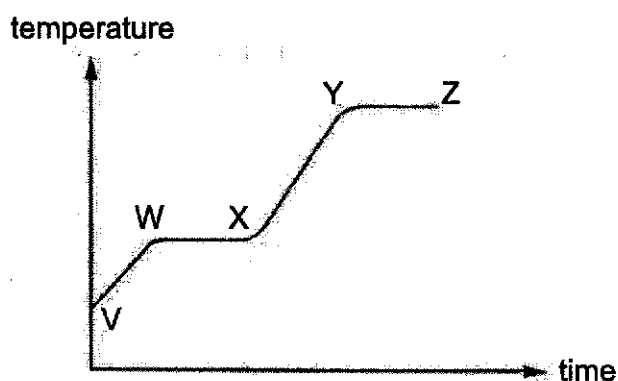
- 9 A beaker filled with ether is placed on a film of water. Air is then blown into the ether through the tube. After some time, it is observed that the film of water freezes into ice.



Which of the following best describes the processes that result when air is blown through the tube?

	rate of evaporation of ether	average energy of remaining ether molecules	temperature of ether
<b>A</b>	increases	increases	rises
<b>B</b>	decreases	increases	falls
<b>C</b>	decreases	decreases	rises
<b>D</b>	increases	decreases	falls

- 10 Some ice, placed in a beaker, is heated until the beaker contains boiling water. The graph shows the variation of the temperature of water with time.



At which portion of the graph does the beaker contain a mixture of water and ice?

- A** VW      **B** WX      **C** XY      **D** YZ

11 When water is heated steadily, the speed of the water particles will stop increasing when the water starts to

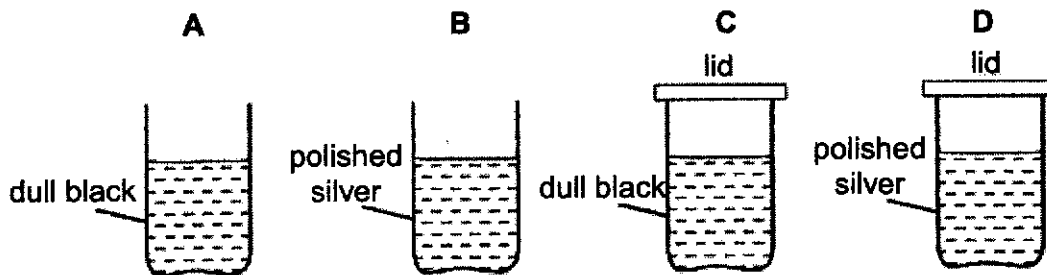
- A boil.    B condense.    C evaporate.    D freeze.

12 When you stand with one foot on a cement floor and the other foot on a carpet in a cold room, the cement floor feels colder than the carpet.

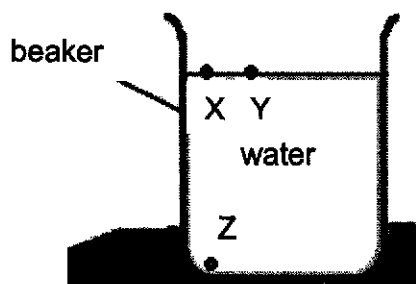
Which is the most likely explanation?

- A Air is unable to circulate through the carpet fibres.  
 B The cement floor is at a lower temperature than the carpet.  
 C There is a higher rate of heat transfer from the carpet to your foot than from the cement floor to your foot.  
 D There is a higher rate of heat transfer from your foot to the cement floor than from your foot to the carpet.
- 13 The diagram shows four similar cans. Each can contains the same volume of water initially at 60 °C.

After ten minutes, which can will contain water with the lowest temperature?

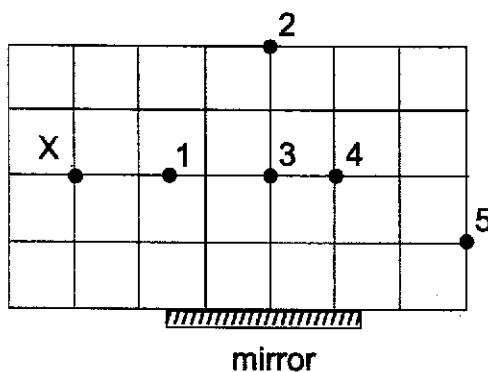


- 14 A student wants to set up a convection current in a beaker of water.



Which of the following actions at X, Y or Z would achieve this?

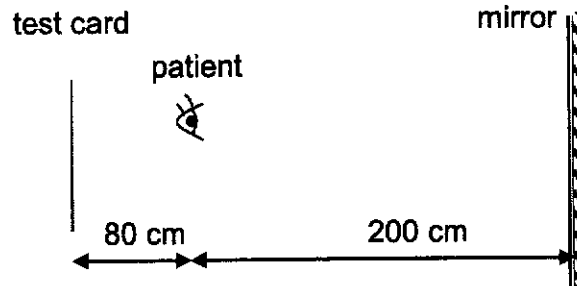
- A heating at X
  - B heating at Y
  - C cooling at X
  - D cooling at Z
- 15 A student stands at point X as shown in the diagram below.



Which of the pins, 1, 2, 3, 4 or 5, will he be able to see in the mirror?

- A pins 1, 2 and 3
- B pins 2, 3 and 4
- C pins 3, 4 and 5
- D pins 2, 3, 4 and 5

- 16 The diagram below shows a plane mirror placed at a distance of 200 cm in front of a patient. The optician's test card is fixed at 80 cm behind the eyes of the patient.



What is the distance from the patient's eyes to the image of the card?

- A 400 cm      B 480 cm      C 560 cm      D 680 cm
- 17 An object is placed 27 cm from a converging lens of focal length 9 cm.  
Which of the following statements about the image formed is true?
- A The image is virtual.  
B The image is magnified.  
C The image is inverted.  
D The image is 8 cm from the lens.
- 18 A magnifying glass is used to read some small print on a book as shown below.

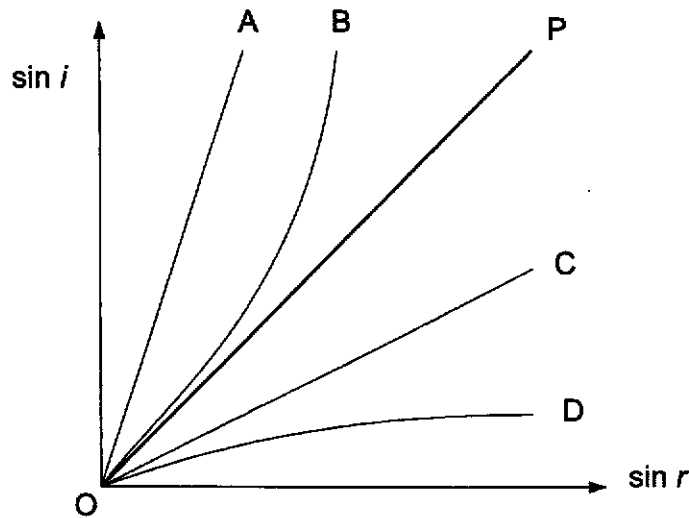


Which of the following statements is **incorrect**?

- A The image of the small print is real.  
B The image distance is longer than the object distance.  
C The object distance is shorter than the focal length of the lens.  
D The small print and its image are on the same side of the lens.

- 19 In the diagram below, OP represents the graph of  $\sin i$  against  $\sin r$  for light travelling from air to glass.

$i$  is the angle of incidence and  $r$  is the angle of refraction.

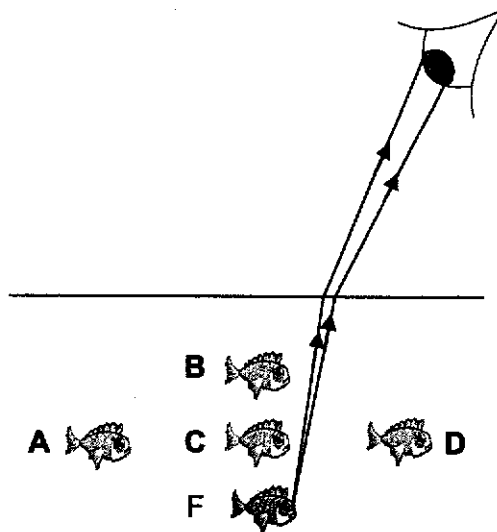


Which graph best represents how  $\sin i$  varies with  $\sin r$  when light travels from air to diamond?

- A OA      B OB      C OC      D OD

- 20 The diagram below shows a student looking at a fish F in a pond.

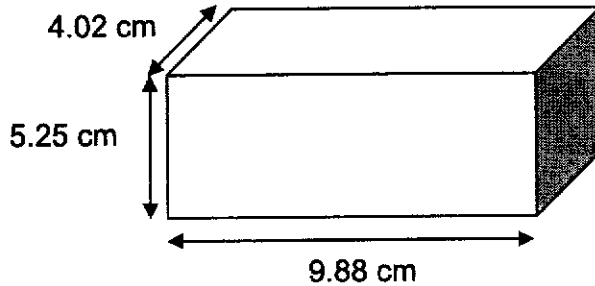
At which position, A, B, C or D, will he see the image of the fish?



**SECTION A [ 30 marks ]**  
Answer all questions in this section.

- 1 During a space exploration, an object in the shape of a regular rectangular block was collected from Mars and brought back to Earth. The object weighs 14.8 N on Mars.

Fig. 1.1 shows the dimensions of the object, as measured by an instrument. The gravitational field strength on Mars is 3.7 N/kg.



**Fig. 1.1**

- (a) State the instrument used to measure the dimensions of the object.  
.....[1]

(b) Calculate

- (i) the mass of the object,

mass = .....[1]

- (ii) the density of the object in g/cm<sup>3</sup>,

density = .....g / cm<sup>3</sup> [2]

- (iii) the weight of the object on Earth, given that the gravitational field strength on Earth is 10 N/kg.

weight of object on Earth = .....[1]



- (c) The object was then placed in a displacement can filled with alcohol of density  $0.80 \text{ g/cm}^3$ .

Determine the mass of alcohol displaced when the object was placed in the can.

mass of alcohol displaced = .....[2]

- 2 Fig. 2.1 illustrates the arrangement of particles of a substance in three different states of matter.

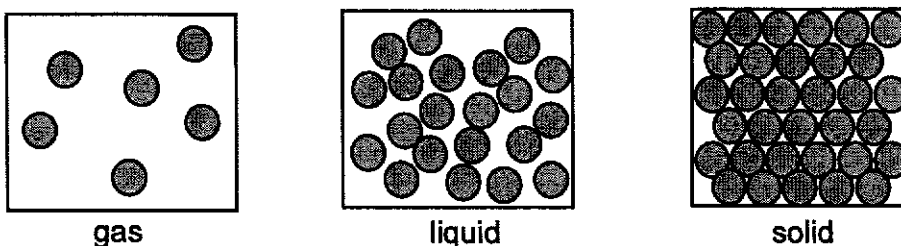


Fig. 2.1

- (a) State which particles (solid, liquid or gas) move at the lowest speed.

Provide a reason for your answer.

.....  
.....[2]

- (b) Explain why the density of the gas is lower than that of the solid.

.....  
.....[2]

- (c) Describe the movement of the particles in

(i) the solid,  
.....[1]

(ii) the liquid,  
.....[1]

(iii) the gas.  
.....[1]

- 3 A substance, initially in a gaseous state, was cooled in a freezer. The temperature of the substance was taken at regular intervals of time and the temperature-time graph is plotted as shown in Fig. 3.1.

temperature / °C

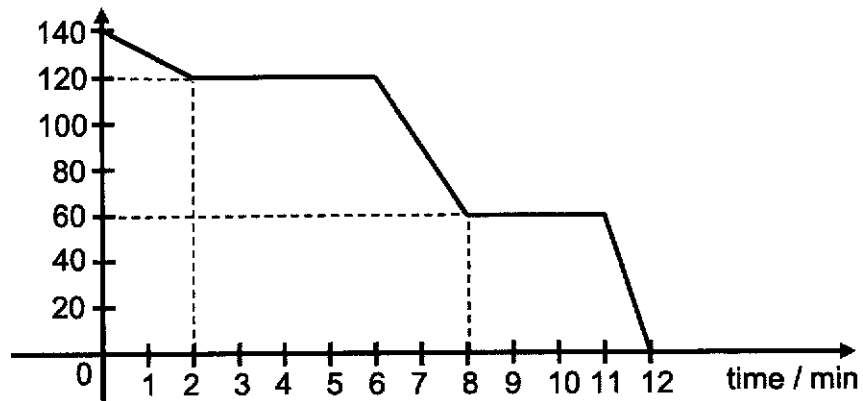


Fig. 3.1

- (a) Using Fig. 3.1, state
- (i) the freezing point of the substance,  
.....[1]
  - (ii) the state of the substance from time = 2 min to 6 min.  
.....[1]
- (b) Using Kinetic Model of Matter, explain why the temperature remains constant from time = 8 min to 11 min, even though heat is constantly removed from the substance.  
.....  
.....  
.....  
.....[2]
- (c) Describe the following changes from time = 6 min to 8 min in
- (i) the space between particles,  
.....[1]
  - (ii) the speed of the particles.  
.....[1]

4 A student notices puddles of water on the road, as shown in Fig. 4.1.

For  
examiner's  
use

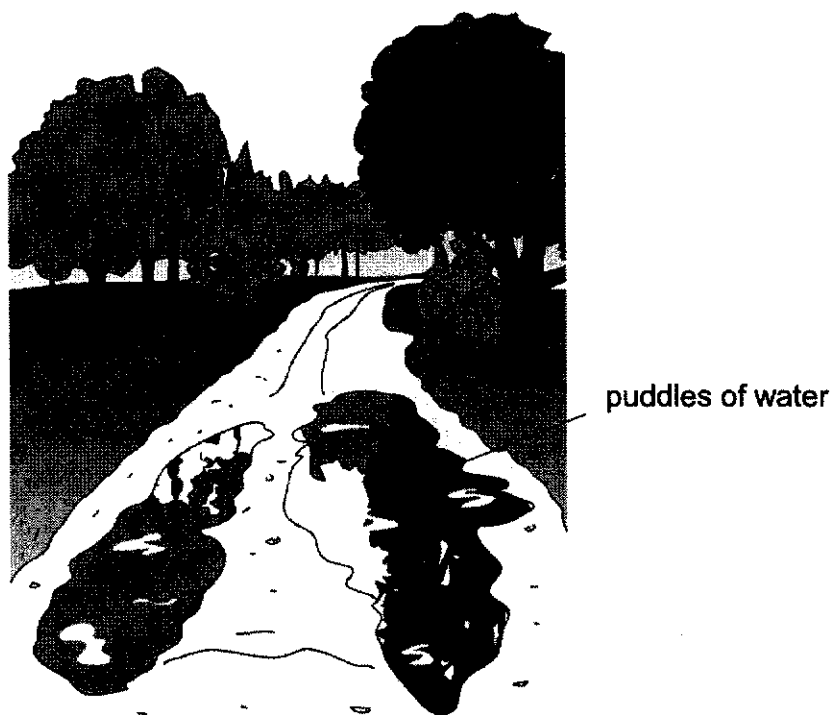


Fig. 4.1

Later in the day, he passes the puddles again and some of the water has evaporated.

(a) State two changes in the atmospheric conditions that would cause the water to evaporate faster.

1.....

2.....

[2]

(b) Explain, in terms of molecular movements, what happens during evaporation.

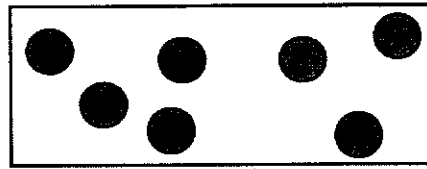
.....

.....

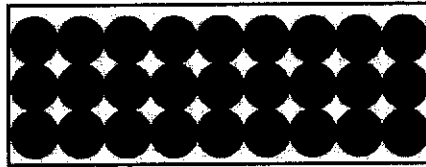
.....

..... [2]

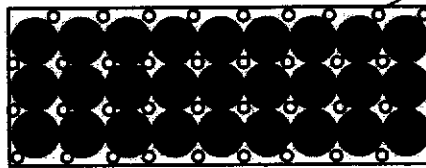
5 Fig. 5.1 shows the arrangement of particles for gas, glass and copper.



gas



glass



free moving electrons

copper

Fig. 5.1

With reference to Fig. 5.1, explain why

(a) glass is a better conductor of thermal energy than gas,

.....

.....

.....

.....

.....

.....[2]

(b) copper is a better conductor of thermal energy than glass.

.....

.....

.....

.....

.....

.....[2]

7

- 6 In cold countries, like England, the windows installed in houses have double layers of glass as shown in Fig. 6.1.

For  
examiner's  
use

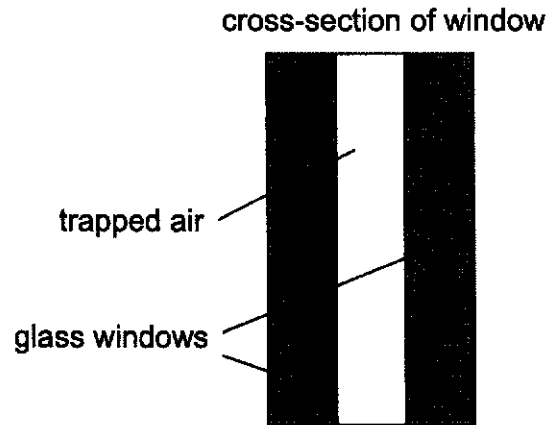


Fig. 6.1

Explain how this type of windows help keep the interior of a house warm.

.....

.....

.....

.....[2]

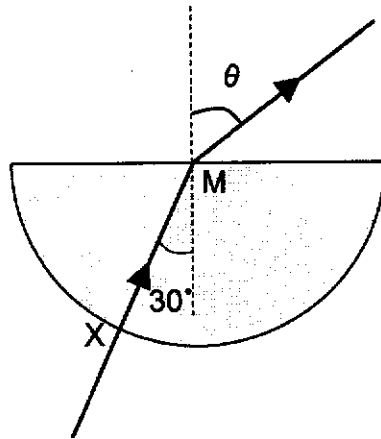
**Section B [ 20 marks ]**

For  
examiner's  
use

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

Write your answers in the spaces provided.

- 7 (a) Fig. 7.1 shows the passage of a ray of red light into a semi-circular glass block. The ray meets the straight side of the block at M, the center of the semi-circle and refracts away from the normal.



**Fig. 7.1**

The refractive index of the glass block is 1.5.

- (i) Explain why the light ray did not bend as it enters the glass at point X.

.....  
 .....[1]

- (ii) Calculate the angle of refraction,  $\theta$ .

$\theta = \dots\dots\dots$ [2]

- (iii) Explain why light ray refracts away from the normal at point M.

.....  
 .....  
 .....[2]

- (b) Fig. 7.2 shows a second ray of light strikes the same glass surface at M with an angle of incidence  $C$  equal to the critical angle of light in glass.

For  
examiner's  
use

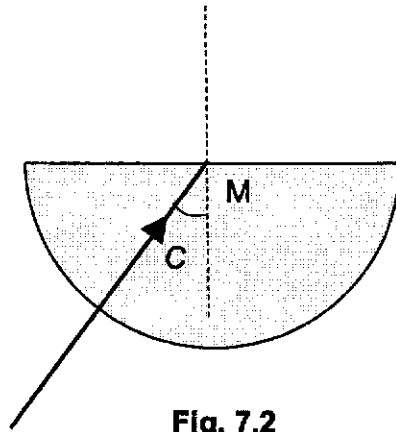


Fig. 7.2

- (i) Calculate the critical angle of light in glass.

critical angle = .....[2]

- (ii) On Fig. 7.2, continue the ray of light after it strikes the glass surface at M. [1]
- (iii) A third ray of light strikes the glass surface at M with an angle of incidence greater than  $C$ .

Describe, giving a reason for your answer, what happens to the ray of light after it strikes the glass surface at M.

.....

.....

.....

.....

.....

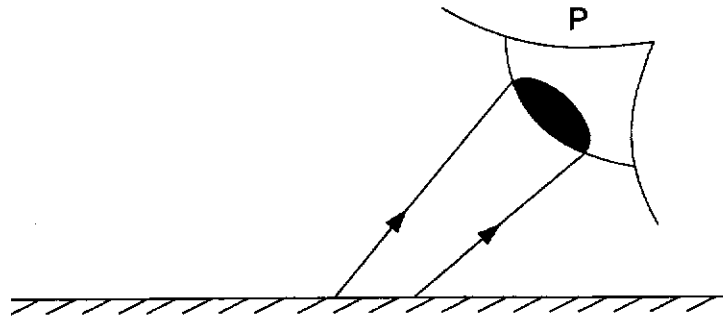
.....

.....

.....

.....[2]

- 8 (a) Fig. 8.1 shows two light rays reflected off a mirror into the eye of an observer at P.



**Fig. 8.1**

- (i) On Fig. 8.1, determine the position of the image of the object with a cross (x). [1]
- (ii) Show on Fig. 8.1 the position of the object O. [1]
- (iii) Complete Fig. 8.1 to show how light rays from the object O enter the eye of the observer at P. [1]
- (iv) The image is *virtual*. Explain this term. [1]

.....  
 .....[1]

- (v) State one other characteristic of the image. [1]
- .....  
 .....[1]



- (b) A small, very brightly illuminated display is located at the back of a projector. The projector lens produces an inverted and magnified image of the display on a white classroom wall.

Fig. 8.2 is a scale diagram showing the position and size of both the display and the image on the wall.

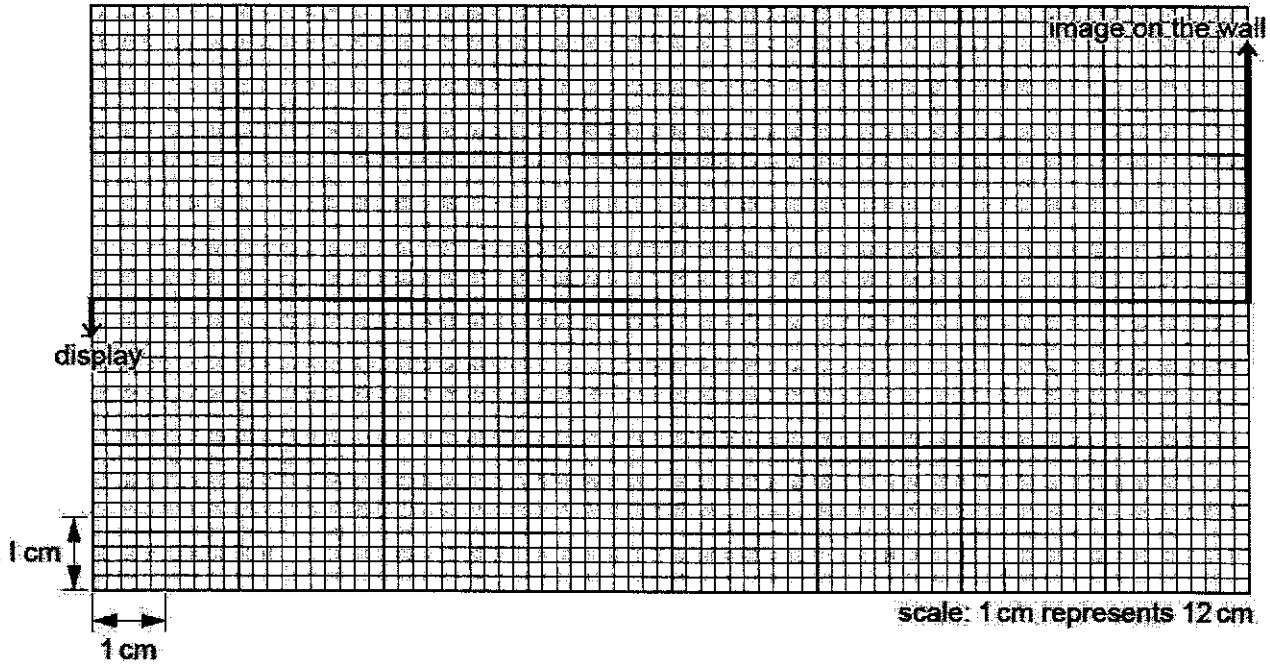


Fig. 8.2

- (i) Construct a ray diagram on Fig. 8.2 to determine the position of the lens. Mark the center of the lens as O. [2]
- (ii) Mark the focal point of the lens on Fig. 8.2. Label the focal point as F. [1]
- (iii) Determine the focal length of the lens.  
focal length = .....[1]
- (iv) The image is inverted and magnified.  
State one other characteristic of the image.  
.....[1]

9 (a) Fig. 9.1 shows food being cooked on a black tray in an electric grill.

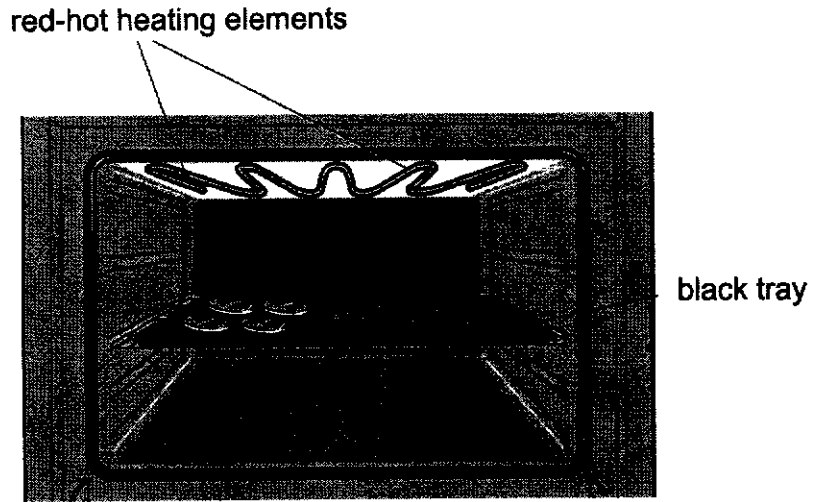


Fig. 9.1

There are red-hot heating elements above the food and thermal energy (heat) is transmitted to the food by radiation.

(i) Explain what is meant by radiation.

.....  
.....[1]

(ii) Explain why trays used in electric grills are usually black in colour.

.....  
.....  
.....  
.....[2]

(iii) Explain why very little thermal energy is transferred from the heating elements to the food by

1. convection

.....  
.....  
.....  
.....  
.....[2]

2. conduction.

.....

.....

.....

.....[1]

(b) Fig. 9.2 shows a fire fighter.

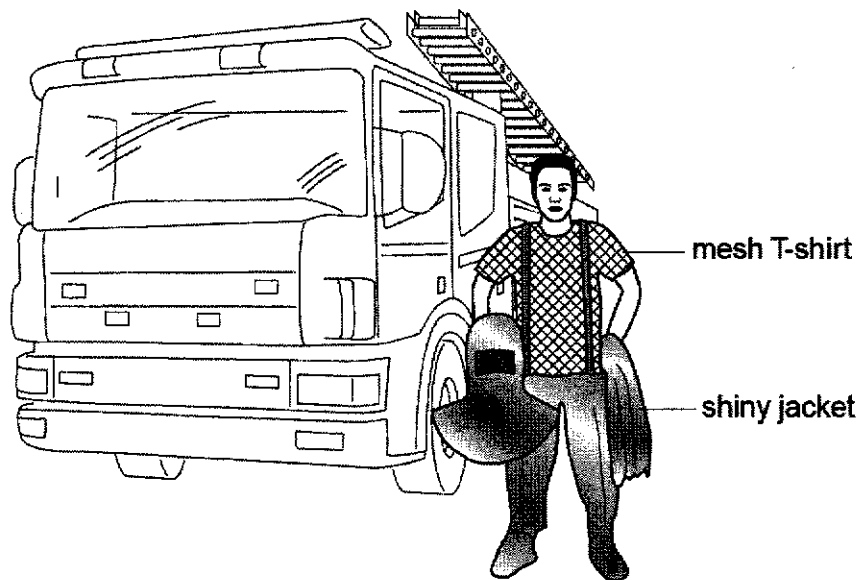


Fig. 9.2

The jacket of his protection suit has a shiny, silver-coloured outer surface. Underneath it, he wears a loosely-woven mesh T-shirt (string vest) which consist of many holes.

Explain how wearing the shiny jacket and mesh T-shirt helps to keep the firefighter cool when he is close to a source of intense heat.

1. shiny jacket : .....

.....

.....

.....[2]

2. mesh T-shirt : .....

.....

.....

.....[2]

**END OF PAPER**

© BGSS 2019

partnerInLearning

More papers at [www.47testpapersfree.com](http://www.47testpapersfree.com)

For  
examiner's  
use



**BEDOK GREEN SECONDARY SCHOOL  
SCIENCE DEPARTMENT  
MARKING SCHEME  
YEAR (2019)**

**SUBJECT: Science Physics 5076**  
**SETTER: Mr David Lim**  
**LEVEL: 3 Exp**

**EXAM: Mid Year**

**PAPER 1: 20 marks**

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

[1 Mark each]

**PAPER 2**

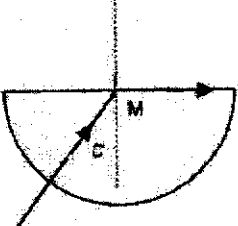
**Section A: 30 marks**

<b>Qn. No.</b>	<b>Scoring Points</b>	<b>Marks</b>	<b>Max. Marks</b>
1(a)	vernier calipers	1	1
1(b)i	$m = w / g_{\text{mars}}$ $= 14.8 / 3.7$ $= 4 \text{ kg}$	1	1
1(b)ii	$v = 4.02 \times 5.25 \times 9.88$ $= 209 \text{ cm}^3$  $\rho = m / v$ $= 4000 / 209$ $= 19.1 \text{ g / cm}^3$	1  1	2
1(b)iii	$w = mg$ $= 4 \times 10$ $= 40 \text{ N}$	1	1
1(c)	$m = \rho \times v$ $= 0.80 \times 209$ $= 167 \text{ g}$	1 1	2

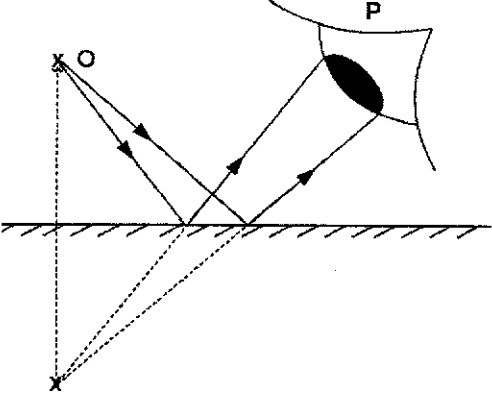
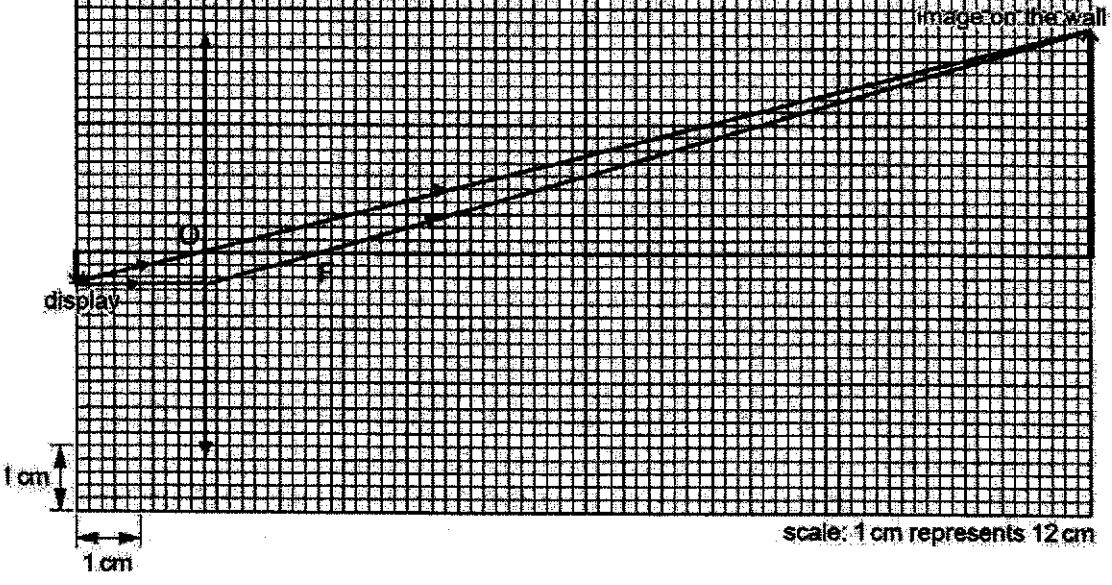
2(a)	Solid particles move at the lowest speed. Solid particles experiences strong forces of attraction between the particles and have the least energy among the three states.	1 1	2
2(b)	The number of gas particles is smaller than number of solid particles for the same volume. Since gas has a smaller mass per unit volume, it has a smaller density.	1 1	2
2(c)i	Particles vibrate in fixed positions.	1	1
2(c)ii	Particles slide past each other freely.	1	1
2(c)iii	Particles move freely apart from each other in random motion.	1	1
3(a)i	60°C	1	1
3(a)ii	Gas – liquid mixture	1	1
3(b)	Heat is released to form forces of attraction between particles as it turns from liquid to solid state.  As kinetic energy of particles remain constant, the temperature remains constant as temperature is proportional to kinetic energy of particles.	1  1	2
3(c)i	Space between the particles decreases	1	1
3(c)ii	Speed decreases.	1	1
4(a)	Decrease in humidity Increase in temperature Presence of wind	2 (choose any 2)	
4(b)	The molecules at the surface of the puddles of water <b>gained energy from surroundings and break the forces of attraction between particles</b> to become gaseous particles.  (not necessary to explain the KE and temperature of remaining water molecules)	1 1	2
5(a)	Particles in glass are much more closely packed compared to gas particles. Heat is transferred more quickly in glass as particles can transfer kinetic energy faster when they collide with their neighboring particles.	1 1	2

5(b)	Copper contains free moving electrons, unlike glass.  When heated, the free moving electrons in copper can diffuse very quickly to other parts of copper, transferring kinetic energy to other parts of copper quickly.	1  1	2
6	The trapped air in between the glass windows is a poor conductor of heat (or a good insulator of heat).  Heat loss from interior to exterior of house is slower, keeping the interior of house warm.	1  1	2

**SECTION B: 20 Marks**

Qn. No.	Scoring Points	Marks	Max. Marks
7(a)i	The light strikes the glass perpendicularly to the surface.	1	1
7(a)ii	$n = \sin r / \sin i$ $1.5 = \sin r / \sin 30$ $r = 48.6^\circ$	1 1	2
7(a)iii	As light travels from <b>optically denser medium to less dense medium</b> , the <b>speed of light increases</b> and the light ray refracts away from the normal.	1 1	2
7(b)i	$n = 1 / \sin c$ $c = \sin^{-1} (1 / 1.5)$ $c = 41.8^\circ$	1 1	2
7(b)ii		1	1
7(b)iii	The ray undergoes total internal reflection.  The angle of incidence of the light ray is greater than the critical angle and the light ray is travelling from optically denser to less dense medium.	1  1	2



<p>8(a) (i-iii)</p>	 <ul style="list-style-type: none"> <li>- image position marked with a cross and construction of virtual rays (without arrows)</li> <li>- object position labelled O (check image distance = object distance)</li> <li>- construct of solid light rays to complete ray diagram</li> </ul>	<p>1</p> <p>1</p> <p>1</p>	<p>3</p>
<p>8a(iv)</p>	<p>The image cannot be captured on a screen.</p>	<p>1</p>	<p>1</p>
<p>(v)</p>	<p>Object distance is equal to image distance Same size as object. Laterally inverted Upright</p>	<p>Choose any</p> <p>1</p>	<p>1</p>
<p>8(b) i &amp; ii</p>		<p>1</p> <p>1</p> <p>1</p>	<p>3</p>
	<ul style="list-style-type: none"> <li>- draw both rays (with arrows) from object to image</li> <li>- label centre of lens O correctly</li> <li>- label focal point as F correctly</li> </ul>	<p>1</p> <p>1</p> <p>1</p>	

8b(iii)	focal length = 21.6 cm (accept 19.2 cm to 24 cm)	1	1
8b(iv)	Real	1	1
9(a)i	Radiation is the transfer of heat through transmission of infra red rays or radiant heat without a medium.	1	1
9(a)ii	Black is a good absorber of radiant heat.	1	2
	Heat transfer from the heating element to the food through radiation is hence quicker.	1	
9a(iii)	1. The heated air, which is less dense remains at the top of the grill while the cooler, denser air remains at the bottom.	1	3
	No convection currents are created, which slows down heat transfer by convection.	1	
	2. Air, which separates the food and the heating elements, is a poor conductor of heat.	1	
9(b)	1. Shiny jacket: It is a good reflector of radiant heat. The rate of heat transfer from heat source to fireman is slower.	1	2
		1	
	2. Mesh T-shirt: It allows evaporation of perspiration to take place more easily.	1	2
	The increase in rate of evaporation allows the fireman to keep cool.	1	