GAN ENG SENG SCHOOL
End-of-Year Examination 2017

CANDIDATE NAME			
CLASS		**INDEX NUMBER**	

SCIENCE (PHYSICS, CHEMISTRY)
Sec 3 Express

5076/01

12 Oct 2017
1 hour

Paper 1 Multiple Choice

Additional Materials: OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number on the OTAS.

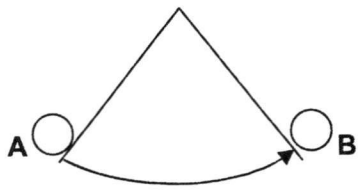
There are **forty** questions in this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C**, and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate OTAS.

Read the instructions on the OTAS 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 the second last page.
A copy of the Periodic Table is printed on the last page.
The use of an approved scientific calculator is expected, where appropriate.

Total Marks
40

1 The time taken for a pendulum to swing from rest position A to B is 0.8 s. What is the time taken for the pendulum to make 20 complete oscillations?



A 0.8 s

B 1.6 s

C 16.0 s

D 32.0 s

2 A micrometer screw gauge is used to measure the diameter of a steel ball. Fig. 2.1 shows the initial zero reading of the micrometer screw gauge, and Fig. 2.2 shows the reading when the diameter of the steel ball is measured.

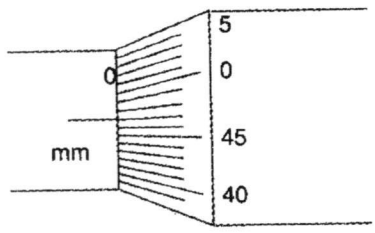


Fig. 2.1

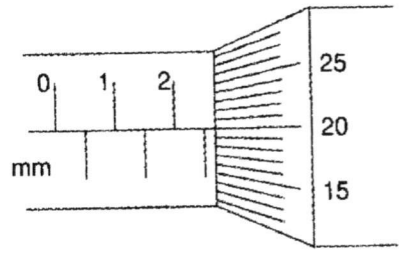


Fig. 2.2

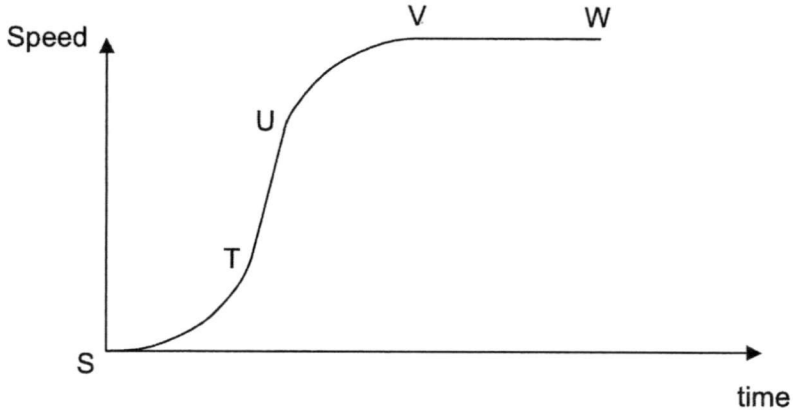
What is the zero error and actual diameter of the steel ball?

	Zero Error / mm	Actual diameter / mm
A	- 0.03	2.73
B	- 0.02	2.72
C	+ 0.02	2.68
D	+ 0.03	2.67

3 Which physical quantity is paired incorrectly with its SI unit?

	Physical quantity	SI unit
A	force	newton
B	moment	newton metre
C	temperature	degree Celsius
D	work done	joule

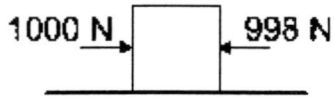
4 The graph shows the speed of a parachutist after jumping from an aeroplane. Which part of the graph shows that the acceleration is decreasing?



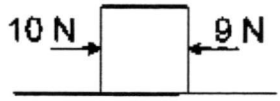
A ST **B** TU **C** UV **D** VW

5 Two forces are acting on a wooden block placed on a horizontal surface. Which of the following combinations gives the block the greatest acceleration?

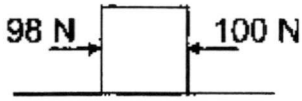
A



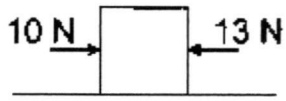
B



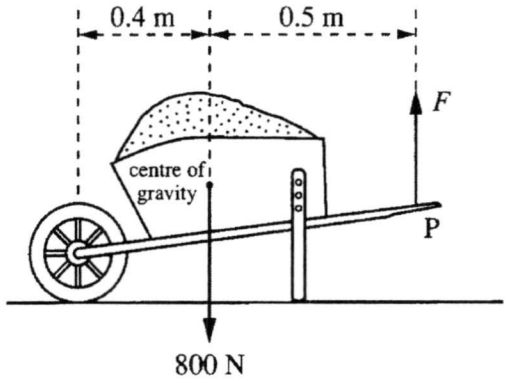
C



D



6 The total load on a wheelbarrow is 800 N.



What is the minimum force F required to lift up the end P?

A 356 N **B** 640 N

C 720 N **D** 800 N

7 A Taekwondo practitioner practises kicking a wooden board. In order to break it, he needs to apply a pressure of 50 000 N/m^2 onto the board during his kick.
Given that the board has a dimension of 20 cm by 20 cm, how much force must his leg exert in order to break the board?

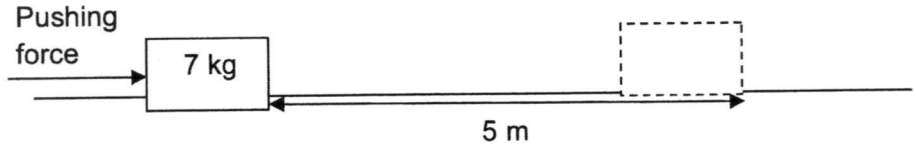
A 125 N

B 2.0×10^3 N

C 1.25×10^6 N

D 2.0×10^7 N

8 A box of mass 7 kg is initially at rest and is pushed 5 m across a rough floor with a pushing force of 25 N.

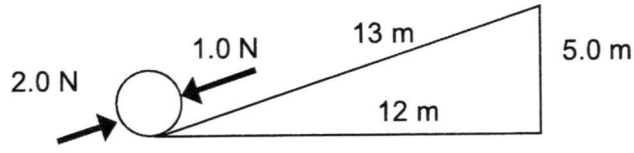


What is the work done in pushing the box across the floor through a distance of 5 m?

A 14 J **B** 35 J

C 125 J **D** 314 J

9 A ball is pushed up by a constant force of 2.0 N onto the top of an inclined plane. The frictional force acting on the ball is 1.0 N.



What is the work done against friction?

A 10 J **B** 13 J **C** 24 J **D** 26 J

10 When a piece of ice is melting, which of the following statement is true?

A The intermolecular force weakens and the molecules move faster.

B The intermolecular force weakens and the speed of molecules remains constant.

C The intermolecular force becomes stronger and the molecules move faster.

D The intermolecular force becomes stronger and the molecules move slower.

11 When pure water freezes, its particles ..... .

A move closer together and stop moving completely.

B move closer together and vibrate at a low speed.

C move further apart and vibrate about fixed positions.

D move further apart and continually change places with nearby particles.

12 Which substance has the most internal energy?

A 100 g of boiling water at 100 °C

B 100 g of ice at 0 ° C

C 100 g of steam

D 100 g of water at room temperature

13 Which component in a vacuum flask reduces heat transfer through radiation?

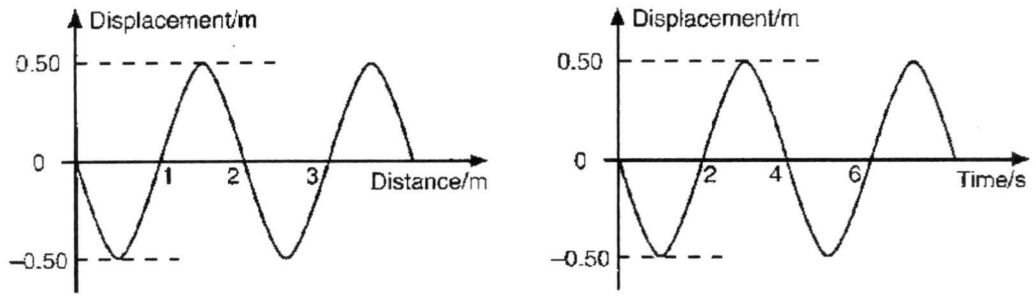
A the silvered walls

B the stopper

C the vacuum between the walls

D the cork supporting the walls

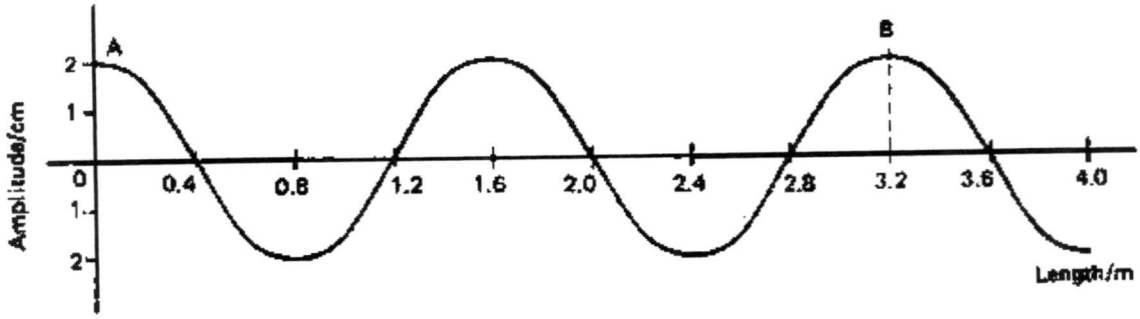
14 The graphs below represent the variations in the displacement of a transverse wave with distance and time.



Which of the following correctly describes the wavelength, amplitude, and period of the wave?

	Wavelength / m	Amplitude / m	Period / s
A	1	1.0	2
B	2	0.5	4
C	2	1.0	4
D	3	0.5	6

15 A transverse wave is represented by the graph below.



Given that the velocity of propagation of the wave is 8 m/s, how long does it take the crest to travel from A to B?

A 0.1 s

B 0.2 s

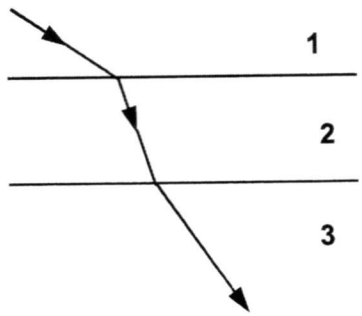
C 0.3 s

D 0.4 s

16 If a student stands 3 m in front of a mirror, what is the distance between him and his image?

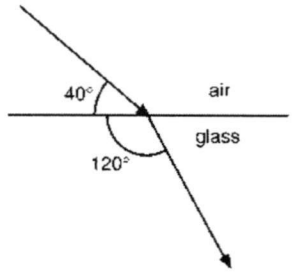
A 1.5 m **B** 3 m **C** 6 m **D** 7.5 m

17 The diagram below shows a ray of light travelling through 3 media: air, glass and water. The light ray is refracted by different amount as it passes through these media. What is the correct order of these media?



	1	2	3
A	Glass	Water	Air
B	Air	Glass	Water
C	Glass	Air	Water
D	Air	Water	Glass

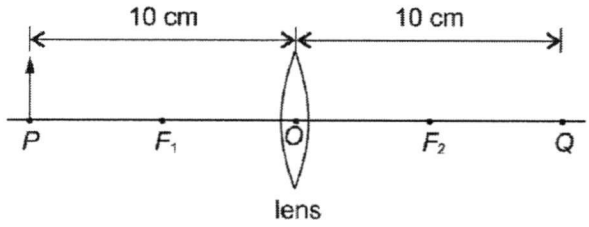
18 The diagram shows a ray of light passing from air into glass.



What is the refractive index of the glass?

A 0.75 **B** 1.2 **C** 1.5 **D** 1.8

19 The diagram shows an object placed 10 cm away from a converging lens which has a focal length of 5 cm.



At which point will the image be formed?

A F_2

B Q

C Between O and F_2

D Between F_2 and Q

20 Which of the following has the longest wavelength?

A Light rays

B Microwaves

C Radio waves

D X-rays

GAN ENG SENG SCHOOL
End-of-Year Examination 2017

CANDIDATE NAME			
CLASS		**INDEX NUMBER**	

SCIENCE (PHYSICS, CHEMISTRY)
Sec 3 Express
Paper 2 Physics

5076/02
11 Oct 2017
1 hour 15 minutes

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

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
You may use a soft pencil for any diagrams, graphs, table 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.
Write your answers in the spaces provided on the question paper.

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

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

For Examiner's Use

Section A

Answer **all** questions in the spaces provided

1 Fig. 1.1 shows the reading of a vernier caliper when its jaws are totally closed.

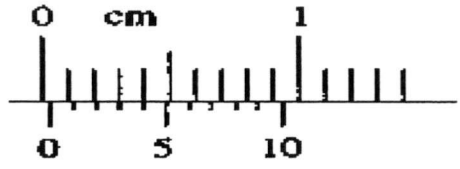


Fig. 1.1

(a) State the zero error.

zero error = ... cm [1]

(b) The thickness of a pencil is measured using the same vernier caliper as shown in Fig. 1.2 below.

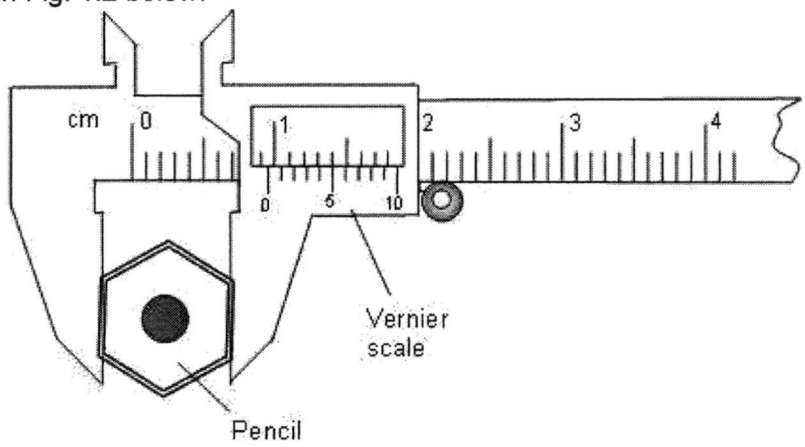


Fig. 1.2

(i) Determine the reading shown by the vernier caliper.

reading = ... cm [1]

(ii) Determine the actual thickness of the pencil. Show your working clearly.

actual thickness = ... cm [1]

For Examiner's Use

2 Complete the following sentences.

1.7 km is equal to ..... mm.

220 V is equal to ..... MV. [2]

3 Fig. 3.1 shows a painting that is held by two wires and a nail. The tension in each wire is 4.0 N and the angle between the wires is 60°.

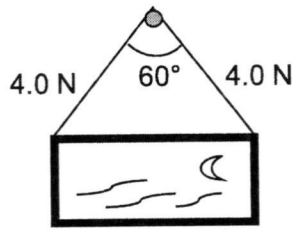


Fig. 3.1

Draw a vector diagram to scale in order to determine the weight of the painting. State the scale used.

scale: .....

weight = ... N [4]

For Examiner's Use

4 Fig. 4.1 shows a block of mass 5 kg resting on a table. The block is pushed with a force of 15 N in the direction shown, giving it an acceleration of 2 m/s^2.

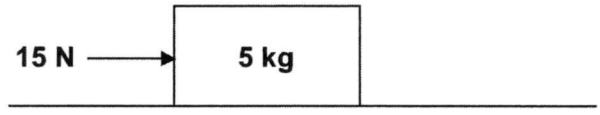


Fig. 4.1

(a) What is the resultant force acting on the block?

resultant force = ... [2]

(b) What is the frictional force acting on the block by the table?

frictional force = ... [2]

5 A container containing 1 000 cm^3 of paint has a total mass of 1.8 kg when full.

(a) If the mass of the empty container and the lid is 800 g, calculate the density of the paint.

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

(b) If the container is made up of a metal whose density is 7 100 kg/m^3, calculate the volume of the metal used to make the container and its lid in cm^3.

volume = ... cm^3 [2]

For Examiner's Use

6 A uniform rod **XY** of length 2.0 m and weight 10 N is freely hinged to a wall at **X** as shown in Fig. 6.1. It is held horizontal by a force **F** acting at **Y**.

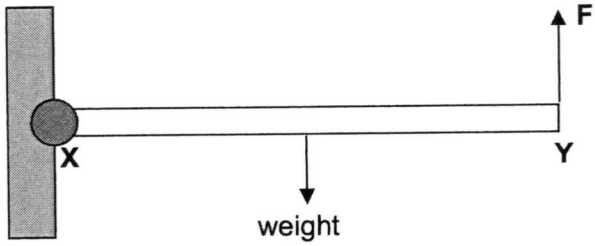


Fig. 6.1

(a) Calculate the moment of the weight about the hinge at X.

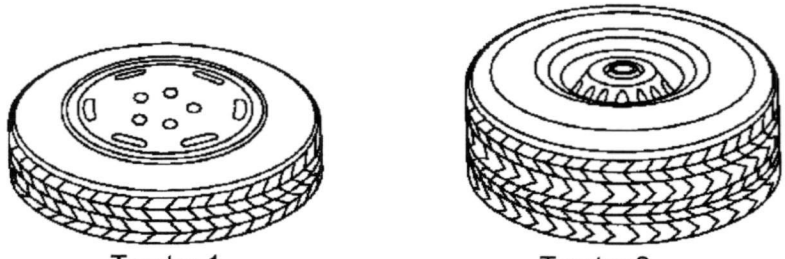
moment of the weight = ... Nm [2]

(b) Determine the value of force F.

force F = ... N [2]

For Examiner's Use

7 A farmer has two tractors with the same mass of 2400 kg when empty. The tractors have six wheels each. However the tractors are fixed with different wheels as shown in Fig. 7.1.



Tractor 1 Tractor 2

Fig. 7.1

(a) Which tractor should the farmer use to drive across fields when the ground is muddy and very soft? Explain your answer.

.....

..... [2]

(b) When Tractor 2 is driven over a flat ground, each wheel exerts a pressure of 100 kPa on the ground.
Calculate the surface area of each wheel in contact with the ground. Assume that the mass of the tractor is distributed uniformly over the six wheels.
(Take g = 10 N/kg)

surface area = ... m^2 [3]

For Examiner's Use

8 A pure substance P has melting point of 70 °C and boiling point of 110 °C. Fig. 8.1 shows the variation of the temperature of P as it is heated from its solid state.

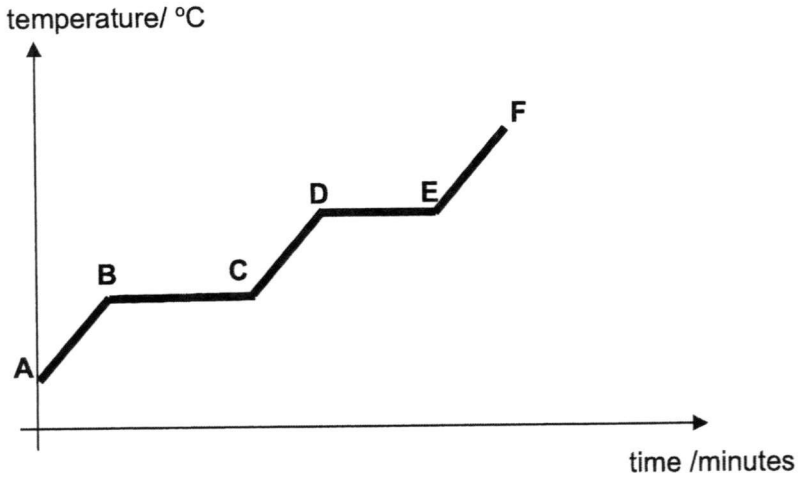


Fig. 8.1

(a) Write down the section of the graph at which P is

(i) 110 °C. .....

(ii) 25 °C . ..... [2]

(b) Give a reason why the temperature at section DE remains constant.

.....

..... [2]

For Examiner's Use

9 Fig. 9.1 shows a ripple tank that is used to investigate waves on water. The dipper moves up and down 75 times in 5 seconds and the distance between the wave crests at positions **A** and **B** is 50 cm.

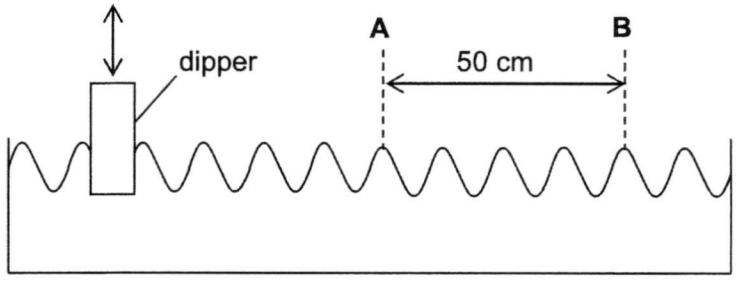


Fig. 9.1

(a) Calculate the wavelength of the water wave.

wavelength = ... [1]

(b) Calculate the speed of the water wave.

speed = ... [2]

(c) Given that the volume of water is halved and the same tank is used,

(i) state how the frequency, wavelength and speed of the wave will change (if any) when the dipper moves up and down 75 times in 5 seconds.

Frequency : .....

Speed : .....

Wavelength : ..... [1]

(ii) Explain your answer for the change (if any) in speed.

.....

..... [1]

For Examiner's Use

10 Fig. 10.1 shows four objects in front of a mirror. The card prevents the observer's eye from seeing the objects directly.

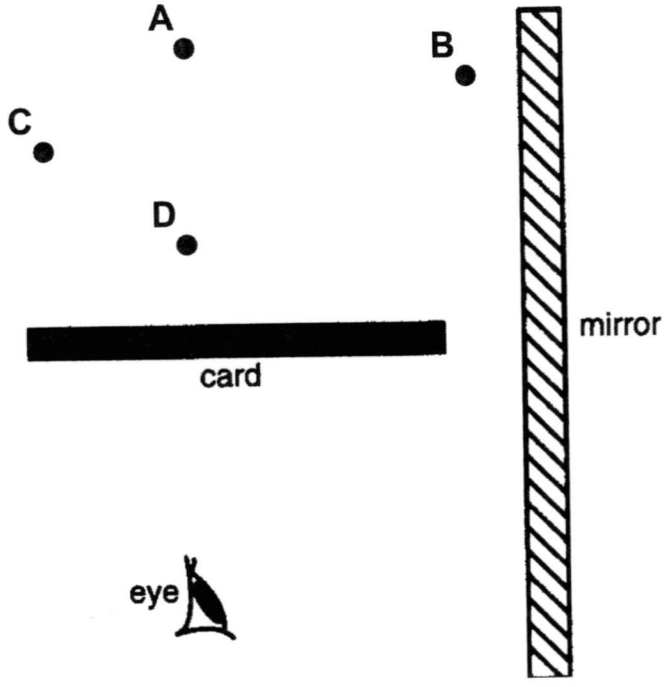


Fig. 10.1

(a) Which object's image can be seen in the mirror?

..... [1]

(b) Draw a ray diagram to show 2 rays from the object in part **(a)** entering the eye in Fig. 10.1. [2]

For Examiner's Use

11 A fly is originally at position P. A ray of light PQRS from the fly enters and leaves a circular glass block as shown in Fig.11.1. An observer standing at the opposite end of the glass block is able to see the fly.

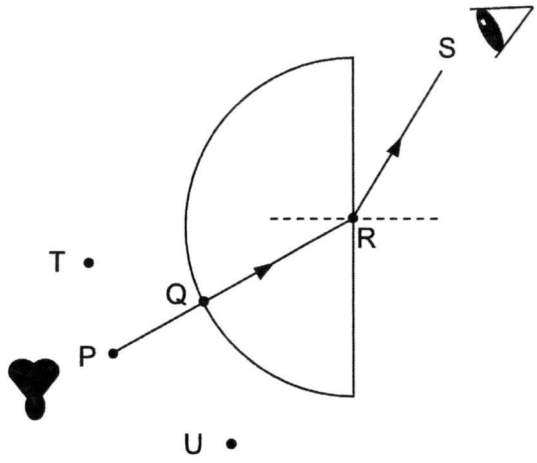


Fig. 11.1

(a) The speed of light in air is assumed to be the same as that in vacuum and the refractive index of glass is 1.5.

(i) Explain why there is no change in the direction of the ray as it enters the glass block at Q.

.....

..... [1]

(ii) Calculate the speed of light between Q and R.

Speed = ... [2]

(b) Draw on Fig.11.1, a ray of light from the fly as it enters and leaves the glass block when the fly is at position T instead. [1]

For Examiner's Use

12 Fig. 12.1 shows a chart on the electromagnetic spectrum.

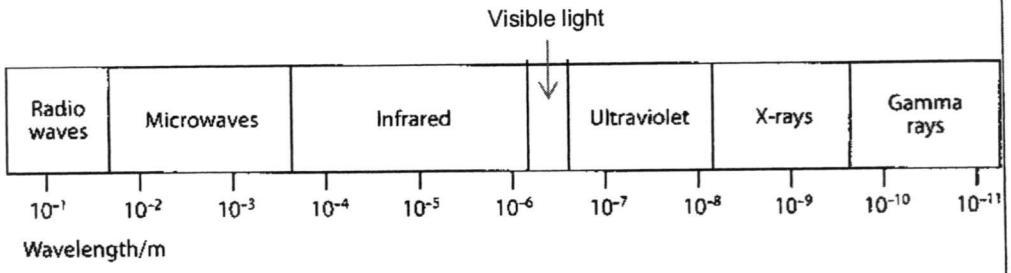


Fig. 12.1

(a) On Fig. 12.1, mark with a line the position of the wave that has a frequency of 3.0×10^{10} Hz. Show your calculations in the space below.

[2]

(b) Write down one application for infra-red.

..... [1]

For Examiner's Use

Section B

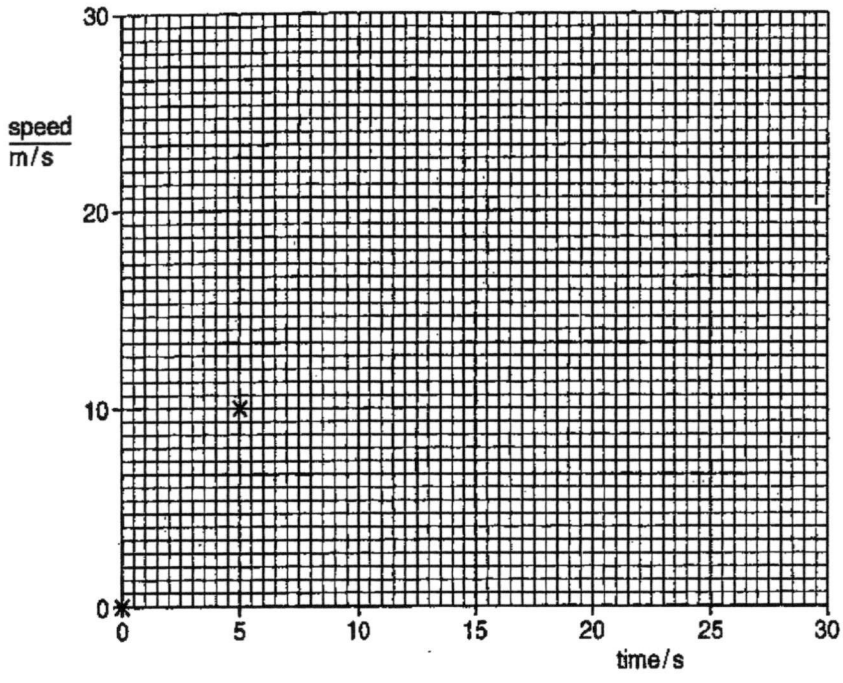
Answer any **two** of the questions in this section.

Write your answers in the spaces provided.

13 A student investigated the motion of a car at different times during part of a journey. She measured the speed of the car every 5.0 s. The table below shows her result.

Time / s	0.0	5.0	10.0	15.0	20.0	25.0	30.0
Speed / m s^{-1}	0	10	20	30	30	30	30

(a) The student has plotted two points on the graph below. Plot other five points on the same graph. Draw the lines to connect all the points.



[2]

(b) Use your graph to calculate

(i) the distance travelled by the car in the first 30 s.

distance = ... m [2]

For Examiner's Use

13 (b) (ii) the average speed of the car for the whole journey.

average speed = ... m/s [1]

(iii) the acceleration of the car when time is 5.0 s.

acceleration = ... m/s^2 [1]

(iv) State and explain whether speed is a scalar quantity or vector quantity.

..... [1]

(c) (i) State a difference between a transverse wave and a longitudinal wave.

.....

.....

..... [1]

(ii) State an example of a transverse wave and a longitudinal wave.

transverse wave : ..... [1]

longitudinal wave : ..... [1]

For Examiner's Use

14 A falling metal hammer is used to drive a hollow steel post into the ground, as shown in Fig. 14.1. The hammer is lifted by an electric motor and then falls freely to hit the baseplate.

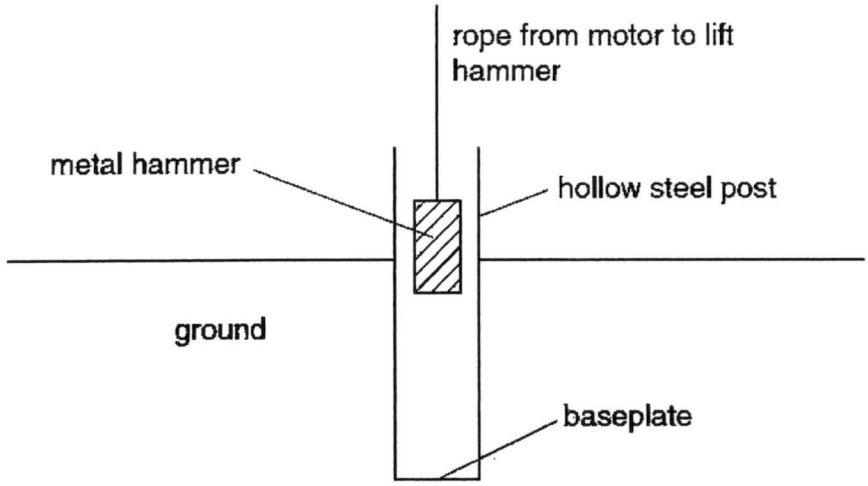


Fig. 14.1

(a) State the Principle of Conservation of Energy.

.....

..... [1]

(b) State the energy conversions that take place, starting from the initial gravitational potential energy of the hammer before it is dropped.

.....

..... [2]

(c) The metal hammer has a mass of 2 500 kg and it hits the baseplate with a speed of 8.0 m s^{-1}. Assume air resistance is negligible.

(i) Calculate the kinetic energy of the hammer as it hits the baseplate.

kinetic energy = ... [2]

For Examiner's Use

14 (c) (ii) State the initial amount of gravitational potential energy of the hammer.

gravitational potential energy = ... [1]

(iii) Calculate the height above the baseplate from which the hammer is dropped.

height = ... [2]

(iv) It takes 5.0 s to raise the hammer to the height calculated in **(iii)**. Calculate the power of the electric motor.

power = ... [2]

For Examiner's Use

15 Fig. 15.1 shows a solar panel that is used to heat water.

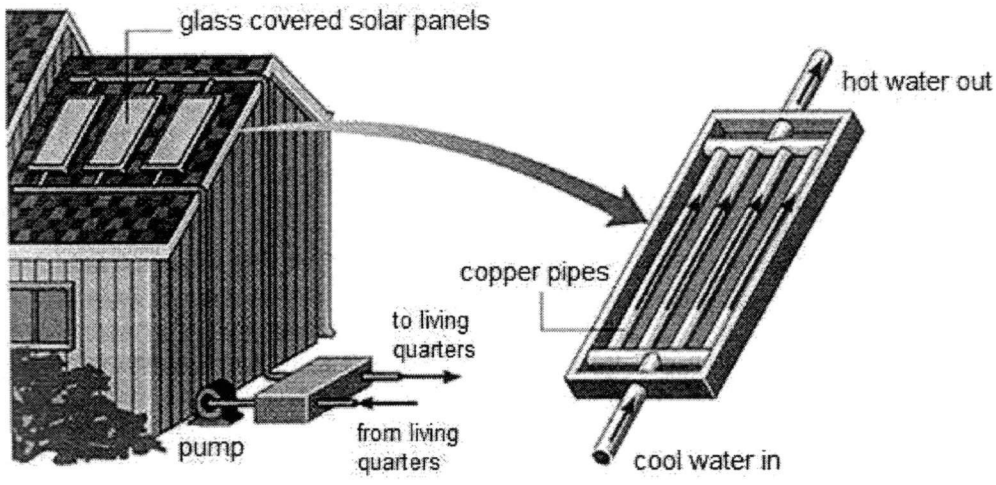


Fig. 15.1

(a) State the process by which the sun's energy reaches the solar panels.

..... [1]

(b) State and explain the colour that is most suitable for the copper pipes and explain your choice.

.....

..... [2]

(c) Explain why there are multiple rows of copper pipes in the solar panel.

.....

..... [2]

(d) The water from the solar panel is channelled to an insulated storage tank after it is heated up. Fig. 15.2 shows a simplified diagram of the tank (upright position).

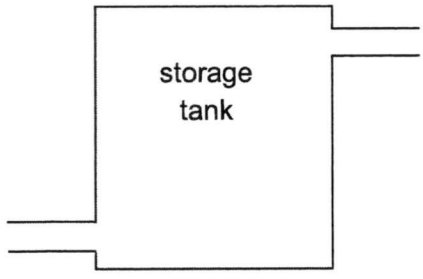


Fig. 15.2

Draw an arrow on Fig. 15.2 to indicate where the heated water should enter the tank. Explain your choice.

..... [2]

For Examiner's Use

15 (e) A metal rod is heated at one end until it becomes red hot.

(i) Explain how heat is transferred from the hotter end to the cooler end of the rod.

.....

.....

..... [2]

(ii) After some time, the temperature of the rod becomes steady. Explain why the temperature does not rise further although the rod continues to be heated at one end.

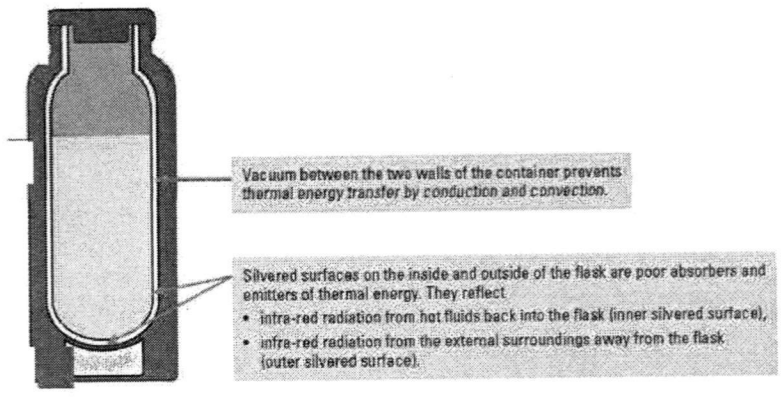
.....

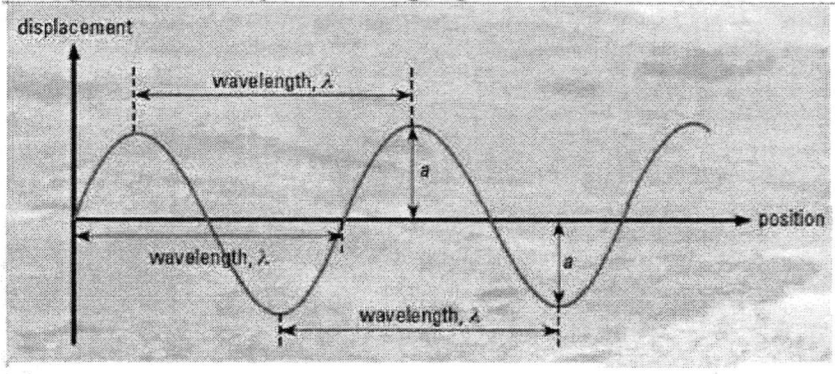
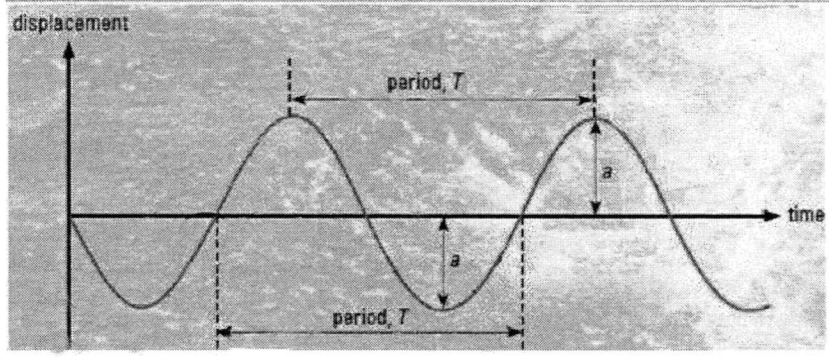
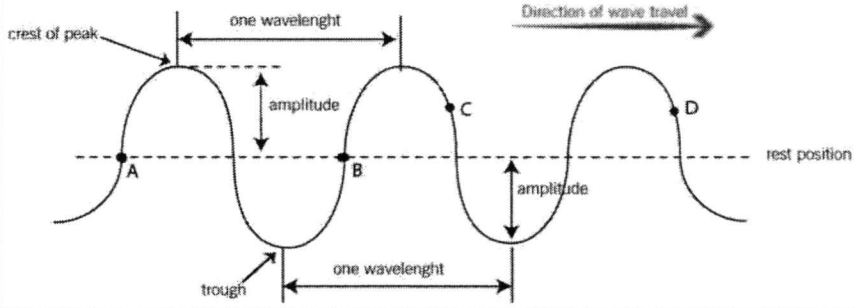
..... [1]

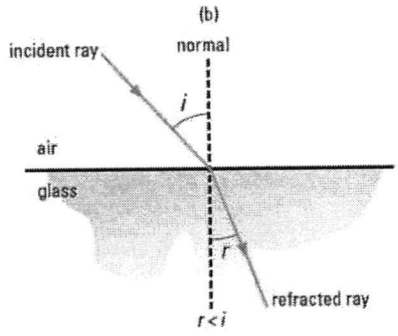
END OF PAPER

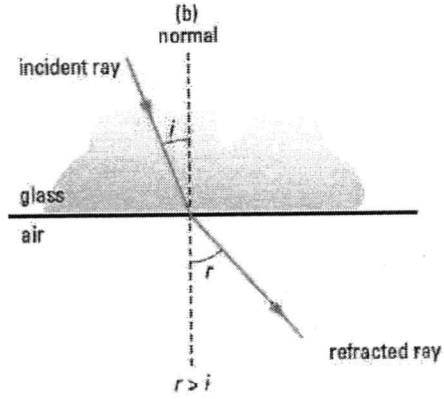
Answer Scheme
GAN ENG SENG SCHOOL
End of Year Examination 2017
ScPHYSICS (Sec 3 Express, 3H)
Paper 1 Multiple Choice, 5076/01

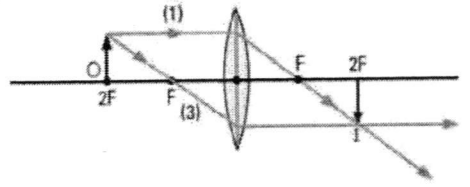
<table>
<tr><th>Question</th><th>Answer</th><th>Explanation</th></tr>
<tr><td>1</td><td>D</td><td>08 X 2 X 20 = 32 s</td></tr>
<tr><td>2</td><td>A</td><td>Zero Errror = - 0.03 mm
Reading = 2.5 +0.20 mm = 2.70 mm
Actual Diameter = 2.70 – (-0.03) = 2.73 mm</td></tr>
<tr><td>3</td><td>C</td><td><table><tr><th>Base Quantity</th><th>Name of Unit</th><th>Symbol of Unit</th></tr><tr><td>length</td><td>metre</td><td>m</td></tr><tr><td>mass</td><td>kilogram</td><td>kg</td></tr><tr><td>time</td><td>second</td><td>s</td></tr><tr><td>electric current</td><td>ampere</td><td>A</td></tr><tr><td>temperature</td><td>kelvin</td><td>K</td></tr><tr><td>amount of substance</td><td>mole</td><td>mol</td></tr><tr><td>luminous intensity</td><td>candela</td><td>cd</td></tr></table></td></tr>
<tr><td>4</td><td>C</td><td>The acceleration is the gradient of the speed-time graph. The gradient and UV is decreasing, therefore the acceleration is decreasing.</td></tr>
<tr><td>5</td><td></td><td>Net force for:
A : 1000 – 998 = 2 N
B : 10 – 9 = 1 N
C : 100 = 98 = 2 N
D : 13 – 10 = 3 N
Therefore D produces the greatest acceleration</td></tr>
<tr><td>6</td><td>A</td><td>Taking moments about the pivot at the wheel:
800 x 0.4 = F x (0.4 + 0.5)
F = 356 N</td></tr>
<tr><td>7</td><td>B</td><td>P = F / A
50,000 = F / (0.2 x 0.2)
F = 2000 N</td></tr>
<tr><td>8</td><td>C</td><td>Work Done = F x d
= 25 x 5
= 125 J</td></tr>
<tr><td>9</td><td>B</td><td>Work Done Against Friction = F x d
= 1 x 13
= 13 J
[note that the F is 1 N and not 2 N This is the Frictional Force.]</td></tr>
</table>

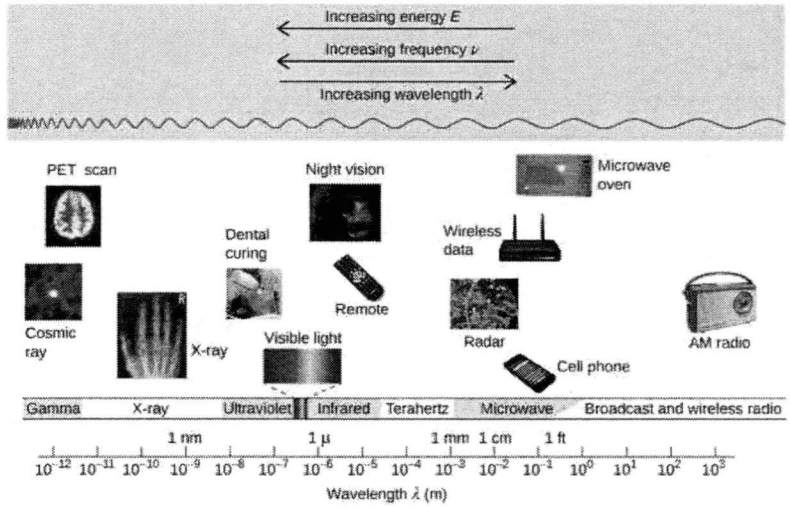
10	**B**	When the temperature increases, thermal energy is transferred to the molecules and the molecules gain kinetic energy. This will cause the molecules to move faster. Melting is the process whereby energy is supplied to change the state of a substance from solid to liquid, without a change in temperature Properties of matter: Solid Forces between molecules/ Motion of the molecules: • The strong attractive forces prevent the molecules from leaving their positions while the repulsive forces which act when they are too close to each other prevent them from collap xplains why a solid has fixed shape and a fixed volume. When a solid is heated, the molecules gain energy and vibrate. The separation between molecules increases slightly and the solid expands. Properties of matter: Liquid Forces between molecules/ Motion of the molecules: Though there are still forces between the molecules, they are not held in a fixed position. Because of this, the molecules move among one another throughout the liquid. That is why liquids flow and take the shape of their container. • The attractive forces between the molecules make it difficult for the molecules to leave the liquid and thus liquids have a definite volume. When a liquid is heated the molecules vibrate and move about vigorously. Thus the liquid expands slightly.
11	**B**	Move closer and vibrate at low speed.
		The internal energy of a body is the combination of the total kinetic energy and potential energy of the molecules in the body. For the same mass, steam have to most internal energy compare to liquid water and ice.
13	**A**	10.4 **What is radiation** Vacuum Flash 

14	**B**	Wavelength = 2 m Amplitude = 0.5 m Period = 4 s **Displacement-position graph**  **Displacement-time graph**  
15	**D**	Speed = distance / time 8 = 3.2 / t T = 0.4 s
16	**C**	3 m + 3 m = 6m
17	**B**	Refractive index of Glass is highest, next is water, then air. 1 has the lowest Refractive Index. 2 has the highest Refractive Index. a ray of light bends towards the normal when it enters an optically denser medium at an angle due to a decrease in speed.

<table>
<tr><td></td><td></td><td>


a ray of light bends away from the normal when it enters an optically less dense medium at an angle


</td></tr>
<tr><td>18</td><td>C</td><td>n = sin i / sin r
= sin 50 ° / sin 30 °
= 1.53</td></tr>
<tr><td>19</td><td>B</td><td>
Images Produced by Thin Converging Lens
<table>
<tr><th>Locaton of object</th><th>Ray diagrams</th></tr>
<tr><td>At 2f</td><td> 
</td></tr>
</table>
<table>
<tr><th>Characteristics of image</th><th>Location of image</th><th>Uses</th></tr>
<tr><td>• Real
• Inverted
• Same size</td><td>• I at opposite side of O
• At 2F</td><td>• photocopier</td></tr>
</table>
</td></tr>
<tr><td>20</td><td>C</td><td></td></tr>
</table>


Increasing energy E
Increasing frequency ν
Increasing wavelength λ
PET scan
Night vision
Microwave oven
Dental curing
Wireless data
Remote
Cosmic ray
X-ray
Visible light
Radar
AM radio
Cell phone
Gamma
X-ray
Ultraviolet
Infrared
Terahertz
Microwave
Broadcast and wireless radio
1 nm
1 μ
1 mm
1 cm
1 ft
Wavelength λ (m)