Pasir Ris Secondary School

Name	Class	Register Number

SECONDARY 3 EXPRESS
END OF YEAR EXAMINATION 2017

SCIENCE (PHYSICS) **5076/01**

Paper 1 **4 Oct 2017**

Wednesday 0800 – 0930 **Papers 1 and 2: 1 hour 30 minutes**

Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Do not use staples, paper clips, highlighters, glue, correction fluid or tape.

There are **ten** questions in this paper. Answer **all** questions. For each question, there are four possible answers **A**, **B**, **C** and **D**. Write your answers in the spaces provided in the table on page 4.

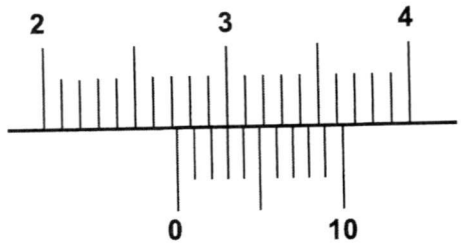
You are advised to spend no more than 20 minutes on Paper 1.
You may proceed to answer Paper 2 as soon as you have completed Paper 1.
The use of an approved scientific calculator is expected, where appropriate.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
The total marks for this paper is 10.

At the end of the examination, hand in your Paper 1 and Paper 2 separately.

Answer all questions. Write your answers in the table provided on page 4.

1 The figure shows part of a vernier scale.



If the zero error is - 0.02 cm, what is the correct reading?

A 2.35 cm **B** 2.71 cm **C** 2.73 cm **D** 2.75 cm

2 A bicycle accelerates from a speed of 5.0 m/s to 7.5 m/s in 10 s. What is the acceleration of the bicycle?

A 0.25 m/s^2 **B** 0.5 m/s^2 **C** 0.75 m/s^2 **D** 1.25 m/s^2

3 A wooden block, of dimension 2 m x 2 m x 2 m, has a mass of 6 400 kg. The wooden block is then sawed in half. What is the density of the each half of the wooden block?

A 200 kg/m^3 **B** 400 kg/m^3 **C** 800 kg/m^3 **D** 1600 kg/m^3

4 Cleve took two hours to make a journey of 90 km. During these two hours, he took a break of 30 mins and spent the rest of the time driving his car. What was the average speed of his car during the time it was actually moving?

A 36 km/h **B** 45 km/h **C** 60 km/h **D** 180 km/h

5 The work done by a man in pushing a 15 kg mass across a rough floor in 5.0 s is 100 J. What is the average power exerted by man in pushing the mass?

A 3 W **B** 20 W **C** 300 W **D** 7500 W

6 Which of the following best explains why a gas has no definite shape?

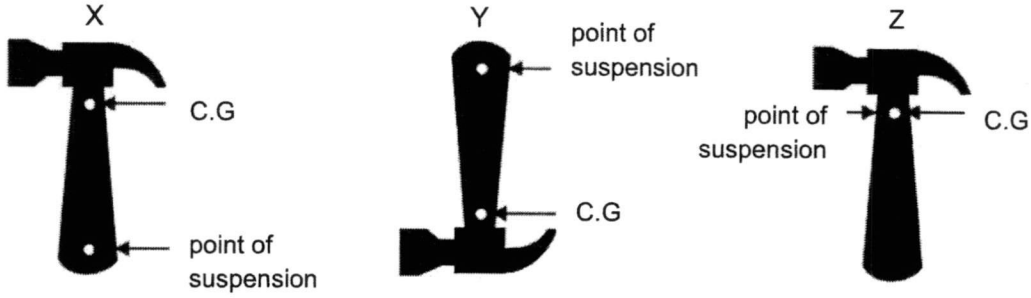
A gas molecules collide with each other

B gas molecules are constantly in motion

C the forces between gas molecules are negligible

D the separations between gas molecules are negligible

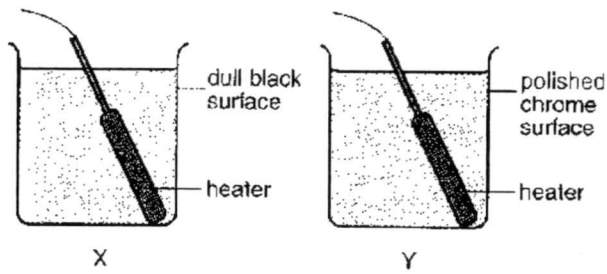
7 A hammer can be suspended in equilibrium from three different positions.



Which of the following matches the figures with their respective types of equilibrium?

	neutral	stable	unstable
A	X	Y	Z
B	Y	X	Z
C	Z	X	Y
D	Z	Y	X

8 In the figure, two copper cans X and Y, with outer surface of different textures, are filled with the same amount of water at room temperature and heated by heaters of the same power.



Which of the following statements is correct?

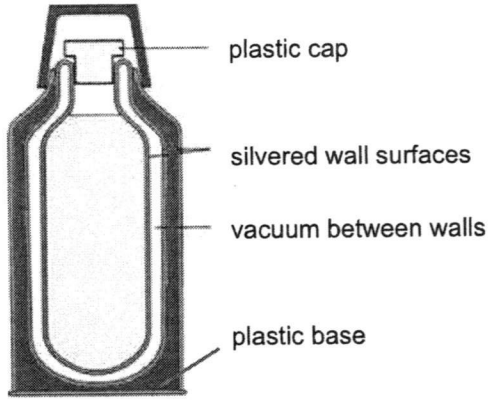
A The water in X boils faster because a dull black surface is a better absorber of radiation.

B The water in X boils faster because a dull black surface is a better insulator.

C The water in Y boils faster because a polished chrome surface is a better insulator.

D The water in Y boils faster because a polished chrome surface is a poorer emitter of radiation.

9 A vacuum flask has properties which reduces the loss of thermal energy, allowing the stored liquid to be kept warmer for a longer period.



Which method(s) of thermal transfer is/are reduced by the vacuum between the walls?

A conduction only
B radiation only
C conduction and convection
D convection and radiation

10 An astronaut of mass 75.0 kg lands on the Moon. The gravitational field strength on the Earth is 10 N/kg and the gravitational field strength on the Moon is 1.6 N/kg. What is the mass and weight of the astronaut on the Moon?

	mass on the Moon / kg	weight on the Moon / N
A	12.0	20
B	12.0	120
C	75.0	120
D	75.0	750

Answers

Q1	Q2	Q3	Q4	Q5
Q6	**Q7**	**Q8**	**Q9**	**Q10**

- End of Paper 1 -

Pasir Ris Secondary School

Name	Class	Register Number

SECONDARY 3 EXPRESS
END OF YEAR EXAMINATION 2017

SCIENCE (PHYSICS) **5076/02**

Paper 2 **4 Oct 2017**

Wednesday 0800 – 0930 **Papers 1 and 2: 1 hour 30 minutes**

Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue, correction fluid or tape.

Section A (40 marks)
Answer all questions. Write your answers in the spaces provided.

Sections B (20 marks)
Answer 2 out of 3 questions. Write your answers in the spaces provided.

The use of an approved scientific calculator is expected, where appropriate.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 60.

At the end of the examination, hand in your Paper 1 and Paper 2 separately.

Section A (40 marks)

Answer all questions. Write your answer in the spaces provided.

1 **(a)** Fig. 1.1 shows the micrometer screw gauge reading of the diameter of a marble.

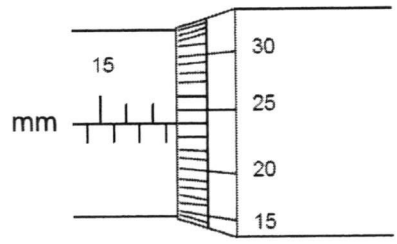


Fig. 1.1

State the diameter of the marble.

diameter = ... [1]

(b) Complete the following sentences.

(i) 50 m is equal to ..... km. [1]

(ii) 36 km/h is equal to ..... m/s. [1]

2 Fig. 2.1 shows a 100 N force acting on a box of mass 30 kg. The box moves across a horizontal floor at a constant speed without tipping.

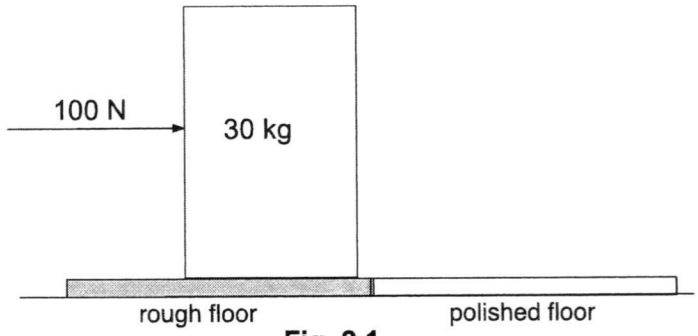


Fig. 2.1

(a) State the size of the frictional force acting on the box. Explain your answer.

.....

.....

..... [2]

(b) As the box moves onto the polished section of the floor, the 100 N horizontal force continues to act on the box. The frictional force acting on the box is now 40 N. Calculate the acceleration of the box. [2]

3 Fig. 3.1 (not drawn to scale) shows a boat travelling through water with a forward driving force of 250 N. Water currents exerts a force of 150 N at an angle of 50° to the boat.

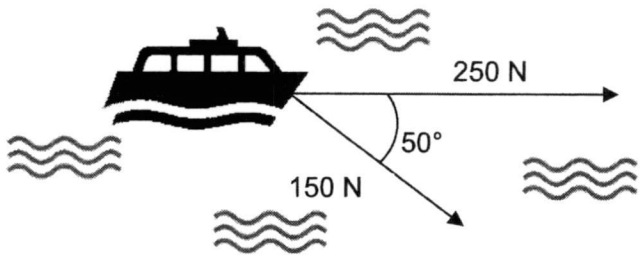


Fig. 3.1

By using a suitable scale diagram, determine the size and the direction of the resultant force acting on the boat. State the scale used. [4]

4 A moving car drips oil on the road at a rate of one drop per second. The trail left by the car is shown in Fig. 4.1.

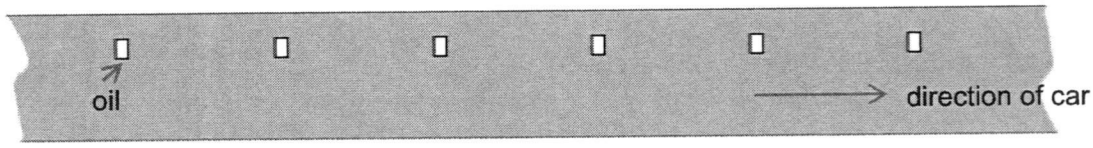


Fig. 4.1

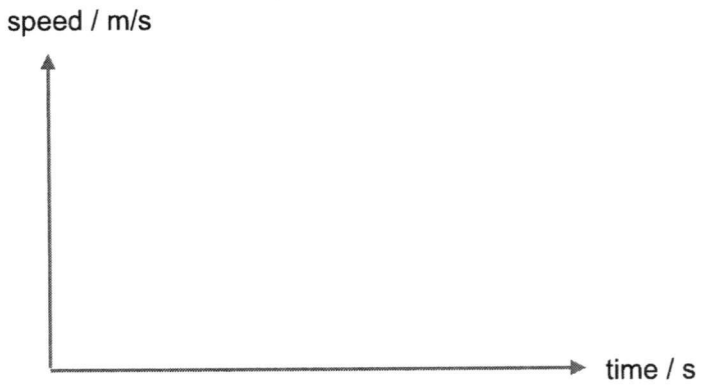
(a) Describe the motion of the car. Explain your answer.

.....

..... [2]

(b) The car then decelerates uniformly from 50 m/s to rest in 10 s.

(i) On the axes below, sketch a speed-time graph to show the motion of the car during the 10 s.



[2]

(ii) Calculate the total distance travelled by the car during the 10 s. [2]

5 **(a)** A uniform metre rule **AB** of weight 10 N pivoted at **A**. A solid **T** is suspended from the rule as shown in Fig. 5.1. The end **B** is supported by an upward force of 33 N.

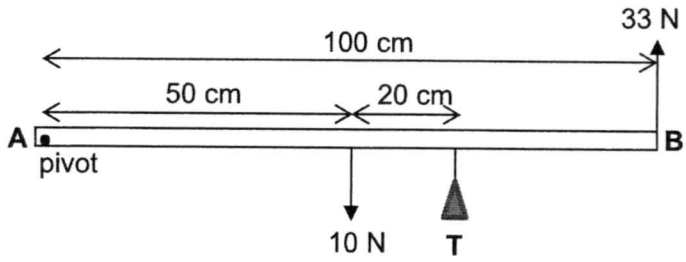


Fig. 5.1

Determine the weight of the solid **T**. [3]

(b) Fig. 5.2 shows a retort stand found in a science laboratory.

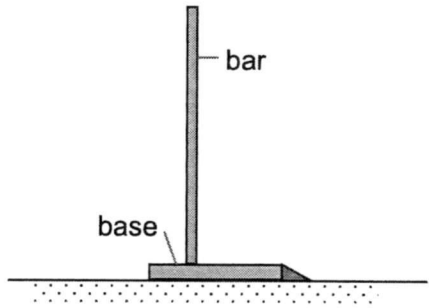


Fig. 5.2

State two design characteristics of the retort stand that makes it stable.

.....

.....

..... [2]

6 Fig. 6.1 shows Thomas pushing a thumbtack into a notice board with a force of 4 N. The tip of the thumbtack has an area of 0.4 cm^2.

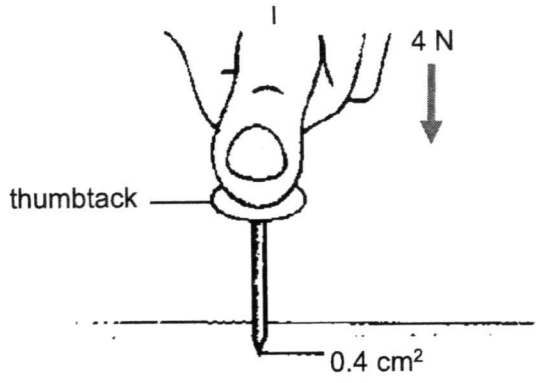


Fig. 6.1

(a) Convert 0.4 cm^2 into m^2.

area = ...m^2 [1]

(b) Calculate the pressure (in Pascals) exerted by the thumbtack on the notice board. [2]

(c) State and explain one modification that can be made to the thumbtack so that Thomas can push the thumbtack more easily into the notice board.

.....

..... [1]

7 Fig. 7.1 shows Mr Tan's living room.

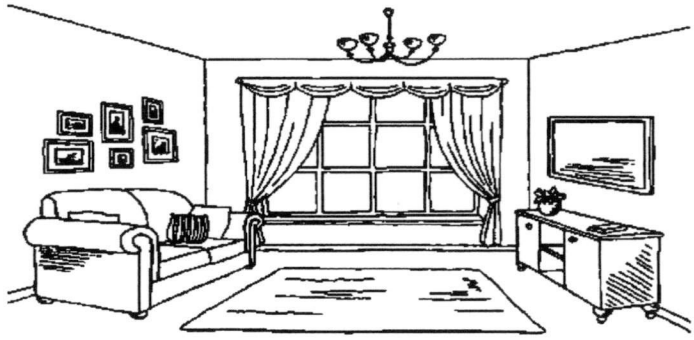


Fig. 7.1

(a) Mark an X on Fig. 7.1 to indicate a possible spot where Mr Tan would install an air-condition unit to cool the room. [1]

(b) Explain your answer to (a).

.....

.....

.....

..... [3]

8 Fig. 8.1 shows the molecular arrangement of a piece of wood block. A heat source is introduced at **X**.

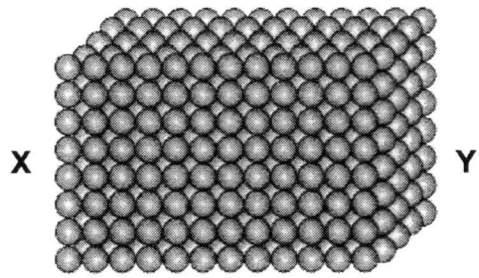


Fig. 8.1

(a) State and describe the process by which thermal energy is transferred from **X** to **Y**.

.....

.....

.....

..... [3]

(b) The wood block is replaced with a metal block. State and explain the change (if any) on the rate of thermal energy transfer from X to Y.

.....

.....

..... [2]

9 Fig. 9.1 shows an object placed in front of a thin converging lens. The positions of the focal points are marked **F**.

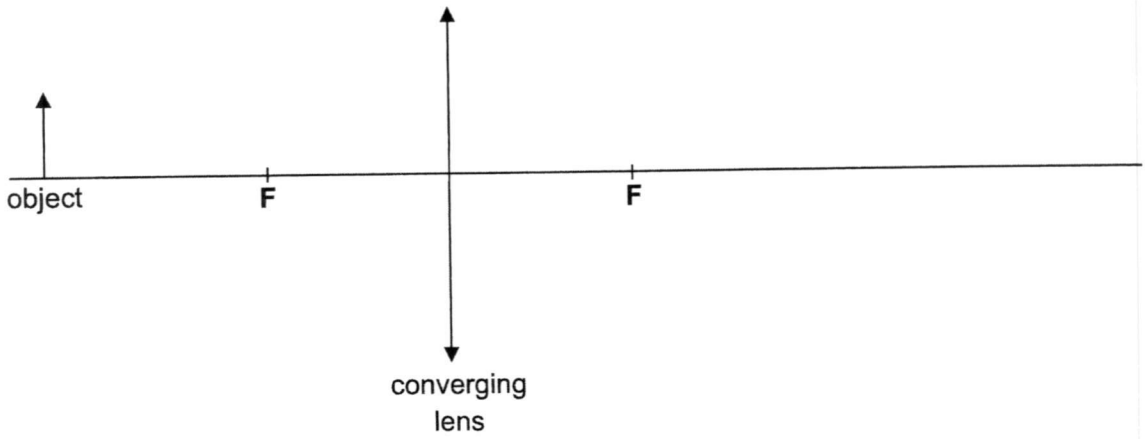


Fig. 9.1

(a) On Fig. 9.1, draw rays from the top of the object to determine the position of the image. Label the image, **I**. [3]

(b) State two properties of the image formed.

..... [1]

(c) Name an optical instrument which makes use of an image formed in this way.

..... [1]

Section B (20 marks)

Answer 2 out of 3 questions. Write your answers in the spaces provided.

10 Fig. 10.1 shows how the temperature of a pure substance varied as heat was supplied to it at a constant rate. At point **A**, the substance was a solid.

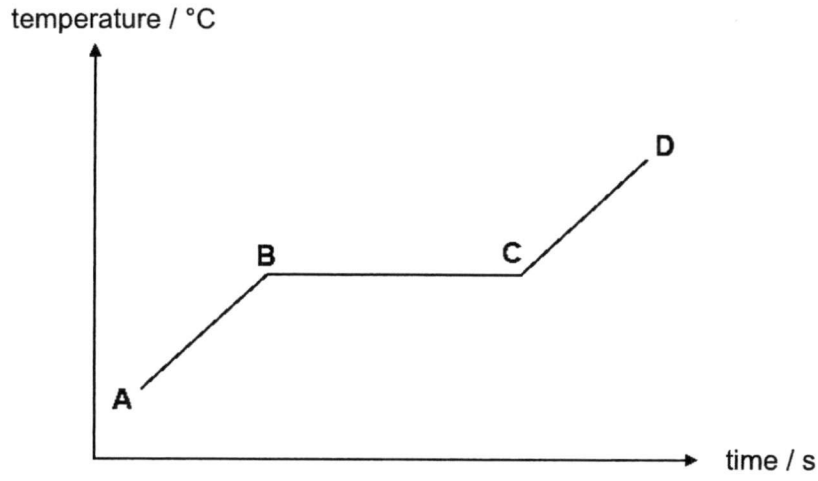


Fig. 10.1

(a) Identify the state(s) of the substance between

(i) **BC**,

..... [1]

(ii) **CD**.

..... [1]

(b) **(i)** Describe the arrangement and motion of the particles of the substance at **A**.

.....

.....

..... [2]

(ii) As heat is supplied, state and explain the changes to the motion and arrangement of the particles.

.....

.....

..... [2]

(c) Explain why the temperature of the substance does not increase although heat is supplied to the substance between **B** and **C**.

.....

.....

..... [2]

(d) Describe two differences between boiling and evaporation.

.....

.....

..... [2]

11 A marble is released from rest from the top of a smooth track at **A** as shown in Fig. 11.1. The marble moves round the smooth loop **BCD** and then along a rough horizontal track **DE**.

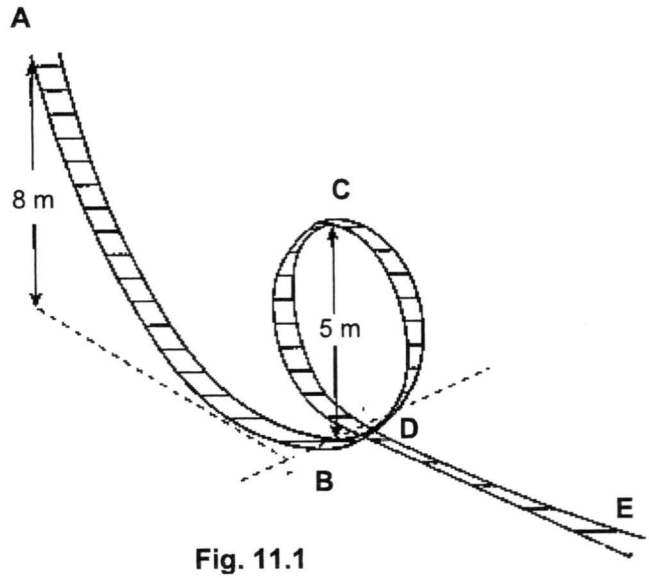


Fig. 11.1

(a) State the *principle of conservation of energy*.

.....

.....

..... [2]

(b) State the main energy/energies possessed by the marble at **B** and **C**. [1]

B: .....

C: .....

(c) The mass of the marble is 0.5 kg. The gravitational field strength on the Earth is 10 N/kg.

(i) Calculate the change in gravitational potential energy of the marble from **A** to **B**. [2]

(ii) Assuming that air resistance is negligible, calculate the speed of the marble at **B**. [2]

(iii) Determine the kinetic energy of the marble at **C**. [2]

(d) Explain why the marble will slow down along **DE.**

.....

..... [1]

12 **(a)** State the two laws of reflection.

.....

.....

..... [1]

(b) An object 'P' is placed in front of a plane mirror, as shown in Fig. 12.1.

(i) On Fig. 12.1, draw, as accurately as possible, the image of the object. [1]

(ii) Draw a light ray from point X of object 'P' to show how, by reflection, the eye can see image of this point in the mirror. [2]

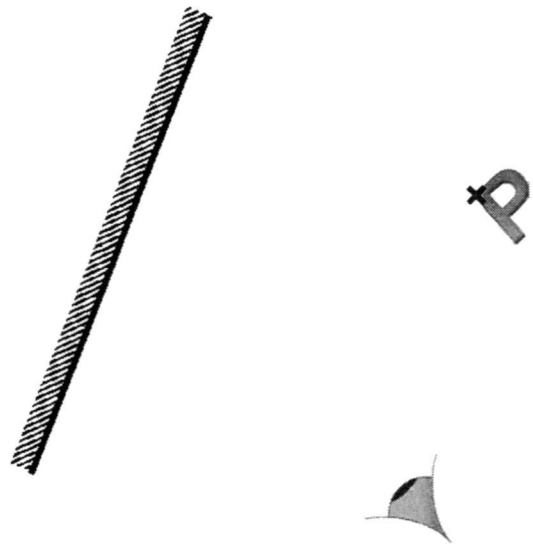


Fig. 12.1

(c) Fig. 12.2 shows a ray of light passing through a rectangular glass block **WXYZ** of refractive index 1.5. The figure is not drawn to scale.

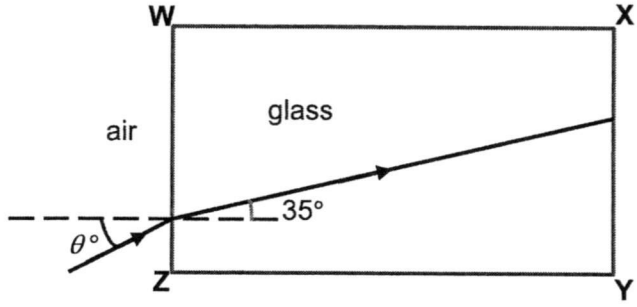


Fig. 12.2

(i) Calculate the value of θ. [2]

(ii) Calculate the critical angle of the glass block. [2]

(iii) Describe the path of the light ray after it strikes the rectangular glass block at side **XY**. Explain your answer.

.....

.....

..... [2]

- End of paper 2 -

PRSS 3E Sc(Phy) 2017 SA2 Answers

Paper 1

1	2	3	4	5
D	A	C	C	B
6	**7**	**8**	**9**	**10**
C	D	D	C	C

Paper 2

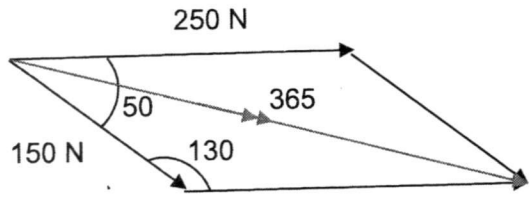
- ½ mark for answers without units or with incorrect units up to a maximum of 2 marks
- 1 mark for answers left in fractions

1a) 17.74mm [1]
1bi) 0.05 km [1]
1bii) 10 m/s [1]

2a) 100 N [1/2] As the box moves at zero acceleration [1/2], there is zero resultant force [1] the frictional force equals to the horizontal force.

2b) $F - fr = ma$
$100\ N - 40\ N = (30kg)(a)$ [1]
$a = 2\ m/s^2$ [1]

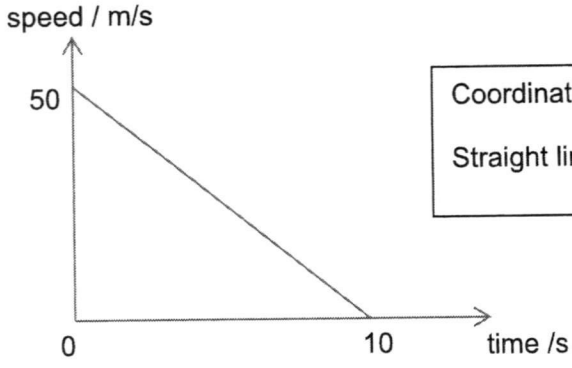
3)



Appropriate s
(e.g. 1 cm = 20 N)
Vectors drawn to scale and aligned at 50° to each other [1]
Resultant vector drawn correctly and labelled [1]

Magnitude: 365±25 N [1/2]
Direction: 18°±2 from 250 N [1/2]
or 32°±2 from 150 N

4a) The car is moving at <u>constant velocity/speed</u>
the same [1]



Coordinate labels (10,0) & (0,50) – [½],[½] mark

Straight line from (0,50) to (10,0) – 1 mark (ECF)

4bii) Distance = area under graph
= (0.5)(10)(50) [1]
= 250 m [1]

5a) sum of clockwise moments = sum of anti-clockwise moments
(10 N)(0.5 m) + (T)(0.7 m) = (33 N)(1.0 m) [1], [1]
T = 40 N [1]

5b) Heavy base [1]
Wide base area [1] (no marks awarded for low CG)

6a) 4×10^{-5} / 0.00004 m^2

6b) $\text{pressure} = \frac{\text{force}}{\text{area}}$

$\text{pressure} = \frac{4}{0.00004}$ [1] ECF (a)

Pressure = 1×10^{5} / 100000 Pa [1] ECF

The tip of the thumbtack to be made smaller [1/2] (also accept more pointed/sharper tip). This increases the pressure exerted [1/2].

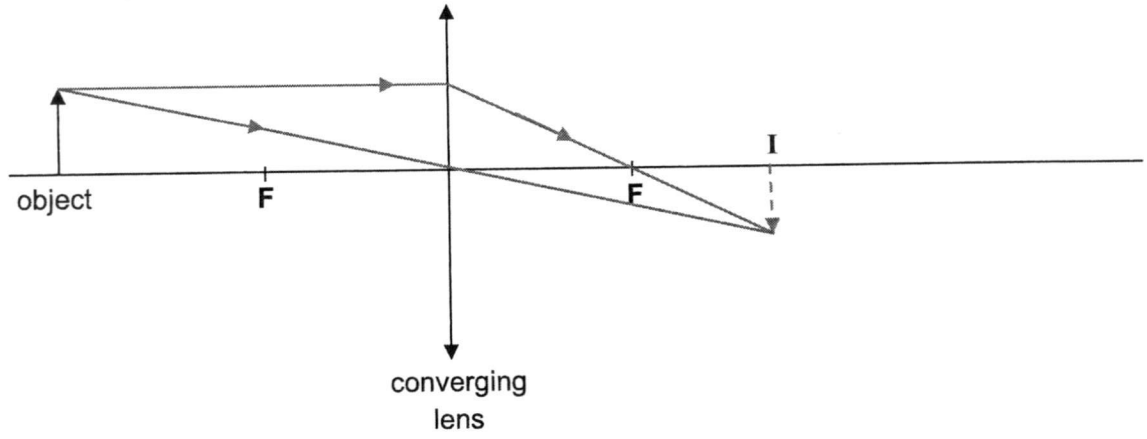
7a) X marked at any point along the ceiling of living room. [1]

Cool air that is released by the air-condition has a higher density [1/2], sinks [1/2]. Warmer air at the bottom of the living room of lower density
process/cycle repeats [1/2] and a convection current is formed [1/2].

Conduction [1]. Atoms near X gain energy and vibrate faster
neighbouring atoms [1/2] an
repeats [1/2] and energy can be transferred from X to Y.

8b) Rate of energy transfer will increase [1]. Conduction in metals take place through vibrating atoms as well as the <u>movement of free electrons</u> [1].

9a) Ray passing through optical centre drawn [1]
Horizontal ray passing through focal point drawn [1] (-1/2 if arrows not drawn)
Image I drawn and labelled [1]



9b) Real, inverted, diminished Any 2 correct [1] (No half mark)
9c) Camera lens / Binoculars [1]

10ai) solid & liquid [1] 10aii) liquid [1]

10bi) Particles of the substance at A are arranged in a neat and orderly arrangement [1], the particles vibrate about a fixed position [1].

10bii) Particles gain kinetic energy [1], move further apart from one another [1/2] and vibrate faster [1/2] about a fixed position.

10c) The substance is changing state/melting [1/2]. Thermal energy is absorbed by the particles to overcome intermolecular forces of attraction between the particles [1], there is no increase in kinetic energy [1/2].

10d) - Evaporation takes place only at the surface of the liquid, boiling takes place throughout the liquid.
- Evaporation takes place at all temperatures, boiling occurs only at a fixed temperature
- Bubbles are formed during boiling process, nothing visible happens for evaporation
[2] for any two

11a) Energy cannot be created or destroyed.
Energy can be transferred from one form to another.
Total energy in a system remains constant.

3 statements correct – 2 marks
2 statements correct – 1 mark

11b) B - Kinetic Energy [1/2]
C - Gravitational Potential energy and Kinetic energy [1/2]

11ci) Change in energy = loss of GPE
= mgh
= (0.5)(10)(8) [1]
= 40 J [1]

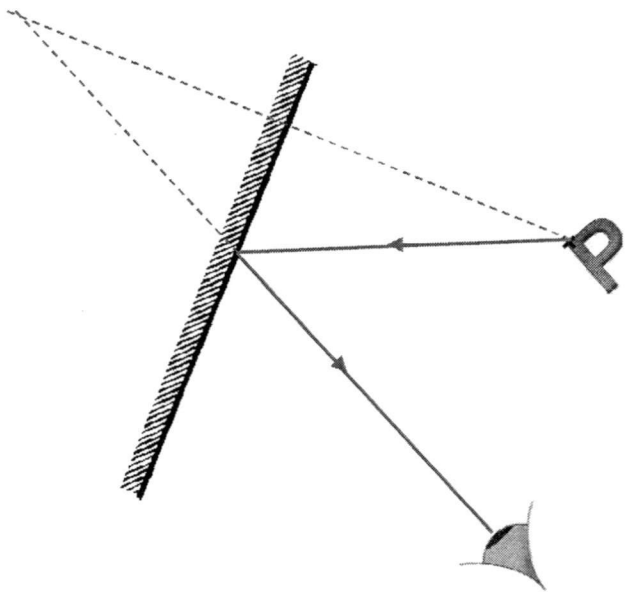
11cii) loss of GPE = gain in KE
$40\ J = \frac{1}{2} mv^2$
$40\ J = \frac{1}{2} (0.5)v^2$ [1]
$v = 12.6$ m/s (3sf) [1]

11ciii) KE at C = loss of GPE between A and C
= mgh at A – mgh at C
= (0.5)(10)(8) – (0.5)(10)(5) [1]
= 15 J [1]

11d) Kinetic energy is converted to thermal energy [1/2] (and sound) due to friction [1/2] along DE.

12a) Angle of incidence equals angle of reflection [1/2]
The incident ray, reflected ray and normal all lies on the same plane [1/2]

12b) Image correctly drawn [1]
Virtual rays drawn [1] -1/2 if not dotted lines
Incident & reflected rays drawn [1] -1/2 if no arrows



12ci) $n = \frac{\sin i}{\sin r}$
$1.5 = \frac{\sin \theta}{\sin 35}$ [1]
$\theta = 59.4°$ [1]

12cii) $n = \frac{1}{\sin c}$
$1.5 = \frac{1}{\sin c}$ [1]
$c = 41.8°$ [1]

12d) The ray of light will exit/leave the glass block [1/2], refracted [1/2] at an angle of 59.4° [1/2]. The incident angle is smaller than the critical angle of the glass block [1/2].