Name	Class				Index Number		

BROADRICK SECONDARY SCHOOL
SECONDARY 3 EXPRESS
END-OF-YEAR EXAMINATION 2021

SCIENCE (PHYSICS/CHEMISTRY) 5076/01

Paper 1 Multiple Choice October 2021

Additional Materials: Multiple Choice Answer Sheet 1 hour

READ THESE INSTRUCTIONS FIRST

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

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 answer sheet.

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

[Take g to be 10 m / s^2 or the weight of 1 kg to be 10 N]

This question paper consists of XX printed pages, including this page.

1 Which of the following quantities is a derived quantity?

A density

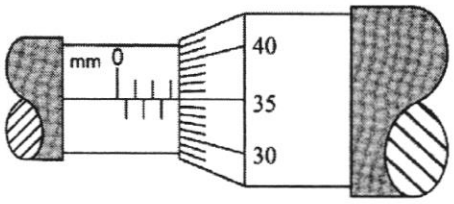
B electric current

C luminous intensity

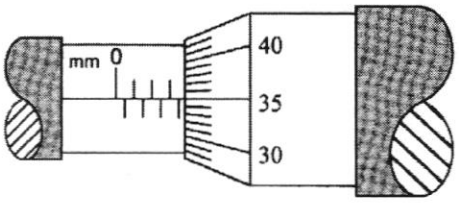
D temperature

2 Which of the following shows a reading of 3.35 cm?

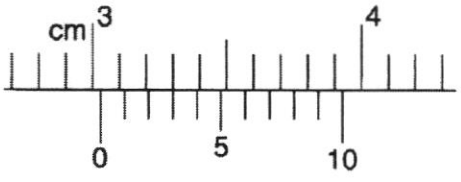
A



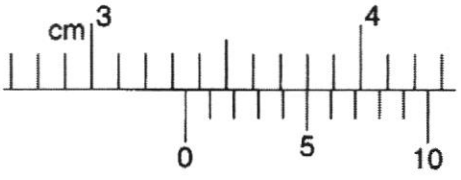
B



C

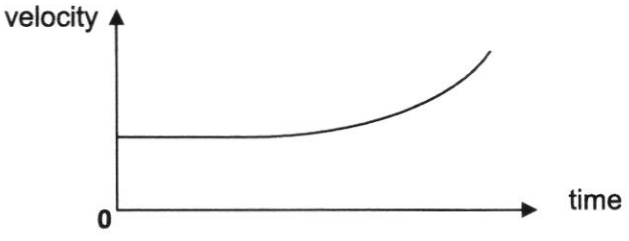


D



3 The graph shows how the velocity of a car changes with time.

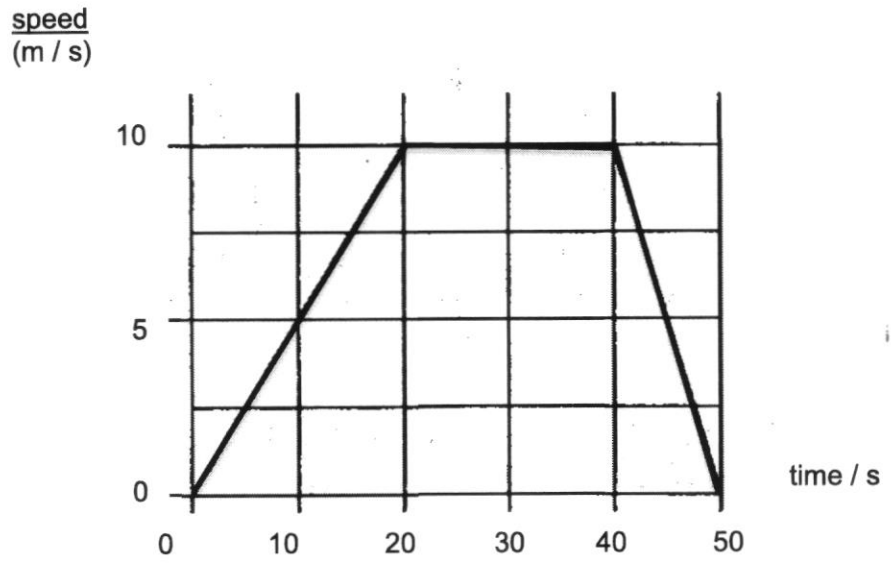
Which of the following can be deduced from the graph?



A The car starts from rest then accelerates uniformly.
B The car starts from rest then accelerates non-uniformly.
C The car moves with steady velocity then accelerates uniformly.

D The car moves with steady velocity then accelerates non-uniformly.

4 The graph shows the movement of a car for a duration of 50 s.

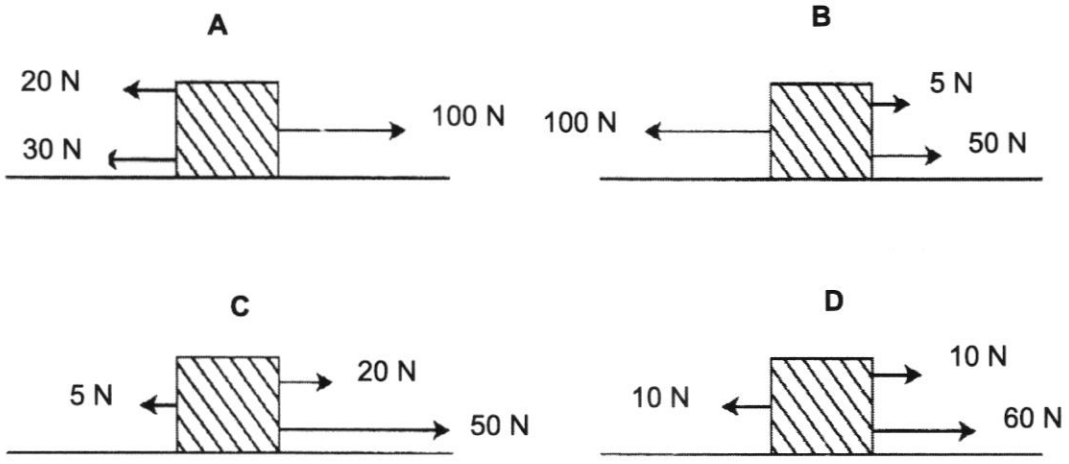


What was the distance travelled by the car during the time when it was moving at a steady speed?

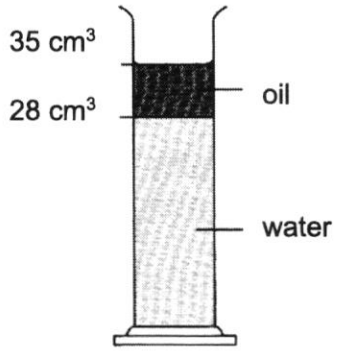
A 10 m **B** 100 m **C** 200 m **D** 400 m

5 The diagram below show boxes of the same mass with forces acting on it.

Which diagram shows the mass moving with the greatest acceleration?



6 The diagram below shows a mixture of oil and water in a measuring cylinder. The level of the water and the oil is at the 28 cm^3 and 35 cm^3 mark respectively.



What is the density of oil if the mass of the oil is 6.4 g?

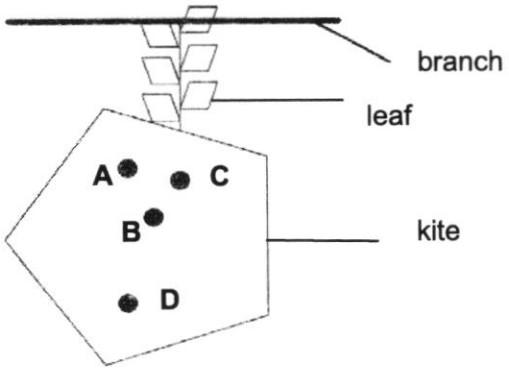
A 0.18 g / cm^3 **B** 0.23 g / cm^3 **C** 0.91 g / cm^3 **D** 1.00 g / cm^3

7 The gravitational field strength on the surface of a planet is 5 N / kg.

What will be the weight of an object of mass 0.4 kg on the planet?

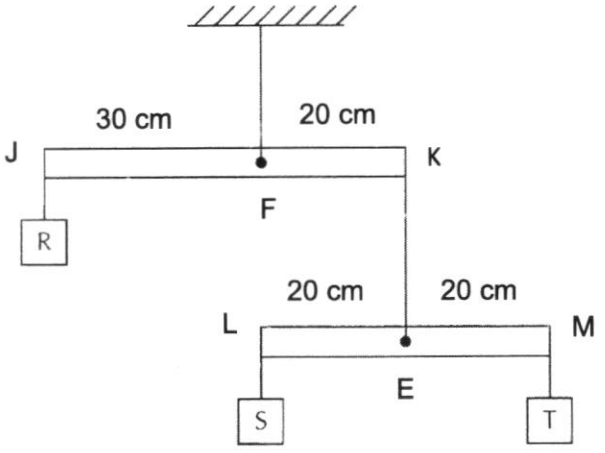
A 2 N **B** 200 N **C** 2 000 N **D** 4 000 N

8 A kite hangs freely on the branch of a tree as shown in the diagram below.



Which point is possibly the centre of gravity of the kite?

9 The diagram below shows a balancing structure, which consists of objects R, S and T, hung from two light rods (JK and LM) of negligible mass.



Which of the following gives a possible combination of the masses of R, S and T which keep the structure balanced?

	Mass of R / g	Mass of S / g	Mass of T / g
A	10	20	20
B	10	10	20

C	20	15	15
D	20	10	5

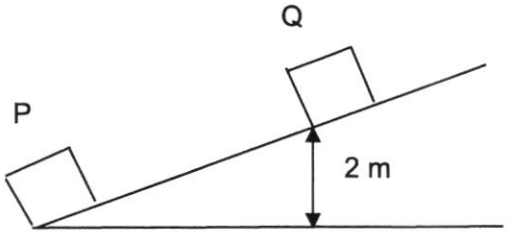
10 Atmospheric pressure is 100 000 N / m^2.

What is the total weight of the atmosphere pressing down on a flat horizontal roof of dimensions 4 m x 2 m?

A 1250 N **B** 12 500 N **C** 100 000 N **D** 800 000 N

11 A metal block of mass 20 kg is pushed up a rough inclined plane as shown below. The total work done on the block from P to Q is 1000 J.

What is the work done against friction?

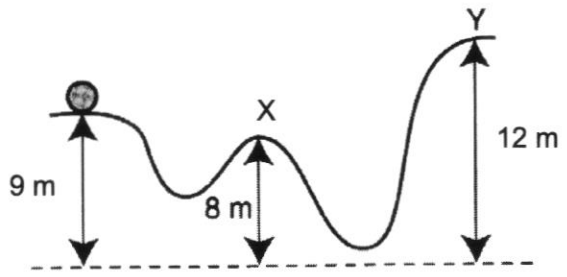


A 20 J **B** 400 J **C** 500 J **D** 600 J

12 A marble is being rolled down a frictionless slope. The speed of the marble is 15.0 m / s when it is at a point X.

What is the speed of the marble at Y?

Y



A 11.0 m / s **B** 11.6 m / s **C** 12.0 m / s **D** 19.0 m / s

13 What is a property of both liquids and gases?

A They always fill their containers.

B They are incompressible.

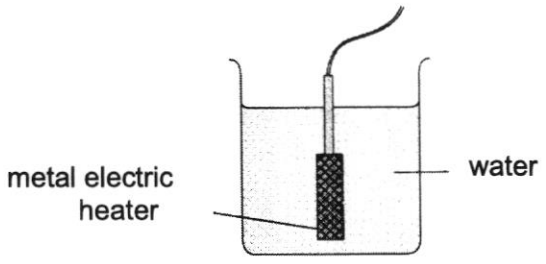
C They can flow.

D They have molecules in fixed positions.

14 How are the forces between the molecules in a gas and the average speed of these molecules best described?

	Forces between molecules	Average speed of molecules
A	Strong	Fast
B	Very strong	Very slow
C	Very weak	Very fast
D	Weak	Slow

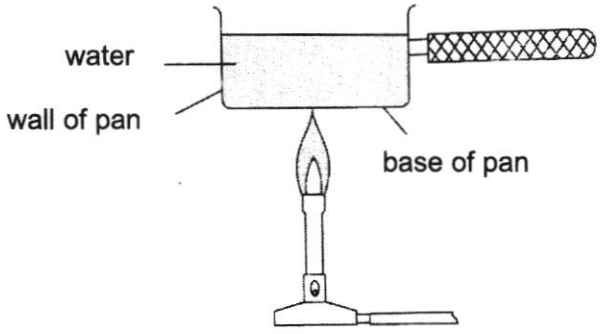
15 A metal electric heater is submerged into a beaker of water.



What are the main processes by which the heat is transferred within the metal, from the metal to the water and from the heated water to the entire water?

	Within the metal	Metal to the water	Heated water to the entire water
A	Conduction	Conduction	Conduction
B	Conduction	Conduction	Convection
C	Radiation	Convection	Conduction
D	Radiation	Radiation	Convection

16 To boil the water in a pan fast, what colour should the pan have?



	Wall of pan	Base of pan
A	Black	Black
B	Black	Silvery

C	Silvery	Black
D	Silvery	Silvery

17 What happens to the molecules of a substance when it is heated at the boiling point?

A forces between molecule increases

B kinetic energy of the molecule increases

C molecular separation increases

D size of the molecule increases

18 Which of the following statements is/are correct?

1 Heat is defined as the energy which is transferred from one place to another due to a temperature difference between them.

2 Heat will flow from one body of higher energy level to another of lower energy level.

3 When an object has higher temperature, its internal energy is higher than another object of lower temperature.

A 1 only **B** 1 and 3 only **C** 2 only **D** 2 and 3 only

19 What causes a metal to expand when it is being heated?

A The decrease in the density of the molecules.

B The increase in the mass of the molecules.

C The increase in the size of the molecules.

D The increase in the distance between the molecules.

20 The table below shows the melting points and boiling points of four different substances.

Which substance is a gas at 150 ^{0}C and a solid at - 50 ^{0}C?

	Melting point	Boiling point
A	- 40 ^{0}C	100 ^{0}C

B	- 40 ^{0}C	300 ^{0}C
C	-120 ^{0}C	60 ^{0}C
D	-200 ^{0}C	200 ^{0}C

END OF PAPER

Solutions 2021 End- of -Year Examination 3E Science(Physics) P1 Paper 1

Q No	Answer	Q No	Answer
1	A	11	D
2	D	12	C
3	D	13	C
4	C	14	C
5	C	15	B
6	C	16	C

7	A	17	C
8	C	18	A
9	C	19	D
10	D	20	A

END

Name	Class				Index Number		

BROADRICK SECONDARY SCHOOL
SECONDARY 3 EXPRESS
END-OF-YEAR EXAMINATION 2021

SCIENCE(PHYSICS) 5076/02
Paper 2

Candidates answer on the Question Paper

October 2021
1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST
Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid. If working is needed for any question it must be shown with the answer. Omission of essential working will result in loss of marks. Calculators should be used where appropriate.

Sections A and B
Answer **all** questions in the spaces provided on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.
[Take g to be 10 m /s^2 or the weight of 1 kg to be 10 N]

For examiner's use	
Paper 1	
Paper 2	
Section A	
Section B	
Total	

Target Grade:
Actual Grade:
For Examiner's Use
65

This document consists of 20 printed pages.

Section A (45 marks)

Answer all the questions in the spaces provided.

1 A barge is pulled at a steady speed through still water by two horizontal cables as shown in the plan view in Fig. 1.1. By means of a scale drawing determine the magnitude and direction of the resultant force exerted on the barge by the cables. State the scale you have used.

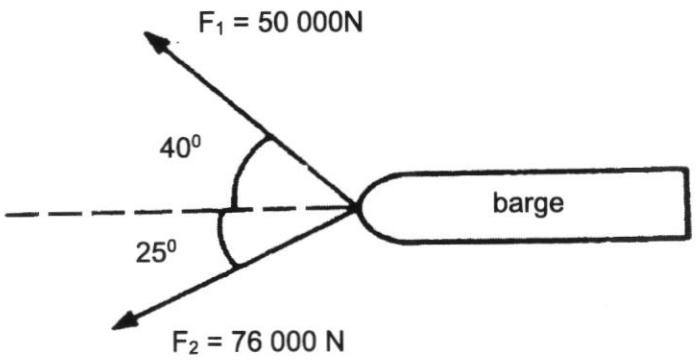


Fig. 1.1

scale used = ... [1]

magnitude of the resultant force = ...N [3]

direction of the resultant force = ... [1]

2 The unbalanced force on an object of mass 100 kg varies as shown in Fig. 2.1.
The initial speed of the object is zero. Assume that there is no force of friction acting on the object.

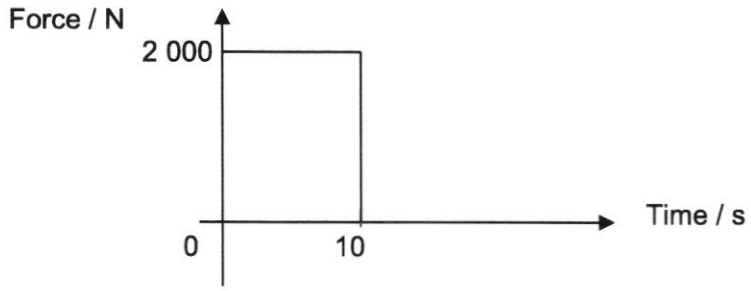


Fig. 2.1

(a) Calculate the acceleration of the object for the first 10 s.

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

(b) Calculate the velocity of the object at the end of 10 s.

velocity = ... m / s [2]

(c) Sketch a speed-time graph for the motion of the object from 0 s to 10 s on the axes below. [2]

3 A company purchases corrugated cardboard boxes to pack its goods. The boxes are not made up when they are delivered, but are flat, as shown in Fig. 3.1.

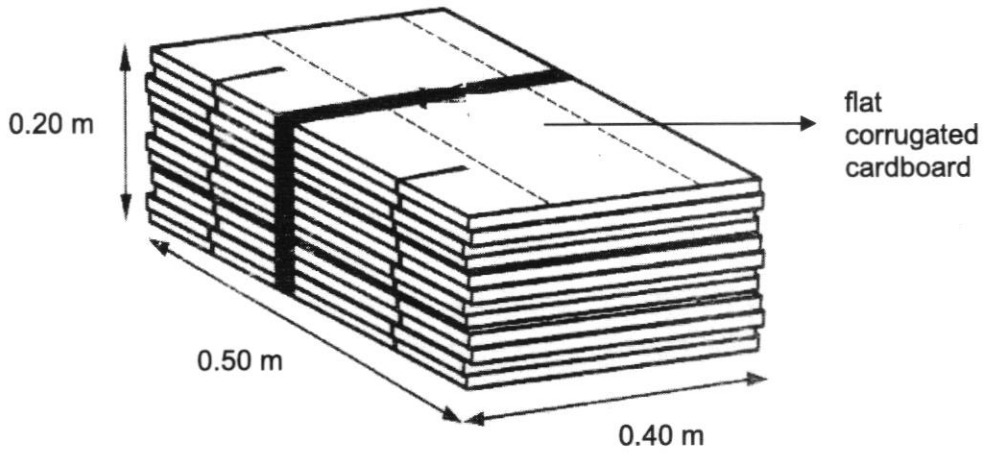


Fig. 3.1

(a) A bundle of these boxes measures 0.50 m x 0.40 m x 0.20 m and has a mass of 5.2 kg.

Calculate the density of the corrugated cardboard when they are flat.

density = ...kg / m^3 [2]

(b) A worker lifted two such bundles together from the floor and placed them on a writing table that is 0.8 m above the floor in 1.2 s.

Calculate the power generated by the worker.

power generated = ...W [2]

(c) Corrugated cardboard is made up of three sheets of thick paper stuck together. Fig. 3.2. and Fig. 3.3 shows an enlarged view of the edge of a sheet of corrugated cardboard after being made-up.

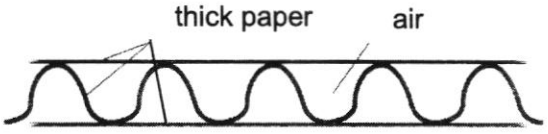


Fig. 3.2

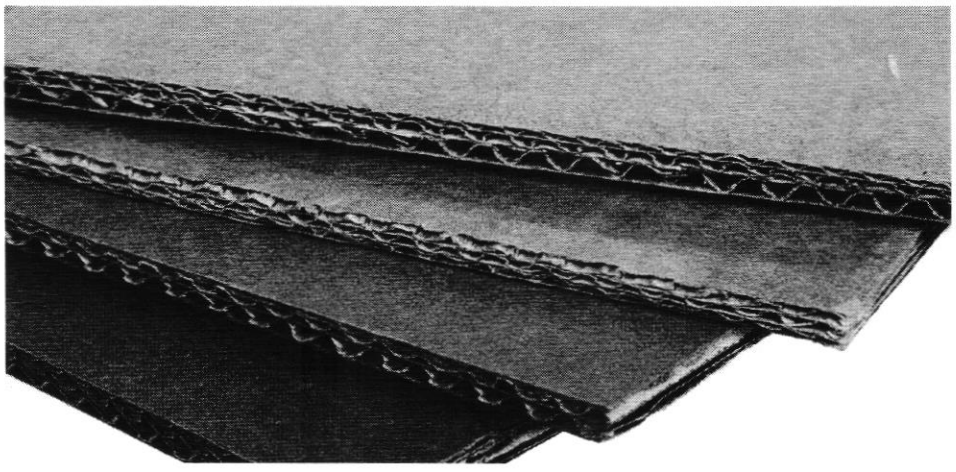


Fig. 3.3

What can you say about the density of the corrugated cardboard compared to the value calculated in **(a)** for this arrangement. Explain your answer.

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..... [2]

4 In the high jump competition, two competitors Jane and Peter, use different styles. Jane uses an old-fashioned 'scissors' jump as shown in Fig. 4.1.

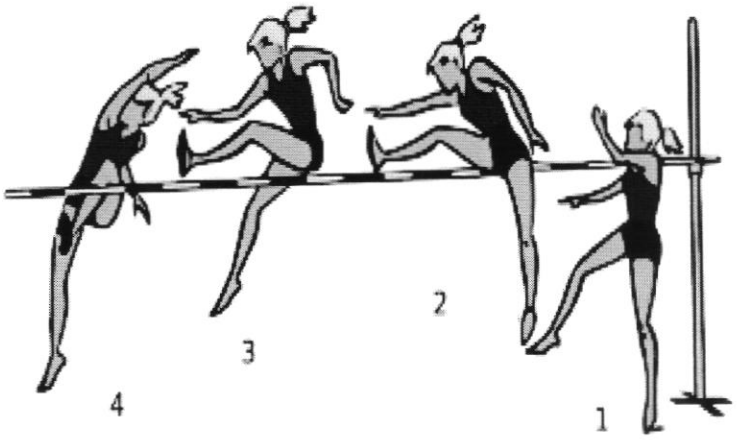

Fig. 4.1

Peter uses the modern 'Fosbury Flop' technique as shown in Fig. 4.2.

The Fosbury Flop is a jumping style used in the track and field sport of high jump. It was popularized and perfected by American athlete Dick Fosbury, whose gold medal in the 1968 Summer Olympics in Mexico City brought it to the world's attention.

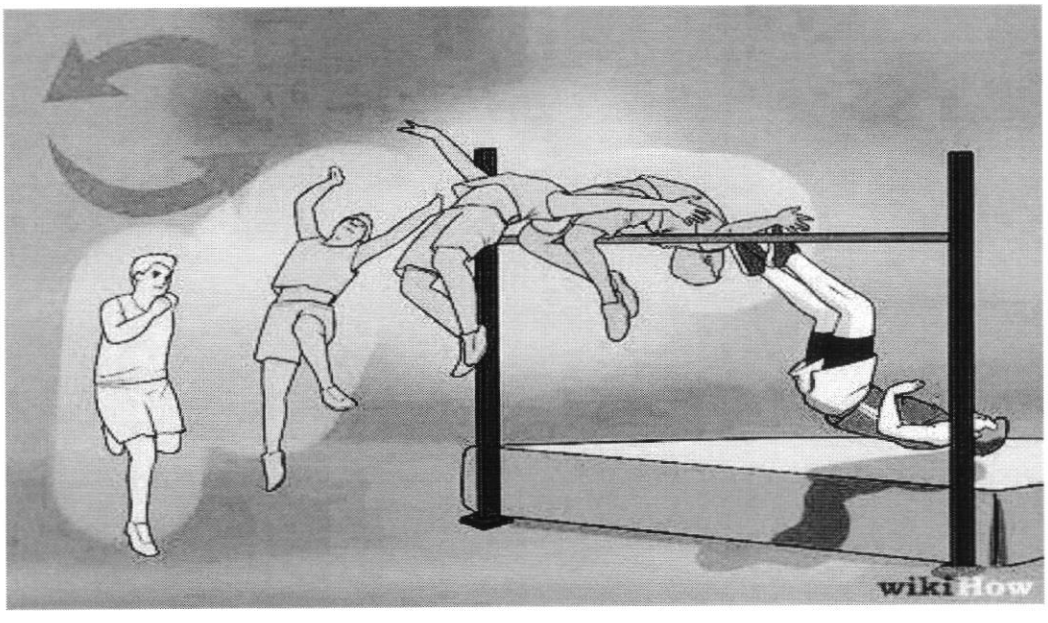

Fig. 4.2

Explain, with reference to the position of the centre of gravity of each jumper, why Peter's technique is more efficient and successful.

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..... [3]

5 Fig. 5.1 shows a horizontal uniform rod PQ of weight 10 N and length 100 cm, pivoted at P. An irregular solid X, is suspended 30 cm from the end Q. The end Q is supported by a spring balance which reads 19 N.

Calculate the weight of the irregular solid X.

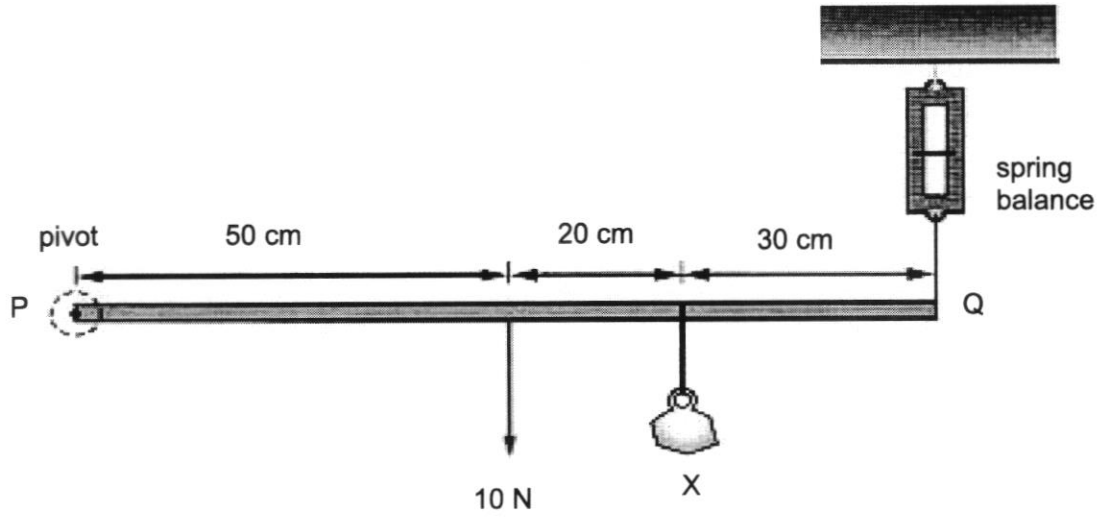

Fig. 5.1

weight of X = ... N [2]

6(a) Define pressure.

.....

.....[1]

(b) Fig. 6.1 shows a simplified brake mechanism that utilizes a hydraulic system.

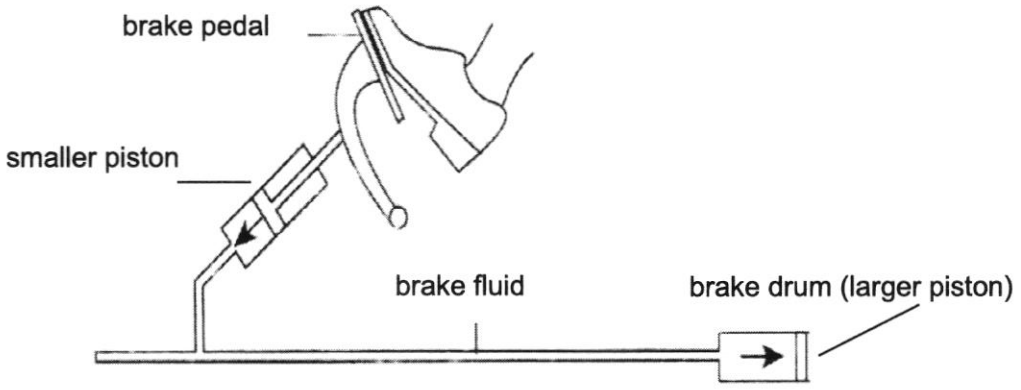

Fig. 6.1

A driver exerts a force of 50 N on the smaller piston. The ratio of the cross-sectional area of the larger piston at the brake drum to the smaller piston located at the brake pedal is 24:1.

Calculate the force exerted on the brakes at the brake drum.

force = ...N [2]

7 A student sets up the following experiment to demonstrate Brownian motion. He introduces smoke particles into a thin transparent sealed container and then observes the motion of the particles through a microscope as shown in Fig. 7.1.

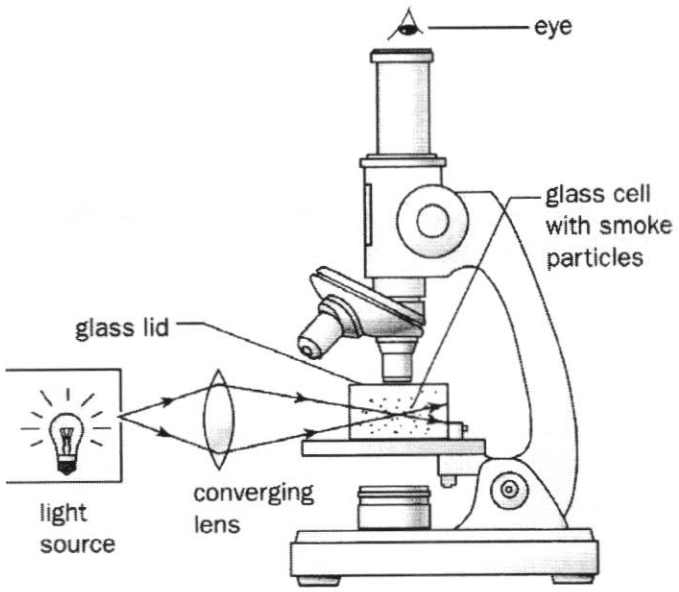

Fig. 7.1

Fig. 7.2 shows the path taken by a smoke particle when viewed from the microscope.

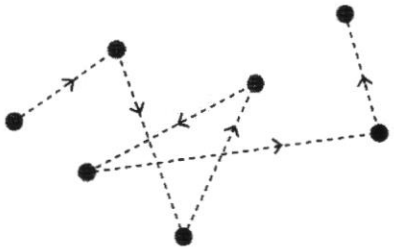

Fig. 7.2

(a) Explain why smoke particles are needed even though the student wants to observe the motion of the gas molecules.

.....

.....[1]

(b) Explain what causes the smoke particles to move in the manner as shown in Fig. 7.2.

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.....

.....[2]

(c) The gas in the container is heated. Predict how the motion of the smoke particle is different from that before the heat is supplied.

.....

.....[1]

(d) The student assumes that the particles in a solid will behave similarly to gaseous particles when heat is supplied.

Is he right to conclude this? Explain your answer.

.....

.....

.....

.....[2]

8(a) Two metal cans are filled with boiling water as shown in Fig. 8.1. One can is insulated with felt. The temperature of the water in each can is taken every minute, The cans are allowed to cool until they reach room temperature.

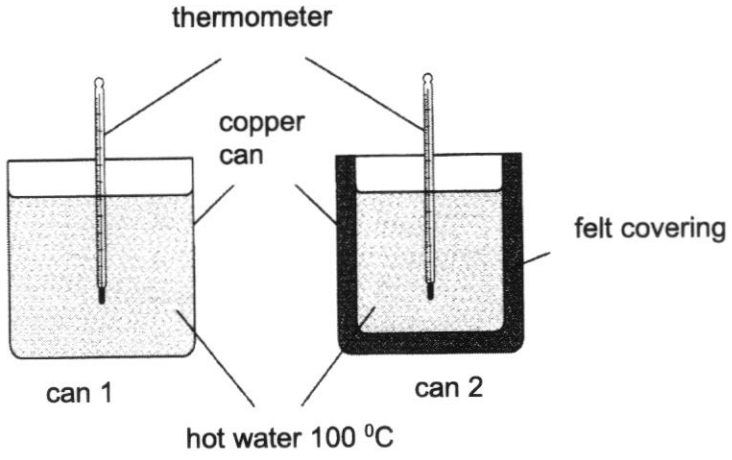
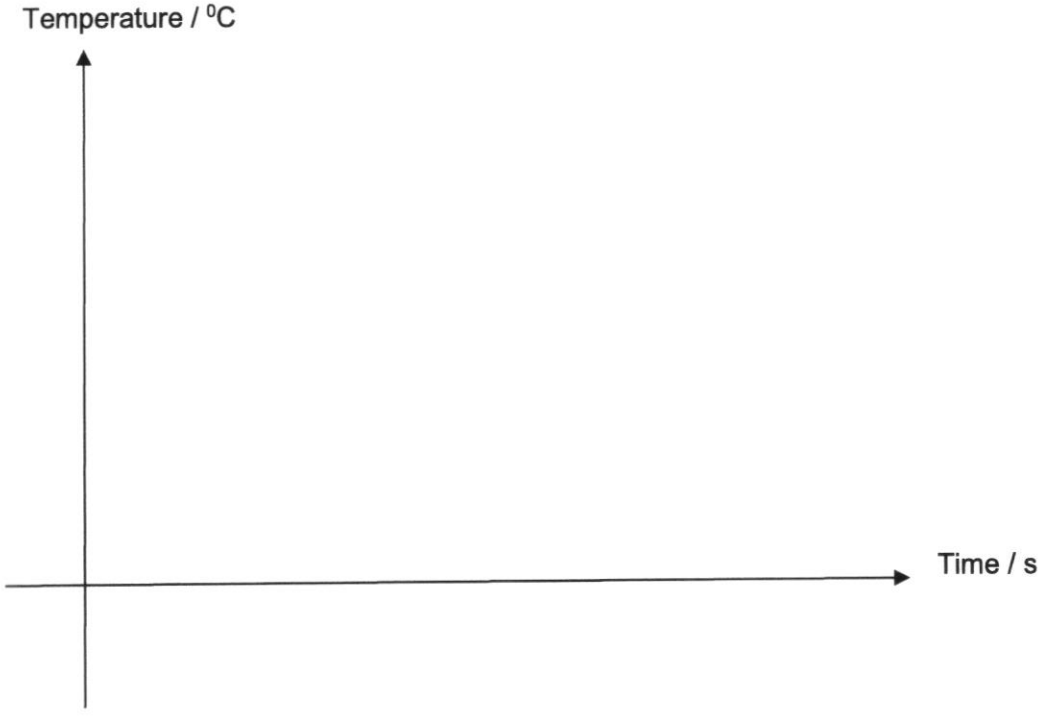


Fig. 8.1

On the same axis below, sketch the variation of temperature of the two cans with respect to time. Label your graphs clearly by writing 'can 1' and 'can 2'. [2]



(b) A student is studying by the light from a filament lamp.
Fig. 8.2 shows the filament lamp in an upright position.

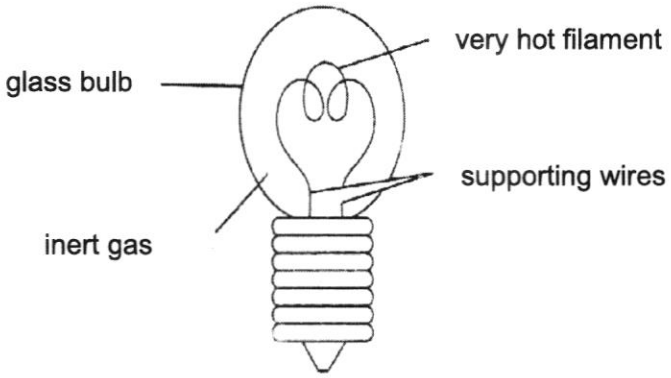


Fig. 8.2

(i) On Fig. 8.2, draw arrows to represent heat radiation from the filament. [1]

(ii) State two places where thermal conduction takes place.

.....

.....[2]

9 A substance is heated with an electric heater of power 500 W from a temperature of - 200 ^{0}C.
Fig. 9.1 shows the heating curve of the substance.

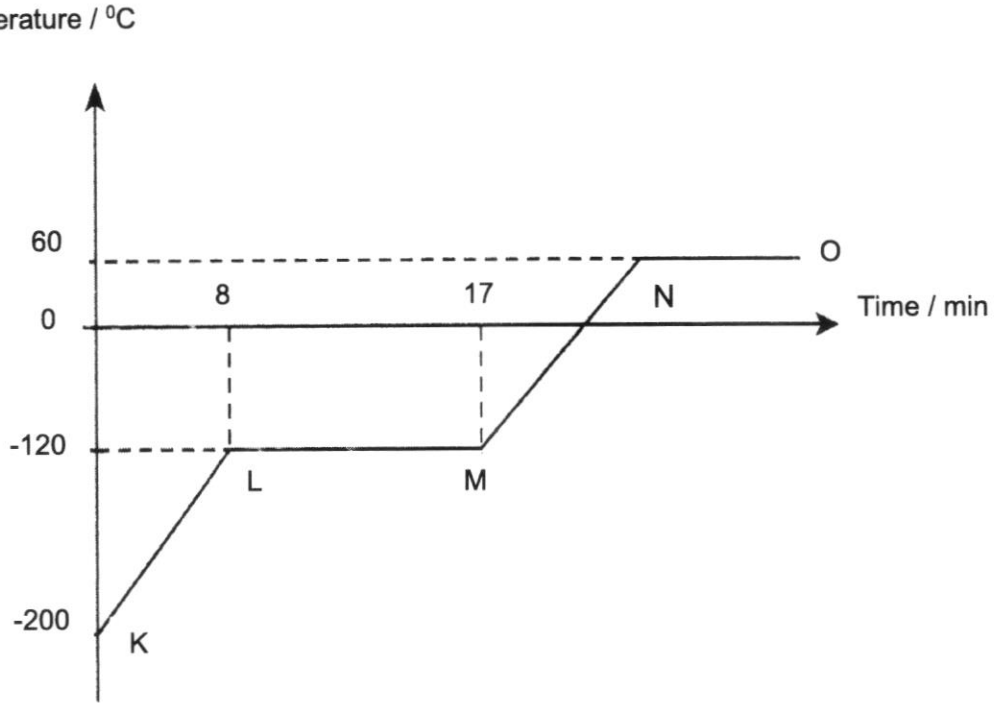


Fig. 9.1

(a) Define the internal energy of a substance.

.....

..... [1]

(b) State the state(s) of the matter in section LM.

LM : ..... [1]

(c) Assuming no heat is lost to the surroundings, calculate the amount of heat absorbed by the substance during the melting process.

amount of heat = ...[2]

(d) Explain, in terms of the kinetic theory of matter,

(i) why the temperature at section KL rises,

.....

.....[1]

(ii) why the temperature at section LM remains constant,

.....

.....

.....

.....

.....[2]

(iii) the process that is taking place along NO.

.....

.....

.....

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.....[2]

End of Section A

Section B (20 marks)

Answer all the questions in the spaces provided.

10 A model rocket is fired vertically into the air.
Fig. 10.1 shows the rockets flight.

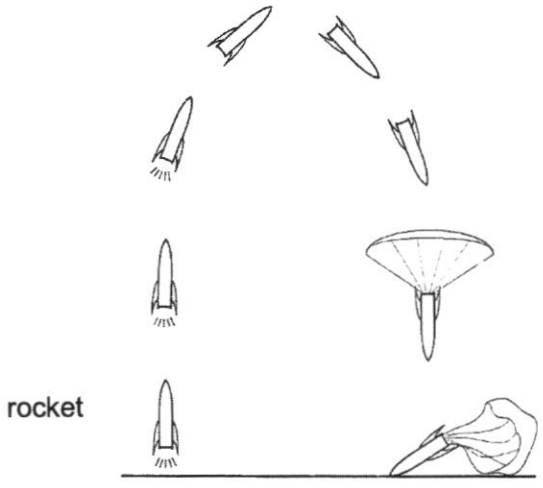

Fig. 10.1

Fig. 10.2 shows how the velocity of the rocket changes during part of its flight.

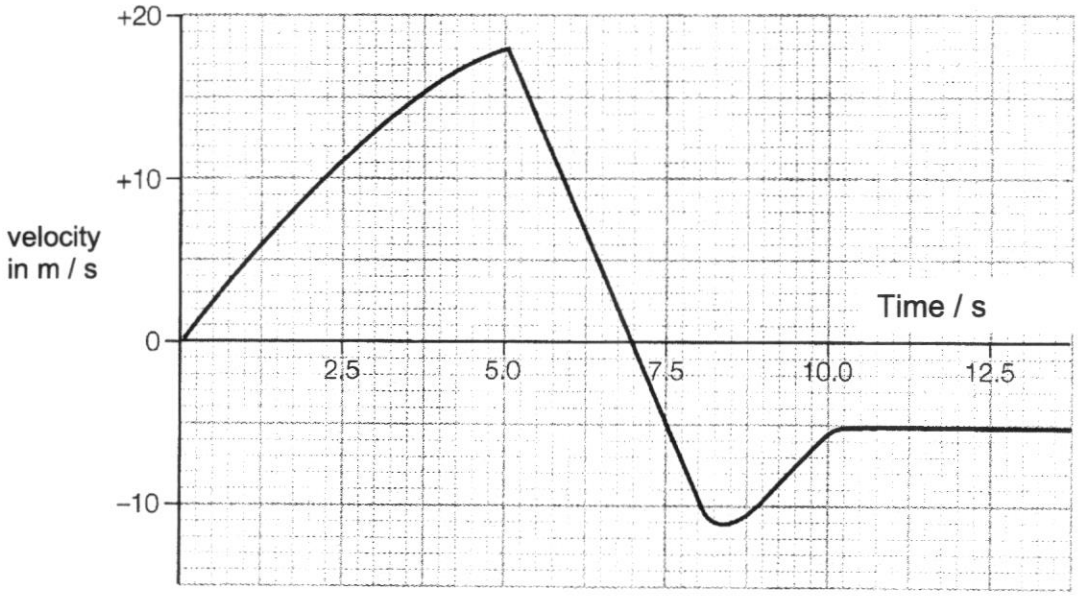

Fig. 10.2

(a) Briefly describe the acceleration of the rocket between the times of 0 s and 5 s.

.....

.....[1]

(b) During its ascent, the rocket travelled further then when it was descending.

How can you tell this from Fig. 10.2?

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.....[2]

(c) State the time the rocket begins to fall.

Explain your answer.

.....

.....

.....

.....[2]

(d)(i) After 8.5 s the parachute opened. There is a change in the speed of the rocket.

Explain why the speed changed in this way from 8.5 s onwards.

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.....[3]

(ii) Define terminal velocity.

.....

.....[1]

(iii) State the rocket's terminal velocity.

..... [1]

11 A roller coaster train has an initial speed, *v*, at point A as shown in Fig. 11.1. It then climbs a height of 10 m to the highest point, B on the track, such that its speed is 3 m / s.

The train continues its motion down hill and at a point C (same level as A), the train enters a pool of water which provides an average braking force of 600 N. The force decelerates the train which comes to a complete stop at D.

The total mass of the train including the passengers is 500 kg.
(Assume there is no friction on the track and no air resistance.)

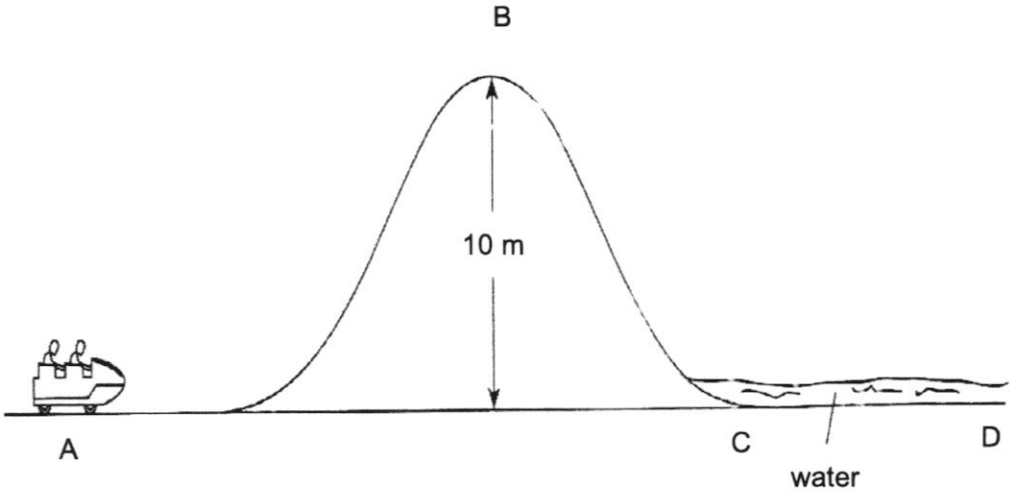


Fig. 11.1

(a) Calculate the weight of the train with the passengers.

weight = ...N [1]

(b) Calculate the potential energy of the train when it reaches point B.

potential energy = ... J [2]

(c) Deduce the kinetic energy of the train at point A such that it arrives at point B with a speed of 3 m / s.

kinetic energy = ...J [2]

(d) Hence, find the speed v of the train at point A.

speed v = ...m / s [2]

(e) State the kinetic energy of the train at point C.

kinetic energy = ...J [1]

(f) Using the Principle of Conservation of energy, calculate the stopping distance, CD (this is the distance in which the train takes to stop completely).

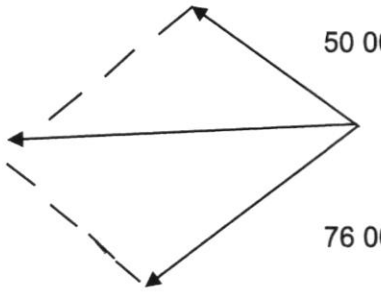
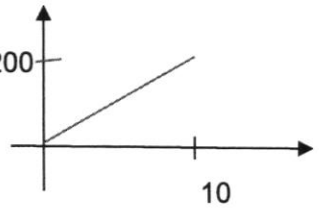
stopping distance = ...m [2]

END OF PAPER

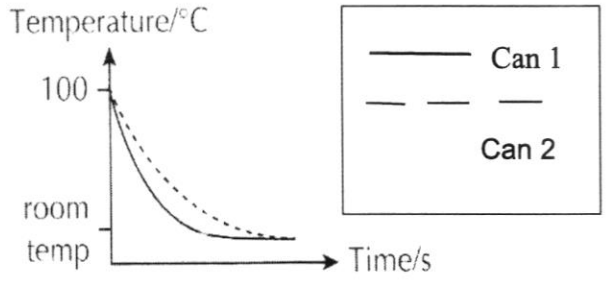
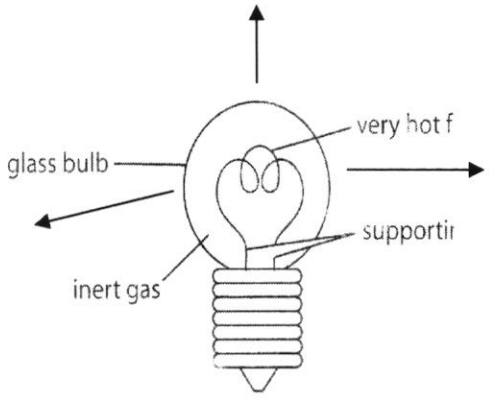
Solutions 2021 End- of -Year Examination 3 Exp Science(Physics) P1 5076
Paper 1

Q No	Answer	Q No	Answer
1	A	11	D
2	D	12	C
3	D	13	C
4	C	14	C
5	C	15	B
6	C	16	C
7	A	17	C
8	C	18	A
9	C	19	D
10	D	20	A

Paper 2 Sec 3 Exp EOY 2021 Sc(Physics) 5076

Q No	Solution	Marks
1	 Resultant =10.6 cm 1 cm rep 10 000N 106 000 N	Scale: 1 m Direction: 1m Vector diagram 2 m Magnitude : 1 m
2(a)	F = ma 2000 = 100 x a a = 20 m / s^2	1 1
(b)	a = (v -u) / t 20 = (v – 0) / 10 v = 200 m /s	 1 1
(c)		Line : 1 m Values on axes : 1 m
3(a)	Density = mass / volume = 5.2 / 0.2 x 0.5 x 0.4 = 130 kg / m^3	1 1
(b)	Power = work done / time = 5.2 x 2 x 10 x 0.8 / 1.2 = 69.3 W	1 1
(c)	Density is lower There are air particles between the spaces	1 1

Q No	Solution	Marks
4	Fig.4.1: Jane -The centre of gravity of the jumper is above the bar, higher. Fig.4.2: Peter : The centre of gravity is lower than that of Jane. So Peter need not jump too high to lift his body in order to clear the bar.	1 1 1
5	Taking moments about the pivot Sum of clockwise moment = sum of anticlockwise moment (10 x 50) + (X x 70) = 19 x 100 X = 20 N	1 1 1
6(a)	Pressure is defined as force per unit area	1
(b)	50 x 24 = 1200 N	1 1
7(a)	The gas molecules cannot be seen by the naked eye.	1
(b)	-Assume that air is made up of particles which are always in constant random motion. -They bombard the smoke particles from all directions with different speeds and kinetic energies. So the smoke particles move in a zig zag manner.	1 1
(c)	The smoke particles gain kinetic energy and move faster and make more collisions with each other.	
(d)	No -The particles of a solid are closely packed together. -They can only vibrate about their fixed mean position and cannot travel. -As for gas molecules they are very free to move. - So when a solid is heated the particles will vibrate to a greater amplitude and with a greater speed about its fixed mean positions.	1 1

Q No	Solution	Marks
8(a)		Can 1 – 1 m Can 2 – 1 m
(b)		1 m
(c)	Glass bulb, hot filament,	1, 1
9(a)	It is the total kinetic and potential energy of the molecules.	1
(b)	Solid and liquid	1
(c)	W = P x t W = 500 x 9 x 60 W = 270 000 J	1 1
(d) (i)	It gains kinetic energy	1
(ii)	- There is a change of state from solid to liquid. - Heat supplied is used to break the forces of attraction between the molecules. - - Kinetic energy remains constant - -Temperature iremains constant	1 1
(iii)	-At boiling point, the molecules have enough thermal energy to break the forces of attraction between neighbouring molecules. -The molecules move further away from each other.	1 1

Paper 2 Section B

Q No	Solution	Marks
10 (a)	The acceleration decrease non-uniformly.	1
(b)	The area under the line and the time axis represents the distance travelled. This area is greater for the first 5 s than for the next 2.5 s.	1 1
(c)	7.0 s There is a change in the velocity from positive to negative.	1 1
(d)(i)	-When the parachute opens, the air resistance which is acting upwards increases. - The upward force (air resistance) is greater than the downward force (weight of the rocket). -So speed decreases. - Soon the upward force = the downward force - Resultant force is zero - Acceleration is zero - Rocket travels at a constant speed.	1 1 1
(ii)	It is the highest constant speed for a falling object when the air resistance equals the weight of the object.	1
(iii)	- 5 m /s	1
11(a)	W = mg = 500 x 10 = 5 000 N	1
(b)	E_p = mgh = 500 x 10 x 10 = 50 000 J	1 1

(c)	$E_k = ½ m v^2 = 1/2 \times 500 \times 3 \times 3$ $= 2\,250$ J E_k at A = 50 000 + 2 250 = 52 250 J	 1 1
(d)	$½ m v^2 = 52\,250$ $1/2 \times 500 \times v^2 = 52\,250$ $v = 14.5$ m / s	 1 1
(e)	52 250 J	1
(f)	W = F x s 52 250 = 600 x s s = 87.1 m	1 1
	END OF PAPER	