FUCHUN SECONDARY SCHOOL
END OF YEAR EXAMINATION 2017
SECONDARY 3 EXPRESS

NAME:

CLASS: | | INDEX NUMBER: | |

SCIENCE (PHYSICS)

5076

6 October 2017
1 hour 45 minutes
Maximum mark: 85

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on the work you hand in.
You may use an HB pencil for diagrams, graphs, tables 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 the appropriate units.

Take gravitational field strength, g = 10 N/kg.

Section A

Write in soft pencil.
There are **twenty** questions on this section. Answer **all** the 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 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.

Section B

Answer **all** the questions.
Write your answers in the spaces provided on the question paper.

Section C

Answer any **two** questions.
Write your answers 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.

For Examiner's Use	
Section A	
Section B	
Section C	
Total	

Name of setter: Mr LH Liang

This document consists of 29 printed pages.

Section A [20 marks]

Answer **ALL** the questions on the Multiple Choice Answer Sheet.

1 Which device can be used to measure the thickness of a single sheet of paper?

A a measuring tape
B a micrometer
C a plastic ruler
D a metre rule

2 A girl stands on a bathroom scale. The reading of the scale is 60 kg.

What is the mass and weight of the girl?

	mass	weight
A	60 kg	60 N
B	60 kg	600 N
C	6 N	60 kg
D	60 N	6 kg

3 What do physical quantities consist of?

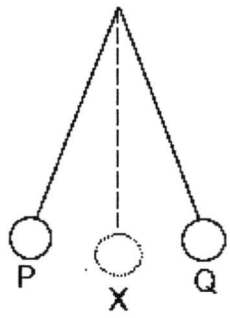
A a numerical magnitude and direction
B a numerical magnitude and unit
C a unit and direction
D a unit and an error

4 A book hits the ground and comes to rest almost immediately.

As the book hits the ground, what is the direction and size of the force acting on the ground?

A downwards and equals to the weight of the book
B upwards and equals to the weight of the book
C downwards and larger than the weight of the book
D upwards and larger than the weight of the book

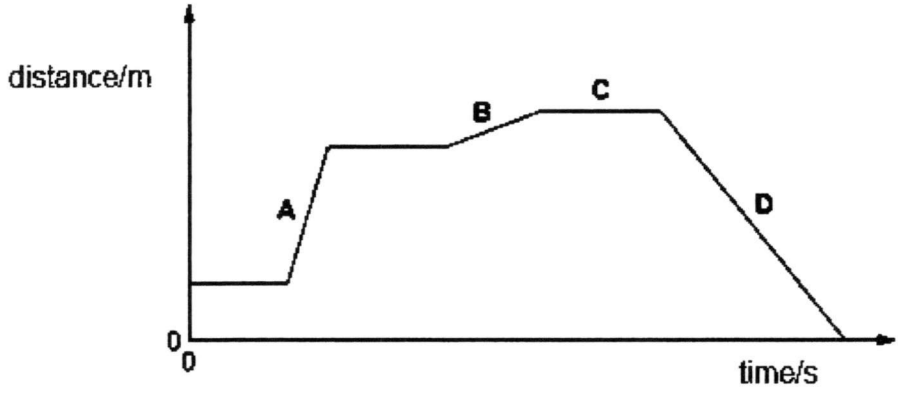
5 The diagram shows a simple pendulum. It swings between P and Q. Which sequence should be timed to measure the period of the pendulum?



A P → X
B P → X → Q
C P → Q → X
D P → Q → P

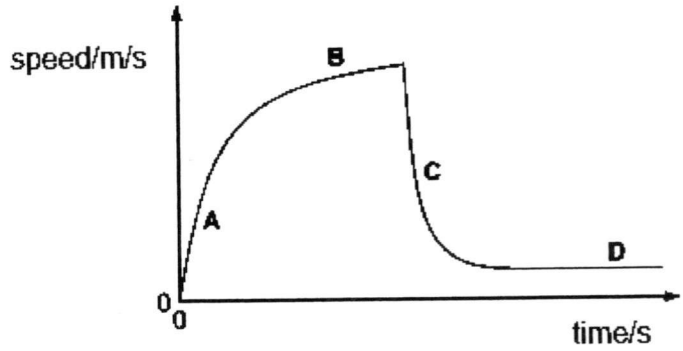
6 The graph shows how the distance of a bike changes with time.

Which section shows the bike being stationary?

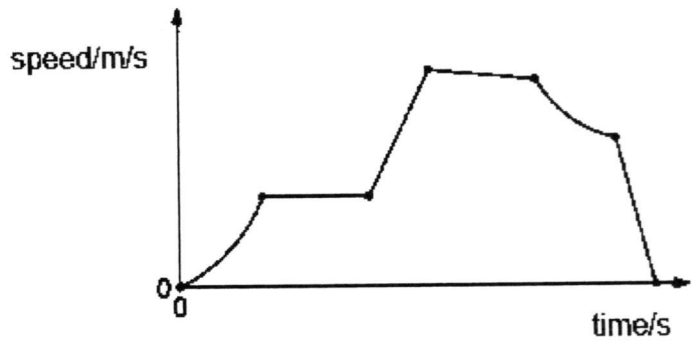


7 The graph shows the speed of a falling sky diver. As he falls, the sky diver opens his parachute.

Which part of the graph shows maximum resultant force acting on the sky diver?



8 The graph shows how the speed of a car travelling along a straight line changes with time.



How many section(s) represent(s) the car moving with uniform acceleration?

A 1 **B** 2 **C** 3 **D** 4

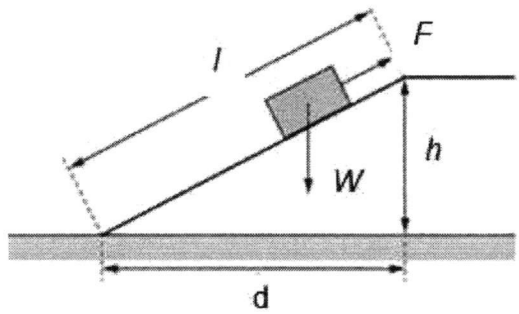
9 A boy drops a ball from the second floor of a building. The ball bounces several times on the ground before rolling to a rest. The boy notices that each successive bounce of the ball reaches a smaller maximum height than the previous bounce. Below are four statements about the energy of the ball.

I The total energy of the ball is conserved.
II Some of the energy of the ball is lost as heat.
III The kinetic energy of the ball remains constant during the bounces.
IV When the ball hits the ground for the first time, the kinetic energy gained by the ball is equals to the gravitational potential energy lost by the ball.

Which of these statement(s) is/are correct?

A I only **B** II only **C** I and IV **D** II and III

10 A constant force *F* pulls a block of weight *W* up the slope as shown.



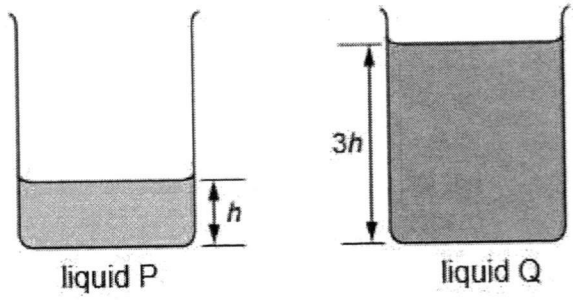
How much work is done in pulling the block up the slope?

A $F \times h$ **B** $F \times l$ **C** $W \times h$ **D** $W \times l$

11 Which statement about the resultant force on an object is correct?

A A resultant force is needed to keep an object moving with uniform velocity.
B A resultant force is needed to keep an object moving with increasing velocity.
C A resultant force is needed to keep an object at rest.
D The resultant force is zero if the object is slowing down.

12 Two identical beakers contain the same mass of liquid. There is a different liquid in each beaker.



Liquid Q has a density ρ.

What is the density of liquid P?

A ρ/3
B ρ
C 3ρ
D 9ρ

13 A wooden block of weight 100 N and base area 0.50 m^2 is placed on a table.

What is the pressure exerted by this block on the table?

A 25 Pa
B 100 Pa
C 50 Pa
D 200 Pa

14 Four rocks are situated in places with different gravitational field strengths.

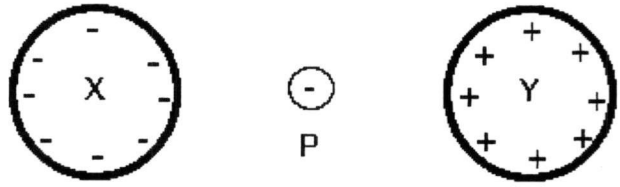
Which rock has the least weight?

	mass/ kg	gravitational field strength/ N/kg
A	1.0	10.0
B	1.5	8.5
C	2.0	10.0
D	2.5	7.5

15 The inertia of a body is its resistance to changes in motion. Which property is a measure of the body's inertia?

A its weight
B its volume
C its mass
D its density

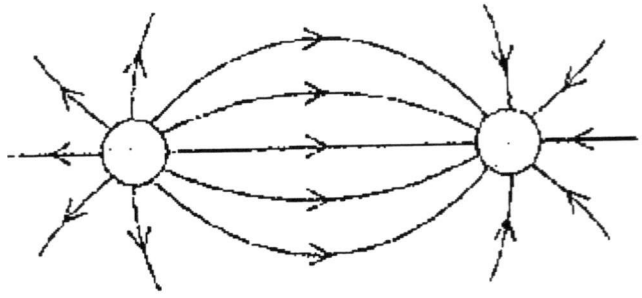
16 Sphere X carries a negative charge and sphere Y carries a positive charge. They are placed a short distance apart and a small negative charge P is placed between them.



In which direction does P move, and what is the force between X and Y?

	movement of P	force between X and Y
A	towards X	attraction
B	towards Y	attraction
C	towards X	repulsion
D	towards Y	repulsion

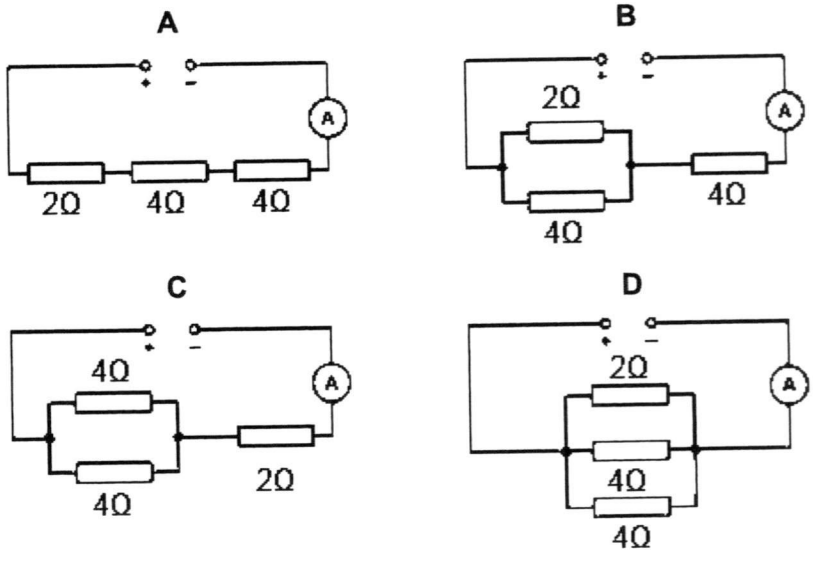
17 The diagram shows the electric field pattern between two isolated point charges.



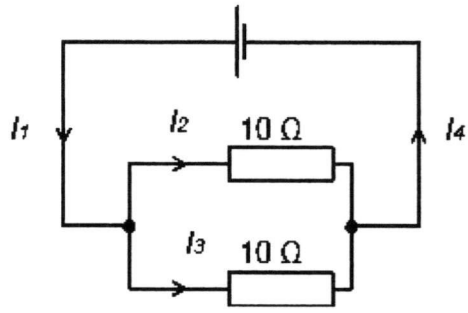
Which two point charges produce this pattern?

18 An ammeter is connected to three resistors and a power supply.

Which arrangement of resistors gives the smallest ammeter reading?



19 The current in different parts of the circuit are I_1, I_2, I_3 and I_4.



Which statement is correct?

A $I_1 = I_4$ and I_2 is greater than I_3.
B $I_1 = I_4$ and I_2 is less than I_3.
C $I_1 = I_4$ and $I_2 = I_3$.
D I_1 = is greater than I_4 and $I_2 = I_3$.

20 How could the unit of potential difference, the volt, also be written?

A A/s **B** C/A **C** C/J **D** J/C

End of Section A

Section B [45 marks]

Answer **ALL** the questions in the spaces provided.

1 A micrometer is used to measure the thickness of a sheet of glass.

When the jaws are closed without any sheet of glass, the micrometer reading is shown in Fig. 1.1. With the jaws closed around the sheet of glass, the micrometer reading is shown in Fig. 1.2.

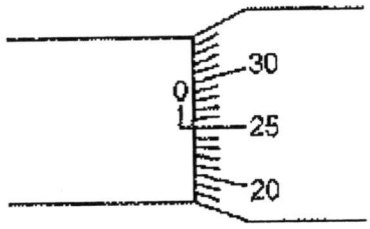


Fig. 1.1

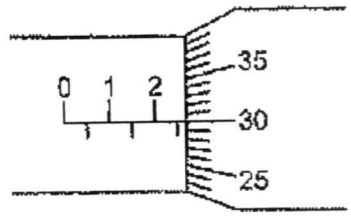


Fig. 1.2

(a) What is the zero error of the micrometer?

zero error = ...mm [1]

(b) What is the corrected reading of the micrometer?

corrected reading = ...mm [1]

2 In hospitals, doctors and nurses operate taps with their elbows to avoid contamination.

Fig. 2.1 shows a tap with a long handle.

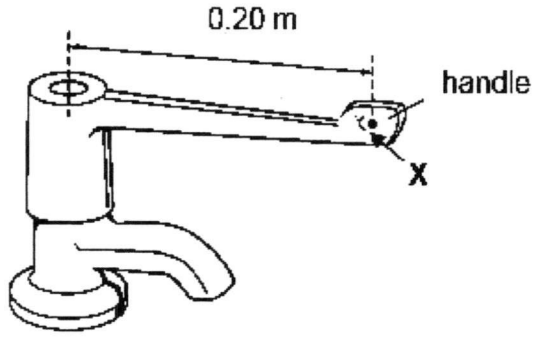


Fig. 2.1

(a) A doctor applies a force of 5.0 N at a point **X** on the handle, 0.20 m from the axis of the tap.

(i) Calculate the maximum moment about the axis that this force can produce.

moment = ...Nm [2]

(ii) The moment produced by the doctor is less than this maximum value.

Suggest a reason why this is so.

.....

.....[1]

(b) Describe how the force needed to operate the tap is affected by the length of the handle.

.....

..... [1]

3 **(a)** A car of mass 2000 kg is travelling on a road at a speed of 70 km/h.

(i) Convert 70 km/h to m/s.

70 km/h = ... m/s [1]

(ii) As the lorry stops, some of the kinetic energy is lost to the surroundings. State the energy conversion that occurs at this stage.

.....

.....

..... [1]

(b) A hair-dryer has a power rating of 500 W. Calculate the amount of useful energy produced by the hair-dryer when it is switched on for 10 minutes.

useful energy = ... J [2]

4 Fig. 4.1 shows a stationary boat in still water in a narrow tunnel.

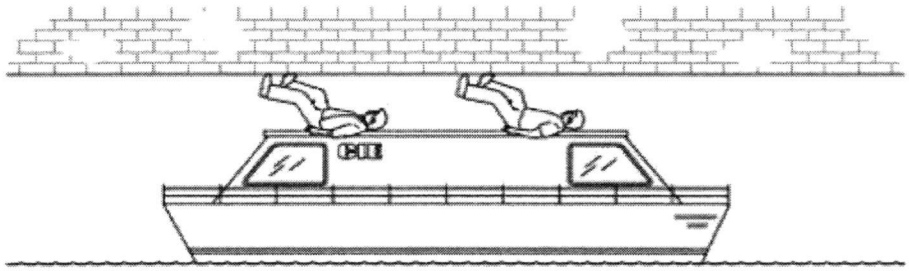


Fig. 4.1

To move the boat, two men lie on top of it and push it against the tunnel roof with their legs. They exert a total forward force of 2000 N on the boat.

(a) The men push the boat 50.0 m to the end of the tunnel. Calculate the work done on the boat by the men.

work done = ...J [2]

(b) Explain why the kinetic energy of the boat at the end of the tunnel is less than the work done on the boat by the men.

.....

.....

..... [2]

5 Tug boats are used to pull large ships in shallow waters.

Fig. 5.1 shows two tug boats pulling a large ship.

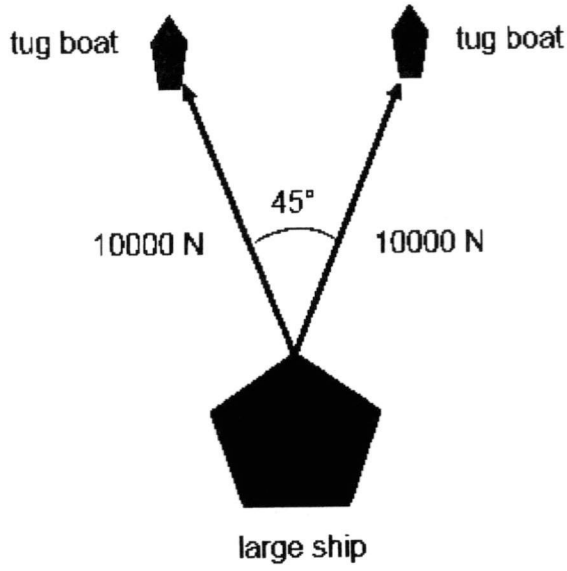
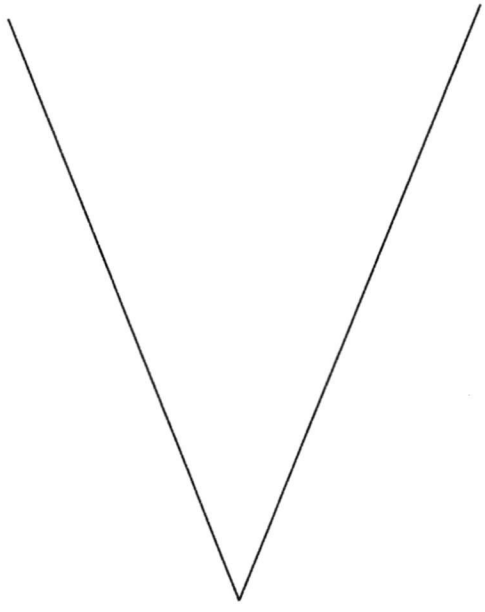


Fig. 5.1

The mass of the large ship is 3×10^6 kg. The angle between the forces exerted by the tug boats is 45°. Each tug boat pulls with a force of 10000 N in the direction as shown in Fig. 5.1.

Use the lines below to draw a suitable scale diagram to determine the resultant force the tug boats exert on the large ship. On your diagram, show the direction of each force. State the scale used.

[4]



Scale = 1 cm represents .....N

Resultant force = ...N

6 **(a)** Fig. 6.1 shows a uniform metre rule pivoted at the 34.0 cm mark.

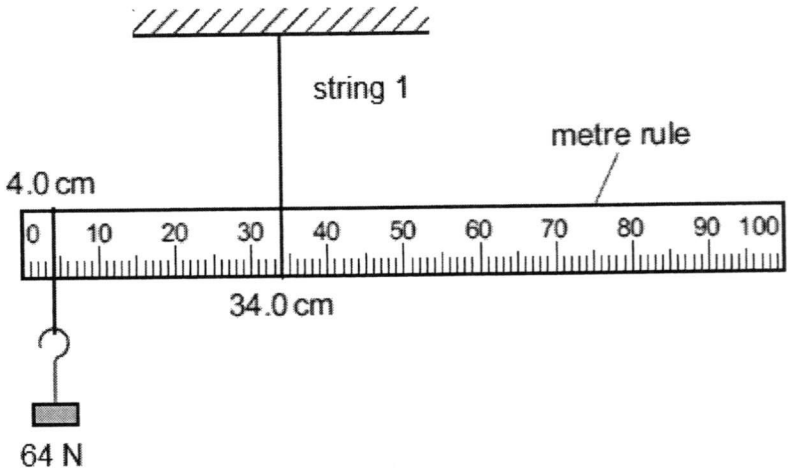


Fig. 6.1

A weight of 64 N suspended from the 4 cm mark balances the metre rule horizontally.

(i) On Fig. 6.1, draw an arrow to represent the weight of the metre rule. [1]

(ii) Define the *principle of moments*.

.....

.....[2]

(iii) Calculate the weight of the metre rule.

weight = ... N [2]

(iv) What is the tension in string 1?

tension = ... N [1]

(b) Fig. 6.2 shows a boy stands with his right foot and right shoulder touching a wall.

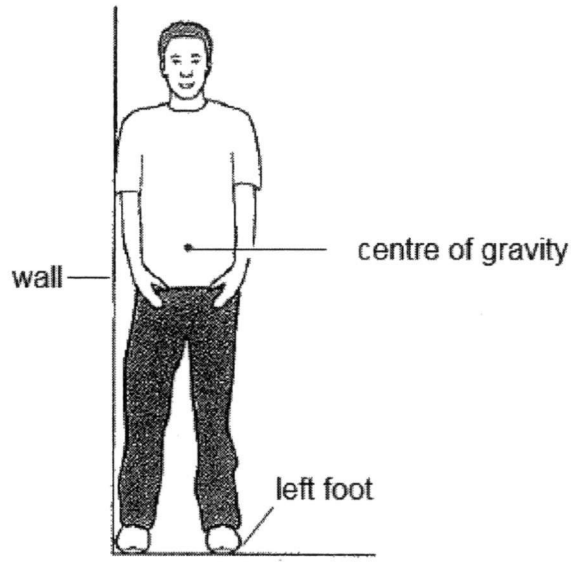


Fig. 6.2

Explain why the boy cannot raise his left foot off the ground without losing his balance.

.....

.....

.....[2]

7 **(a)** Fig. 7.1 shows two empty garden pots **A** and **B**.

pot **A** pot **B**

Fig. 7.1

State and explain which pot is more stable. Give two reasons for your answer.

The more stable pot is .....

reason 1.....

reason 2.....

[2]

(b) Give an example of an object in real life which is made more stable using the idea in **(a)**.

.....

.....

[1]

8 A block has a mass of 10 kg.

(a) An adult pushes the block with a force, *F1*, of 50 N towards the right. There is a frictional force, *F2*, of 20 N acting on the block. On Fig. 8.1, draw and label arrows to represent *F1* and *F2*.

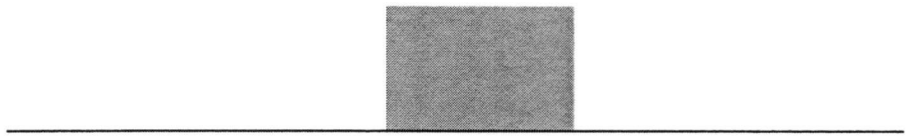


Fig. 8.1

[2]

(b) Calculate the acceleration of the block.

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

9 Fig. 9.1 shows a softball as it comes in contact with a bat.

Fig. 9.1

The softball has a mass of 0.20 kg and it hits the bat with a speed of 30 m/s. After being in contact with the bat for 0.0013 s, the softball rebounds with a speed of 20 m/s in the direction exactly opposite to its original direction.

Calculate

(a) the change in velocity of the softball,

velocity change = ... m/s [1]

(b) the average acceleration of the ball whilst in contact with the bat,

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

(c) the average force exerted on the ball by the bat.

force = ... N [2]

10 **(a)** Describe what is meant by an *electric field*.

.....

..... [1]

(b) What does the direction of the electric field represent?

.....

..... [1]

(c) Fig. 10.1 shows an isolated positive point charge. On Fig.10.1, draw the electric field pattern due to the charge. Show the direction of the field.

[2]

Fig. 10.1

11 A wire of length L and cross-sectional area A has a resistance of 10 Ω. Using wires of the same material, state the value of the corresponding resistance R for each of the combinations below.

resistance R / Ω	length L / m	cross-sectional area A / m^2
	$2L$	A
	$2L$	$2A$
	L	$A/2$

[3]

End of Section B

Section C [20 marks]

Answer any **two** questions from this section. Answer in the spaces provided.

12 **(a)** A rock from space is travelling in a straight line at high speed when it enters the Earth's atmosphere.

The speed v of the rock is measured at different times t.
Fig. 12.1 shows the results obtained.

time/s	speed/m/s
0	6000
5	6000
10	6000
15	5800
20	4600
25	3400
30	2200
35	1200
40	1000
45	1000
50	1000

Fig. 12.1

(i) Using the data in Fig. 12.1, plot a graph of speed of the rock against time on Fig. 12.2.

[3]

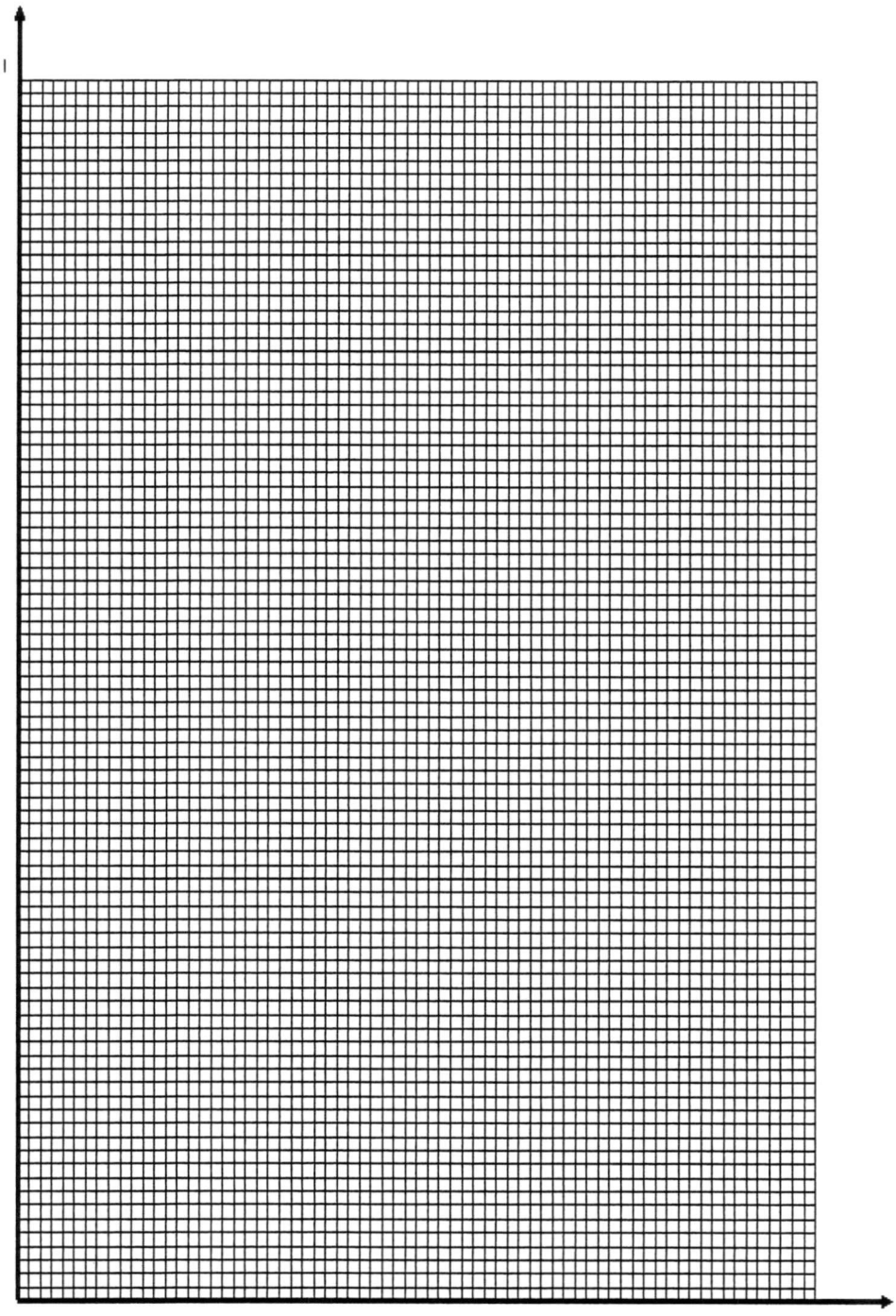


Fig 12.2

(ii) On Fig. 12.2, mark

- a letter A, where the rock is moving with constant speed,
- a letter B, where the rock is moving with uniform deceleration.

[2]

(iii) At time t = 25 s, the mass of the rock is 12.0 kg. Determine the size of the acceleration of the rock at the time t = 25 s.

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

(b) With reference to the forces acting on the rock, describe and explain the variation in acceleration of the rock.

From t = 10 s to t = 40 s.....

.....

.....

.....

From t = 40 s to t = 50 s.....

.....

.....

.....[3]

13 **(a)** Fig. 13.1 shows a ball rolling down a hill.

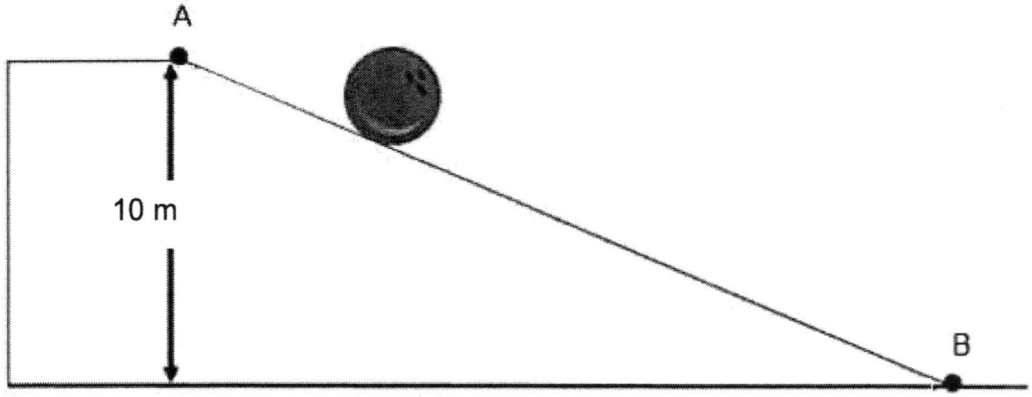


Fig 13.1

The ball starts from at point A at a speed of 3.0 m/s and rolls down the hill to point B, through a vertical distance of 10 m.

The mass of the ball is 5 kg.

(i) Calculate the gravitational potential energy possessed by the ball at point A.

gravitational potential energy = ...J [2]

(ii) Calculate the kinetic energy possessed by the ball at point A.

kinetic energy = ...J [2]

(iii) State the total energy at point A.

total energy at point A = ...J [1]

(iv) Calculate the speed of the ball at point B.

speed at point B = ...m/s [2]

(v) Describe and explain the effect of raising the height of the ramp on the speed of the ball.

.....

.....

.....[2]

(b) A car drives around a bend at constant speed.

Explain why the car's velocity changes even though its speed is constant.

.....

.....

..... [1]

14 A 2.0 V cell, an ammeter and three resistors are used to set up the circuit as shown in Fig. 14.1.

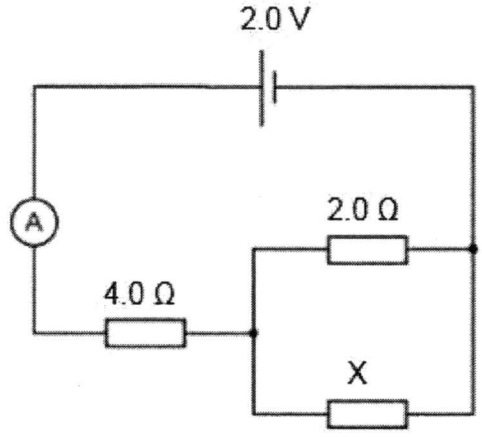


Fig 14.1

(a) Resistor X and the 2.0 Ω resistor have a combined resistance of 1.0 Ω.

Calculate

(i) the resistance of X,

resistance of X = ...Ω [2]

(ii) the total resistance of the circuit.

total resistance = ... Ω [1]

(b) Determine the reading of the ammeter.

reading = ...A [2]

(c) State the potential difference (p.d) across

(i) the 4.0 Ω resistor,

p.d. = ...V [1]

(ii) the 2.0 Ω resistor.

p.d. = ...V [1]

(d) With an aid of a diagram, describe an experiment to determine the resistance of a metallic conductor using a voltmeter and an ammeter.

.....

.....

.....

.....

.....

..... [3]

End of Paper

Marking Scheme

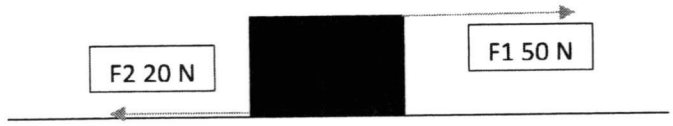
Section A

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

Section B

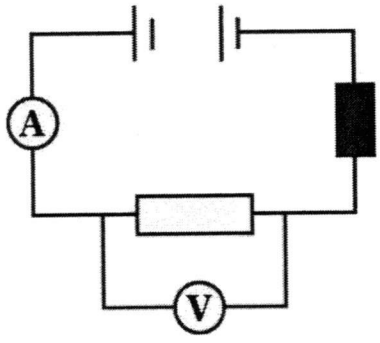
1		
i)	0.25	B1
ii)	Corrected reading = observed reading – zero error or 2.80 – 0.25 = 2.55	B1
		[2]
2		
ai	Fxd or 5.0 x 0.20	M1 A1
	Force is not applied at right angles to the tap	B1
	long(er) distance needs small(er) force (for same moment)	B1
		[4]
3		
ai	$\frac{70km}{h} = \frac{70000m}{3600s}$ $= 19.4$	
Aii	Heat energy and sound energy	B1
b	$power = \frac{W\ D}{time}$ $500 = \frac{energy}{10 \times 60}$ $energy = 300000$	A1
		[4]
4		
a	FXD or 2000x50 100000	M1 A1
b	friction/drag/resistance of water/air work done against friction/resistance/drag or energy lost due to friction/resistance/ drag or energy lost as heat/internal/thermal	B1 B1

		[4]
5	Scale given (must have unit of cm:N or cm/N or N:cm or N/cm)	B1
	Correct triangle or rectangle and correct resultant	B1
	18 000 N <= value <= 18 500 N	B1
	Direction of resultant force indicated on the triangle	B1
	** must check..	
		[4]
6		
ai	At the 50 cm mark	B1
aii	Clockwise moment is equals to anti-clockwise moment When a body is in equilibrium the sum of the **clockwise moment *about a pivot*** is **equals to the sum of the anti-clockwise** moment ***about the same pivot***.	B1 B1
aiii	64X0.3 = 0.16XW W = 120	M1 A1
aiv	T = 120 + 64 = 184	B1
b	When the boy lifts his left foot the weight of the boy now acts outside of the base	**B1**
	Weight acts outside of the base; causes a resultant clockwise moment about his right foot (pivot) which causes him to lose his balance.	**B1**
		[8]
	The more stable pot is pot B	
	Reason 1: CG is lower	**B1**
	Reason 2: Base is broader/contact area	Award 1 mark if both reasons are correct
b	A wine glass has a broad base. This lowers its centre of gravity when it is filled with liquid. / A racing car is constructed with a very low centre of gravity and a broad base area. / A container ship loads its heaviest cargo near the bottom of the ship to lower the centre of gravity of the ship.	

		[3]
8		
		**B2**
	A = F/M = 30/10 = 3	**M1** **A1**
		[4]
9		
a	(-) 50	**B1**
B	(-) 50/0.0013	**C1** **A1**
		C1 **A1**
		[5]
10		
a	(region) where (electric) charge experiences an electric force	**B1**
b	direction of electric force that would act on a small **positive**	**B1**
c	Radiating outwards Symmetrical  + charge	**B1** **B1**
		[4]
11	B: 20	**B1**
	C:10	**B1**
	D: 20	**B1**
		[3]

Section C

12			
AI	Labelling of axes Accuracy of plotted points (one mark for every 5 correct plotted points)	B1 B1 B1	Some didn't know how to label the axes. Some labelled wrongly e.g. ms, m-s
AII	t>=0 and t<=10s OR t>=40 and t<=50s	B1	Generally well done.
			Generally well done.
AIII	Two speed values from graph between 20 s to 30 s AND Two corresponding time between 20 s and 30 s a = (v-u)/t (-)240 m/s2 (variation of 1 unit on the graph)	B1 A1	Most were able to quote the correct formula to use. Some used the wrong points. A number tried to use the F = MA formula to solve the question.
	Gravitational Force and air resistance act on the rock	B1	Poorly done. Only a handful used the forces acting on the body to explain the variation of acceleration of the rock.
	10s to 40s: unbalanced forces/gravitational force > air resistance/body experiences acceleration	B1	Most described the acceleration.
	40s to 50s: balanced forces/gravitational force = air resistance/body experiences NO acceleration/constant speed	B1	Most described the acceleration.
		[10]	
13			

aI	Mgh 5x10x10 500	M1 A1	Question well done.
aII	1/2MV2 OR 1/2X5X3X3 22.5	M1 A1	Question well done.
aIII	500+22.5 = 522.5	**A1**	**Most sum ai and aii.**
aIV	1/2MV.V ½(5)(V2) = 522.5 V = 14.5	M1 A1	
av	Increase in energy /increase in GPE/increase in KE Speed of the ball increases	B1	Most students understood that the KE when it reaches the bottom of the ramp. This translates into greater speed.
	stays the same	B1	Most were not able to explain that direction of the car changes resulting in the change in velocity.
		[10]	
14			
AI	(1/2 + 1/X)-1 = 2	M1 A1	
AII	5	B1	No issue.
B	R = V/I	M1 A1	No issue.
CI	4/5*2 = 1.6	A1	No issue.
CII	1/5*2 = 0.4	A1	A number got this wrong.
D	Diagram  Vary resistance, record V and I. Plot graph of V against I. Ratio of V against I gives u the R.	B1 B1	

		B1	
		[10]	