Geylang Methodist School (Secondary)
Mid-Year Examination 2017

SCIENCE (Physics/Chemistry) **5076/01**

Paper 1 **Sec 3 Express**

Additional materials : OAS **45 minutes**

Setter : Mr Yip Cheng Hou **12 May 2017**

READ THESE INSTRUCTIONS FIRST

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1 The gravitational field strength on Earth is around 10 N/kg.

Which of the following is the definition for gravitational field strength?

A It is the amount of gravitational force acting on every kilogram of object.
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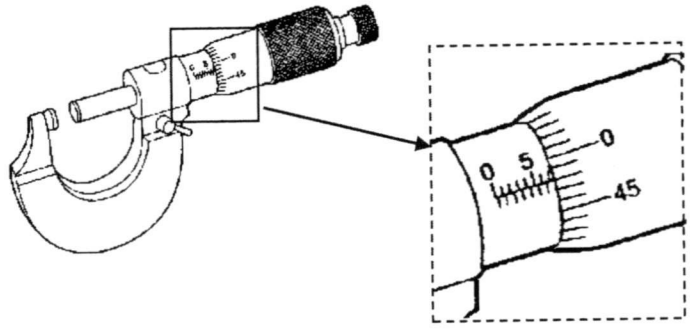

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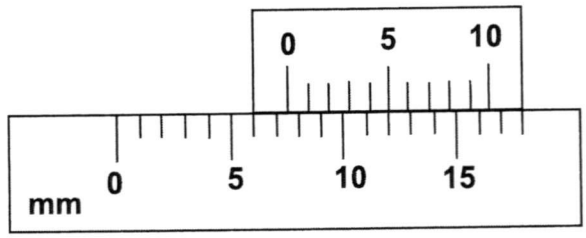

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How long does another pendulum of the same length, but carries a 200 g bob, take to complete 1 swing?

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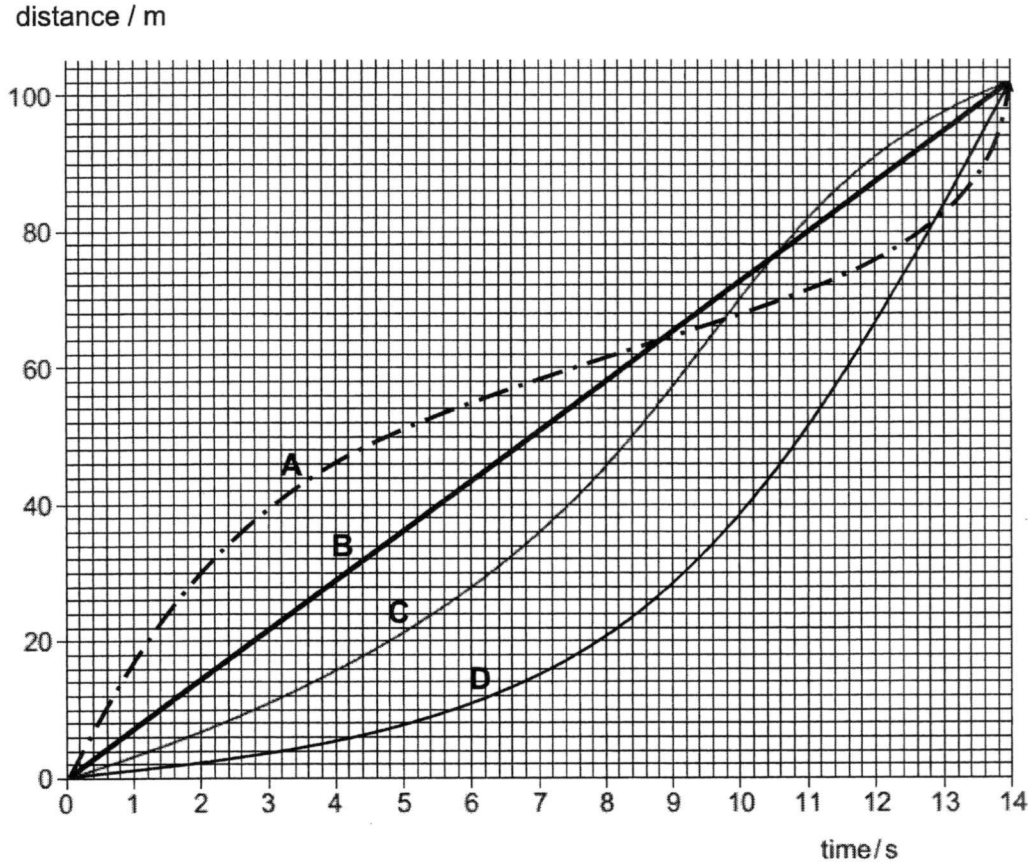

Who is the fastest athlete who won the race?

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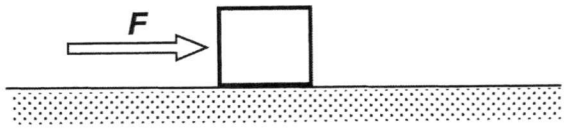
What is the car's acceleration?

A -10 ms^{-2} **B** -20 ms^{-2} **C** 10 ms^{-2} **D** 20 ms^{-2}

Refer to the situation below to answer questions 7 and 8.

A force F acting on an object which is placed on a rough surface as shown in the diagram.



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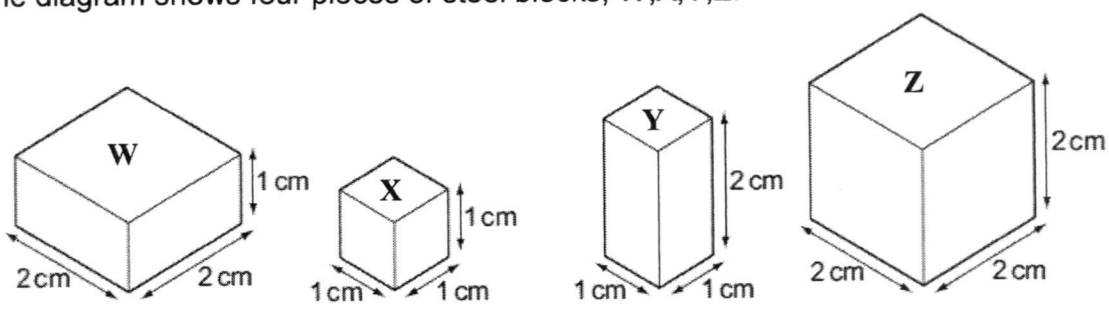

Which of the following statements is correct?

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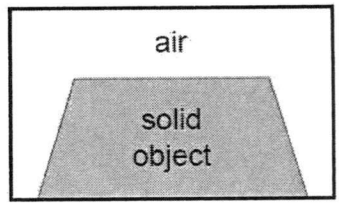

What is the mass of the object?

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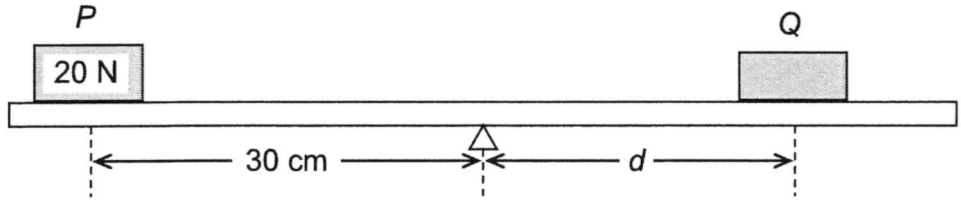

Which of the following are possible values for the weight of object *Q* and distance *d* from the pivot?

	Weight of object Q / N	***d / cm***
A	20	20
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D	40	30

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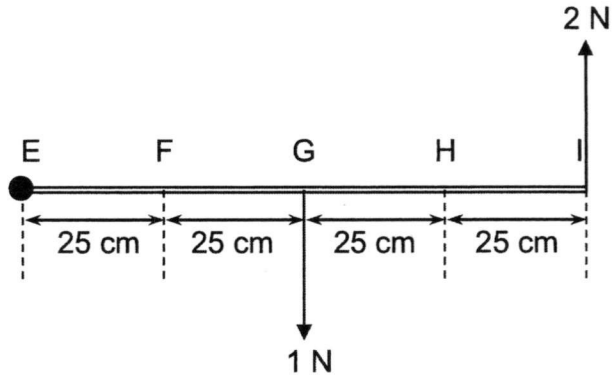

Under which of the following conditions will the stick be in equilibrium?

A Apply an upward 2 N force at G.

B Apply a downward 2 N force at F.

C Apply a downward 2 N force at H.

D Apply a downward 2 N force at I.

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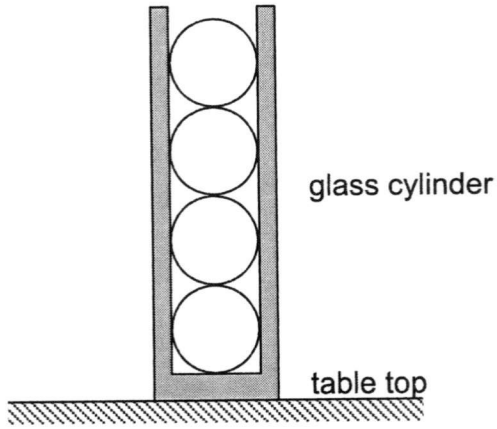

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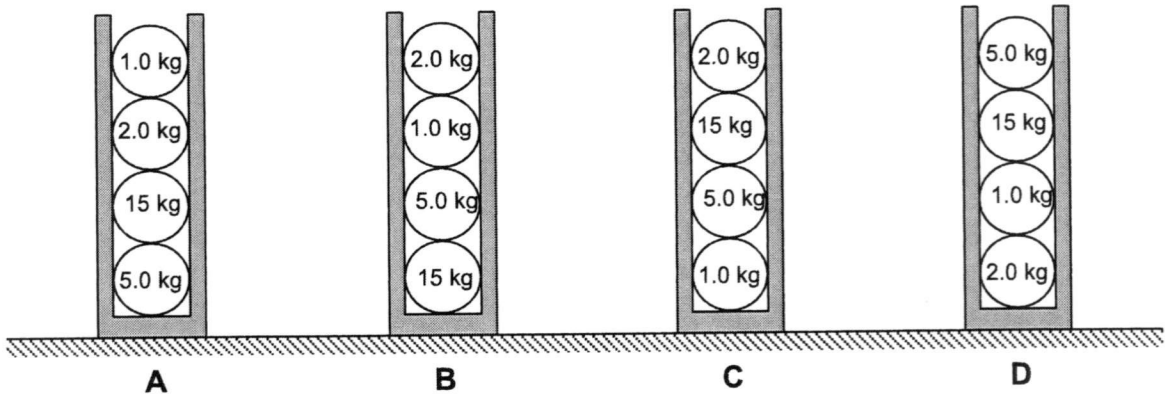

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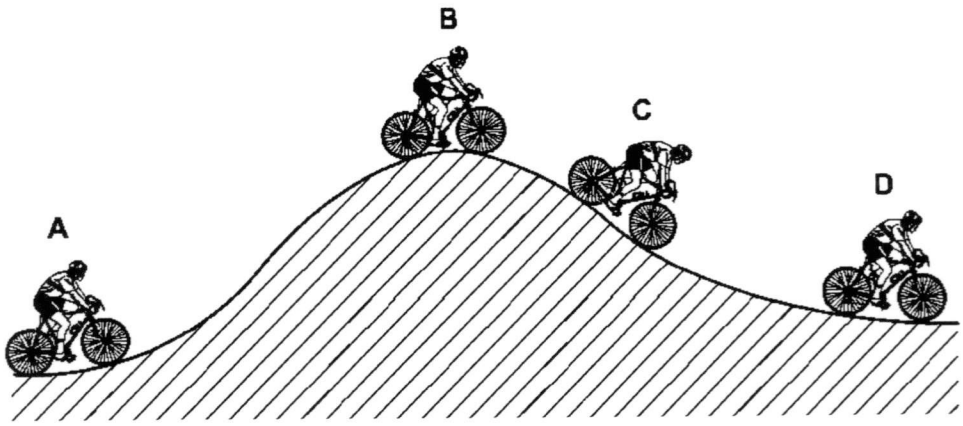

At which position does the cyclist have the least kinetic energy and gravitational potential energy?

15 The efficiency of an electrical generator is 65 %.

Which useful output can be expected if the energy input to the generator is 12 kJ?

A 4.2 kJ **B** 7.8 kJ **C** 18.5 kJ **D** 34.3 kJ

END OF PAPER 1

Geylang Methodist School (Secondary)
Mid-Year Examination 2017

Candidate Name			
Class		Index Number	

SCIENCE (PHYSICS)

5076/02

Paper 2

Sec 3 Express

Additional materials : Writing Papers

1 hour

Setter : Mr Yip Cheng Hou

08 May 2017

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.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your answers to **Section A** and **Section B** in the spaces provided on the question paper.

Candidates are reminded that all quantitative answers should include appropriate units. You are advised to show all your working in a clear, orderly manner.

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For Examiner's Use	
Section A	/ 35
Section B	/ 20
Total	/ 55

This document consists of **11** printed pages and **1** blank page.

[Turn over

SECTION A

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

1(a) Water is poured into the measuring cylinder shown in Fig. 1.1.

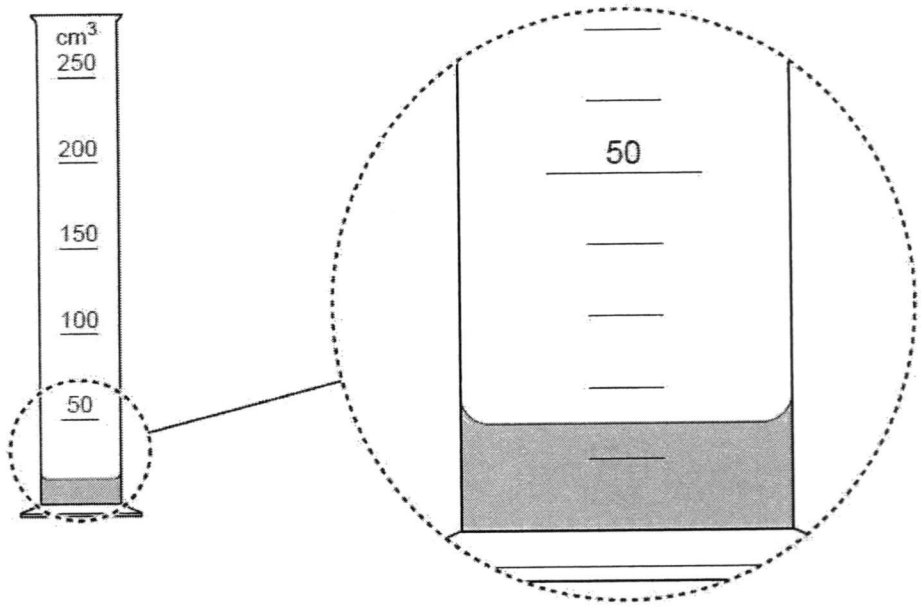


Fig. 1.1

(i) Estimate the volume of water using Fig. 1.1.

volume = ... [1]

(ii) **On the enlarged part of Fig. 1.1**, draw the level of water when another 25 cm^3 of water has been added to the measuring cylinder. [1]

1(b) A student carries out an experiment to find the density of water, using a method that is slightly different from normal. In his method, he starts with a measuring cylinder containing some water, and then adds more water to that already in the measuring cylinder. His experiment is illustrated in Fig. 1.2.

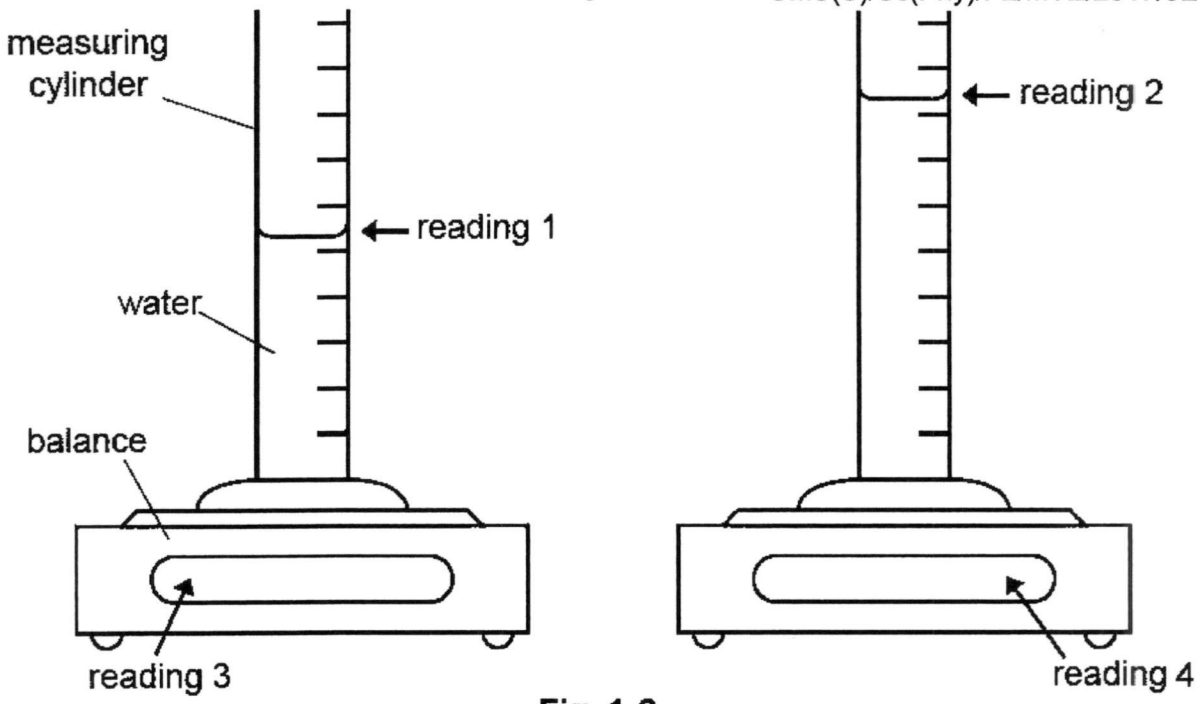


Fig. 1.2

The readings he obtains are as follows:
reading 1: 53 cm^3
reading 2: 84 cm^3
reading 3: 205 g
reading 4: 238 g

Calculate

(i) the volume of the added water,

volume = ... [1]

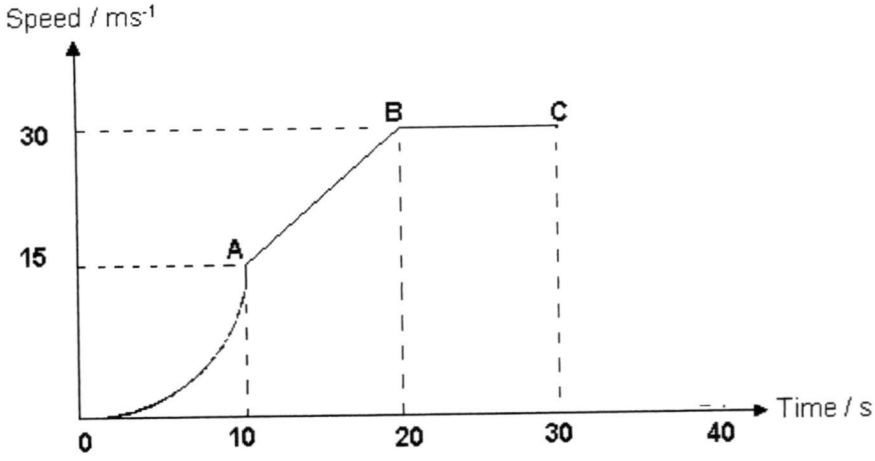
(ii) the mass of the added water,

mass = ... [1]

(iii) the density of water in kg / m^3,

density = ... [3]

2 The graph below shows the speed of a car changing with time.



(a) Describe the motion of the car during the first 10 s.

.....[1]

(b) Calculate the acceleration the car from time = 10 s to time = 20 s.

acceleration = ... [2]

(c) At point C, the car started to decelerate uniformly until it was brought to a stop 10 seconds later. Complete the graph above to show this last part of the motion of the car. [1]

(d) Calculate the distance travelled by the car from time = 30 s to time = 40 s.

distance = ... [2]

3 **Fig. 3.1** shows four forces acting on an object.

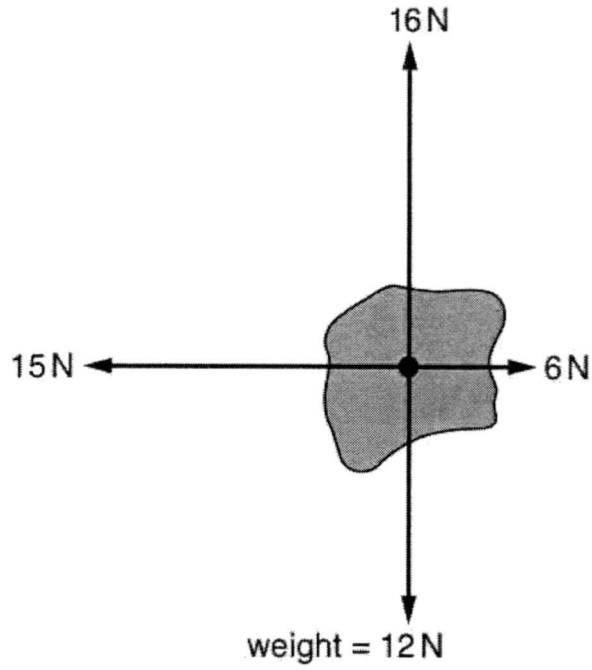


Fig. 3.1

(a) Draw a labelled vector diagram to scale to determine the magnitude and direction of the resultant force acting on the object.

scale = ...

magnitude = ...

direction = ... [4]

(b) State the effect of the four forces on the motion of the object.

.....

.....[2]

4 Fig 4.1 shows a lamina suspended from a hole on one corner at A. The mass of the metal is 20 g and the centre of gravity is at B. The diagram is drawn full scale.

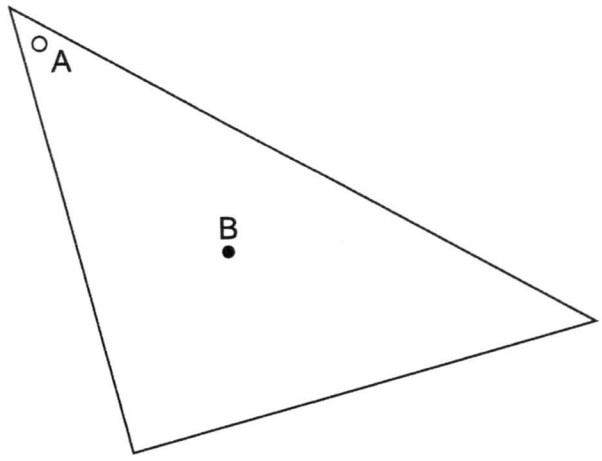


Fig. 4.1

(a) Explain what is meant by the *centre of gravity* is at B.

.....

.....[1]

(b) The lamina turns because of the moment of the weight about point A. State what is meant by the *moment* of the weight and how is it calculated.

.....

.....

.....[2]

(c) Using a measurement taken from Fig 4.1, calculate the moment of the weight about point A. On Fig 4.1, indicate the measurement that you make.

moment = ... [3]

(d) The lamina in Fig 4.1 swings freely and comes to rest. In the space below, sketch a diagram of the lamina in its final rest position. Mark the points A and B on your diagram. [1]

(e) Explain why the lamina remains at rest in this position?

.....

.....[2]

(f) When the lamina is placed on a table, state the type of equilibrium of the lamina. Explain why the lamina remains at rest in this position?

.....[1]

(g) State three reasons to explain your answer in **(f)**.

.....

.....

.....

.....[3]

5 A ball originally at position **A** is raised to position **B**.

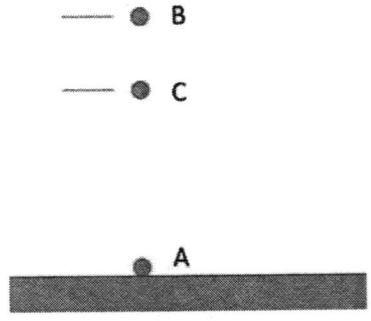


Fig. 5.1

(a) Assuming no loss of energy to the environment, what type of energy is gained by the ball?

.....[1]

(b) The ball is released and falls. After one bounce, the ball rises only to the height of point **C**. Explain why the height is lower in terms of energy conversion involved from **B** to **C**.

.....

.....

.....

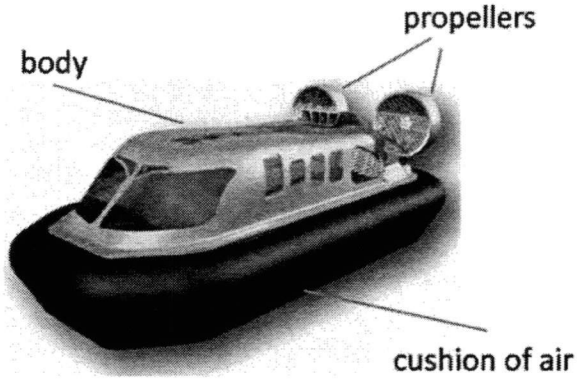
.....[2]

End of Section A

SECTION B

Answer **all** the questions in this section in the spaces provided.

7 A hovercraft moves on a cushion of air which is underneath it, as shown in the figure below. The cushion of air enables the body to "float" from the ground. The mass of the body is 25 000 kg.



(a) Calculate the upward force that is needed for the body to "float".

upward force = ... [2]

(b) The hovercraft starts moving horizontally from rest and reaches a speed of 3 m/s in 5.0 s. Calculate the average acceleration of the hovercraft.

average acceleration = ... [2]

(c) Determine the resistive forces exerting on the hovercraft if the forward force exerted by the propellers is 18 000 N.

resistive forces = ... [3]

(d) The pressure exerted by the hovercraft when it is resting on the ground is 31250 Pa.

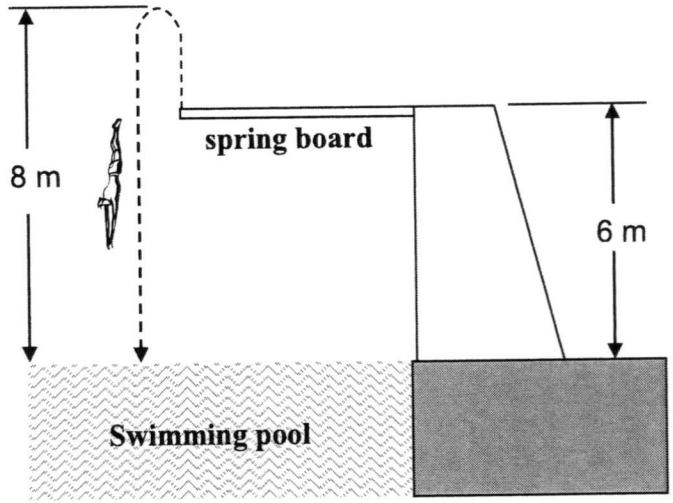
(i) Explain what is meant by *pressure exerted*.

.....[1]

(ii) Calculate the base area of the hovercraft.

base area = ... [2]

8 A 60 kg man climbs up a flight of steps to reach a spring board which is 6 m above the water surface in a swimming pool.



(a) State the Principle of Conservation of Energy.

.....

.....[1]

(b) If the man takes 12 s to reach the spring board,

(i) calculate the power developed by him and;

power = ... [2]

(ii) explain what is meant by the *power developed by him*.

.....[1]

(c) The man then jumps up into the air to reach a height of 8 m above the water surface and then falls into the water.

(i) Calculate the kinetic energy of the man as he reaches the water.

kinetic energy = ... [2]

(ii) Calculate the speed at which the man reaches the water.

speed = ... [2]

(iii) State whether the actual speed will be greater, equal or less than the calculated value in **(iii)**. Explain why.

.....

.....[2]

END OF PAPER

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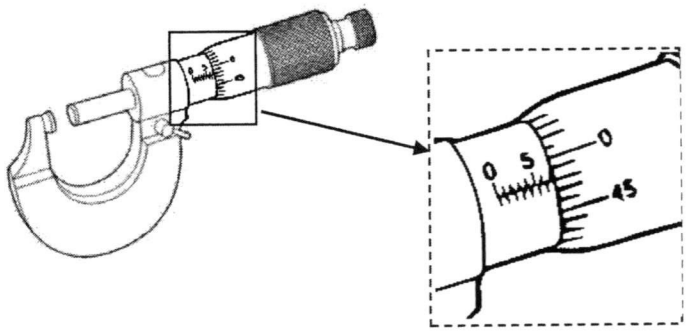

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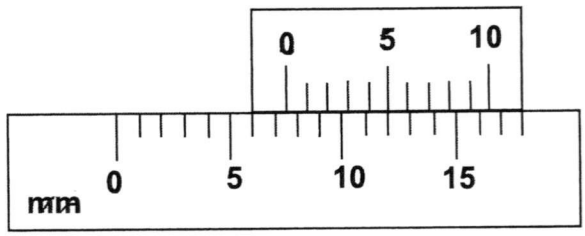

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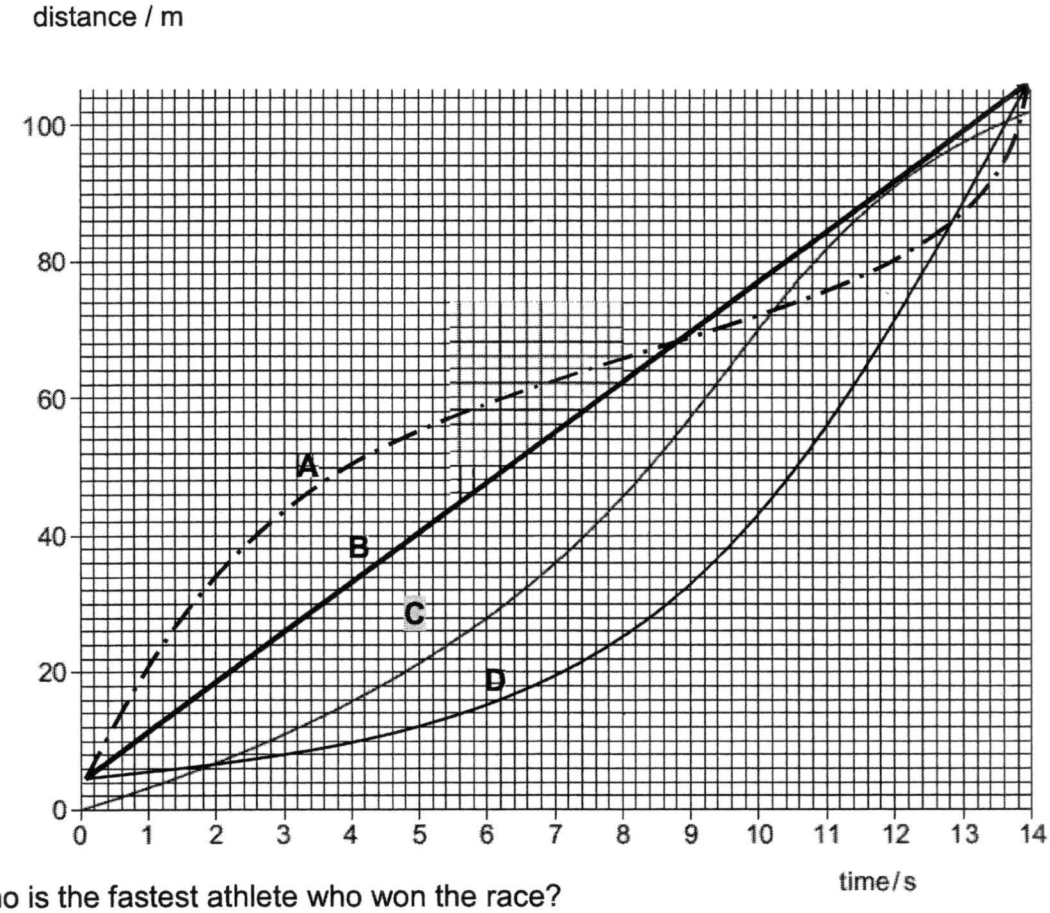

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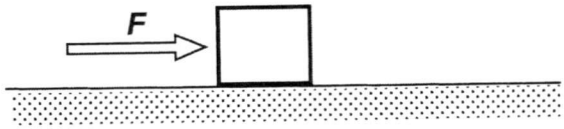

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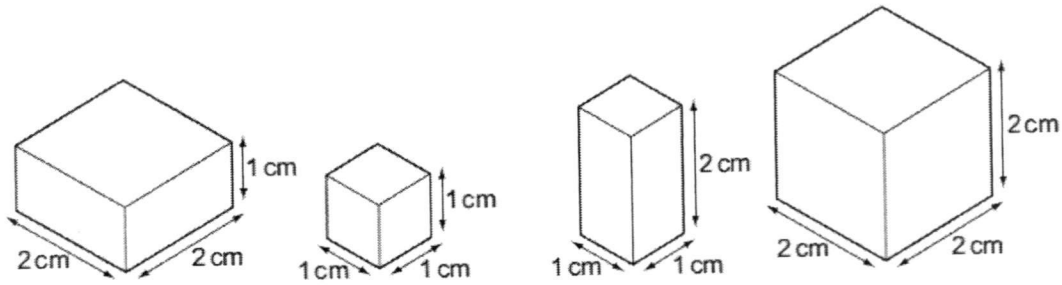

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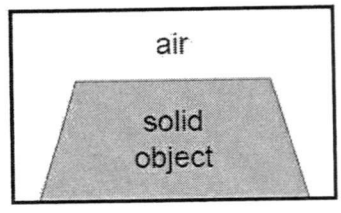

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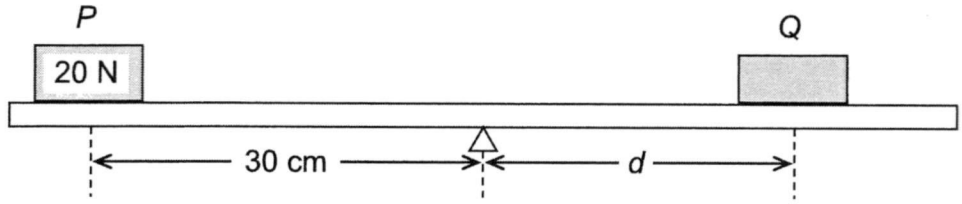

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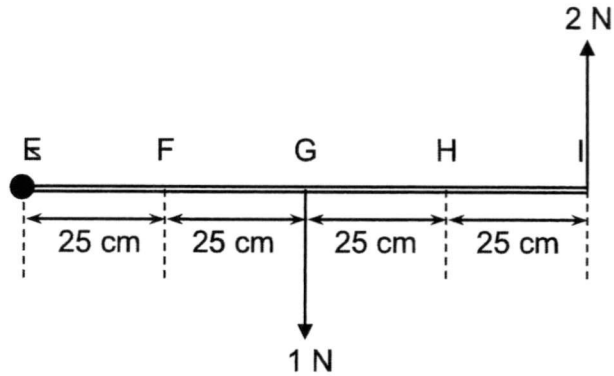

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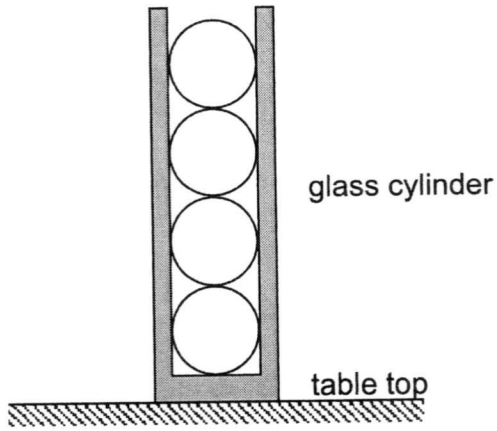

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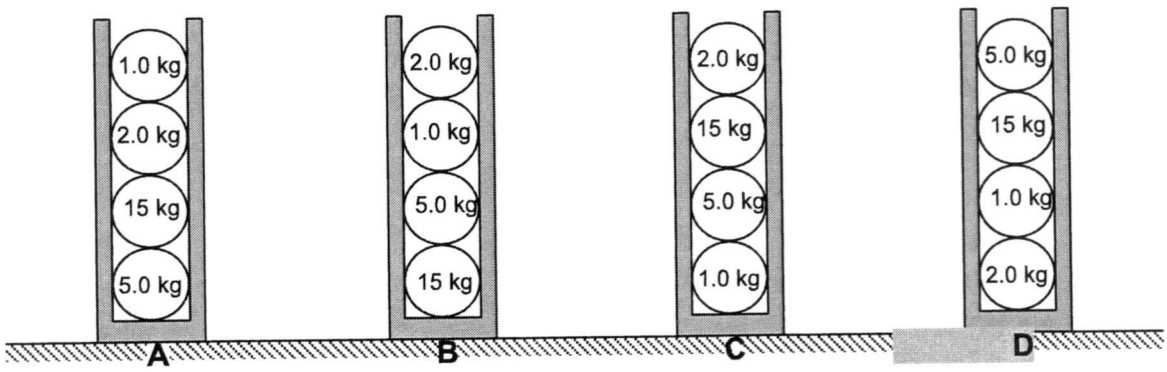
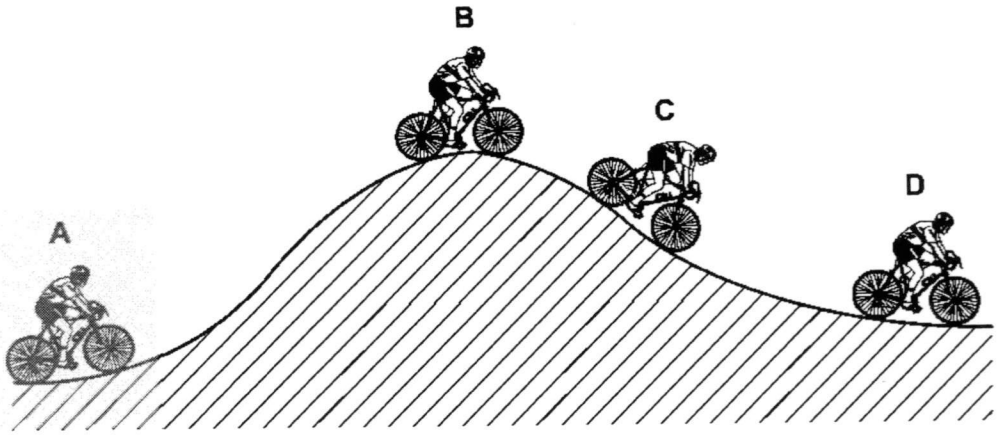


14 The diagram shows a cyclist pedalling up a hill and rolling downhill.



At which position does the cyclist have the least kinetic energy and gravitational potential energy?

15 The efficiency of an electrical generator is 65 %.

Which useful output can be expected if the energy input to the generator is 12 kJ?

A 4.2 kJ **B** 7.8 kJ **C** 18.5 kJ **D** 34.3 kJ

END OF PAPER 1

Geylang Methodist School (Secondary)
Mid-Year Examination 2017

Candidate Name	ANSWERS		
Class		Index Number	

SCIENCE (PHYSICS)

5076/02

Paper 2

Sec 3 Express

Additional materials : Writing Papers

1 hour

Setter : Mr Yip Cheng Hou

08 May 2017

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.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your answers to **Section A** and **Section B** in the spaces provided on the question paper.

Candidates are reminded that all quantitative answers should include appropriate units. You are advised to show all your working in a clear, orderly manner.

Gravitational field strength is assumed to be 10 N/kg and acceleration due to gravity, *g*, is assumed to be 10 m/s^2, unless otherwise specified.

For Examiner's Use	
Section A	/ 35
Section B	/ 20
Total	/ 55

This document consists of **11** printed pages.

SECTION A

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

1(a) Water is poured into the measuring cylinder shown in Fig. 1.1.

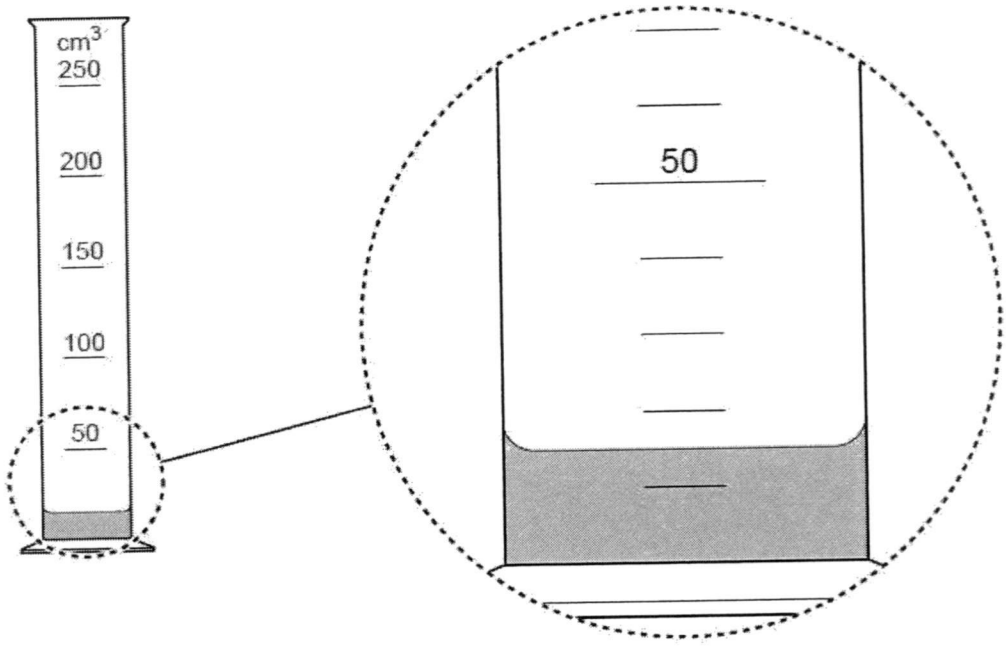


Fig. 1.1

(i) Estimate the volume of water using Fig. 1.1.

volume = ...**15 cm^3**..... [1]

(ii) **On the enlarged part of Fig. 1.1**, draw the level of water when another 25 cm^3 of water has been added to the measuring cylinder. **40 cm^3** [1]

1(b) A student carries out an experiment to find the density of water, using a method that is slightly different from normal. In his method, he starts with a measuring cylinder containing some water, and then adds more water to that already in the measuring cylinder. His experiment is illustrated in Fig. 1.2.

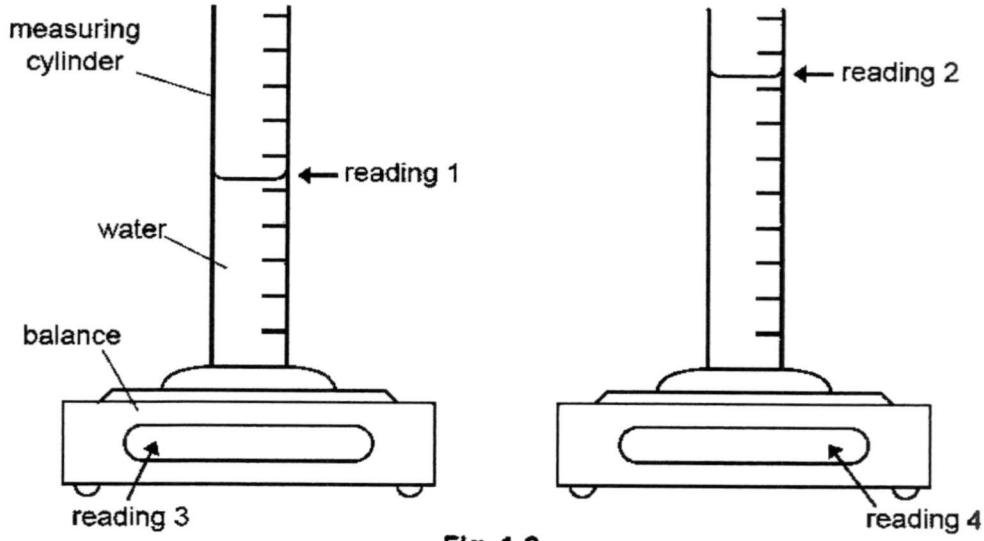


Fig. 1.2

The readings he obtains are as follows:
reading 1: 53 cm^3
reading 2: 84 cm^3
reading 3: 205 g
reading 4: 238 g

the volume of the added water,

84 – 53 = 31 cm^3

volume = ... [1]

(ii) the mass of the added water,

238 - 205 = 33 g

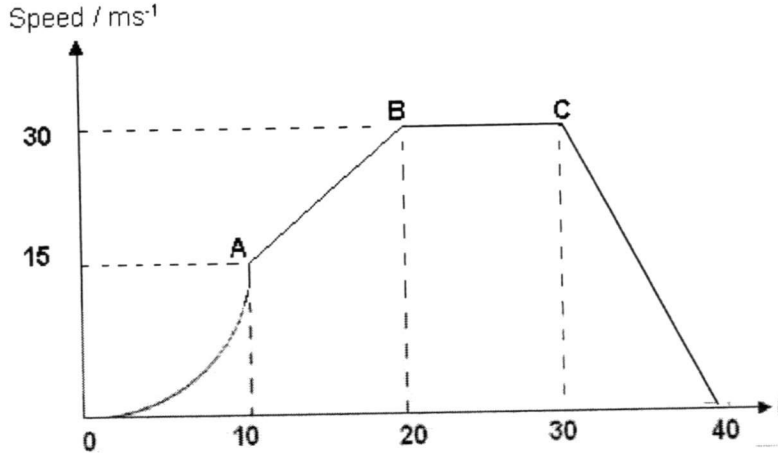
mass = ... [1]

(iii) the density of water in kg / m^3,

ρ = m / v
= 33 g / 31 cm^3 (1)
= 1.06 g / cm^3 (1)
= 1060 kg / m^3 (1)

density = ... [3]

2 The graph below shows the speed of a car changing with time.



(a) Describe the motion of the car during the first 10 s.

The car is moving with an increasing (½) acceleration (½).

.....[1]

(b) Calculate the acceleration the car from time = 10 s to time = 20 s.

a = (v - u) / t
= (30 - 15) / 10 (1)
= 1.5 m/s^2 (1)

acceleration = ... [2]

(c) At point C, the car started to decelerate uniformly until it was brought to a stop 10 seconds later. Complete the graph above to show this last part of the motion of the car. [1]

(d) Calculate the distance travelled by the car from time = 30 s to time = 40 s.

d = area under graph
= ½ x 10 x 30 (1)
= 150 m (1)

distance = ... [2]

3 **Fig. 3.1** shows four forces acting on an object.

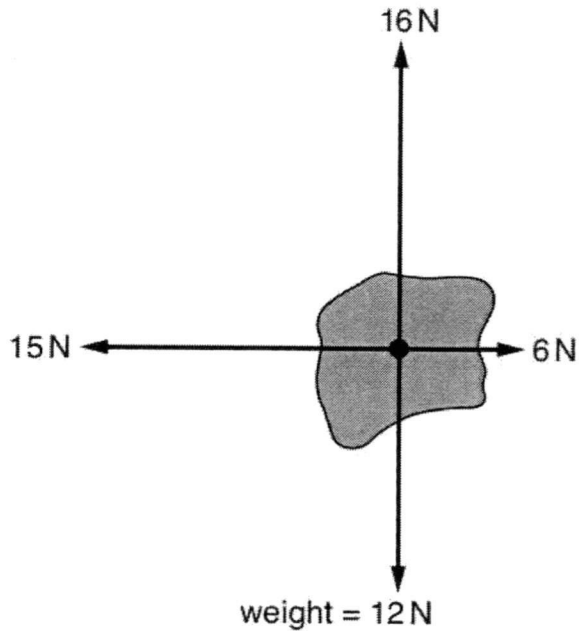
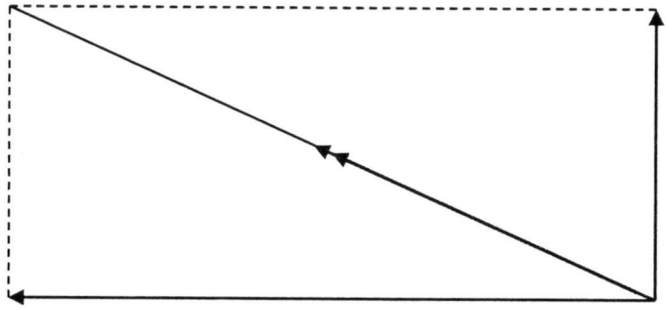


Fig. 3.1

(a) Draw a labelled vector diagram to scale to determine the magnitude and direction of the resultant force acting on the object.



scale = ...1 cm : 1 N.....

magnitude = ...9.9 N (8.9 ~ 10.9)....

direction = 24° from 9 N or 66° from 4 N [4]

(b) State the effect of the four forces on the motion of the object.
They will accelerate (1) the object in the direction of the resultant
.....
force (1)
.....[2]

4 Fig 4.1 shows a lamina suspended from a hole on one corner at A. The mass of the metal is 20 g and the centre of gravity is at B. The diagram is drawn full scale.

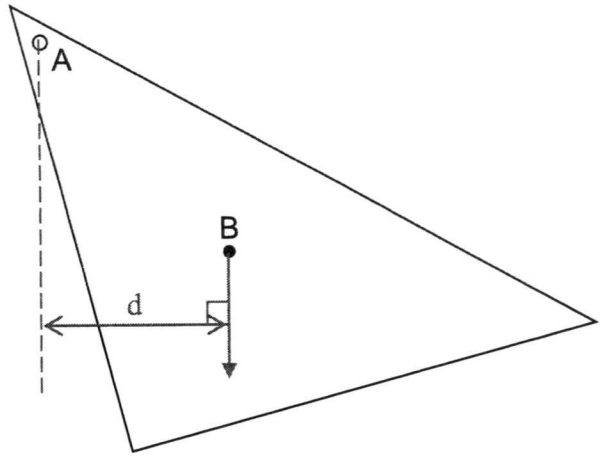


Fig. 4.1

(a) Explain what is meant by the *centre of gravity* is at B.

B is the point where the whole weight of the lamina appears to act
.....
through.
.....[1]

(b) The lamina turns because of the moment of the weight about point A. State what is meant by the *moment* of the weight and how is it calculated.

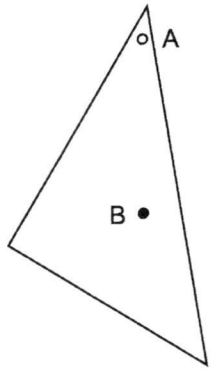
It is the turning effect caused by the weight (1). It is calculated by the
.....
product of the weight of lamina and the perpendicular distance d
.....
as indicated on Fig. 4.1
.....[2]

(c) Using a measurement taken from Fig 4.1, calculate the moment of the weight about point A. On Fig 4.1, indicate the measurement that you make.

Moment = (20/1000)kg x 10 N/kg x ____ cm = _____ N cm

moment = ... [3]

(d) The lamina in Fig 4.1 swings freely and comes to rest. In the space below, sketch a diagram of the lamina in its final rest position. Mark the points A and B on your diagram. [1]



(e) Explain why the lamina remains at rest in this position?

The perpendicular distance d between line of action of the weight and

.....

the pivot is zero (1), hence the moment is also zero (1).

.....[2]

(f) When the lamina is placed on a table, state the type of equilibrium of the lamina. Explain why the lamina remains at rest in this position?

Stable equilibrium

.....[1]

tate three reasons to explain your answer in **(f)**.

The height of C.G is raised when the lamina is tilted slightly.

.....

The line of action of the weight still lies within the base of the lamina.

.....

The lamina returns back to its original position after it is released.

.....

.....[3]

5 A ball originally at position **A** is raised to position **B**.

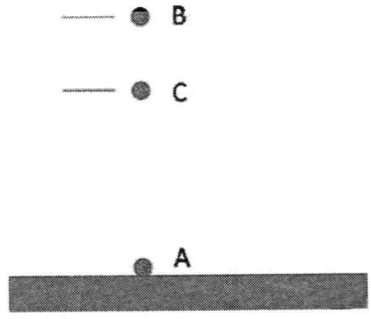


Fig. 5.1

(a) Assuming no loss of energy to the environment, what type of energy is gained by the ball?

gravitational potential energy.

.....[1]

(b) The ball is released and falls. After one bounce, the ball rises only to the height of point **C** Explain why the height is lower in terms of energy conversion involved from **B** to **C**.

Gravitational potential energy from B is converted to kinetic energy at A. However some kinetic energy at A is lost to the surrounding as heat and sound energy (1) so the remaining is converted to gravitational potential energy to reach a lower height at C (1).

.....

.....

.....

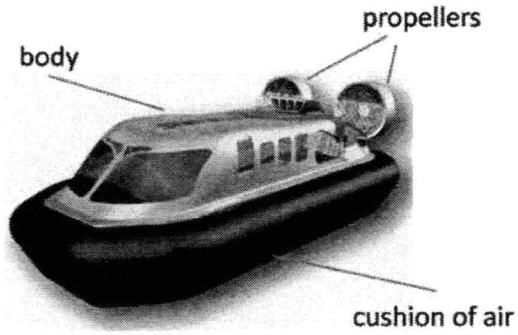
.....[2]

End of Section A

SECTION B

Answer **all** the questions in this section in the spaces provided.

7 A hovercraft moves on a cushion of air which is underneath it, as shown in the figure below. The cushion of air enables the body to "float" from the ground. The mass of the body is 25 000 kg.



(a) Calculate the upward force that is needed for the body to "float".

Upward force = Downward force
= 25 000 kg x 10 N/kg
= 250 000 N

upward force = ... [2]

(b) The hovercraft starts moving horizontally from rest and reaches a speed of 3 m/s in 5.0 s. Calculate the average acceleration of the hovercraft.

a = (v – u) / t
= (3 – 0) / 5
= 0.6 m/s^2 (1)

average acceleration = ... [2]

(c) Determine the resistive forces exerting on the hovercraft if the forward force exerted by the propellers is 18 000 N.

Resultant force, F = m x a
= 25 000 x 0.6 (1)
= 15 000 N (1)

Resultant force = Forward force – Resistive forces
15 000 N = 18 000 – Resistive forces
Resistive forces = 18 000 – 15 000
= 3000 N (1)

resistive forces = ... [3]

(d) The pressure exerted by the hovercraft when it is resting on the ground is 31250 Pa.

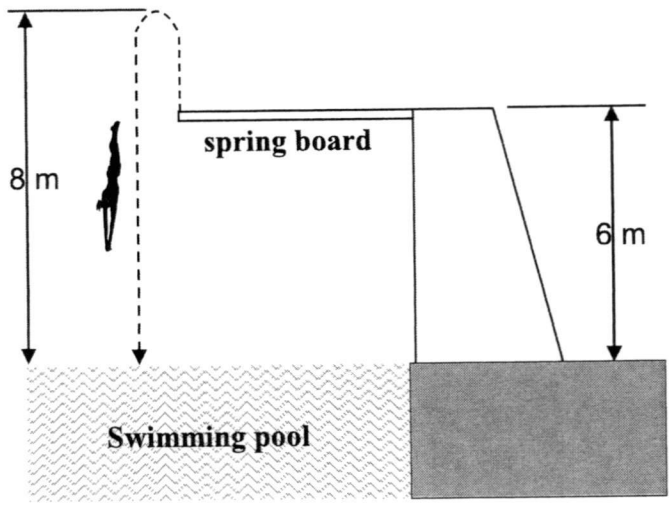
(i) Explain what is meant by *pressure exerted*.
It is the amount of force exerted on a unit area.
.....[1]

(ii) Calculate the base area of the hovercraft.

Pressure = F / A
31250 Pa = 250 000 N / A (1)
Area = 8 m^2 (1)

base area = ... [ ]

8 A 60 kg man climbs up a flight of steps to reach a spring board which is 6 m above the water surface in a swimming pool.



(a) State the Principle of Conservation of Energy.

Energy cannot be created nor destroyed, it can only be converted from one form to another, and the total amount remains constant.(1)
.....

.....[1]

(b) If the man takes 12 s to reach the spring board,

(i) calculate the power developed by him and;

P = E / t
= (60 kg x 10 N/kg x 6 m) / 12 s (1)
= 300 W (1)

power = ... [2]

(ii) explain what is meant by the *power developed by him.*

It means he developed 300 J of energy in every one second.
.....[1]

(c) The man then jumps up into the air to reach a height of 8 m above the water surface and then falls into the water.

(i) Calculate the kinetic energy of the man as he reaches the water.

Gain in KE = Loss in GPE
= m x g x h
= 60 kg x 10 N/kg x 8 m (1)
(1)

kinetic energy : ..... [2]

(ii) Calculate the speed at which the man reaches the water.

KE = ½ x m x v^2
4800 J = ½ x 60 kg x v^2 (1)
v = 12.6 m/s (1)

speed = ... [2]

(iii) State whether the actual speed will be greater, equal or less than the calculated value in **(iii)**. Explain why.

Less (1). Not all the energy is converted from GPE to KE. Some are converted into sound and heat loss to the surrounding. (1)
.....

.....[2]

END OF PAPER