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TAMPINES SECONDARY SCHOOL

Secondary Three Express

Weighted Assessment (Term 2) 2022

NAME

CLASS

REGISTER NUMBER

PHYSICS **6091**

Candidates answer on the Question paper

Calculator is allowed.

No Additional Materials are required.

11 May 2022

50 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black ink on both sides of the paper.
Do not use staples, paper clips, glue or correction fluid.

Section A

There are **ten** questions in this section. 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 answer. Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Section B

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

Section C

Answer **all** 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 (10 marks)	
SECTION B (20 marks)	
SECTION C (10 marks)	
TOTAL (40 marks)	

This document consists of **10** printed pages

Section A

Select the most appropriate answer and write the letter **A**, **B**, **C** or **D** into the boxes below.

1	2	3	4	5	6	7	8	9	10

1 An object is accelerating under the influence of a force on a frictionless surface.

What will happen to the object when an opposing force of the same magnitude acts on it?

A The object will move at constant velocity.

B The object will move in the opposite direction.

C The object will slow down gradually before it stops moving.

D The object will come to rest immediately after the opposing force acts on it.

2 A 3.0 kg object falls at terminal velocity. The gravitation field strength is 10 N/kg.

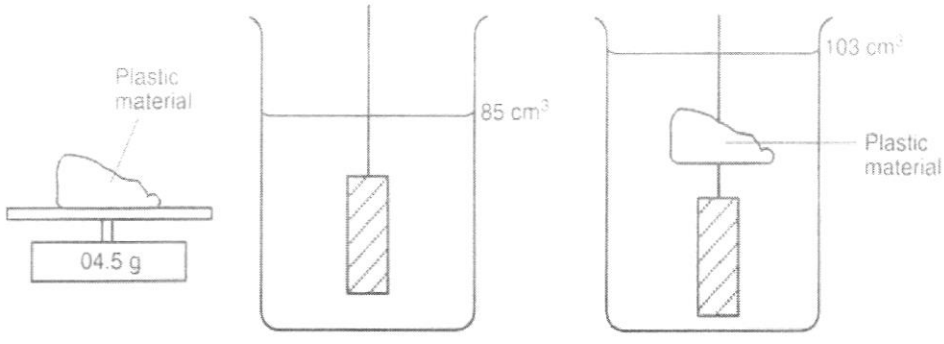
Which of the following gives its weight, the air resistance and the resultant force acting on it?

	weight	air resistance	resultant force
A	0.30 N downwards	zero	0.30 N upwards
B	3.0 N downwards	3.0 N upwards	zero
C	10 N downwards	10 N downwards	20 N downwards
D	30 N downwards	30 N upwards	zero

3 How will the mass and weight of an object change as it moves from Earth to outer space?

	mass	weight
A	remain constant	remain constant
B	remain constant	decrease
C	Increase	increase
D	decrease	decrease

4 The results obtained in an experiment to determine the density of a plastic material is shown in the figures below.



What is the density of the plastic material?

A 0.044 g/cm³

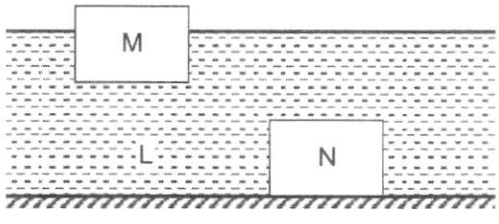
B 0.053 g/cm³

C 0.25 g/cm³

D 4.0 g/cm³

5 The diagram shows solid M and solid N in a liquid L.

Which of the following statements is correct?



A density of M > density of N > density of L

B density of M > density of L > density of N

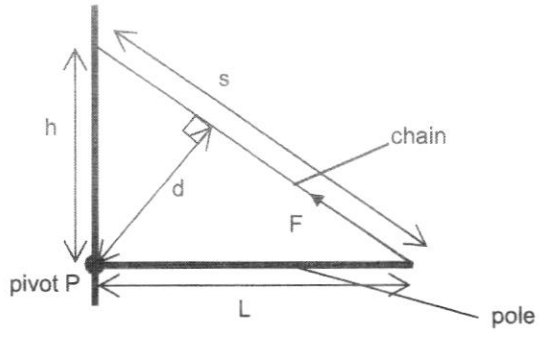
C density of N > density of L > density of M

D density of N > density of M > density of L

6 For a fully loaded lorry, how difficult is it for the lorry to start moving and to stop moving?

	to start	to stop
A	difficult	difficult
B	difficult	easy
C	easy	difficult
D	easy	easy

7 A horizontal pole is attached to the side of a building via a pivot P at the wall. A chain is connected from the end of the pole to a point higher up the wall. There is a tension force F in the chain.



What is the moment of force F about the pivot P?

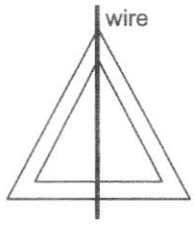
A F x d

B F x h

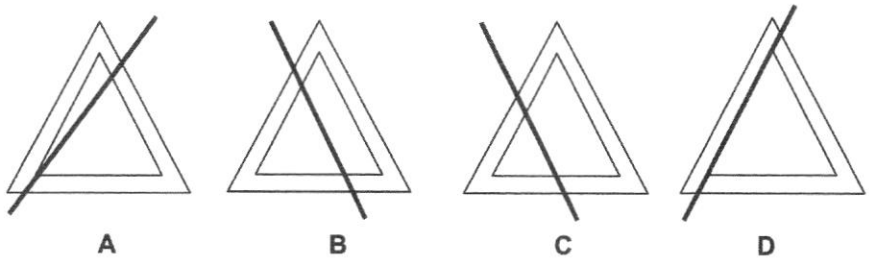
C F x L

D F x s

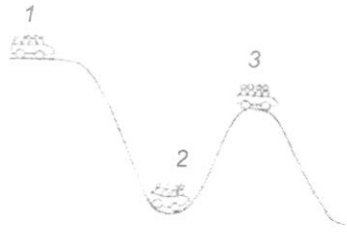
8 A triangular piece of card with a triangular hole is balanced on a wire as shown.



In which of the following will the triangular card be balanced too?



9 The figure shows the side view of a roller-coaster track. The car is shown in three different positions on the track.

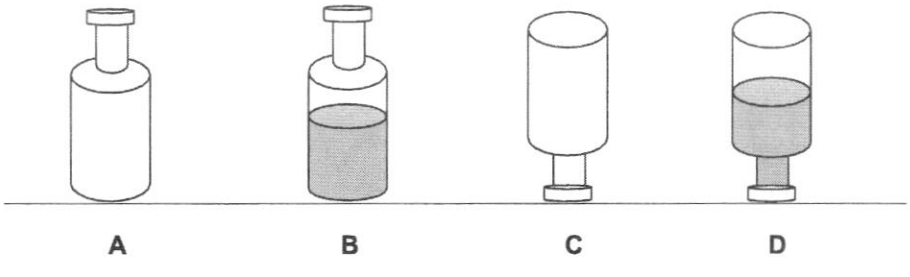


Which of the following correctly lists the three different types of equilibrium?

	1	*2*	*3*
A	stable	neutral	unstable
B	neutral	stable	unstable
C	unstable	stable	neutral
D	unstable	neutral	stable

10 Ananya placed four identical bottles in different positions. Two of the bottles contain some amount of water.

Which bottle has the lowest possibility of toppling when given a slight push at the top?



Section B

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1 A mass of weight W is supported by two strings as shown in Fig. 1.1 below. The tension T, in each string is 40 N. Each string makes the same angle, θ, with the vertical.

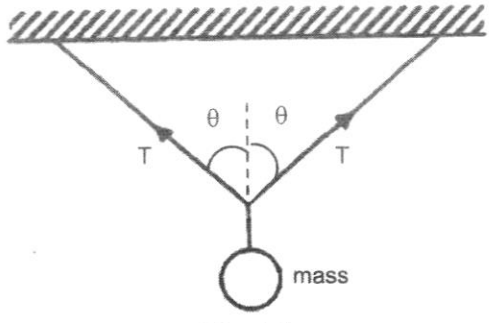

Fig. 1.1

(a) Draw a labelled diagram to show the resultant of the two tensions when the angle, θ is 40°.

Determine the size of the resultant force.

force = ... [3]

(b) State the magnitude of the weight W.

..... [1]

(c) State one difference between mass and weight.

.....

.....

..... [1]

(d) Angle θ is increased to 60°.

State how will tension in each string, T change?

..... [1]

2 An alloy is a mixture of two or more metals. An alloy X is made by melting 4.0 cm^3 of metal A with 8.0 cm^3 of metal B. The density of metal A is 5.0 g/cm^3 while metal B has a density of 6.0 g/cm^3. Assume there is no changes in volume when the metals A and B are mixed.

(a) Calculate the mass of metal A and metal B respectively.

metal A = ... [1]

metal B = ... [1]

(b) Calculate the density of alloy X.

density = ... [2]

(c) Mikaela commented that the density of alloy X will be lower if it is measured on Moon. This is because Moon has a lower gravitational field strength as compared to Earth and thus it will be lighter. Hence alloy X will be lighter on Moon.

State whether Mikaela is correct or not. Explain your answer.

.....

.....

..... [2]

3 A uniform rod AB of weight 100 N and length 2 m is supported by two vertical strings at its ends. Isaac hangs a 20 kg load on the rod as shown in Fig. 3.1. If the tension in any string exceeds 220 N, the string will snap. The gravitational field strength is 10 N/kg.

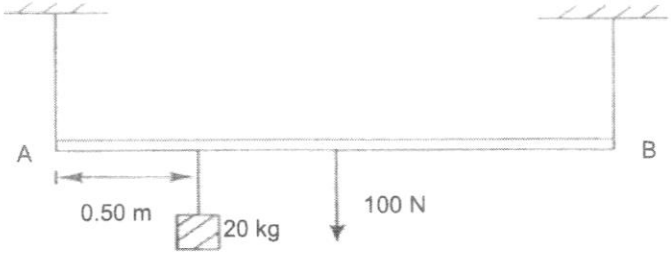

Fig. 3.1

(a) By taking moment about B, calculate the tension in the string at A.

tension = ... [2]

(b) Calculate the tension in the string at B.

tension = ... [2]

(c) Isaac slowly shifts the load towards A and one of the strings snapped.

(i) State which string snapped first.

..... [1]

(ii) Using Principle of Moments, explain your answer in **(c)(i)**.

.....

.....

..... [3]

Section C

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

4 A space shuttle is descending vertically towards the Moon surface. There are two stages in its landing process. The gravitational field strength on Moon is 1.6 N/kg.

(a) During Stage 1 of the landing process,

- this stage will last for 15 min,
- the upward thrust provided by the space shuttle is 24 kN, and
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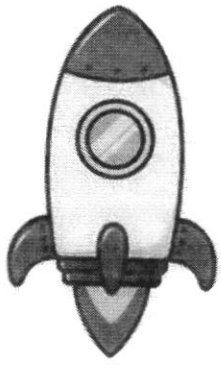

Fig. 4.1

(ii) Determine the mass of the space shuttle.

mass = ... [2]

(b) During Stage 2 of the landing process,

- the upward thrust provided by the space shuttle will increase to 26 kN, and
- the space shuttle will land on the surface of the Moon at a speed of 400 m/s.

(i) Determine the acceleration of the space shuttle during Stage 2.

acceleration = ... [2]

(ii) Calculate the time taken for the space shuttle to complete Stage 2.

time = ... [1]

(iii) In reality, state how will your answer in part (b)(ii) change (if any).
Explain your answer.

.....

.....

..... [2]

(c) State why the space shuttle does not use parachutes for their landing process.

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.....

..... [2]

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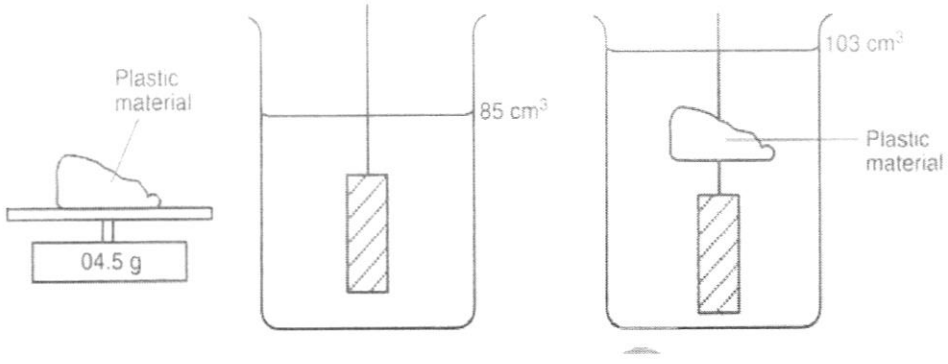

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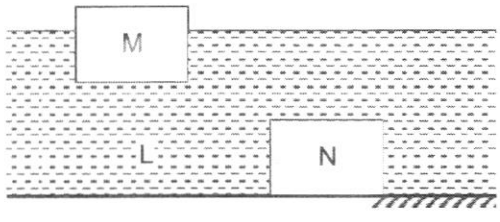
Which of the following statements is correct?



A density of M > density of N > density of L

B density of M > density of L > density of N

C density of N > density of L > density of M

D density of N > density of M > density of L

6 For a fully loaded lorry, how difficult is it for the lorry to start moving and to stop moving?

	to start	to stop
A	difficult	difficult
B	difficult	easy
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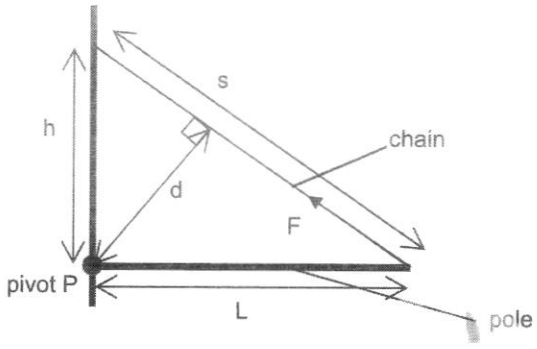

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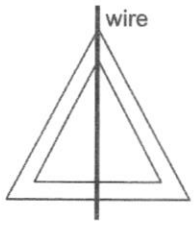

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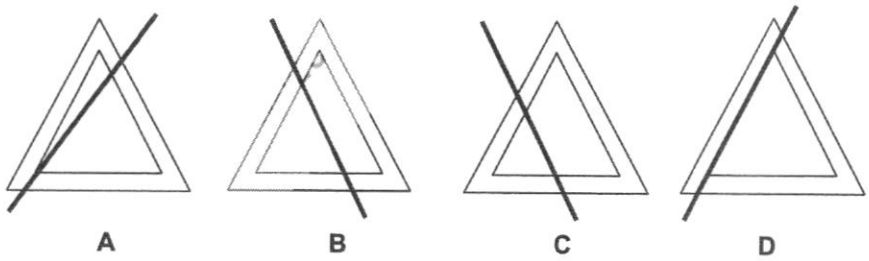

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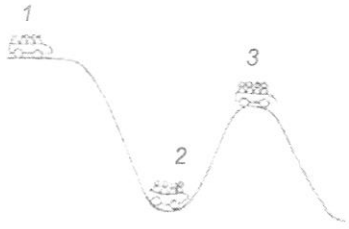

Which of the following correctly lists the three different types of equilibrium?

	1	2	3
A	stable	neutral	unstable
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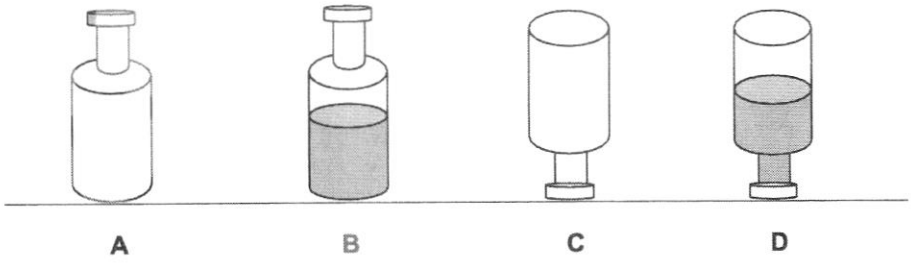
Which bottle has the lowest possibility of toppling when given a slight push at the top?



Section B

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1 A mass of weight W is supported by two strings as shown in Fig. 1.1 below. The tension T, in each string is 40 N. Each string makes the same angle, θ, with the vertical.

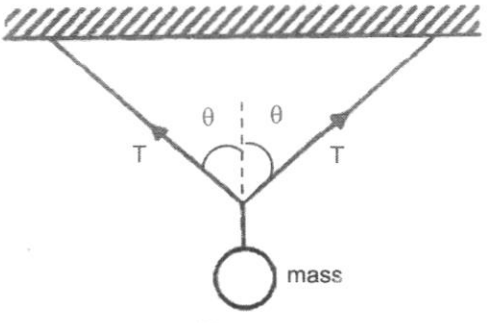

Fig. 1.1

(a) Draw a labelled diagram to show the resultant of the two tensions when the angle, θ is 40°.

Determine the size of the resultant force.

- [1] accurate parallelogram/triangle shape and orientation of resultant F.
- [1] Magnitude of resultant F = 61 N (Accept answers between 60 N to 62 N)
- [1] correct labelings of direction (arrow), force and angles.

** Zero mark ➔ if the parallelogram/triangle/resultant force is drawn wrongly

force = ... [3]

(b) State the magnitude of the weight W.

..... [1]

(c) State one difference between mass and weight.

.....

.....

..... [1]

(d) Angle θ is increased to 60°.

State how will tension in each string, T change?

- Increase [1]

..... [1]

2 An alloy is a mixture of two or more metals. An alloy X is made by melting 4.0 cm^3 of metal A with 8.0 cm^3 of metal B. The density of metal A is 5.0 g/cm^3 while metal B has a density of 6.0 g/cm^3. Assume there is no changes in volume when the metals A and B are mixed.

(a) Calculate the mass of metal A and metal B respectively.

$$Density_A = \frac{Mass_A}{Vol_A} \qquad Density_B = \frac{Mass_B}{Vol_B}$$

$$Mass_A = (5.0)(4.0) \qquad Mass_A = (6.0)(8.0)$$

$$= 20g \quad [1] \qquad = 48g \quad [1]$$

metal A = ... [1]

metal B = ... [1]

(b) Calculate the density of alloy X.

$$Density_{Alloy} = \frac{Mass_{Alloy}}{Vol_{Alloy}}$$

$$= \frac{20+48}{4.0+8.0} \quad [1]$$

$$= 5.7 g/cm^3 \quad [1]$$

density = ... [2]

(c) Mikaela commented that the density of alloy X will be lower if it is measured on Moon. This is because Moon has a lower gravitational field strength as compared to Earth and thus it will be lighter. Hence alloy X will be lighter on Moon.

State whether Mikaela is correct or not. Explain your answer.

- No change [1]
- This because mass OR volume of the object is **independent of gravitational field strength**. [1]

.....

.....

..... [2]

3 A uniform rod AB of weight 100 N and length 2 m is supported by two vertical strings at its ends. Isaac hangs a 20 kg load on the rod as shown in Fig. 3.1. If the tension in any string exceeds 220 N, the string will snap. The gravitational field strength is 10 N/kg.

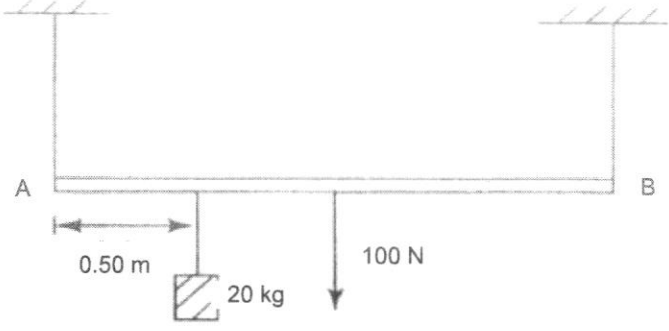

Fig. 3.1

(a) By taking moment about B, calculate the tension in the string at A.

$$ACW = CW$$
$$(20)(10)(1.5) + (100)(1) = T_A(2) \quad [1]$$
$$T_A = 200N \quad [1]$$

tension = ... [2]

(b) Calculate the tension in the string at B.

$$CW = ACW$$
$$(20)(10)(0.5) + (100)(1) = T_B(2) \quad [1]$$
$$T_B = 100N \quad [1]$$

OR

$$F_{net} = ma$$
$$T_A + T_B = (20)(10) + 100 \quad [1]$$
$$T_B = 300 - 200$$
$$= 100N \quad [1]$$

tension = ... [2]

(c) Isaac slowly shifts the load towards A and one of the strings snapped.

(i) State which string snapped first.

- String A.

..... [1]

(ii) Using Principle of Moments, explain your answer in **(c)(i)**.

As the perpendicular distance between B and box increases

- Taking moment about B, the **total anticlockwise moment increases** [1]
- **To remain equilibrium** OR **To increase the clockwise moment must increase**, [1]
- the **force** in string A will **increase** since its **perpendicular distance** is **constant** [1]
- Hence String A will snap eventually.

.....

.....

Section C

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

4 A space shuttle is descending vertically towards the Moon surface. There are two stages in its landing process. The gravitational field strength on Moon is 1.6 N/kg.

(a) During Stage 1 of the landing process,

- this stage will last for 15 min,
- the upward thrust provided by the space shuttle is 24 kN, and
- the space shuttle moves vertically down towards the surface of the moon with a steady speed of 600 m/s.

(i) On Fig 4.1, draw two forces acting on the space shuttle during Stage 1. [1]
Label them clearly.

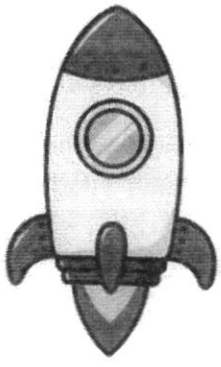

Fig. 4.1

(ii) Determine the mass of the space shuttle.

$$F_{net} = ma$$
$$W - F_{up} = ma$$
$$W - F_{up} = 0$$
$$W = F_{up} = 24000N \quad [1]$$
$$mg = 24000$$
$$m = \frac{24000}{1.6}$$
$$= 15000kg \quad [1]$$

mass = ... [2]

(b) During Stage 2 of the landing process,

- the upward thrust provided by the space shuttle will increase to 26 kN, and
- the space shuttle will land on the surface of the Moon at a speed of 400 m/s.

(i) Determine the acceleration of the space shuttle during Stage 2.

$$F_{net} = ma$$
$$W - F_{up} = ma$$
$$24000 - 26000 = (15000)(a) \quad [1]$$
$$a = -0.133 \text{m/s}^2 \quad [1]$$

** minus 1 mark if student give +ve a (0.133m/s^2)

acceleration = ... [2]

(ii) Calculate the time taken for the space shuttle to complete Stage 2.

$$a = \frac{v - u}{\Delta t}$$
$$-0.133 = \frac{400 - 600}{\Delta t}$$

** Zero mark if student use t is negative or (initial v – final v)

$$t = 1500s \quad [1]$$

time = ... [1]

(iii) In reality, state how will your answer in part (b)(ii) change (if any).

Explain your answer.

- Time taken will be **shorter/reduced**. [1]
- **Mass** of the craft will **decreasing** ➔ the **deceleration** (negative acceleration) will be **higher**. [1]

..... [2]

(c) State why the space shuttle does not use parachutes for their landing process.

- There **is little /no air/no air resistance** on the Moon to provide [1]
- sufficient force to **reduce the landing speed** [1]

..... [2]

End of Paper

5 A 2.2 kg ball is on a sliding ramp as shown in Fig. 3.1 At this moment, the ball has a speed of 2.80 m/s at point A. The gravitation field strength is 10 N/kg.

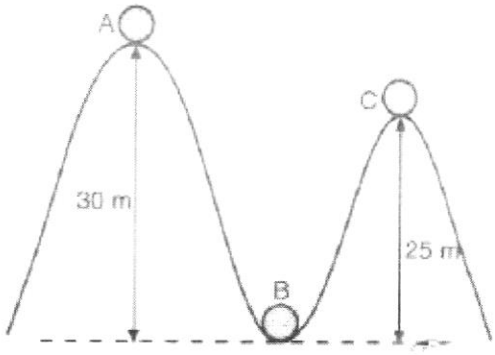

Fig. 3.1

(d) Calculate the total energy the ball possesses at point A.

$E_{total} = E_p + E_K$

$= (2.2)(10)(30) + \left(\frac{1}{2}\right)(2.2)(2.8)^2$ [1]

$= 668J$ [1]

** 1 m for finding Either E_K or E_P correctly (anywhere in the working)

energy = _____ [2]

(e) State the kinetic energy the ball possesses at point B.

- 668J [1]

energy = _____ [1]

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

$E_K = \frac{1}{2}mv^2$

$668 = \frac{1}{2}(2.2)v^2$ [1]

$v = 24.6 m/s$ [1]

energy = _____ [2]

(g) Calculate the speed of the ball at point C.

energy = _____ [2]

(h) State one assumption you made in all the calculations above.

Any one assumption [1]

- The ramp is frictionless (8need to state location)
- No air resistance