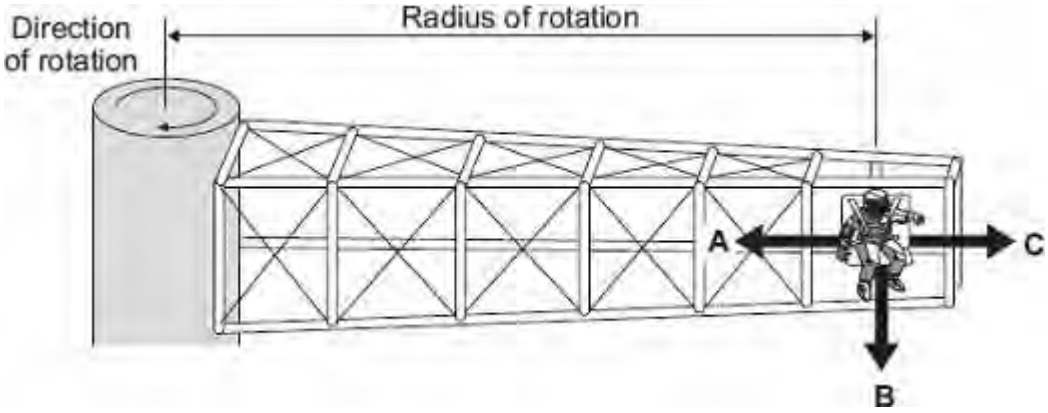
**Q1.**The diagram shows a 'G-machine'. The G-machine is used in astronaut training.




The G-machine moves the astronaut in a horizontal circle.

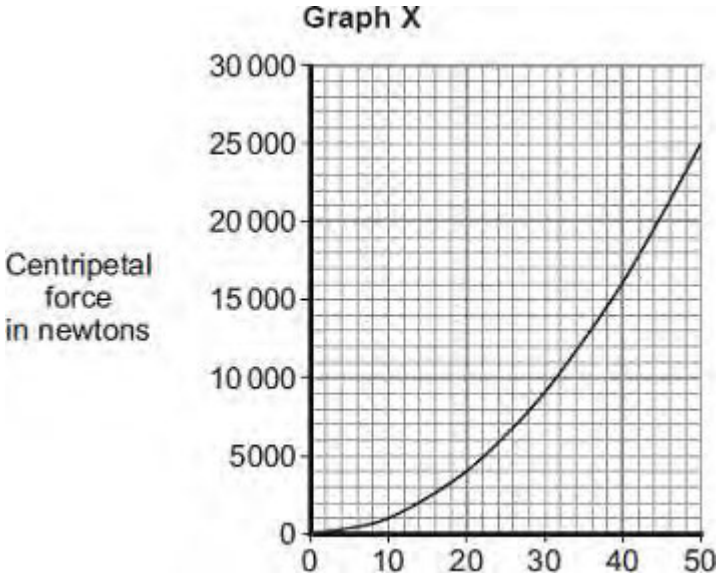
(a) In which direction, **A**, **B** or **C**, does the centripetal force on the astronaut act?

Write your answer in the box. ☐

**(1)**

(b) The centripetal force on the astronaut is measured.

**Graph X** shows how the centripetal force is affected by the speed of rotation. The radius of rotation is kept the same.



Speed of rotation
in metres per second

(i) Use **Graph X** to determine the centripetal force on the astronaut when rotating at a speed of 30 metres per second.

Centripetal force = ..... newtons

**(1)**

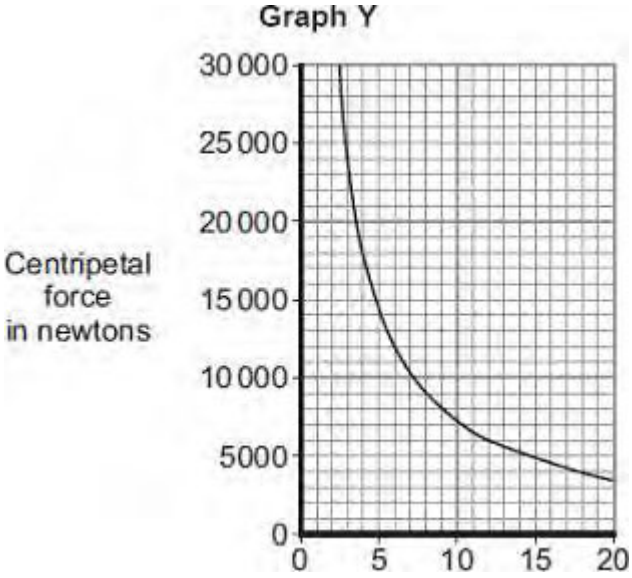
(ii) Complete the following sentence to give the conclusion that can be made from **Graph X**.

Increasing the speed of rotation of a G-machine will
.....

the centripetal force on the astronaut.

**(1)**

(iii) **Graph Y** shows how the centripetal force is affected by the radius of rotation, when the speed of rotation is kept the same.



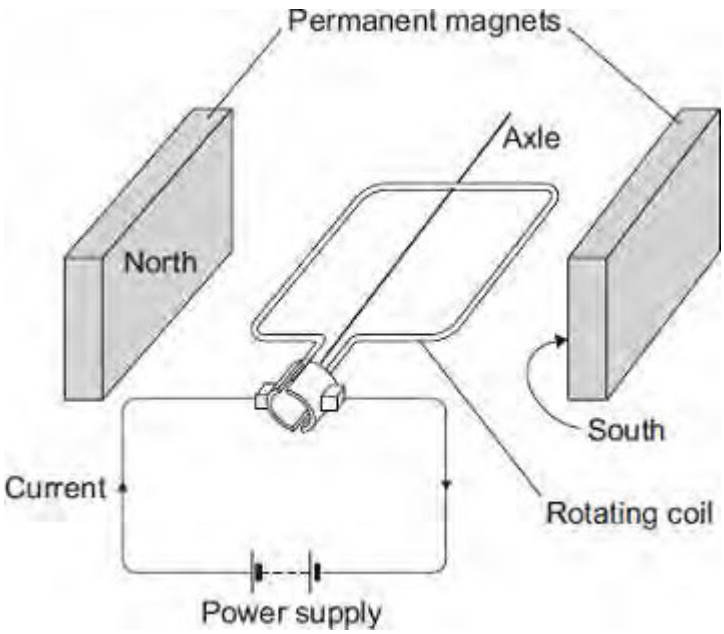

Complete the following sentence to give the conclusion that can be made from **Graph Y**.

The greater the radius of rotation, the ..... the centripetal force

on the astronaut.

**(1)**

(c) The G-machine is rotated by an electric motor. The diagram shows a simple electric motor.




The following statements explain how the motor creates a turning force. The statements are in the wrong order.

**M** – The magnetic field interacts with the magnetic field of the permanent magnets.

**N** – A magnetic field is created around the coil.

**O** – The power supply applies a potential difference across the coil.

**P** – This creates a force that makes the coil spin.

**Q** – A current flows through the coil.

Arrange the statements in the correct order. Two of them have been done for you.




**(2)**

(d) The electric motor produces a turning force.

Give **two** ways of increasing the turning force.

1 .....

.....

2 .....

.....

**(2)**

(e) Draw a ring around the correct answer to complete the sentence.

It costs a lot of money to send astronauts into space.

This is

| | |
|---|---|
| an economic | |
| an environmental | issue. |
| a social | |

**(1)**
**(Total 9 marks)**

**Q2.** The hammer throw is an athletic event.

The athlete throws a heavy metal ball attached by a wire to a handle.



(a) The hammer thrower swings the hammer round in a circle before letting go.

He swings the hammer slowly at first and then faster.

Complete the following sentence by drawing a ring around the correct word or line in the box.

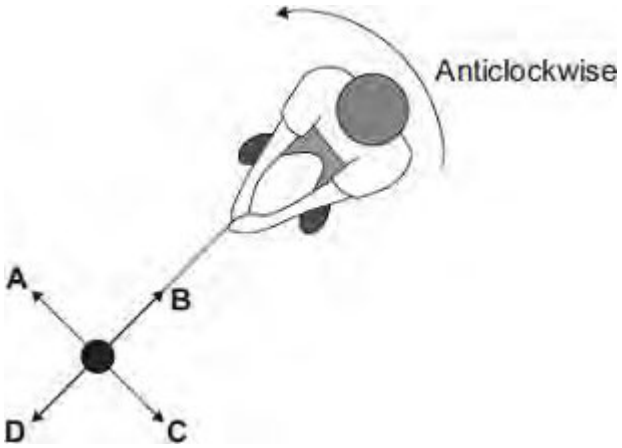
As the speed of the swing increases, the centripetal force on the

hammer

| |
|---|
| decreases. |
| does not change. |
| increases. |

**(1)**

(b) The diagram shows an overhead view of a hammer thrower swinging the hammer anticlockwise in a circle.




(i) In which direction, **A**, **B**, **C** or **D**, does the centripetal force act on the hammer? ☐

**(1)**

(ii) Complete the following sentence by drawing a ring around the correct line in the box.

The centripetal force is provided by the

| |
|---|
| air resistance. |
| gravitational force. |
| tension in the wire. |

**(1)**

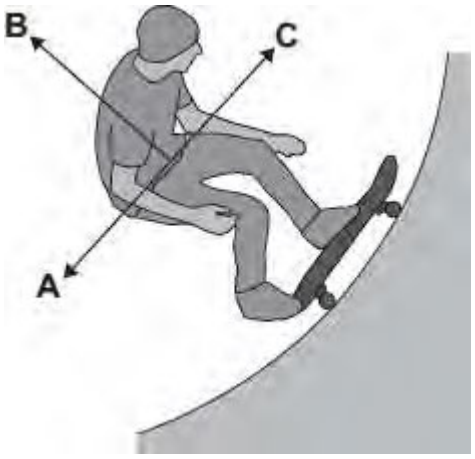
(iii) At the instant shown in the diagram above, the athlete lets go of the handle.

In which direction, **A**, **B**, **C** or **D**, does the hammer move?

**(1)**
**(Total 4 marks)**

**Q3.** The drawing shows a skateboarder moving in a circular path.

• Centre of circular path




(a) (i) What is the name of the resultant force which allows the skateboarder to move in a circular path?

Draw a ring around your answer.

**centripetal force** **gravitational force** **weight**

**(1)**

(ii) In which direction, **A**, **B** or **C**, does this resultant force act on the skateboarder?

Write your answer, **A**, **B** or **C**, in the box.

**(1)**

(b) Another skateboarder has a smaller mass.

Complete the following sentences by drawing a ring around the correct line in each box.

(i) She uses the same part of the ramp at the same speed.

The force which allows her to move in a circular path will need

| |
|---|
| decrease. |
| to stay the same. |
| ncrease. |

**(1)**

(ii) If she goes faster, this resultant force will need to

| |
|---|
| decrease. |
| stay the same. |
| increase. |

**(1)**

(c) On their website, the managers of a skateboard park give the following information about some of the ramps where skateboarders move in a circular path.

| **Name of ramp** | **Inside radius of the ramp in metres** |
|---|---|
| Bull pit | 6 |
| Dragon's den | 11 |
| Tiger cage | 8 |
| Witch's cauldron | 7 |

A skateboarder uses each ramp at the same speed.

Name the ramp where the resultant force on the skateboarder will need to be the greatest.

.....

Explain the reason for your answer.

.....

.....

**(2)**
**(Total 6 marks)**

**Q4.** The hammer throw is an athletic event.

The athlete throws a heavy metal ball attached by a wire to a handle.



(a) The hammer thrower swings the hammer round in a circle before letting go.

He swings the hammer slowly at first and then faster.

Complete the following sentence by drawing a ring around the correct word or line in the box.

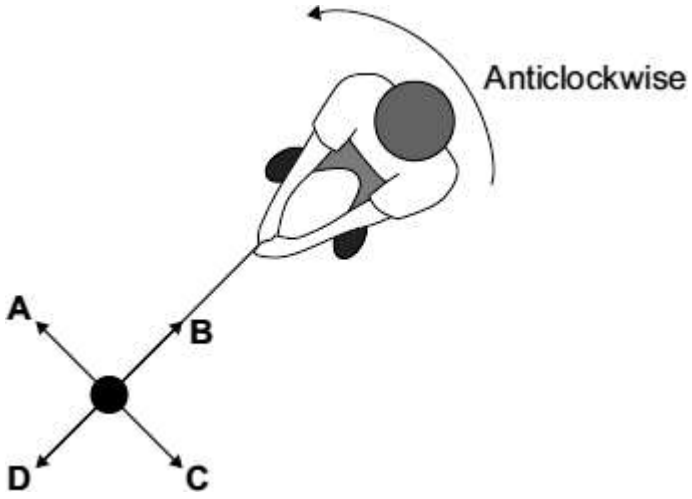
As the speed of the swing increases, the centripetal force on the

| | |
|---|---|
| hammer | decreases.<br>does not change. |

ncreases.

**(1)**

(b) The diagram shows an overhead view of a hammer thrower swinging the hammer anticlockwise in a circle.




(i) In which direction, **A**, **B**, **C** or **D**, does the centripetal force act on the hammer?

**(1)**

(ii) Complete the following sentence by drawing a ring around the correct line in the box.

The centripetal force is provided by the

air resistance.

gravitational force.

tension in the wire.

**(1)**

(iii) At the instant shown in the diagram above, the athlete lets go of the handle.

In which direction, **A**, **B**, **C** or **D**, does the hammer move?

**(1)**
**(Total 4 marks)**

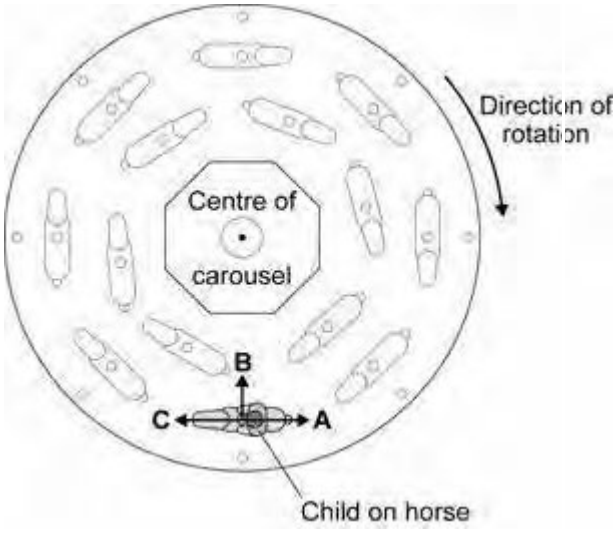
**Q5.** The picture shows a fairground carousel.

The diagram shows the position of one child, at one point in the ride, viewed from above.

*Picture*



*Diagram*




Draw a ring around the correct answer to complete the following sentences.

(a) The resultant force needed to keep the child moving in a circular path is

called the centripetal force.

| |
|---|
| circular |
| gravitational |

**(1)**

(b) The resultant force on the child acts in the direction

| |
|---|
| **A.** |
| **B.** |
| **C.** |

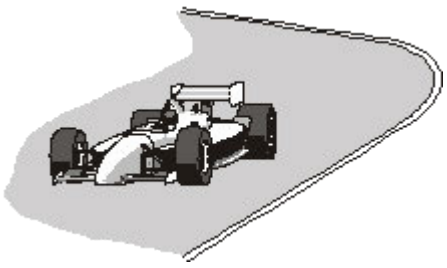
**(1)**

(c) At the end of the ride, as the carousel slows down, the resultant force on the child

| |
|---|
| decreases. |
| stays the same. |
| ncreases. |

**(1)**
**(Total 3 marks)**

**Q6.** (a) Complete the following sentence by drawing a ring around the correct line in the box.



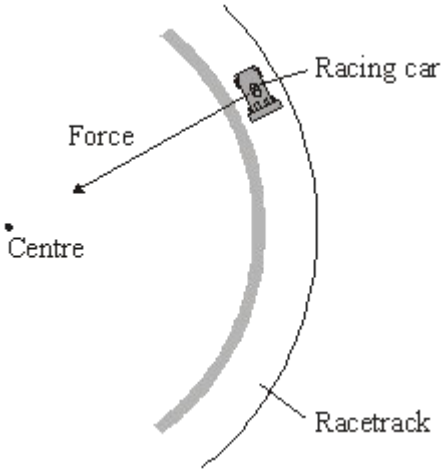
A racing car can accelerate by changing

| |
|---|
| ts direction only |
| ts speed only |
| either its direction or its speed |

.

**(1)**

(b) A racing car moves round a circular part of a racetrack.




A force acts on the racing car. The force is towards the centre of the circular part of the racetrack.

Complete the following sentences by drawing a ring around the correct line in each of the boxes.

(i)

The force is caused by

| |
|---|
| electrostatics |
| friction |

.

gravity

**(1)**

(ii)

The force is a [centripetal force / circular force / perpendicular force].

**(1)**

(iii) If another racing car has a greater mass and travels at the same speed around the same racetrack, then the force will need to [decrease / stay the same / ncrease].

**(1)**

(iv)

When the racing car goes faster, the force will need to [decrease / stay the same / ncrease].

**(1)**

(c) This is an item from a newspaper.

## No to racetrack plan

At last night's meeting, one local resident said, "The racetrack will be noisy but motor racing leads to safety improvements in all our cars.''

"We'll need better brakes. Motor racing encourages speeding and leads to more accidents'', said another.

Most of the residents were against the plan to build a racetrack.

Do you agree with most of the residents?

Put a tick (✓) in the box next to your answer and explain.

Yes ☐ No ☐ Not sure ☐

.....

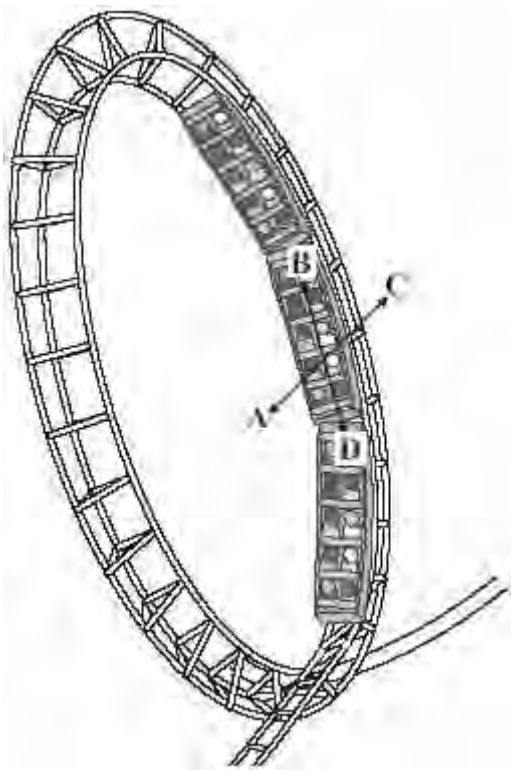
.....

.....

.....

**(2)**
**(Total 7 marks)**

**Q7.** The drawing shows a set of carriages on a roller coaster.
The carriages are moving upwards in a nearly circular path at a constant speed.




(a) Complete the following sentences by drawing a ring around the correct line in each box.

(i) The carriages will accelerate because of a change in their

| direction |
| --- |
| mass |
| speed |

.

**(1)**

(ii) The resultant force which causes the carriages to accelerate is the

| circular |
| --- |
| centripetal |
| gravity |

force.

**(1)**

(b) In which direction, **A**, **B**, **C** or **D**, does the resultant force act?

Write your answer in the box. ☐

**(1)**

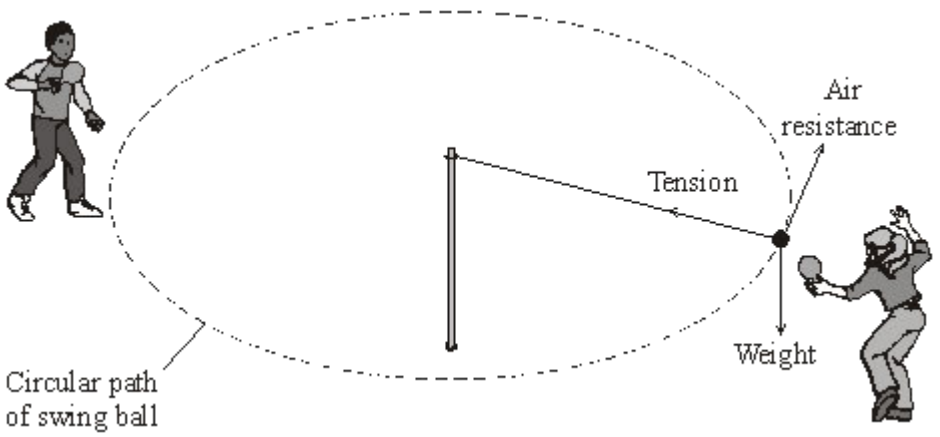
(c) Complete the following sentence by drawing a ring around the correct line in the box.

| | |
|---|---|
| The resultant force will need to be greater if the | mass of the passengers is greater<br>radius of the circle is greater<br>speed of the carriages is less |

.

**(1)**
**(Total 4 marks)**

**Q8.** The diagram shows two children playing with a toy called a swing ball. The ball is joined to a pole by a strong string. The children hit the ball so that it goes round in a circular path.



(a) Which force causes the ball to move in a circle?

Draw a ring around your answer.

**air resistance** **tension** **weight**

**(1)**

(b) Complete the sentences by ticking (✓) the correct ending.

(i) The force needed to make the ball move in a circular path is larger if

the speed of the ball is increased. ☐

the speed of the ball is decreased. ☐

the string is made longer. ☐

**(1)**

(ii) The continuous acceleration of a ball moving in a circular path changes

the speed of the ball. ☐

the direction of the ball. ☐

the weight of the ball. ☐

**(1)**

(c) Which of the following words is used to describe any force that causes an object to move in a circular path?

Draw a ring around your answer.

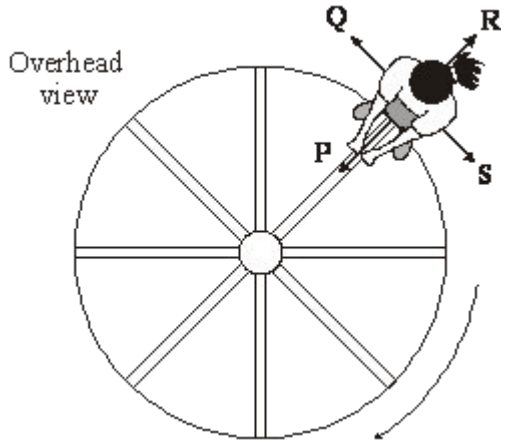
**centripetal** **frictional** **gravitational** **universal**

**(1)**

**(Total 4 marks)**

**Q9.** A girl and her father visit a children's playground.

(a) The diagram shows the girl holding on to a roundabout which is turning.




A centripetal force must act because the girl moves in a circular path.

(i) In which direction, **P**, **Q**, **R** or **S**, does the centripetal force act?

Direction .....

**(1)**

(ii) What provides this centripetal force?

.....

.....

**(1)**

(iii) Her father pushes the roundabout so that it turns faster. The girl continues to stand on the same part of the roundabout.

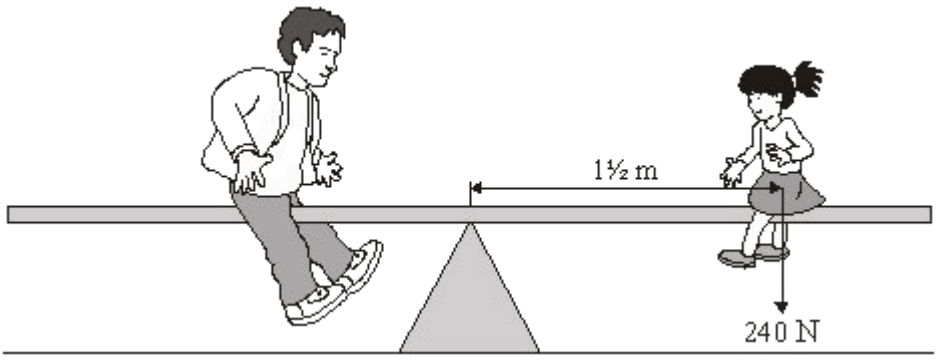
Complete the following sentence by drawing a ring around the correct line in the box.

The centripetal force on the girl

| |
|---|
| decreases |
| does not change |
| ncreases |

**(1)**

(b) The diagram shows the girl and her father on a see-saw.




(i) Use the equation in the box to calculate the moment of the girl.

| |
|---|
| moment = force × perpendicular distance from the line of action of the force to the axis of rotation |

.....

.....

Moment of the girl = ..... Nm

**(2)**

(ii) What must her father do to increase his moment?

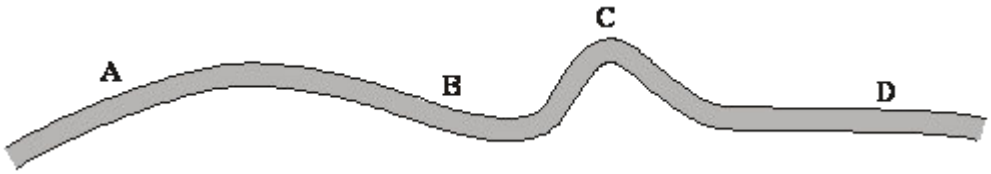
.....

.....

**(1)**

(c) The diagram shows part of a level road that they take when they drive home. They

drive at a steady speed.




(i) At which point, **A**, **B**, **C** or **D**, will the centripetal force on the car be greatest?

Centripetal force is greatest at ..... .

**(1)**

(ii) What provides the centripetal force when the car goes round a bend?

.....

.....

**(1)**

**(Total 8 marks)**

**Q10.** Malik uses a camera to photograph the Moon.



(a) Complete each sentence by choosing the correct words from the box.

You may use each word once, more than once or not at all.

| converging | diverging | image | longer |
|---|---|---|---|
| object | real | shorter | virtual |

In a camera a ..... lens is used to produce an .....

of an ..... on a film. The ..... is smaller than

the ..... and it is a ..... distance from the lens.

**(6)**

(b) The Moon moves in a nearly circular path around the Earth.

(i) What is the name of the force which causes the Moon to move around the Earth?

.....

**(1)**

(ii) In which direction does this force act?

.....

**(1)**

(c) A force is needed to make a car change direction when it goes round a bend.

(i) What is the name of this force and where does it act?

.....

.....

**(2)**

(ii) Complete the **two** spaces in the sentence.

The force needed is greater if the ..... of the car is greater and

the ..... of the bend is smaller.

**(2)**

(d) What word is used to describe any force which causes an object to move in a circular path?

.....

**(1)**

**(Total 13 marks)**