

CHAPTER: 1 (FORCE)

SECTION: C (Uniform circular motion)

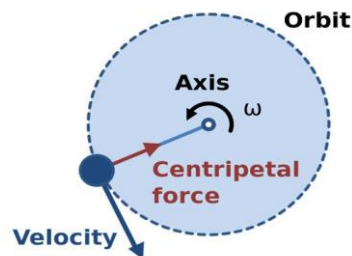
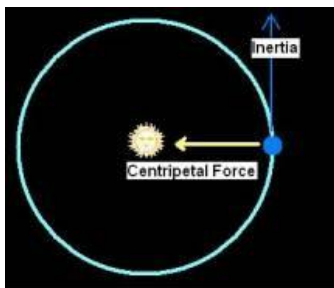
Uniform circular motion can be described as the motion of an object in a circle at a constant speed. As an object moves in a circle, it is constantly changing its direction. At all instances, the object is moving tangent to the circle.

Examples of Uniform Circular Motion-ii

- Wheel of any vehicle moves along a circular path.
- Merry-go-around in full speed.
- Water pump in a garden which throws water in a circular motion.
- An electron moving around its nucleus.
- Amusement park rides.
- An audio CD or disc runs in a player.
- Moving fan.
- Moving turbine.

Centripetal force

Force acting on a body moving in a circular path, in direction towards the centre of the circular path.

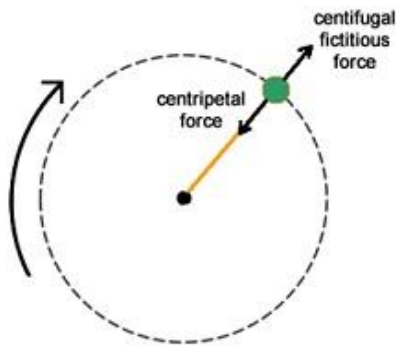


Some examples:

1. Twirling a lasso, spinning a ball on a string(Like a Bola): Centripetal Force is provided by the force of tension on the rope pulls the object in toward the center.
2. Turning a car: Centripetal Force is provided by the force of Friction between the wheels and the ground.
3. Riding a Gravitron, going through a loop on a roller coaster: Centripetal Force is provided...

Centrifugal force

A force, arising from the body's inertia, which appears to act on a body moving in a circular path and is directed away from the centre around which the body is moving.



Differences Between Centripetal And Centrifugal Force	
Centrifugal Force	Centripetal Force
If an object moving in a circle and experiences an outward force than this force is called the centrifugal force	If the object travels in a uniform speed in a circular path is called centripetal force.
The object has the direction along the centre of the circle from the centre approaching the object	The object has the direction along the centre of the circle from the object approaching the centre.
Mud flying of a tire is one example of the centrifugal force.	A satellite orbiting a planet is an example of the centripetal force.

Exercise Ex. 1C

Question 1

Explain the meaning of uniform circular motion. Why is such motion said to be accelerated?

Solution 1

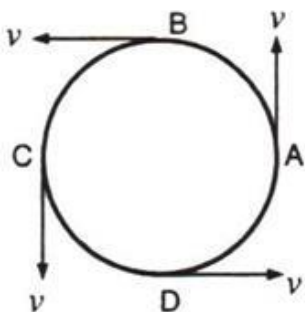
When a particle moves with a constant speed in a circular path, its motion is said to be the uniform circular motion. For example : Revolution of earth around sun is an example of uniform circular motion.

Question 2

Draw a neat labelled diagram for a particle moving in a circular path with a constant speed. In your diagram show the direction of velocity at any instant.

Solution 2

Particle moving in a circular path with a constant speed.



Question 3

Is it possible to have an accelerated motion with a constant speed? Name such type of motion.

Solution 3

Yes, uniform circular motion has an accelerated motion with a constant speed.

Question 4

Give one example of motion in which speed remains uniform, but the velocity changes.

Solution 4

Motion of a cyclist on a circular track is an example of motion in which speed remains uniform, but the velocity changes.

Question 5

A uniform circular motion is an accelerated motion. Explain it. State whether the acceleration is uniform or variable? Name the force responsible to cause this acceleration. What is the direction of force at any instant? Draw diagram in support of your answer.

Solution 5

When the object moves in a circular path with uniform speed, it means that its magnitude of velocity does not change, only its direction changes continuously. Hence, it is considered as uniformly accelerated motion.

Question 6

Differentiate between a uniform linear motion and a uniform circular motion.

Solution 6

Uniform linear motion	Uniform circular motion
The body moves along a straight line.	The body moves along a circular path.
Speed and direction both remain constant.	Speed is constant, but direction changes continuously.
It is not an accelerated motion.	It is an accelerated motion.

Question 7

Name the force required for circular motion. State its direction.

Solution 7

Centripetal force is required for circular motion. It is always directed towards the centre of circle.

Question 8

What is centripetal force?

Solution 8

Force acting on a body which is in circular motion is called centripetal force. It acts towards the centre of circular path.

Question 9

Explain the motion of a planet around the sun in a circular path.

Solution 9

A planet moves around the sun in a nearly circular path for which the gravitational force of attraction on the planet by the sun provides the necessary centripetal force required for circular motion.

Question 10

(a) How does a centripetal force differ from a centrifugal force with reference to the direction in which they act?

(b) Is centrifugal force the force of reaction of centripetal force?

(c) Compare the magnitudes of centripetal and centrifugal force.

Solution 10

(a) They act in opposite directions.

(b) No, centrifugal force is not the force of reaction of centripetal force.

Question 11

Is centrifugal force a real force?

Solution 11

No, centrifugal force is a fictitious force.

Question 12

A small pebble tied at one end of a string is placed near the periphery of a circular disc, at the center of which the other end of the string is tied to a peg. The disc is rotating about an axis passing through its centre.

- (a) What will be your observation when you are standing outside the disc? Explain.
- (b) What will be your observation when you are standing at the centre of the disc. Explain.

Solution 12

- a. On standing outside the disc, we find that the pebble is moving on a circular path. On standing at the centre of the disc, we find that the pebble is stationary placed just in front of us.

Question 13

A piece of stone tied at the end of a thread is whirled in a horizontal circle with uniform speed with the help of hand. Answer the following questions.

- a. Is the velocity of stone uniform or variable?
- b. Is the acceleration of stone uniform or variable?
- c. What is the direction of acceleration of stone at any instant?
- d. What force does provide the centripetal force required for circular motion?
- e. Name the force and its direction which acts on the hand.

Solution 13

Force of tension in the thread provides the centripetal force.

Question 14

State two differences between the centripetal and centrifugal force.

Solution 14

Centripetal force	Centrifugal force
It acts towards the centre of the circle.	It acts away from the centre of the circle.
It is a real force.	It is a fictitious force.

Question 15

State whether the following statements are true or false by writing T/F against them.

- a. The earth moves around the sun with a uniform velocity.
- b. The motion of the moon around the earth in circular path is an accelerated motion.
- c. A uniform linear motion is unaccelerated, while a uniform circular motion is an accelerated motion.
- d. In a uniform circular motion, the speed continuously changes because the direction of the motion changes.
- e. A Boy experiences a centrifugal force on his hand when he rotates a piece of stone tied at one end of a string, holding the other end in the hand.

Solution 15

- (a) False
- (b) True
- (c) True
- (d) False
- (e) False

Question 16

Which of the following quantity remains constant in uniform circular motion:

- (a) Velocity
- (b) Speed
- (c) Acceleration
- (d) Both velocity and speed

Solution 16

Speed

Hint: Speed is scalar but velocity and acceleration are vector quantities. So, speed remains constant but velocity and acceleration change with the change in direction, and in circular motion the direction of motion changes at every point.

Question 17

The centrifugal force is:

- a. a real force
- b. the force of reaction of centripetal force
- c. a fictitious force
- d. directed towards the centre of circular path

Solution 17

The centrifugal force is a fictitious force.