Questions

1) Complete the following statements:

1- When a force acts on a moving body in the same direction, its speed ……. Without changing …….

2- When a force acts on a moving body in an opposite direction of its motion, its speed ……. without changing …….

3- If a body moves in a circular path, its velocity changes in …….

4- If the radius of curvature of the path of a body moving in a circular path increases four times , so the centripetal force required to make the speed of the body cost ant decreases to …….

5- From life applications of centripetal force are ……., ……. and …….

6- The centripetal force acting on a satellite of mass (m) rotates around Earth with velocity (v) in constant orbit of a distance (r) from Earth's center equals …….

7- The universal gravitational constant is determined using the relation G = …….

8- The ratio between the universal gravitational constant on Earth's surface to that on Moon's surface is …….. unity.

9- If the distance between the centers of two bodies is doubled the force of attraction between them becomes its ……value.

10- ……. is the unit for measurement the universal gravitational constant.

2) **Q2: Define:**

1- Uniform circular motion
2- Centripetal force.
3- Tangential velocity
4- Reaction force
5- Centripetal acceleration
6- Periodic time
7- Universal gravitational law
8- Gravitational field
9- Gravitational field intensity
10- Satellite
11- Orbital velocity
12- Astronomical moon

3) **Q3: Give reason:**

1- Although the object moves in a uniform circular motion and is affected by an acceleration , it has a linear constant velocity.
2- When a car turns in a circular path , it conserves moving in the curved path.
3- Although the body moving in a circular path is affected by centripetal force, it doesn't go to center of the circle.
4- Racer leans his body with the motorbike towards the center of the circular path at the curved part of the path.
5- The driver must decrease his velocity in the curved path.

6- The attraction force between two masses increases as they move nearer to each other.

7- The orbital velocity keeps the satellite at the same height.

8- The importance of satellites.

4) Q4: What's meant by?

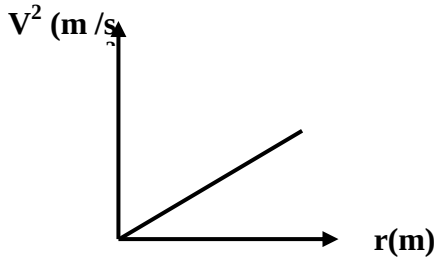
1- The centripetal force acting on an object is 100N.

2- The centripetal acceleration of an object is 40 m/s^2.

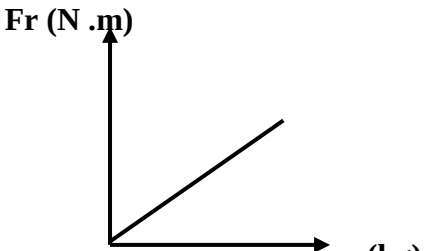
3- The orbital velocity of a satellite = 9.7 X 10^4 m/s.

4- The gravitational filed intensity of the Earth = 10 N/Kg.

5) Q5: Write down the slope of the straight line and the mathematical relation for each of the following:



(a)



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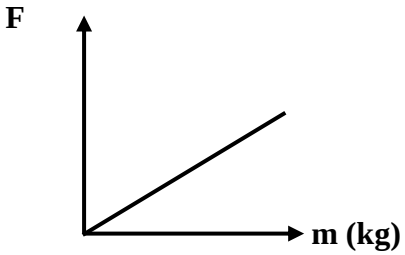

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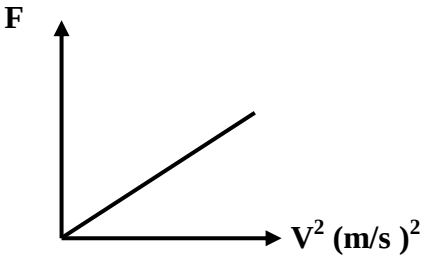

(c)

Q6: Problems:

1- A bicycle rider move in a circular path of radius 40m.With tangential velocity 13.2 m/s. If the force that conserves the circular motion of the bicycle is 377 N. Calculate the mass of the bicycle and the rider.

2- A car of mass 905 kg. Moves on a circular path of radius 3.25m. , calculate the centripetal acceleration for the same object if its velocity is doubled and its radius of rotation decreases to its half value.

3- An object of mass 2kg is held at the end of a rope and rotate in a horizontal circular path of radius 1.5 m. so , it makes 3 revolutions in one second , calculate :

   a. The tangential velocity.
   b. The centripetal acceleration
   c. The tension in the rope

4- Find the mutual attraction between the sun and Jupiter giving that the mass of the sun 2 X 10^{30}kg , the mass of Jupiter 1.89 X 10^{27}kg and the distance between their centers is 7.73 X 10^{11}m (G = 6.67 X 10^{-11} N.m^2 /kg^2)

5- A mine is at 500m deep below the surface of Earth. Find the acceleration due gravity inside that mine giving that:

   (G) = 6.67 X 10^{-11} N.m^2/kg^2 (R) = 6360km (M) = 5.98 X 10^{24}kg

6- A planet has mass twice that of Earth and a diameter twice that of Earth. Find the ratio of the acceleration due gravity of the two planets.

Model Answer

Q1: Complete the following statements:

1) Increases – direction
2) Decreases – direction
3) Direction only
4) Its quarter
5) Candy floss – rotating barrels in amusement park – Drying cloths.
6) m $\frac{v^2}{r}$
7) G = $\frac{Fr^2}{mM}$
8) Equal
9) Quarter
10) $N.m^2/kg^2$

Q2: Define:

1) The motion of a body in a circular path with constant speed and changeable direction.
2) The force acting continuously in a normal direction of the moving body changing its straight path into circular path.
3) The velocity of a body in the tangential direction of circular path at the release moment.

4) The force acting normally to the direction of a body moving in a circular path that is in clined to the horizontal towards the center of the curved path helping the body to move in a circular path.
5) The acceleration acquired by an object moving in a circular path due to a continuous change in the direction of its velocity.
6) The time taken by the body to make one complete revolution.
7) A body in the universe attracts another body by a force which is directly proportional to the product of their masses, and inversely proportional to square the distance between them.
8) The space in which the gravitational forces appear.
9) The gravitational force acting on a mass of 1 kg.
10) An object projected at a certain velocity to rotate in a roughly circular path at a constant distance from the Earth's surface.
11) The velocity that makes the satellite orbit Earth in a roughly circular path at a constant distance from the Earth's surface.
12) They are huge telescopes floating in space in which they can photograph space accurately.

Q3: Give Reason:

1) Because when the body moves in a circular path it will acquire a centripetal acceleration which changes the direction of the velocity without changing its magnitude.
2) Due to the friction force between the road and car tyers which is normal to the direction of motion of the car causing its motion in a curved path.

4) To create a force normal to the direction of motion so the direction of motion changes and the object moves in in a circular path.

5) Because according to the relation F = $\frac{mv^2}{r}$ when the car velocity decreases , F also decreases and the car doesn't skid out the road.

6) Because the gravitional force is inversely proportional to the square of the distance between the attracted masses.

7) Because the orbital velocity can be determined by the relation V= $\sqrt{\frac{GM}{r}}$ since M , G are constants then V $\propto \frac{1}{\sqrt{r}}$

8) Because it is used in different fields such as : Communication , photograph space accurately , determine the mineral resources and abound the information needed by military and political leaders.

Q4: What's meant by?

1) The force acting in a normal direction on the object's motion to turn it in a circular path is 100N.
2) The acceleration acquired by an object due to the change of its velocity direction during its motion in a circular path = 40m/s^2
3) The velocity which makes the satellite rotate in a curved path so that its distance from Earth's surface constant = 9.7 X 10^{4}m/s
4) The attraction force of Earth to an object of mass 1kg = 10N.

Q5:

a- Slope = $\frac{v^2}{r}$ = a (centripetal acceleration)

$a = \frac{v^2}{r}$

b- Slope = a = $\frac{F}{m}$

F = ma

c- Slope = $\frac{F}{v^2} = \frac{m}{r}$

$F = \frac{mv^2}{r}$

d- Slope = $\frac{Fr}{m} = V^2$

$F = \frac{mv^2}{r}$

Q6: Problems:

1- $F = \frac{mv^2}{r}$

$m = \frac{Fr}{v^2} = \frac{377\ X\ 40}{(13.2)^2} = 86.5kg.$

2- $V = \sqrt{\frac{Fr}{m}}$

$= \sqrt{\frac{2140\ X\ 3.25\ X\ 10^3}{905\ X\ 2\pi}} = 34.97\ m/s$

3- a- $V = \sqrt{\frac{2\pi r}{T}} = \frac{2\pi\ X\ 105}{\frac{1}{3}} = 28.26\ m/s$

b. $a = \frac{v^2}{r} = \frac{(28.26)^2}{1.5} = 532.4\ m/s^2$

c. F = ma = 2 X 532.4 = 10 64.8 N

4- $F = G\frac{Mm}{r^2}$

$= 6.67\ X\ 10^{-11}\ X\ \frac{2\ X\ 10^{30}\ X\ 1.89\ X\ 10^{27}}{(7.73\ X\ 10^{11})^2} = 4.22\ X\ 10^{23}N$

This force keeps Jupiter orbiting the sun.

5- $g = \frac{GM}{(R-h)^2} = \frac{6.67\ X\ 10^{-11}\ X\ 5.98\ X\ 10^{24}}{(6360\ X\ 10^3 - 500)^2}$ 9.86 N/kg

6- $M_1 = 2\ Me$ $R_1 = 2R_e$

$\frac{g_1}{g_e} = \frac{M_1 Re^2}{M_e {R_1}^2} = \frac{2M_e Re^2}{M_e\ X\ 4Re^2} = \frac{1}{2}$