CHP # 3  **Dynamics**

The branch of physics which deals with the study of motion of material objects with discussing the causes of motion (forces) is called Dynamics.

**Q.1 Define Force and its unit?**

A. **Force**
   - It is an agent which can produce or tends to produce motion in a body. **OR**
   - It is an agent which can stop or tends to stop a moving body. **OR**
   - It is an agent which tends to change the speed and direction of a moving body.
   It is denoted by “F”. Its SI unit is newton “N”.

**Unit of Force (newton)**

The amount of force is said to be one unit “If it produce 1m/s$^2$ acceleration in 1Kg mass. Mathematically

\[ F = ma \]

\[ 1N = 1Kg \times 1m/s^2 \]

\[ N = Kgm/s^2 \]

**Q.2 State Newton’s first law of motion with example?**

A. **Statement**

This law state that “A body continues its state of rest or uniform motion until an external force acts upon them.” Mathematically

\[ F = 0 \]

\[ V = \text{Constant} \]

\[ a = 0 \]

**Example**

This law has two parts, in the first part “if we place a book on a table. It continues its state of rest forever, if someone does not pick it up “.
In the second part “if we roll a ball on a flat floor. It continues its motion forever. But after sometime the ball is stopped. If we observe carefully the speed of the ball decreasing continuously. It means that forces are acted on the body which is friction force, air resistance and gravitational force.
This law is also called the law of inertia.

**Q.3 What is inertia? Give examples**

A. **Inertia**

It is the property of matter, which can be defined as “The resistance to change in velocity is called inertia.” For examples
(i) A fast moving child falls forward when his toe stumble against a stone. The reason is that the lower part of his body stopped but the upper part of his body continues its motion due to inertia. Thus he falls on his face.
(ii) A passenger sitting in a bus falls backward when suddenly the bus starts motion. It is because his feet move with the bus but the upper part of his body wants to continue its state of rest. Thus, he falls backward due to inertia.
Q.4 State and explain Newton’s second law of motion?
A. **Statement**
This law states that “whenever a net external force acts on a body, it produces acceleration in the body in the direction of force. This acceleration is directly proportional to the force and inversely proportional to the mass of the body.”

**Explanation**
Consider a force “F” acts on a body of mass “m” to produce acceleration “a”. Mathematically

\[ a \propto F \] \hspace{1cm} \text{--------- (1)}

\[ a \propto \frac{1}{m} \] \hspace{1cm} \text{--------- (2)}

Combining equation (1) and (2), we get

\[ a \propto \frac{F}{m} \]

\[ a = \text{Constant} \left( \frac{F}{m} \right) \]

\[ a = K \left( \frac{F}{m} \right) \]

Where k is constant of proportionality and its value is 1. When Force, mass and acceleration are in SI units.

\[ a = 1 \left( \frac{F}{m} \right) \]

\[ a = \frac{F}{m} \]

\[ ma = F \]

\[ F = ma \]

Q.5 State and explain Newton’s third law of motion?
A. **STATEMENT**
This law states that “To every action there is always an equal and opposite reaction in the universe.”

**EXPLANATION**
According to this law for every action in the universe there is a reaction. This action and reaction are equal in magnitude but opposite in direction.

**FOR EXAMPLE**
Strike a rubber ball on a flat floor. The ball bounces off back from the floor. The reason is that the ball exerts an action force on the ground. In response the ground exerts an equal reaction force on the ball in opposite direction.
Q.6 Differentiate between mass and weight?
A. **Mass**
   - The quantity of matter in a body is called mass.
   - Mass is a scalar quantity.
   - Mass is a constant quantity.
   - The SI unit of mass is kilogram “Kg”.
   - Mass can be measured with the help of beam balance.

**Weight**
- The downward force acting on a body towards the centre of the earth is called weight. Mathematically
  \[ W = mg \]
- Weight is a vector physical quantity.
- Weight is a variable quantity.
- The SI unit of weight is newton “N”.
- Weight can be measured with the help of spring balance.

Q.7 Write the applications of Newton’s laws of motion?
A. Applications of Newton’s laws of motion are:
   (i) **Tension in a string**
   Consider a person is holding an object of mass “m” with the help of a string, the object exert a force on the hand in downward direction called action and the hand exerts an equal force on the object in the upward direction called the reaction. That force which is exerted by the string on the hand is called tension force and are denoted by “T”. If the object is at rest the magnitude of tension is equal to the weight of the body. Mathematically
   \[ T = W = mg \]

   (ii) **Motion of bodies connected by a string (Attwood’s machine)**
   Consider two bodies of masses “m_1” and “m_2” are suspended by an inextensible string which passes over a frictionless pulley. Such an arrangement is called Atwood’s machine. Let “m_1” is greater than “m_2”, then “m_1” will move downward and “m_2” will move upward. Since the bodies are connected to an inextensible string, therefore the acceleration produce in both of them will be the same. Let us find out the acceleration and tension in the string.
As $m_1 > m_2$, therefore

$W_1 - T = F_{ext}$

$m_1g - T = m_1a$  (1)

And $m_2 < m_1$, therefore

$T - W_2 = F_{ext}$

$T - m_2g = m_2a$  (2)

Adding equation (1) and (2)

$m_1g - T + T - m_2g = m_1a + m_2a$

$(m_1 - m_2)g = (m_1 + m_2)a$

$a = \frac{m_1 - m_2}{m_1 + m_2} g$

Putting the value of “a” in equation (2)

$T - m_2g = m_2 \left( \frac{m_1 - m_2}{m_1 + m_2} \right) g$

$T = m_2 \left( \frac{m_1 - m_2}{m_1 + m_2} \right) g + m_2g$

$T = \left( \frac{m_1m_2 - m_2^2}{m_1 + m_2} \right) g + m_2g$

$T = \left( \frac{m_1m_2 - m_2^2}{m_1 + m_2} + m_2 \right) g$

$T = \left( \frac{m_1m_2 - m_2^2 + m_1m_2 + m_2^2}{m_1 + m_2} \right) g$

$T = \frac{2m_1m_2}{m_1 + m_2} g$

(iii) When one body moves vertically and the other moves horizontally (Modified Atwood’s machine)

Consider two bodies of masses “$m_1$” and “$m_2$” are connected with an inextensible string which passes over a frictionless pulley as shown in figure. When the system is released the system moves with an acceleration “a”. The mass “$m_1$” moves vertically downward and “$m_2$” moves on the smooth horizontal surface towards the pulley.

The downward vertical force on “$m_2$” can be stated as;

$W_2 - T = F_{ext}$

$m_2g - T = m_2a$  (1)

The horizontal force on “$m_2$” can be stated as;
\[ T = F_{\text{ext}} \]
\[ T = m_1a \] \hspace{1cm} (2)

Put the value of “T” in equation (1)
\[ m_2g - m_1a = m_2a \]
\[ m_2g = m_2a + m_1a \]
\[ m_2g = (m_2 + m_1)a \]
\[ a = \frac{m_1}{(m_2 + m_1)} g \]

Now put the value of “a” in equation (2)
\[ T = m_1(\frac{m_2}{m_2 + m_1})g \]
\[ T = \frac{m_1m_2}{(m_1 + m_2)} g \]

**Q.8 What is meant by momentum?**

**A. Momentum**
The quantity of motion in a body is called momentum. “It can also be defined as” the product of mass and linear velocity is called momentum.”
It is denoted by “p”. It is a vector quantity. Mathematically
\[ \vec{P} = m\vec{V} \]
The SI unit of momentum is Kgm/s.

**Q.9 Prove that the time rate of change momentum is equal to the external applied force.**

**A. “The time rate of change momentum is equal to the external applied force.”**
Mathematically
\[ \frac{\Delta P}{\Delta t} = F \]

**Proof**
Suppose a force “F” increases the velocity of a mass “m” from \( V_i \) to \( V_f \) in a time interval \( \Delta t \), then
\[ \Delta P = mV_f - mV_i = m(V_f - V_i) \]
Rate of change momentum is;
\[ \frac{\Delta P}{\Delta t} = \frac{m(V_f - V_i)}{\Delta t} \]
However, we know that
\[ a = \frac{V_f - V_i}{\Delta t} \]
\[ \frac{\Delta P}{\Delta t} = ma \]
\[ \frac{\Delta P}{\Delta t} = F \]

Q.10 State and explain law of conservation of momentum with example?

A. Statement

This law states that "In the absence of external force the total momentum of the system is always remains constant."

Explanation

According to this the initial momentum of the system is always equal to the final momentum, if the external force on the system is zero.

Mathematically

\[ F = 0 \]

Then

\[ F \Delta t = \Delta P \]
\[ 0 \times \Delta t = \Delta P \]
\[ \Delta P = 0 \]
\[ P_f - P_i = 0 \]
\[ P_f = P_i \]

Example

Consider a body of mass “m” is initially at rest. Therefore, the momentum of the body is zero.

\[ P_i = 0 \]

Now due to some internal interaction the body is split into two masses “m_1” and “m_2” moving with velocities “v_1” and “v_2” respectively. Then according to the law of conservation of momentum;

\[ P_f = 0 \]

But,

\[ P_f = m_1v_1 + m_2v_2 \]

So,

\[ m_1v_1 + m_2v_2 = 0 \]
\[ m_1v_1 = -m_2v_2 \]
\[ v_1 = -\frac{m_2v_2}{m_1} \]
\[ v_1 = \frac{m_2}{m_1}(-v_2) \]

Negative sign shows that the objects are moving in opposite direction.
Q.11 **What is meant by friction force?**

A. **Friction force**

The force which opposes the motion of the objects that are moving at each other is called friction force. Friction force is denoted by “\( f \)”.

As all the objects in the universe are not smooth Therefore friction force arises due to the interlocked of the molecules of the two surfaces, which are in contact with each other.

Friction force is directly proportion to the normal reaction force. Mathematically

\[
  f \propto F_n \\
  f = \mu F_n \\
  f = \mu mg
\]

Where \( \mu \) is constant of proportionality and depends upon the nature of surfaces in contact. It is known as the coefficient of friction. It is the ratio between the two forces. Therefore it has no unit.

There are two types of friction;

(1) **Static friction**

The friction force acting on a body when it is at rest is called static friction. It is denoted by “\( f_s \)”.

Mathematically

\[
  f_s = \mu_s mg
\]

Where \( \mu_s \) is coefficient of static friction.

(2) **Kinetic friction**

The friction force acting on a body when it is in a state of motion is called kinetic friction. It is denoted by “\( f_k \)”.

Mathematically

\[
  f_k = \mu_k mg
\]

Where \( \mu_k \) is coefficient of kinetic friction.

Q.12 **Differentiate between sliding and rolling friction?**

A. **Sliding friction**

The friction force arises due to the dragging of one solid object over the other is called sliding friction. Sliding friction is greater due to the interlocked of more molecules as compared to the rolling friction.

**Rolling friction**

The friction force arises due to the rolling of one object over the other is called rolling friction. Rolling friction is smaller due to the interlocked of less molecules as compared to the sliding friction.
Q.13 Write the advantages and disadvantages of friction?
A. Advantages of friction
   (1) Friction enables us to move on the ground.
   (2) Friction enables us to stop or move objects.
   (3) A nail can stay in wood due to friction.
   (4) We can tie a knot in a rope due to friction.

   Disadvantages of friction
   (1) Friction produces heat in various parts of the machine.
   (2) Friction decreases the efficiency of the machine.
   (3) Friction causes wear and tear in the machines.
   (4) Friction reduces the speed of moving vehicles largely.

Q.14 Write the methods of reducing friction?
A. The methods of reducing friction are;
   (1) The parts of the machine, which are moving over each other, are properly lubricated.
   (2) The sliding friction is change into rolling friction of the machine where possible by using ball bearing.
   (3) Friction can be reduced by polishing the unsmooth surface.

Q.15 Define circular motion with examples?
A. Circular motion
   The motion of an object on a circular path is called circular motion.
   For examples
   ➢ A turn taking cyclist move almost in a circular path.
   ➢ Artificial satellite move around the earth in almost circular path.
   ➢ Electron revolves around the nucleus of an atom in almost circular path.

Q.16 State and explain what is uniform circular motion?
A. Uniform circular motion
   The motion of an object in a circle with uniform speed is called uniform circular motion. In uniform circular motion the speed of the body is always constant. Velocity of the body changes at each and every point due to change in direction of the body. Velocity of the object in a uniform circular motion is tangent to the circle at every point.
Q.17 Define centripetal acceleration and centripetal force?
A.  **Centripetal acceleration**
The acceleration produce due to change in the direction of motion of a body moving in a circle with uniform speed is called centripetal acceleration. It is denoted by $a_c$.
Suppose a body moves with uniform speed $v$ in a circle of radius $r$. Then centripetal acceleration can be given as:

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

**Centripetal force**
The force which compels a body to move in a circle is called centripetal force. It is denoted by $F_c$. Mathematically By Newton second's law

$$F_c = ma_c$$

Since

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

$$F_c = \frac{mV^2}{r}$$

Centripetal force and centripetal acceleration are always directed towards the centre of the circle.

Q.18 What is centrifugal force? Give example
A.  **Centrifugal force**
The force which compels a body to move away from the circle is called centrifugal force. It is the reaction force of centripetal force. Centrifugal force operates as long as centripetal force is active.

For example
If a stone is tied to the end of a string and whirled in a circle. The body exerts a force on the hand to move away from the circle, this force is called centrifugal force.

Q.19 Write the practical applications of centripetal force?
A.  The practical applications of centripetal force are;
1. **Banking of roads**
When a car takes, a turn it bends to slip outward while the force of friction compels it to move inward, sufficient centripetal force is required to enable a fast moving car to take a sharp turn. To provide sufficient force the outer edge of the curve road is made a little higher in some areas, this is called banking of roads.

When the car moving along the curve, its weight is acting downward and normal reaction of the road acting outward. The vertical component of the
reaction balance the weight of the car and horizontal component of the reaction force provide the necessary centripetal force.

2. **Centrifuge**
The device which is used for the separation of liquids of unequal densities is known as centrifuge. It works on the principle of centripetal force. It consists of a wheel which rotates in a horizontal plane. Small buckets are attached to the wheel vertically, when the wheel is at rest. When the wheel turns rapidly the buckets assume a position such as their axis is almost horizontal. When a mixture of unequal densities are placed in the buckets, and the wheel rotates rapidly the liquids become separates. The light liquid remains near to the axis and heavy liquid are farther from the axis. The heavy liquid is at the bottom and lighter liquid is at the top when centrifuge is stopped.

3. **Washing machine dryer**
It is a kind of centrifuge that consists of vessel which has perforated wall and cylindrical tubular rotor. The rotor is driven by an electric motor. When the rotor is spun fast the liquids wetting the clothes separated from the clothes and passes through the perforations. The clothes are dried in the vessel.

4. **Cream separator**
A cream separator is a high-speed centrifuge that acts on the principal of butterfat is lighter than other components in milk.
An electric madhani is a typical simple cream separator. The blades bearing shaft of the motor is inserted in airtight bowl contain milk. When the motor is start, the blades are rapidly turned and the cream is forced towards the centre while the skim collects at the outer wall of the bowl.

**Conceptual questions**

1. **When a tree is shaken, its fruits and leaves fall down why?**
   A. When a tree is shaken it moves, but its fruits and leaves remains at rest due to inertia and therefore detach from the branch of the tree and falls down.

2. **Why does dust fly off, when a hanging carpet is beaten with a stick?**
   A. When a hanging carpet is beaten with a stick it moves forward along with the dust particles but when the carpet moves back, the dust continues its motion in forward direction due to inertia and therefore flies off from the carpet.

3. **Why a person traveling in a bus falls forward when the bus stop suddenly?**
   A. A person sitting in a traveling bus falls forward when the bus stop suddenly due to inertia. The upper part of the person wants to continue its state of motion but the lower part stop, therefore he falls on his face.
4. Out of hard cricket ball and soft tennis ball, which one has more inertia and why?
   A. The hard cricket ball has more mass than a soft cricket ball. The inertia of a body can be measured from mass, therefore the inertia of a hard cricket ball is more than the soft cricket ball.

5. Why is it dangerous to jump out of a moving vehicle?
   A. When some one jumps from a moving vehicle, his feet when touches the ground comes to rest while the upper part of the body is still in motion due to inertia. Therefore he falls on his face.

6. Why a balloon filled with air move forward, when its air is released?
   A. When the air is released from a balloon in the backward direction, from law of conservation of momentum the momentum of the escape air is equal to the momentum of the balloon, therefore the balloon moves forward.

7. You leave a parcel on the seat of a car, when you brake suddenly, the parcel falls onto the floor. Explain why?
   A. When a car is in motion, a parcel lying on the seat is also in motion with the car. But when the brakes are applied and car comes to rest, the parcel continues its motion due to inertia in forward direction and therefore falls forward on the floor of the car.

8. Why does one get hurt seriously while jumping on a hard floor?
   A. When some one jumps on the hard floor and apply a force on it, from Newton's third law of motion, the hard floor exert the same force on him due to which he is hurt seriously.

9. Why does a player move his hand backward while taking a catch?
   A. When a player catches a ball, he moves his hand backward to reduced the speed of the ball gently as a result the momentum of the ball reduces gently and he will catch the ball easily. Otherwise the ball slips from his hand.

10. Why is the surface of a conveyor belt made rough?
    A. The surface of a conveyor belt is made rough to increase its force of friction. Greater the force of friction reduced the motion of the objects tied together.

11. Why do coins move faster on a carom board when dusted with talcum powder?
    A. When the talcum powder is dusted on the carom board it becomes smooth by decreasing the force of friction between the coins and board, therefore the coins move faster on it.
12. Why does a hose pipe tend to move, backward when the fireman directs a powerful stream of water towards fire?
A. When the water from the hose pipe rushing in the forward direction, its action is in the forward direction. From Newton’s third law of motion, the reaction of pipe is in backward direction due to which it tends to move backward.

13. Why does a boatman tie his boat to a pillar before allowing the passenger to step on the river bank?
A. When the passenger from the boat move towards the river bank, pushes the boat in backward direction with his feet. From Newton’s third law of motion the reaction of the boat is in opposite direction. However, when the boat is tie with pillar it can not move and hence the passenger move out from boat easily.

14. Why does a gunman get a jerk on firing a bullet?
A. When the gunman fires the bullet, it moves forward with high velocity which is action of bullet on gun. By Newton’s third law of motion, the gun reacts and hence moves backward due to which gunman gets a jerk.

15. Why is the long jump athletes made to jump in sand pits?
A. Sand pits reduce the athlete’s speed gently as a result the momentum reduces more gently than the hard surface, therefore the athletes jump in sand pits.
NUMERICAL QUESTIONS

(1) What is the acceleration produced by a force of 10N exerted on an object of mass 3000g?

Given data
- \( F = 10N \)
- \( m = 3000g = 3Kg \)
- \( a = ? \)

We know that
- \( F = ma \)
- \( a = \frac{F}{m} \)
- \( a = \frac{10}{3} = 3.33m/s^2 \)

(2) Calculate the mass of a body when a force of 700N, produce an acceleration of 12.5m/s²?

Given data
- \( F = 700N \)
- \( a = 12.5m/s^2 \)
- \( m = ? \)

We know that
- \( F = ma \)
- \( m = \frac{F}{a} \)
- \( m = \frac{700}{12.5} = 56Kg \)

(3) A force of \( 2 \times 10^{-3}N \) acts on a mass of 0.04Kg over a distance of 10m. Assuming the mass initially at rest, find the final velocity and time for which the force acts?

Given data
- \( F = 2 \times 10^{-3}N \)
- \( m = 0.04Kg \)
- \( S = 10m \)
- \( Vi = 0m/s \)
- \( Vf = ? \)
- \( t = ? \)

We know that
- \( F = ma \)
\[
a = \frac{F}{m} = \frac{2 \times 10^{-3}}{0.04} = 0.05 \text{ m/s}^2
\]
\[
2as = V_f^2 - V_i^2
\]
\[
2 \times 0.05 \times 10 = V_f^2 - 0^2
\]
\[
V_f^2 = 1
\]
Taking square root
\[
V_f = 1 \text{ m/s}
\]
Now to find “t”
\[
V_f = V_i + at
\]
\[
1 = 0 + 0.05t
\]
\[
0.05t = 1
\]
\[
t = \frac{1}{0.05} = 20 \text{ s}
\]

(4) How much momentum will a dum bell of mass 10Kg transfer to the floor, if it falls from a height of 0.8m?

**Given data**
- \( V_i = 0 \text{ m/s} \)
- \( m = 10 \text{ Kg} \)
- \( g = 10 \text{ m/s}^2 \)
- \( h = 0.8 \text{ m} \)
- \( P = ? \)
- \( V_f = V = ? \)

We know that
\[
2gh = V_f^2 - V_i^2
\]
\[
2 \times 10 \times 0.8 = V_f^2 - 0^2
\]
\[
V_f^2 = 16
\]
Taking square root
\[
V_f = V = 4 \text{ m/s}
\]
\[
P = mV
\]
\[
P = 10 \times 4 = 40 \text{ Kgm/s}
\]

(5) Calculate the force required to stop a car of mass 1000Kg and a loaded truck of mass 10000Kg in 2 seconds, if they are moving with same velocity of 5m/s?

**Given data**
- Mass of car = \( m = 1000 \text{ Kg} \)
- Mass of truck = \( M = 10000 \text{ Kg} \)
- Initial velocity = \( V_i = 5 \text{ m/s} \)
- Final velocity = \( V_f = 0 \text{ m/s} \)
- Force for stopping car = \( F_1 = ? \)
- Force for stopping truck = \( F_2 = ? \)
Time = 2s
We know that
\[ F_1 = \frac{mV_f - mV_i}{t} \]
\[ F_1 = \frac{1000 \times 0 - 1000 \times 5}{2} \]
\[ F_1 = -\frac{5000}{2} = -2500 \text{N} \] (Negative sign shows stopping)

\[ F_2 = \frac{MV_f - MV_i}{t} \]
\[ F_2 = \frac{10000 \times 0 - 10000 \times 5}{2} \]
\[ F_2 = -\frac{50000}{2} = -25000 \text{N} \] (Negative sign shows stopping)

(6) A bullet of mass 10g is fired with a rifle. The bullet takes 0.003s to move through barrel and leaves with a velocity of 300m/s. What is the force exerted on the bullet by the rifle.

**Given data**

Mass of the bullet = \( m = 10g = \frac{10}{1000} \text{Kg} = 0.01 \text{Kg} \)

Initial velocity of bullet = \( V_i = 0 \text{m/s} \)
Final velocity of bullet = \( V_f = 300 \text{m/s} \)
Time = \( t = 0.003 \text{s} \)
Force exerted on the bullet = \( F = ? \)

We know that
\[ F = \frac{mV_f - mV_i}{t} \]
\[ F = \frac{0.01 \times 300 - 0.01 \times 0}{0.003} \]
\[ F = \frac{3 - 0}{0.003} \]
\[ F = \frac{3}{0.003} = 1000 \text{N} \]
(7) Two bodies of masses 200g and 300g are tied to string which is passed over a pulley. If the pulley has no friction, then find the acceleration of the bodies and tension in the string?

Given data
\[ m_1 = 300g = \frac{300}{1000} Kg = 0.3Kg \]
\[ m_2 = 200g = \frac{200}{1000} Kg = 0.2Kg \]
\[ g = 10m/s^2 \]
\[ a = ? \]
\[ T = ? \]

We know that
\[ a = \frac{m_1 - m_2}{m_1 + m_2} g \]
\[ a = \frac{0.3 - 0.2}{0.3 + 0.2} \times 10 \]
\[ a = \frac{0.1}{0.5} \times 10 = a = 2m/s^2 \]
\[ T = \frac{2m_1m_2}{m_1 + m_2} g \]
\[ T = \frac{2 \times 0.3 \times 0.2}{0.3 + 0.2} \times 10 \]
\[ T = \frac{1.2}{0.5} \times 10 = 24N \]

(8) A girl pushing a box of 60Kg mass on the floor, a force of 300N is applied on the box. What will be the coefficient of friction existing between the box and the floor?

Given data
\[ m = 60Kg \]
\[ F = 300N \]
\[ g = 10m/s^2 \]
\[ \mu = ? \]

We know that
\[ F = \mu mg \]
\[ \mu = \frac{F}{mg} \]
\[ \mu = \frac{300}{60 \times 10} = \frac{300}{600} = 0.5 \]
(9) A car of mass 1000Kg is running on a circular motor way interchange near Swabi with a velocity of 80m/s the radius of the circular motor way interchange is 800m. How much centripetal force is required?

**Given data**

- \(m = 1000\text{Kg}\)
- \(V = 80\text{m/s}\)
- \(r = 800\text{m}\)
- \(F_c = ?\)

We know that

\[
F_c = \frac{mV^2}{r}
\]

\[
F_c = \frac{1000(80)^2}{800}
\]

\[
F_c = 8000\text{N}
\]

(10) A body of 80g attached by a string whirls in a horizontal circle of radius 1m. Find the speed of the stone if the tension in the string is 50N?

**Given data**

- \(m = 80\text{g} = \frac{80}{1000}\text{Kg} = 0.08\text{Kg}\)
- \(r = 1\text{m}\)
- \(T = F = 50\text{N}\)
- \(V = ?\)

\[
F = \frac{mV^2}{r}
\]

\[
V^2 = \frac{rF}{m}
\]

\[
V^2 = \frac{1 \times 50}{0.08}
\]

\[
V^2 = 625
\]

Taking square root

\[V = 25\text{m/s}\]