North South University

Department of Mathematics and Physics

Assignment-2

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Course No : PHY-107

Course Title : Physics I

Section : 8

Date : 14 November, 2022

Numerical Question

1] How many objects need to describe Newton's third law?

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According to Newton's third law, there is an equal and opposite reaction for every action (force) in nature. For this law, we need at least two objects. This force result from interactions of two objects.

2] What is work done? If you throw a ball up, what will be the difference in work done ~~by~~ between you and the gravity force?

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If energy transfer by a force, then there will be work done.

After throw the ball, when the ball is going up. work done by me will be positive and work done by gravity force will be negative. Again, when the ball come back to the ground, then. work done by me will be negative and work done by gravity force will be positive.

3] What is the Center of Mass?

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The center of mass is position, where all the mass of the system gets balanced.

Conceptual Question

1| Describe the work done by gravity force. Is it depend ~~De~~ on the pathway or the height only?

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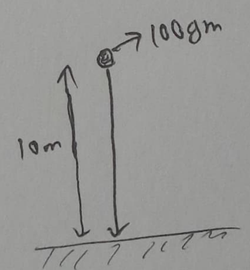
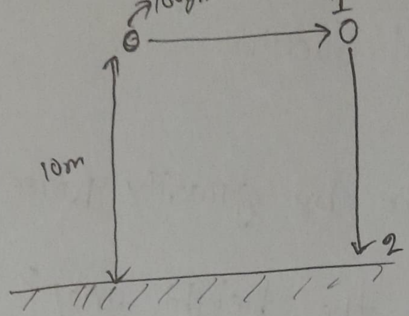
No, its not depend on the pathway, its depends on the height.

Lets imagine an object of 100 gm is above 10m from the ground. Its fall to the ground directly, then what will be the work:



$$W_g = mgh$$
$$= 0.1 \times 9.8 \times 10$$
$$= 9.8\ J$$

Now, imagine the ~~ball~~ object move to the right to position 1, then it fall to the ground, position 2. ~~wh~~ then what will be the work done:



$W_{g_1} = \vec{F} \cdot \vec{d} = F \cdot d \cos 90°$
$= 0 \ j$

$W_{g_1} = \vec{F} \cdot \vec{d} = F \cdot d \cos 0°$
$= 9.8 \times 0.1 \times 10$
$= 9.8 \ j$

$\therefore W_g = W_{g_1} + W_{g_2}$
$= 0 + 9.8$
$= 9.8 \ j$

So, we get the same results as before

Therefore, work done by the gravity force is not depend on the pathway. It's depends on height only.

2) Derive the comparison of velocity before and after an elastic collision. Identify at least three cases.

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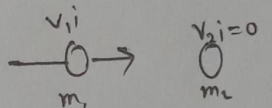
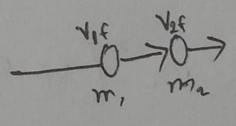
Before and after an elastic collision kinetic energy will be same.

Now, assume that, m_1 is moving towards m_2 with a initial velocity V_{1i}. m_2 is stand-by $(V_{2i} = 0)$.



after the collision m_1 and m_2 moving to the same direction as V_{1i}.



Therefore, we can get,

$$m_1 V_{1i} = m_1 V_{1f} + m_2 V_{2f}$$

$$\therefore m_1 (V_{1i} - V_{1f}) = m_2 V_{2f} \quad \cdots (i)$$

According to kinetic energy, we can get,

$$\frac{1}{2} m_1 v_{1i}^2 = \frac{1}{2} m_1 V_{1f}^2 + \frac{1}{2} m_2 V_{2f}^2$$

$$m_1 (v_{1i}^2 - V_{1f}^2) = m_2 V_{2f}^2 \quad \cdots (ii)$$

devid equation (ii) by the equation (i), we can get two formula,

(A) $V_{1f} = \frac{m_1 - m_2}{m_1 + m_2} V_{1i}$

(B) $V_{2f} = \frac{2m_1}{m_1 + m_2} V_{1i}$

Now, checking some cases:

Case-i:

assume that, $m_1 = m_2$

then, $V_{1f} = 0$

$V_{2f} = V_{1i}$

Case-ii:

assume that, $m_1 << m_2$ (we can ignore m_1 ~~for~~, it's too small)

then,

$V_{1f} \approx -V_{1i}$

$V_{2f} \approx 0$

Case-iii:

assume that, $m_1 >> m_2$ (m_2 as low as, we can ignore)

then, $V_{1f} \approx V_{1i}$

$V_{2f} \approx 2V_{1i}$