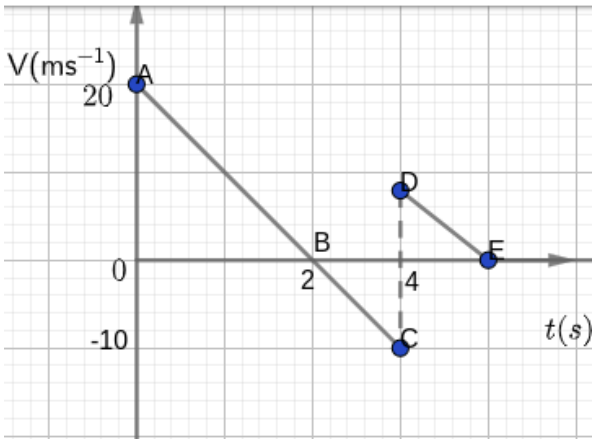
S3- Activity of Intergration Physics Linear Motion TIME 1hr.

1. The diagram below shows part of the motion of a tennis ball, which is projected vertically upwards from the ground and allowed to bounce on the ground. Use this information to answer questions that follow.



i.Describe the motion of the ball relating it to different positions of the ball along the following AB, BC, CDE.

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ii.How high does the ball rise initially?

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iii.Explain why D is not at the same level as A.

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2. You are at a science fair, and one of the exhibits showcases a simple experiment involving viscosity and terminal velocity. In the exhibit, a small steel ball is dropped into two different fluids: honey and water. The ball falls at different rates in each liquid.

Explain why the steel ball falls more slowly through honey compared to water, using your understanding of viscosity and terminal velocity. How do these properties of the fluids influence the ball's motion, and what can this experiment teach us about the behavior of objects in different fluids?"

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3. Imagine two identical cars, Car A and Car B, are initially at rest on a straight road. Car A has a mass of 800 kg, and Car B has a mass of 1,200 kg. Car A starts moving and has a velocity of 20 m/s, while Car B also starts moving but has a velocity of 10 m/s in the opposite direction.

i. Calculate the initial momentum of each car.

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iii. What is the total initial momentum of the system (both cars)?
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iv. The two cars collide head-on and come to a stop after the collision. Calculate the final momentum of the system after the collision.
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v. Using the law of conservation of momentum, explain how the initial and final momenta are related.
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vi. Calculate the change in momentum for each car during the collision.
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vii. How does the change in momentum for Car A compare to the change in momentum for Car B? Explain the physics behind this difference.
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4.Shajara is pulling a wagon up a hill, and the she exerts a force of 300 N to the left The wagon's weight (force due to gravity) is 400 N acting vertically downward. What is the resultant force.

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Marking GUIDE

1. Describe the motion of the ball relating it to different positions of the ball along the following AB, BC, CDE:
AB:The ball is moving upwards from the ground. Its velocity decreases as it moves against gravity, and it reaches its highest point in 2 s.
BC: The ball descend by moving downward and hits the ground in 2 s
CDE: After point C, the ball impacts the ground bounces and then ascent from D to E.
ii. How high does the ball rise initially:
distance = 1/2x2x20= 20 m
iii. Explain why D is not at the same level as A:
The diagram shows that D is not at the same level as A because the ball loses some of its energy during the collision with the ground at point C. When the ball hits the ground, some of its kinetic energy is converted into other forms of energy, such as heat energy and sound,

2. . Viscosity is a measure of a fluid's resistance to flow. The ball falls more slowly through honey, due to the following factors:

Viscosity: Honey is significantly more viscous than water. honey is "thicker" and has more resistance to the motion of the ball than water.

Terminal Velocity: Terminal velocity is the constant speed that an object in free fall eventually reaches when the force of gravity pulling it downward is balanced by the opposing force of air resistance (or fluid resistance in this case). In less viscous fluids, like water, the terminal velocity is higher because the fluid offers less resistance. In more viscous fluids, like honey, the terminal velocity is lower because the fluid offers greater resistance.

This experiment demonstrates how the viscosity of a fluid affects the terminal velocity of a falling object. The steel ball falls more slowly through honey because honey's higher viscosity creates a stronger resisting force, preventing the ball from accelerating as quickly as it does in the less viscous water.

Real-World Application: This experiment helps us understand how different fluids, such as air, water, and honey, impact the motion of objects. It has practical applications in fields like engineering and physics. For example, understanding the effect of fluid viscosity on terminal velocity is crucial in designing parachutes, understanding the flow of liquids through pipes, and even in fields like biology when studying the movement of particles in biological fluids.

3. Calculate the initial momentum of each car:
Momentum (P) is calculated as the product of mass (m) and velocity (v): P = m * v
For Car A:
P_A = 800 kg x20 m/s = 16,000 kg m/s
For Car B:
P_B = 1,200 kg x(-10 m/s) [negative because it's in the opposite direction] = -12,000 kg m/s

Find the total initial momentum of the system:
Total initial momentum = P_A + P_B
Total initial momentum = 16,000 kg m/s - 12,000 kg m/s = 4,000 kg m/s

Calculate the final momentum of the system after the collision:
Since the two cars come to a stop after the collision, the final momentum of the system is 0 kg m/s.

Using the law of conservation of momentum, explain how the initial and final momenta are related:
The law of conservation of momentum states that the total momentum of an isolated system remains constant if no external forces act on it. In this case, the initial total momentum of 4,000 kg m/s is conserved, and it becomes 0 kg m/s after the collision. This means that the momentum lost by Car A is gained by Car B, resulting in the final total momentum of 0 kg m/s.

Calculate the change in momentum for each car during the collision:
For Car A:
Change in momentum (ΔP_A) = Final momentum (0 kg m/s) - Initial momentum (16,000 kg m/s)
ΔP_A = -16,000 kg m/s
For Car B:
Change in momentum (ΔP_B) = Final momentum (0 kg m/s) - Initial momentum (-12,000 kg m/s)
ΔP_B = 12,000 kg m/s

Explain how the change in momentum for Car A compares to the change in momentum for Car B:
Car A experiences a change in momentum of -16,000 kg m/s, meaning it loses momentum during the collision. Car B experiences a change in momentum of 12,000 kg m/s, which is positive, indicating it gains momentum during the collision.

4 The force Shajara exerts (300 N to the left) can be represented as -300 N in the x-direction.
The weight of the wagon (400 N vertically downward) can be represented as -400 N in the y-direction.
using the Pythagorean theorem: R^2 = (-300 N)^2 + (-400 N)^2
R = 500 N

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