PENANG SANGAM HIGH SCHOOL
YEAR 12 PHYSICS
WEEK 10

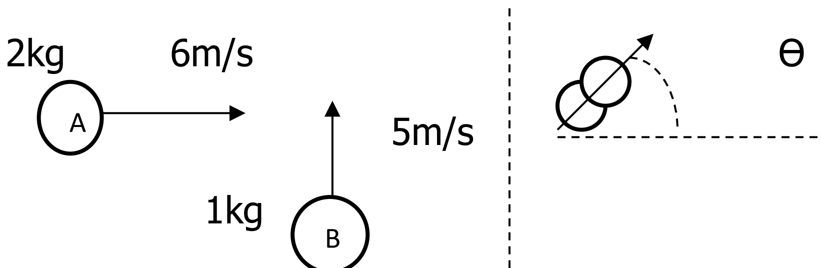
Strand	MECHANICS
Sub Strand	MOMENTUM
Content Learning Outcome	At the end of the lesson students should be able to Apply quantitatively the *Law of conservation of momentum* to two dimensional (at right angle) momentums.

Conservation of momentum

- **Always write an expression for the initial momentum of the system depending on the number masses in the system.**
- **Common velocity of the masses means If the masses move off together with the same velocity**

Let's look at an example when both the masses are moving at right angles to each other

A 2kg ball travels at 6m/s to the right. It undergoes a glancing collision with a 1 kg ball which was traveling at 5m/s as shown in the diagram. After the collision both masses stick together and move off with a common speed.



i. Find the initial momentum of both masses separately

A

$P = mv$

$= (2)(6)$

$= 12$ kgm/s →

B

$P = mv$

$= (1)(5)$

$= 5$ kgm/s ↑

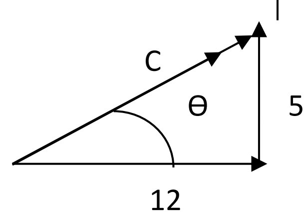
(don't forget to put the directions)

ii. Find the initial momentum of the system

$P_{i\ system} = P_A + P_B$

$= 12 \rightarrow + 5 \uparrow$

$=$



$C^2 = a^2 + b^2$

$c^2 = 12^2 + 5^2$

$c^2 = 169$

$C = \sqrt{169}$

$= 13$kgm/s

$\tan \Theta = O/A$

$\tan \Theta = 5/12$

$\Theta = 22.62^0$

iii. Find the final momentum of the system

The final momentum of the system should be equal to the initial momentum of the system

$P_{f\ system}$ = 13kgm/s ↗

iv. The common velocity of the masses after the collision.

$$P = m\ v$$

$$13 = (2 + 1)\ v$$

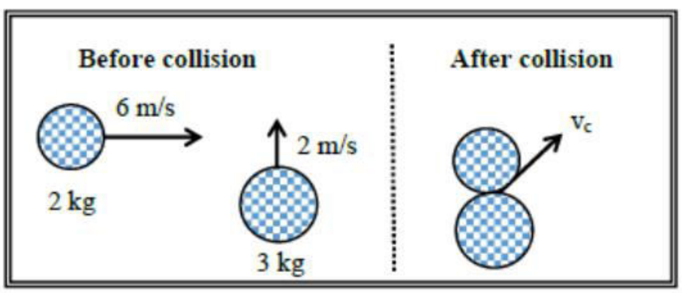
$$13 = 3\ v$$

$$V = 13/3$$

$$= 4.33 m/s$$ ↗

Exercise

A 2 kg ball travelling East at 6 m/s collides with a 3 kg ball travelling North at 3 m/s stick together after collision and move off with a common velocity, v_c.



Find

i. Initial momentum of both masses separately

ii. Initial momentum of the system

iii. Final momentum of the system

iv. Common velocity of the masses after the collision

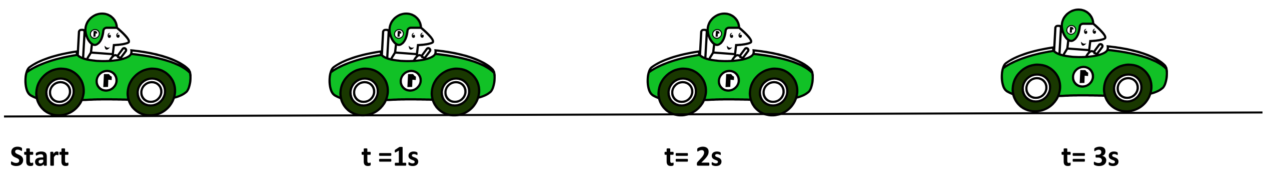
PENANG SANGAM HIGH SCHOOL
YEAR 12 PHYSICS
WEEK 10

Strand	MECHANICS
Sub Strand	Kinematics
Content Learning Outcome	At the end of the lesson students should be able to Use the 3 equations of motion to solve a variety of kinematic problems

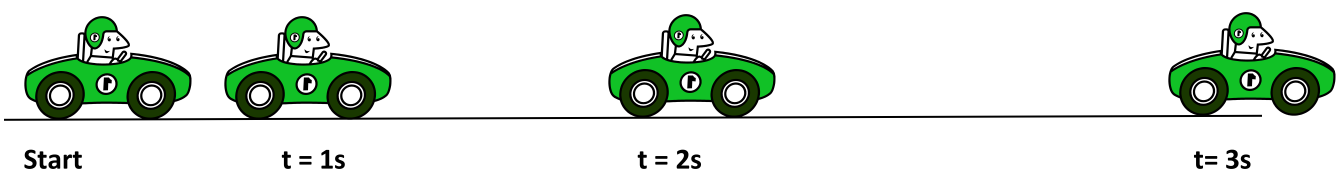
Kinematics

If an object moves in a straight line and its position is plotted at every second

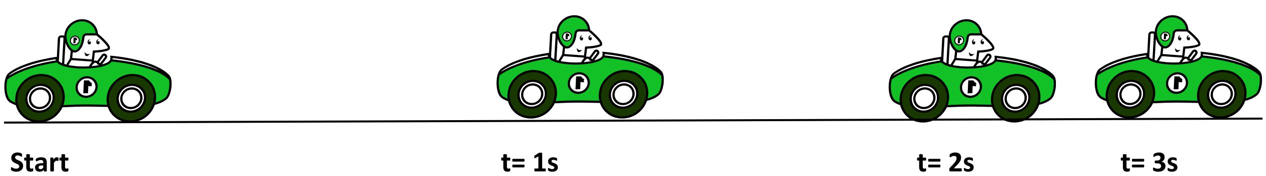
a. If object moves with a constant velocity - distance in between remains the same



b. If object moves with an acceleration - distance increases



a. If the object decelerates - distance decreases



If an object moves with constant velocity then we have to use $S = \frac{D}{t}$

(we have already used this in the previous topic – crossing rivers)

If an object has a constant acceleration then we have to use equations of motion.

$$1.\ V_f = V_i + at$$

$$2.\ V_f^2 = V_i^2 + 2ad$$

$$3.\ d = V_i t + \frac{1}{2} at^2$$

1. An object initially travelling at 5m/s has a constant acceleration of $2m/s^2$. Find
   a. Its final velocity after 8s
   b. The distance it travels in 12s

2. An airplane accelerates down a runway at 3.20 m/s^2 for 32.8 s until is finally lifts off the ground. Determine the distance traveled before takeoff.

3. A car starts from rest and accelerates uniformly over a time of 5.21 seconds for a distance of 110 m. Determine the acceleration of the car.

4. A race car accelerates uniformly from 18.5 m/s to 46.1 m/s in 2.47 seconds. Determine the acceleration of the car and the distance traveled.