Physics Grade 11
Unit 4
Dynamics
Revision Part 1

Dynamics

- Dynamics is the study of cause of motion.
- Newton's law of motion are the basic law of dynamics.

Newton's law of motion

- Newton's laws of motion are three basic laws of classical mechanics that describe the relationship between the motion of an object and the forces acting on it.
    - **Newton's 1st law**
    - **Newton's 2nd law**
    - **Newton's 3st law**

Newton's 1st law (**law of inertia**)

- It stats that "A body will stay at rest or maintain a constant velocity unless an extra force acts to change that motion".
- According to newton's first law being at rest and moving with constant velocity are actually equivalent. Because in both cases, the net force on an object is zero.
- Newton's 1st laws are valid only in inertial frame reference.

  * an accelerating body is a non-inertial frame.

Remark

- The first law implies that in the absence of external Force a body at rest will remain at rest and a body Moving with constant speed in a straight line will continue moving at that speed forever.
- Inertia is the natural tendency of a body to remains at rest or in motion at a constant velocity.
- The mass of a body is measure of inertia. Therefore, the bigger the mass the greater the inertia.

Q#1. If you are riding in a car and it suddenly comes to a stop, what causes you to continue moving forward?

A. The force of the seatbelt pulling you forward

B. The force of friction between your body and the car seat

C. The force of inertia

D. The force of gravity

Q#2. Which of the following is an example of inertia?

A. A soccer ball rolling down a hill

B. A rocket launching into space

C. A person jumping off a diving board

D. A book sitting on a table

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Explanation

On a flat surface, it will keep going at the same speed. The change in speed on slopes is due to gravity. When going downhill, objects will accelerate (go faster), and when going uphill they will decelerate (slow down). On a flat surface, assuming that there is little friction, they will then maintain a constant speed.

Q#3. Which of the following is an example of an object with zero net force acting on it?

A. A ball rolling down a hill

B. A car driving at a constant speed on a flat road

C. A person running uphill

D. A boat sailing against the wind

Q#4. If a spacecraft is traveling through space and experiences no external forces, what will happen to its motion?

A. It will continue to move at a constant speed in a straight line

B. It will slow down and eventually stop

C. It will accelerate indefinitely

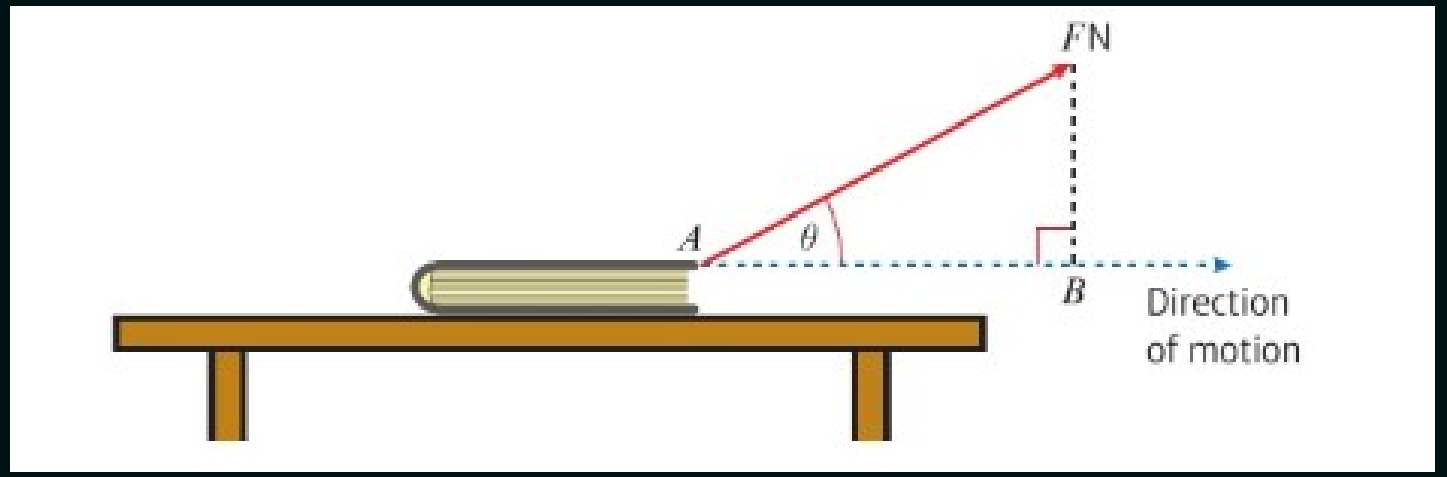
D. It will change direction and start moving in a circular path

Newton's 2nd law (law of acceleration)

- The acceleration of a body is directly proportional to the net force acting to on the body and inversely proportional to the mass of the body.
- F_{net} and a act in the same direction.

Resolving force

- **Resolving means**
- **If a force is applied at an angle to the direction of motion you can resolve it to find the component of the force that acts in the direction of motion.**



Q#5. A particle of weight 30N is being accelerated across a smooth horizontal plane by a force of 6N acting an angle of 25^0 to the horizontal. given that the particle starters from rest find

a) it's a speed after 4s

b) The magnitude of the normal reaction with the plane

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Friction force

Inclined plane

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Q#6. A mass of 600g propelled up the line of greatest slope of a smooth plane inclined at 30^{o} to the horizontal. if it's velocity is 3m/s after the propelling force has a stopped. find the distance it travels before v reaches 0m/s and the magnitude of the normal reaction? Use $g=10m/s^{2}$

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A mass of 3 kg is being pulled up a plane inclined at 20° to the horizontal by a rope parallel to the surface. Given that the mass is accelerating at 0.6 ms^{-2} and that the coefficient of friction is 0.4, find the tension in the rope. Take $g = 9.8\ ms^{-2}$.

Q#7. Masses of 3kg and 5kg are connected by an inextensible string and hang vertically either side of a smooth pulley. they are released from rest. find their acceleration and the time it takes for reach to move 40 cm?

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Q#8. Mass of 3kg is placed on a smooth horizontal table. The coefficient of friction between the 3kg mass and the table is 0.5. A light inextensible string connects it over a smooth peg to a 5kg mass which hangs vertically as shown. Find the tension in the string if the system is released from rest?

Q#8. Mass of 3kg is placed on a smooth horizontal table. The coefficient of friction between the 3kg mass and the table is 0.5. A light inextensible string connects it over a smooth peg to a 5kg mass which hangs vertically as shown. Find the tension in the string if the system is released from rest?

Q#9. **A 3 kg mass held in equilibrium on rough(=0.4) plane inclined at 30^{o} to the horizontal. it is attached by a light, inextensible string to a mass of M kg hanging vertically beneath a smooth pulley, as shown in the diagram find M if the 3kg mass is on the point of sliding up the plane?**

Q#9. **A 3 kg mass held in equilibrium on rough(=0.4) plane inclined at 30^{o} to the horizontal. it is attached by a light, inextensible string to a mass of M kg hanging vertically beneath a smooth pulley, as shown in the diagram find M if the 3kg mass is on the point of sliding up the plane?**

Q#10. A particle A and B of mass 4kg and 10kg respectively are connected by a light, inextensible string over a smooth pulley as shown. a force of 15N acts on A at an angle of 25^{o} to the rough horizontal plane where =0.7. When B is released from rest it takes 2s to fall d m to the ground. find d?

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End of part 1
Thank you