CHALLENGE 5

MARBLE RUN – A Mechanical Engineering Challenge

It's time to slow the roll! Can you create a track/ramp that allows a marble to roll as slowly as possible?

Objective :

The goal of this project is to build ramps for marbles using household materials and to investigate which materials and techniques can cause marble to move down the ramps as slow as possible.

Successfully complete the challenge and your entry will be entered into a draw where at random you stand to win either RM25, RM50 or RM100 in credit.

Challenge Rules :

1. Using items, you can find at home, make a marble run by creating ramps that your marble can roll on against the wall
2. The ramps should be within a 100cm x 100 cm space on the wall
3. Record the time it took for the marble to travel from the top to the end of your marble run. The goal is to try to make the marble roll down the ramps as slow as possible
4. Marble must be able to travel continuously from start to finish without interference
5. Your marble run must have a collection cup at the end of the run to catch your marble
6. Marble alternatives are allowed. Ie ping pong ball, pom pom.

Science Concepts :

With this project, children get a sense of how different forces work on an object. The trajectory and speed of the marble can be controlled by changing the amount of friction acting on the marble and the angle of the track which the marble travels on.

Gravity -the force that causes things to fall towards the earth.

This force can be seen acting on the marble when it is pulled by gravity to roll down the track you built when you release it from the top.

Friction – force that causes resistance of motion of an object moving over another object.

This frictional force is the result of the friction between the marble and the surface of the ramp. The type of surface of the ramp – whether smooth or rough, affects the amount of friction on your marble. Some things make lots of friction, like brakes on a tire, and some make very little friction, like skates on ice.

Angle – a measurable amount used to define an object's distance from horizontal when it is rotated.

The angle of the track can affect the speed your marble travels. You might notice that when your ramp is placed in a position with a larger angle, meaning when it is steeper, your marble moves down quicker. However, when you place your track at a slight downward angle, your marble moves at a slower pace.

Momentum - can be defined as "mass in motion." All objects have mass; so if an object is moving, then it has momentum - it has its mass in motion.

The heavier your marble (whichever object you choose to roll down the ramps of your marble run) the higher the momentum.

Potential energy - Potential energy is energy that is stored because of its position

A marble at the top of the track will have a lot of potential energy and as it travels down the track the potential energy is converted into kinetic energy.

Kinetic energy - Kinetic energy is the energy that an object has because of its motion

As your marble travels down the marble run, it is said to have kinetic energy.

Learning Outcomes (Questions Parents can ask their Child)

1. Observation

Ask your child what they observed at each stage of the project

- Which material produced the most friction?
- How would the absence of gravity affect the movement of your marble?

2. Comprehension

Ask your child what do they think happened?

- What caused your marble to move downwards?

Answer: Gravity is a force that causes things to fall to the ground

- How come some materials cause the marble to move slower?

Answer: Friction force that causes resistance of motion of an object moving over another object.

3. Evaluation

Ask your child if he/she faced any challenges while making this project

- Were there parts of your marble run where your marble went off the ramp?

Tip: Adjusting the angles of the ramps can help direct the marble to the next ramp smoothly

4. Testing & Improving

Ask them what did they do to overcome those challenges?

- What were some changes you made while building your marble run to slow down the movement of the marble?

You can try to make a marble go around a loop.

1. The marble has to be going very fast to make it around the whole loop
2. The marble will have to start from really high up and drop down towards the loop as starting from high up will give it more potential energy that can be converted into kinetic energy.
3. Try adjusting how high you let the marble drop from.

4. You can also change the size of the loop but a bigger loop will require a lot more energy to make it through.
5. What happens if you test different objects on your marble run? Can they all loop the loop? If some objects can't make it, can you figure out why?