Motion and Stability Study Guide

Standard and Objectives:

PS.5.2 Understand force, motion, and the relationship between them.

PS.5.2.1 Carry out investigations to explain how factors such as gravity, friction, and change in mass affect the motion of objects.

PS.5.2.2 Use mathematics and computational thinking to infer the motion of an object (including position, direction, and speed).

Objective: PS.5.2.1 Carry out investigations to explain how factors such as gravity, friction, and change in mass affect the motion of objects.

- ➔ Forces can cause an object to start, stop, change speed or direction.

- ➔ Gravity- a non-contact force, pulls all objects towards the center of the Earth.
  - ◆ Gravity pulls object down to the ground

- ➔ Change in mass- increase/decrease in mass requires increase/decrease in force needed to change motion
  - ◆ If you have 2 trucks. One with a mass higher than the other. You would have to push the truck that has a higher mass with MORE force.
  - ◆ IF you ADD MORE mass to a truck while it is traveling---- it will cause the speed to DECREASE

- ➔ Friction- is a contact force that is created anytime two surfaces move or try to move across each other.
  - ◆ Friction opposes motion causing moving objects to slow down or stay in place.
  - ◆ Increasing or decreasing friction changes an object's motion.
  - ◆ If you push a toy car across a flat surface such as carpet-- it will cause the toy car to DECREASE in speed because of FRICTION

- ➔ The greater a force is, the greater the change in motion it produces. The greater the mass of the object being acted on, the less the effect of the same force.
- ➔

- ➔ What does the pattern of data you observe allow you to conclude from the experiment? (*e.g., increasing friction is slowing the motion of the object*)

- ➔ What do you predict would happen if we changed the mass of the object? (*more*

mass = more friction, more mass = more force needed to change the motion of the object)

- ➔ How would increasing/decreasing friction on an object affect the motion of an object? *(slows down or speeds up)*

- ➔ How could you increase/decrease the friction experienced by an object? (*make a rougher/smoother surface*)
- ➔ Explain a scenario when you would want to decrease or increase friction. *(polished surface for bowling, tread on your shoes when playing basketball)*

- ➔ Use a diagram and arrows to show the direction (*towards the center of the Earth*) gravity pulls on a ship sailing in the ocean after it disappears over the horizon (*the ship would continue to sail as gravity pulls all objects towards the center of the Earth no matter where they are located*)

- ➔ ***Gravity** pulls any object on or near the earth toward it without touching it. If a wagon or bicycle are moving downhill, gravity will force the wagon and bicycle to speed up.

- ➔ ***Friction** is a force that is created anytime two surfaces move or try to move across each other. For example, a wagon being pushed in a straight line with an **increase in friction** on the wheels, would cause the wagon to **SLOW** down. Brakes on a car/bike cause frictional forces on the tires/wheels of the car and bike. Therefore, the vehicle will slow down and eventually stop.

- ➔ A ball that is kicked and rolls along a level field will come to a stop due to friction. If the ball was kicked over a hill, gravity would pull it towards the lowest point and friction would eventually stop the ball's movement.

- ➔ All matter has **mass**.

- ➔ Changing any or all of the above factors will affect the motion of an object.

Words to study and know: gravity, friction, mass, motion, force, increasing, decreasing, speed, direction, non-contact

Objective: PS.5.2.2 Use mathematics and computational thinking to infer the motion of an object (including position, direction, and speed).

- ➔ It is possible to measure the motion of an object based on the distance it travels in a certain amount of time.

- ➔ I can measure the distance objects travel in a given time and compare their relative speeds.

- ➔ I can use data sets/tables and graphs to show how values of one quantity (e.g. position) are related to values of another (e.g. time).

- ➔ A graph can be created using one axis to represent the distance that an object travels, and the other axis to represent the period of time the object is traveling.

- ➔ If position DOES NOT change over a period of time, speed will also NOT change

- ➔ I can analyze a distance/time graph to determine whether an object is moving or stopped.

- ➔ How is the motion of an object changing over time? *(starting, stopping, changing direction)*

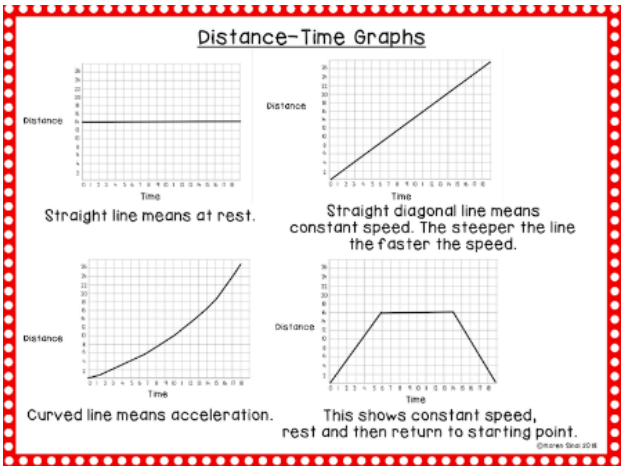
- ➔ What similarities or differences do you notice in the motion displayed in the graphs (e.g. time stopped, number of stops)

- ➔ *If you roll a ball across a surface at 7 feet per second and want to calculate the total distance traveled by the ball, you would need to know the total time if it took the ball to roll (rate x time = distance).

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$



Words to study and know: position, cardinal directions, north, south, east , west, right, left, forward, back, speed, direction, distance, relative, time, axis