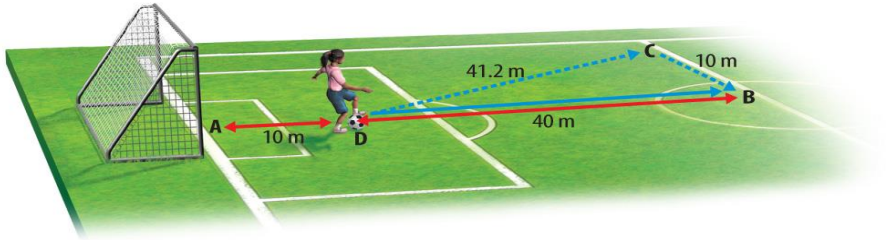
Chapter 8 Lesson 1: Describing Motion

Vocabulary

-reference point	-motion	-velocity
-position	-speed	-acceleration
-displacement		

- A reference point is the starting point used to locate another place or thing.
- Position describes an object's distance and direction from a reference point.
- Displacement is the difference between initial, or starting, position and the final position.
- An object's displacement and the distance it travels are not always equal.



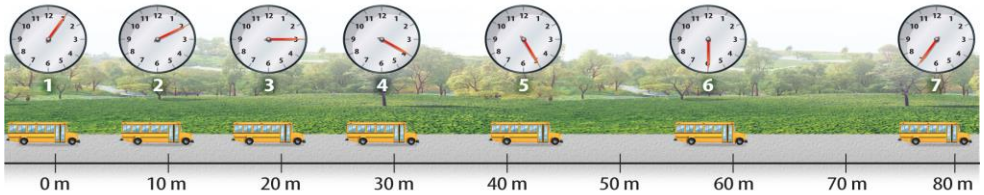
- If the girl runs from position D to position C and then to position B, the distance she runs is 51.2m. Her displacement is 40m.

Motion

- Motion is the process of changing position.

Speed

- Speed is the distance an object moves in a unit of time.
- When an object moves the same distance over a given unit of time, it is said to have a constant speed.
- When the distance an object covers increases or decreases over a given unit of time, the object is said to be changing speed.
- Average speed is equal to the total distance traveled divided by the total time.



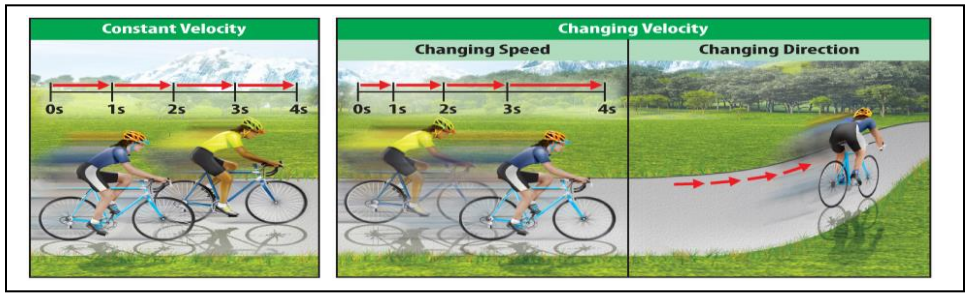
The bus maintains a constant speed of 10 m/s from positions 1 to 4.

The bus is changing speed from positions 4 to 7.

The bus traveled a total of 80m in 30s. Therefore, the average speed of the bus is 80m / 30s which = 2.7m/s

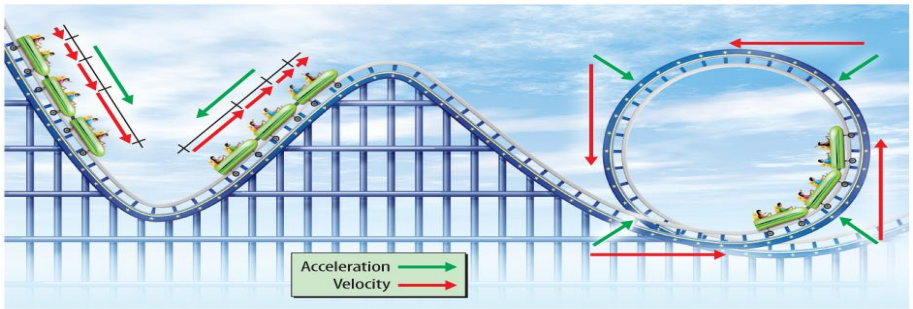
Velocity

- Velocity is the speed and direction of a moving object.
- You can use arrows to show the velocity of an object. The longer the arrow, the fast the object is moving.
- Contant velocity means that an object moves with constant speed and does not change direction.
- Velocity changes when either the speed or the direction of motion of an object changes.



Acceleration

- Acceleration is a measure of how quickly the velocity of an object changes.
- When the velocity of an object changes, it accelerates
- When an object's acceleration is in the same direction as its motion, this is called positive acceleration.
- The action of slowing down is called negative acceleration.



When the roller-coaster car increases speed, decreases speed, or changes direction, it accelerates. Acceleration takes place whenever velocity changes.

Chapter 8 Lesson 2: Graphing Motion

Vocabulary

-distance-time graph

-speed-time graph

Describing motion with graphs

- A graph that shows how distance and time are related is a distance-time graph.
- The y-axis shows the distance an object travels from a reference point, and time is on the x-axis.
- If the angle of the line on distance-time graph changes, you know the speed changes.

Example: In order to better understand how sea turtles migrate, marine biologists attach tracking devices to turtles' shells.

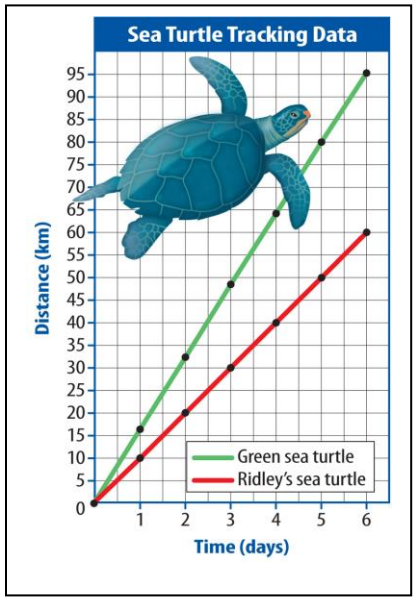
The table shows tracking data that was gathered for a green sea turtle off the coast of Florida.

Green Sea Turtle's Distance and Time Data

Time (days)	Distance (km)
0	0
1	16
2	32
3	48
4	64
5	80
6	96

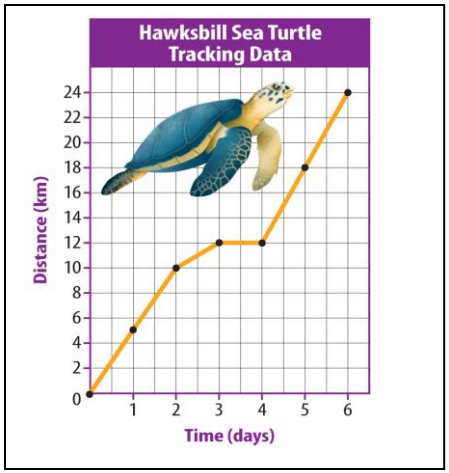
Use the following steps to make a distance-time graph:

1. Draw x- and y- axes.
2. Label the x-axis for time measured in days. Label the y-axis for distance measured in kilometers.
3. Make tick marks on the axes and number them. Be sure the values you choose allow you to plot the data.
4. Plot the data from each row of your data table. Move across the x-axis to the correct time and up the y-axis the correct distance. Draw a small circle/dot.
5. Connect the data points with a line.



- An object moving the same distance in the same amount of time moves at a constant speed
- An object moves with constant speed if the line representing its motion on a position-time graph is straight.
- You can use distance-time graphs to compare the motion of two different objects.
- Steeper lines of distance-time graphs mean that the average speed is greater.

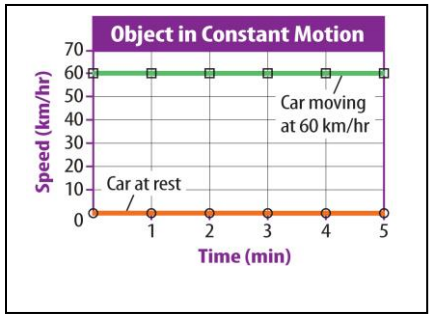
Each change in the steepness of the line means that the average speed of the object changed during that time interval.



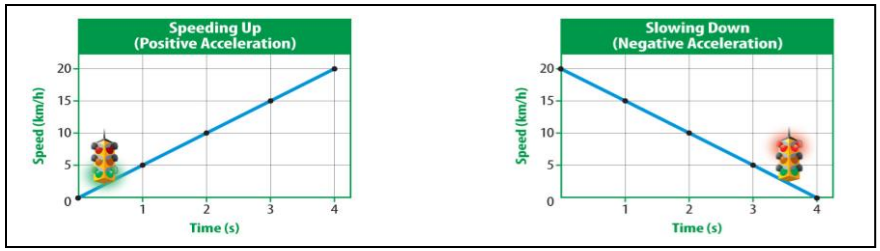
Speed-Time Graphs

- A speed-time graph shows the speed of an object on the y-axis and the time on the x-axis.
- A speed-time graph shows how the speed of an object changes during each interval of time.

- The speed-time graph for an object at rest is a horizontal line at y = 0.
- On a speed-time graph, an object moving with a constant average speed is a horizontal line.



- Increasing speed is indicated by a line that slopes upward.
- Negative acceleration is indicated as a line that slopes downward.



Chapter 8 Lesson 3: Forces

Vocabulary

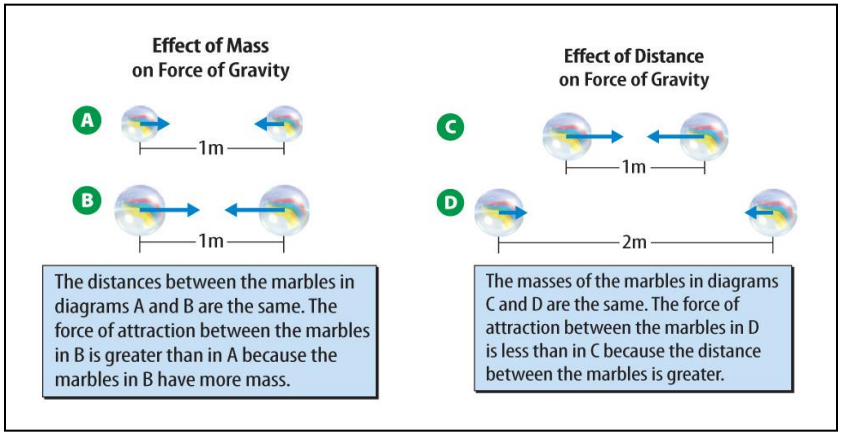
-Force	-Gravity	-Newton's 1st law of motion
-Contact force	-Friction	-Newton's 2nd law of motion
-Noncontact force	-Air resistance	-Newton's 3rd law of motion

What is force?

- A force is a push or pull on an object.
- Force has both size and direction.
- You can use arrows to show the size and direction of a force.
- The unit for force is the newton (N).
- A constant force is a push or pull on one object by another object that is touching it.
- A force that one object can apply to another object without touching it is a noncontact force.

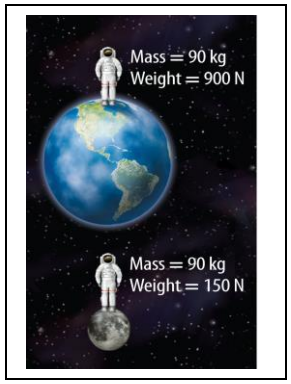
Gravity – A Noncontact Force

- Gravity is an attractive force that exists between all objects that have mass.
- The size of a gravitational force depends on the masses of the objects and the distance between them.



- Weight is a measure of the gravitational force acting on an object's mass.

- The weights of objects on the Moon are smaller than objects on Earth because the mass of the Moon is smaller.



Friction – a Contact Force

- Friction is a contact force that resists the sliding motion of two surfaces that are touching.
- The force of friction acts in the opposite direction of an object's motion.
- The heavier an object, the more it is affected by friction than a lighter one.
- Air resistance is the frictional force between air and objects moving through it.

Combining Forces

- When more than once force acts on an object, the forces combine and act as one force.
- The sum of all the forces acting on an object is called the net force.
- When two forces act on the same object in opposite directions, you must include the direction of the forces when you add them to calculate net force.
- If the net force on an object is 0 N, the forces acting on the object are called balanced forces.
- When the net force on an object is not 0 N, the forces acting on the object are unbalanced.

Unbalanced Forces and Acceleration

- When unbalanced forces act on an object, the object's velocity changes.
- Unbalanced forces can change either the speed or direction of motion.

Balanced Forces and Constant Motion

- When balanced forces act on an object, the motion is constant.
- The object is either at rest or moving at a constant velocity.

Forces and Newton's Laws of Motion

- According to Newton's first law of motion, if the net force acting on an object is zero, the motion of the object does not change.
- Inertia is the tendency of an object to resist a change.
- According to Newton's second law of motion, the acceleration of an object is equal to the net force exerted on the object divided by the objects mass.

$$\text{acceleration } (a) = \frac{\text{force } (f)}{\text{mass } (m)}$$

- The greater the mass, the greater the force needed to accelerate the object at the same rate.

- Newton's third law of motion says that for every action there is an equal and opposite reaction.
- When one object exerts a force on a second object, the second object exerts the exact same force in the opposite direction back onto the first object.
- Equal and opposite forces are called force pairs.