Chp 5: Lect 1: Speed, Distance & Time

What is physics? Before we start talking about motion, it's probably best to introduce physics. What is physics? It is a branch of physical science, but what else is it? Think of what we've learned so far this year. We talked about the LITTLE stuff: atoms and matter, how atoms make up elements and how elements are the building blocks of everything, how matter reacts and interacts with itself. Next month we'll talk about the BIG stuff: space science and how the universe is organized, how planets and planetary bodies look and move. What do the big things and the little things have in common? Basically, EVERYTHING in the universe has an effect on every other thing. Physicists study those_____and _____. It is a science that relates to all other sciences: Chemistry, Biology, Geology, Astronomy, Meteorology, Engineering, etc. If you can name it, chances are physics is involved. Everything on Earth, everything in our solar system, everything in our galaxy, and everything in the universe moves and exists because of forces. Physics studies those FORCES and interactions.

We start with distance: Distance, rate & time: Brain Pop

Distance, Direction, & Position*:* How far do you live from school? Where is your house compared to the school? Notice how you provided a different answer to these questions. To describe the exact location or position, you must specify a _____as well as a distance.

Distance
Distance is the amount of _____ between _____. A distance measurement <u>does not</u> include information about the <u>**direction**</u> you would have to travel to get from one point to the next. If you say you live a distance of one mile from school, you could mean anywhere on the circle of points shown in the picture. There are many ways to give directions. What are some?
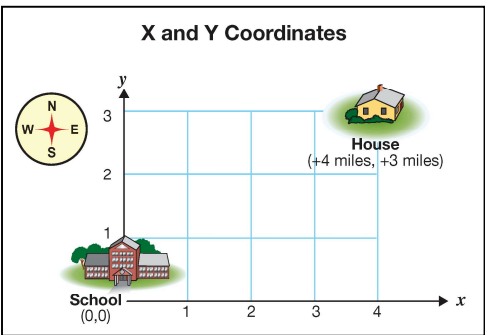1.
2.
"Reverse I Spy"
What kinds of information must you give another person when you are describing a location?
The _____of a place or an object is the location of that place or object. Often you describe where something is by comparing its position with where you currently are. For example, the drinking fountain is approximately 8 meters east of me.

Position
A position is always given compared to an _____. In "I Spy", you were the origin. The origin is a fixed _____ When giving directions to your house from school, the school is the origin. The position of your house might be 1 mile north of school.
Describing Position
Both positive and negative numbers are used to describe position. A _____ position usually means in front of, to the right of, or above the origin. A _____ position usually means behind, to the left of, or below the origin. A number line or graph can be used to think about position in straight-line motion. The origin is at zero.


You Try It! Calculating Position: Draw the lines (direction)

1. You start at the origin, walk 5 meters to your left, 9 to the right, and 2 to the left. Where are you now?	2. You start at the origin and walk 3 meters east, 7 meters west, and 6 meters east. Where are you now?	3. Challenge: You start at the origin, walk 10 miles north, 3 miles east, 14 miles south, 2 miles west, 4 miles north, and 1 mile west. Where are you now?

What is speed?

Speed is the most common measurement used to describe the motion of objects. Saying this Ferrari is fast, while true and an understatement, is not an accurate enough of a description How do you measure speed? In other words, how would I measure the Ferrari's speed around the track - without looking at the speedometer? It depends on the _____traveled and the _____taken to travel that distance. I would measure the length of the race track and divide by the time it took the car to finish. We can use the following equation:

Example of speed: Imagine two bicycles moving along the road at different speeds. The picture below shows the position of each at one second intervals. The fast bicycle (the bottom one) moves _____ _____ the speed of the slow one. In other words: the fast bicycle moves 3 meters each second, while the slow bicycle moves only 1 meter each second. At 1m/s, a bicycle travels one meter each second. At 3 m/s, it travels three meters each second. Both bicycles in the diagram are moving at _____. Constant speed means the _____ is traveled every second. The snapshots are evenly spaced, so you know the distance traveled by each bicycle is the same each second.
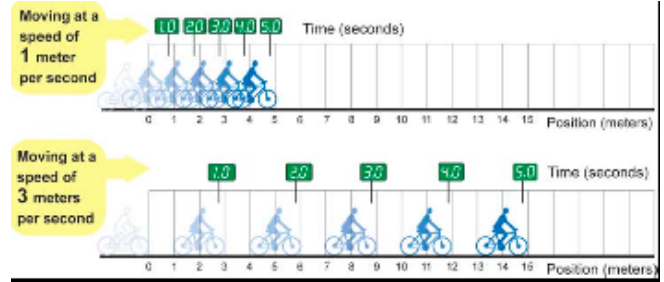
Go to the Motion Graphs & Motion Math Little Book for the next section

What is Average Speed?

Usually, objects _____travel at a constant speed. Do you run at a constant pace when you run the mile for PE? Think about when you drive up to Disneyland & hit traffic. It is more useful to calculate an object's average speed using the following equation: Think about when you meet your friends at the movies. You say "I'll meet you there in 20 minutes". Are you traveling at a constant rate for 20 minutes? No. Instead we average the speed. We went 5 miles in 20 minutes, so I traveled at about .25 miles/minute.

You Try It! Calculating Speed

#1 If your great uncle Eddie traveled 2500 miles from LA to New York in 4 hours, what was the average speed of his airplane?	#2 It takes you 9 minutes to run the mile. What is your average speed in miles per minute? In miles per hour?	#3 A bike rider can ride his bike up a mountain at an average speed of 29 km/hour for 32 kilometers. How long did he ride for in hours? Minutes?

What is velocity?

Here's a riddle: Two birds leave the same tree at the same time.
They both fly at 10 km/h for 1 hr, 15 km/h for 30 minutes, and 5 km/h for 1 hour. Why don't they arrive at the same destination? Even though the birds traveled at the same speed and time, they did not travel in the same _____. They had different _____. This is different from speed! Velocity is the _____in a specific _____. We use the same equation to calculate velocity as we do to calculate speed - but we make sure the answer involves direction!
When I am walk around the room, my _____may be about 4 miles/hour. My _____would be 4 mph going **SOUTH.** Velocity always includes a reference direction. Look at the cars on the highway. They are all traveling from 60-80 mph, but in different directions. They have different velocities! A change in velocity is due to a change in _____, _____or **both**. A _____would be motion in a straight line at a constant speed.

Units for Speed

The word "_____" means "for every" or "for each". A speed of 100 kilometers per hour is short for saying 100 kilometers for _____ _____. Since speed is a ratio of distance over time, the units for speed are a ratio of distance units over time units.

Distance	Time	Speed	Abbreviation
Meters	Seconds		
Kilometers	Hours		
Miles	Hours		

Average vs. Instantaneous Speed:

During a typical trip to school, your car will undergo a series of changes in its speed. If you were to inspect the speedometer readings at regular intervals, you would notice that it changes often. The speedometer of a car reveals information about the instantaneous speed of your car. It shows your speed at a particular instant in time. The instantaneous speed of an object is not to be confused with the average speed. _____**is a measure of the distance traveled in a given period of time;** it is sometimes referred to as the distance *per* time ratio. Suppose that during your trip to school, you traveled a distance of 5 miles and the trip lasted 0.2 hours (12 minutes). The average speed of your car could be determined as: