Matter in Motion

Sci #

Chapter 5

Draw or tiny downloads: showing the following examples

Force	Unbalanced force
Balanced force	Net force
Weight vs mass	Projectile motion
4 Different types of friction:	

Name: _____ Sci Number: ___ period:__

Parent Sig_____

Vocabulary: Section 1 & 2

Word/pg	Definition: The definition in the CHAPTER (not the glossary)
motion	
Speed	
Velocity	
acceleration	
force	
Newton(N)	
Net force	

1. On pg 106. Why is lacrosse a good example of physics in action?

_____
_____
_____

Section 1: Measuring Motion (pages 108-114)

2. You might think that the motion of an object is easy to detect - you just have to _____ the object. But there's more to it than that! You actually must observe the object in relation to another object that appears to _____. The object that appears to stay in place is a _____. When an object changes position over time, when compared with a reference point, the object is in _____.

3. Look at the pictures on the bottom of pg 108. What do they tell you?

_____
_____
_____

4. Name something in motion that you can't see moving.

_____

5. Why do we generally calculate average speed?

_____
_____
_____

6. If you take a walk for 1.5 hours and travel 7.5 km, what is your average speed? _____

7. How is velocity different from speed?

_____
_____
_____

8. What is the equation for acceleration?

9. Match the word with the correct definition by drawing a line to connect the two.

Acceleration	Speed in a given direction
Deceleration	Rate at which velocity changes
Speed	Rate at which an object moves
Velocity	Rate at which velocity decreases

10. A coconut falls from the top of a tree and reaches a velocity of 19.6 m/s when it hits the ground. It takes 2 seconds to reach the ground. What is the coconut's acceleration? _____

11. Copy the graph on page 114 into the box below. Then, draw a graph showing deceleration next to it.

Graph Showing Acceleration	***Graph Showing Deceleration***

Additional section 1 notes:

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Section 2: What is a force? (pages 115-118)

12. A _____ is a push or pull and is measured with a unit called the _____.

13. What are 3 examples of different forces?

_____

_____

_____

14. Copy figure 8 & figure 9 in the two boxes below – as best you can. Be sure to label the forces.

Fig 8: Forces in the Same Direction	Fig 9: Forces in Different Directions

15. a) What is the net force when you combine a force of 7 N south with a force of 5 N north? _____

b) What is the net force when you combine a force of 15 N east with a force of 22 N east? _____

	Definition	Does this produce a change in motion?	Example
Balanced Forces			
Unbalanced Forces			

Be sure to put the units & SHOW WORK for full credit

Motion Math

Solve the following problems. Show all your work and attach additional paper if necessary. Write the formulas in the provided boxes to help. Remember to include the correct units.

Speed Formula:

Speed & Average Speed

1. Nascar driver, Jeff Gordon, has a car that is one of the fastest on the circuit. If it travels 600 miles in 4 hours, what is his cruising speed?

2. The fastest car on Earth, a German-made Thrust SSC, would win every Nascar race in America. If it takes 0.5 hours (30 minutes) to travel 380 miles, what is its speed?

3. The fastest train on Earth, the TGV from France, can travel at faster speeds than trains in the United States. During a speed test, the train traveled 800 miles in 2.5 hours. What is its speed?

4. How fast was a plane flying if it traveled 400 km in 30 min?

5. A Hummer travels at a speed of 50 mi/hr for 4 hrs. How far did the car travel?

6. The fastest plane ever made, the Lockhead SR71, was able to travel 2200 miles per hour. Based on this speed, how far could it travel in:

a. 2 hours?

b. 3 hours?

c. 5 hours?

Be sure to put the units & SHOW WORK for full credit

Velocity Formula:

Velocity

7. A car traveled 1025 km from El Paso to Dallas in 13.5 hr. What was its average velocity?

8. A student walks 10 blocks to a computer store (Assume all the blocks are equal length.)
a. How long will it take him to reach the computer store if he walks 3 blocks in 2 min?

b. What is his average velocity?

9. A cheetah runs at a velocity of 88 ft/sec for 40 seconds. How far does this cheetah run?

Acceleration Formula:

Acceleration

10. Twenty seconds after a soccer ball is kicked (initial velocity = 0), its velocity is 32 m/s. What is its acceleration?

11. A driver starts his parked car and within 1 minute reaches a velocity of 30 mph as he travels east. What is his acceleration?

Random – Find the missing variable

12. V = 40 mi/hr t= 3 hrs. D=?

13 A = 9.8 m/s^2 t= 3 hr V=?

14. t = 5 hr d= 100 m. V=?

15. V = 100 mi/hr d= 400 mi t= ?

Teach a parent: Today's Concept :

Teach your parents about speed , velocity & acceleration!

Help your parent become an expert !

Be sure they write what they have learned from your teaching

Parent Response

1. _____ I'm not sure my child really understands, therefore, I don't either. Please work with him/her and let's try again.
2. _____ The concept was explained thoroughly with effective examples he/she created. "By golly, I think they've got it!"
3. _____ WOW! My child did an exceptional job! It was logically explained, therefore I caught on immediately and feel confident about teaching it to others. The self-created examples were a perfect fit. My child even asked me a question at the end to make sure I understood. I believe my child could effectively teach this concept to others.

Parent Signature:_____ Date: _____

Mom or Dad Comments: Please explain how your student taught you this concept and * <u>what you learned in 3-5 sentences!</u> * This is critical for them to receive full points

_____
_____
_____
_____
_____
_____
_____
_____

Teach a parent: Today's Concept :

Teach your parents about the 4 different types of friction!

Help your parent become an expert !

Be sure they write what they have learned from your teaching

Parent Response

1. _____ I'm not sure my child really understands, therefore, I don't either. Please work with him/her and let's try again.
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Mom or Dad Comments: Please explain how your student taught you this concept and * <u>what you learned in 3-5 sentences!</u> * This is critical for them to receive full points

_____
_____
_____
_____
_____
_____

Vocabulary: Section 3&4

Word/pg	Definition: The definition in the CHAPTER (not the glossary)
friction	
gravity	
weight	
mass	

Friction: Chapter 5, Section 3 – pages 119-124

1. Read the top two paragraphs on page 119. "The painful difference between sliding on grass & sliding on pavement has to do with _____.
2. Friction is a _____ that opposes _____ between two _____ that are touching."
3. What causes friction (figure 11)?

_____

_____

_____

_____

4. Name two ways in which friction can be increased.

_____

_____

Give an example /define the types of friction:	Draw an example
Sliding: _____	
Rolling: _____	
Fluid: _____	
Static: _____	

6. Name two ways that friction is harmful and two ways that friction is helpful to you when riding a bicycle.

_____

_____

_____

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Additional section 3 notes:

_____

_____

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Gravity Chapter 5, Section 4 Questions – pages 125-129

1. How does gravity affect motion on the moon?

_____
_____
_____

2. True or False: All matter experiences gravity, so all objects experience an attraction towards all other objects. Explain:

_____
_____
_____

3. If all objects are being pulled toward you and each other because of gravity on Earth, why don't you notice objects moving towards one another?

_____
_____
_____

4. Newton generalized his observations on gravity in a law known as the law of _____. The law describes the relationships between gravitational _____, _____, and _____. It is called universal because it applies to all objects in the universe, from the tiniest speck of _____ to the largest _____.

5. Copy figure 20 into your notebook & include the labels a-c.

6. How does the mass of an object relate to the gravitational force the object exerts on other objects?

_____
_____
_____

7. How does the distance between objects affect the gravity between them?

_____
_____
_____

8. What is the difference between mass and weight?

_____
_____
_____

A Weighty Problem

Complete this worksheet after you finish reading Chapter 5, Section 4.
Pictured below are two measurement devices, *A* and *B*.

Weight or Mass?	Weight or Mass?

A.

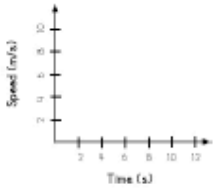
B.

1. Determine whether each device measures *mass* or *weight,* and circle the correct term in each box.
2. The following list contains information that relates to either *mass* or *weight.* Write each of the bulleted items in the correct boxes above. Some information may go in more than one box.

- balance
- spring scale
- measure of gravitational force exerted on an object
- amount of matter in an object
- constant on Earth
- measured in grams
- changes when gravitational force changes
- never changes
- expressed in newtons
- remains the same when gravitational force changes
- six times less on the moon than on Earth

NOTES: SPEED-TIME GRAPHS

Speed & Time Graph

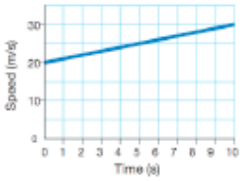


- Show an object's speed or _____ over time
- **Speed or velocity** on ____ -axis
- **Time** on ____ -axis

Label the Graphs

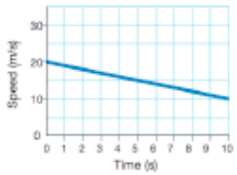
A. _____

This object is getting faster & faster.



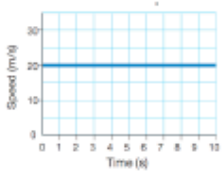
B. _____

This object is getting slower & slower, or _____.



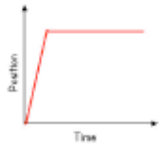
C. _____

This object is maintaining a _____ speed.

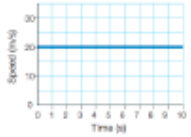


Flat Lines

A flat line on a **position-time** graph means _____.



A flat line on a **speed-time** graph means _____.

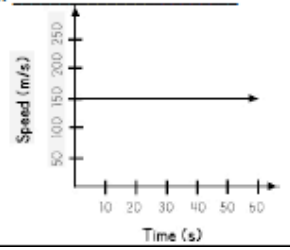


Calculating Distance

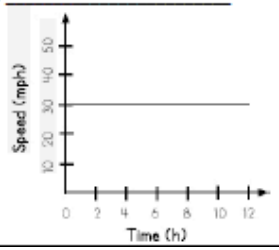
- It is also possible to calculate how _____ an object has traveled using the following equation:

DISTANCE = SPEED x TIME

How far did this object travel during the first 20 seconds? _____



How far did this object travel during the first 8 seconds? _____

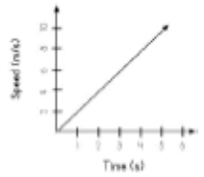


Calculating Acceleration

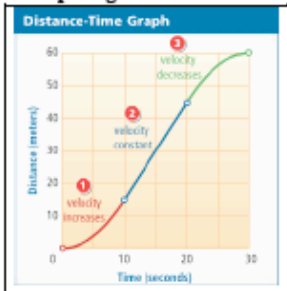
It is also possible to calculate an object's acceleration using the following equation:

$$\text{Acceleration } (m/s^2) = \frac{\text{Change in Speed } (m/s)}{\text{Time } (s)}$$

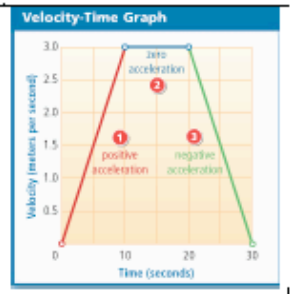
What is the object's acceleration? _____



Comparing a Position-Time Graph to a Speed-Time Graph

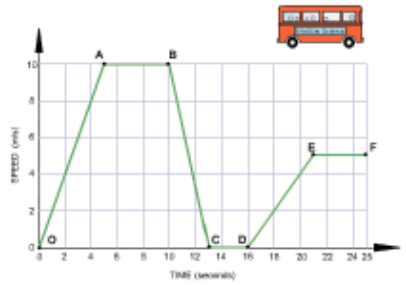


1. As the student starts to push the scooter, his velocity increases. His acceleration is positive, so he moves forward a greater distance with each second that passes.
2. He coasts at a constant velocity. Because his velocity does not change, he has no acceleration, and he continues to move forward the same distance each second.
3. As he slows down, his velocity decreases. His acceleration is negative, and he moves forward a smaller distance with each passing second until he finally stops.



1. How far does the boy travel from the 10-second interval to the 20-second interval? _____
2. What is the boy's acceleration from the 0-second interval to the 10-second interval? _____

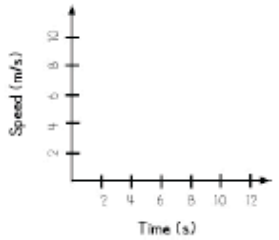
Interpreting a Speed-Time Graph #2



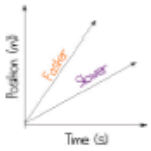
1. How far did the bus travel from point A to point B?
2. What was the bus's speed at point C?
3. For how many seconds did the bus decelerate?
4. What was the bus' acceleration from point D to point E?

Drawing a Speed-Time Graph

Maria walks at a constant speed of 6 m/s for 5 seconds. Then, she runs at a constant speed of 10 m/s for 5 seconds. **Create a speed-time graph using her data.**



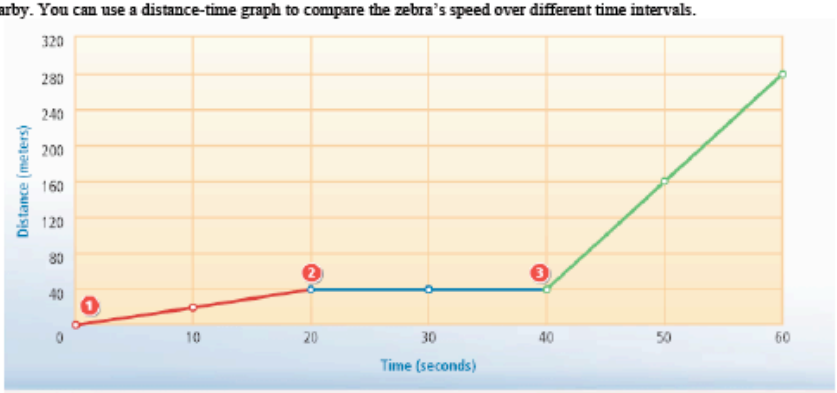
NOTES: POSITION-TIME GRAPHS



- Show an object's position at a given time
- Position or _____ on ____ -axis
- Time on ____ -axis
- An object moving at a _____ speed creates a _____ line.
- The _____ an object moves, the _____ its slope.
- A flat line means the object's position is _____, or the object has _____.
- A line that slopes downwards means the object is _____
- Most importantly, these graphs are used to calculate an object's _____.

$$\text{Slope} = \frac{\text{Change in Position}}{\text{Change in Time}} \qquad \text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Interpret a Distance-Time Graph: A zebra's speed will change throughout the day, especially if a hungry lion is nearby. You can use a distance-time graph to compare the zebra's speed over different time intervals.

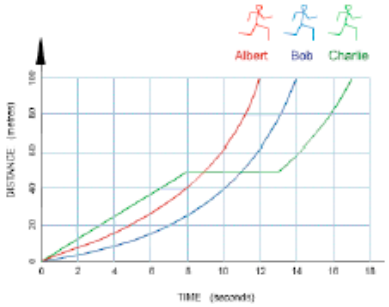


1. When the zebra is walking, its distance from its starting point increases. You can see this motion on the graph as a climbing line.
2. When the zebra stops to graze, it no longer changes its distance from the starting point. Time, however, continues to pass. Therefore, the graph shows a flat, or horizontal, line.
3. As soon as the zebra notices the lion, it stops grazing and starts to run for its life. The zebra is covering a greater distance in each time interval than it was before the chase started, so the line is steeper.

1. How far does the zebra walk in the first 20 seconds? _____
2. How long does the zebra rest for? _____
3. What total distance does the zebra travel? _____
4. During what time interval did the zebra travel the fastest? _____
5. What is the speed of the zebra during the time interval from 0 seconds to 20 seconds? _____
6. What is the speed of the zebra during the time interval from 40 seconds to 60 seconds? _____

Interpret a Distance-Time Graph #2

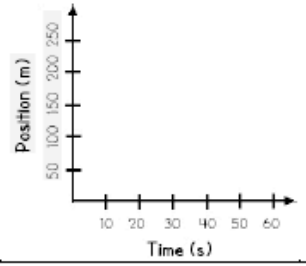
1. Which runner won the race? _____
2. Which runner stopped for a rest? _____
3. How long did he stop for? _____
4. How long did Bob take to complete the track?
   _____
5. Calculate Albert's average speed.



Drawing Position-Time Graphs

Your friend is training for a track meet and wants to know if she is running at a constant speed. You mark the track in 50-meter increments record her time. **Create a position-time graph using her data.**

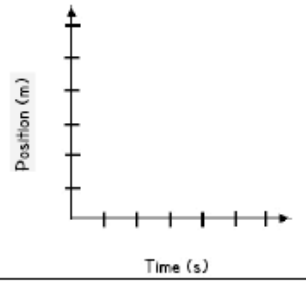
Time (s)	Position (m)
0	0
10	50
20	100
30	150



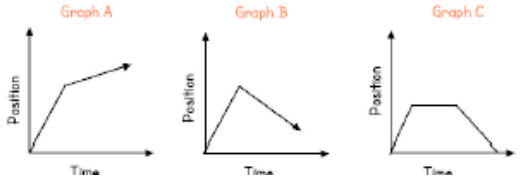
1. What is her average speed?
2. Is she running at a constant speed? How do you know?

The data table shows the position and time of Snookie running down the beach. **Make a graph of the data and use it to calculate her speed.**

Time (s)	Position (m)
0	0
2	6
4	9
6	12
8	15
10	18



1. What is her average speed?
2. Is she running at a constant speed? How do you know?



Interpreting Position-Time Graphs Without Numbers: Describe the motion of the 3 graphs.

Graph A: _____

_____

Graph B: _____

_____

Graph C: _____

_____

Motion Graphs

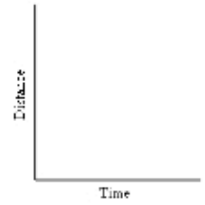
Describing the motion of an object is occasionally hard to do with words. Sometimes **graphs** help make motion easier to picture, and therefore understand.

Remember:

- **Motion** is a change in position measured by distance and time.
- **Speed** tells us the rate at which an object moves.
- **Velocity** tells the speed and direction of a moving object.
- **Acceleration** tells us the rate speed or direction changes.

DISTANCE-TIME GRAPHS

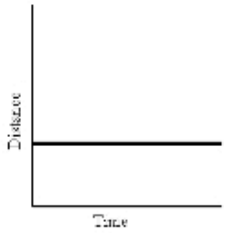
Plotting distance against time can tell you a lot about motion. Let's look at the axes:



Time is always plotted on the X-axis (bottom of the graph). The further to the right on the axis, the longer the time from the start.

Distance is plotted on the Y-axis (side of the graph). The higher up the graph, the further from the start.

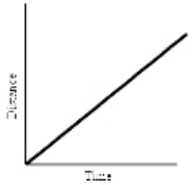
If an object is not moving, a horizontal line is shown on a distance-time graph.



Time is increasing to the right, but its distance does not change. It is not moving. We say it is **At Rest**.

Additional Notes: _____

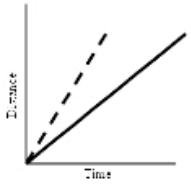
If an object is moving at a constant speed, it means it has the same increase in distance in a given time:



Time is increasing to the right, and distance is increasing constantly with time. The object moves at a **constant speed**.

Constant speed is shown by straight lines on a graph.

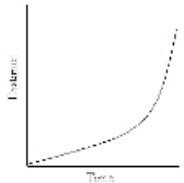
Let's look at two moving objects:
Both of the lines in the graph show that each object moved the same distance, but the steeper dashed line got there before the other one:



A steeper line indicates a larger distance moved in a given time. In other words, **higher speed**.

Both lines are **straight**, so both speeds are **constant**.

Graphs that show acceleration look different from those that show constant speed.



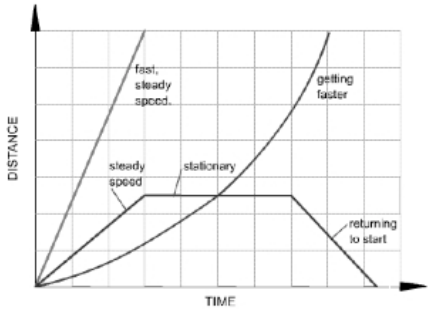
The line on this graph is curving upwards. This shows an **increase in speed**, since the line is getting steeper:

In other words, in a given time, the distance the object moves is change (getting larger). It is **accelerating**.

Summary:

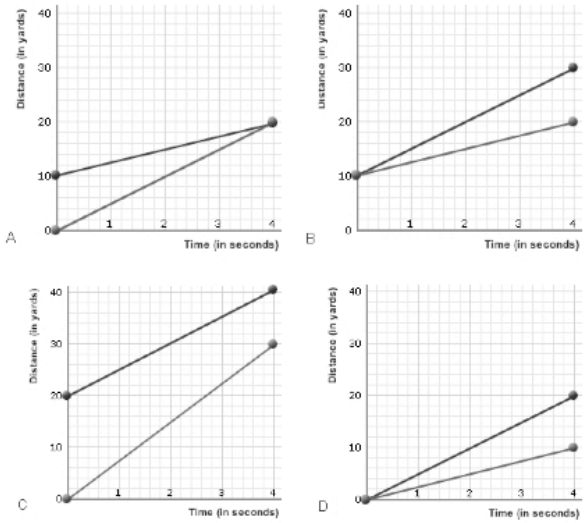
A distance-time graph tells us how far an object has moved with time.

- The steeper the graph, the faster the motion.
- A horizontal line means the object is not changing its position - it is not moving, it is at rest.
- A downward sloping line means the object is returning to the start.



(Graph from:
http://www.bbc.co.uk/schools/gcsebitesize/physics/forces/speedvelocityaccelerationfhrev2.shtml)

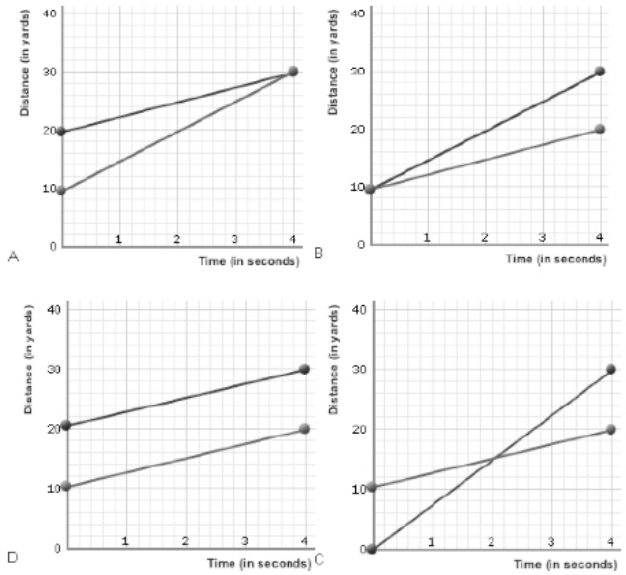
Examine the graphs below.



Which of the graphs shows that one of runners started 10 yards further ahead of the other? Explain your answer.

_____

_____



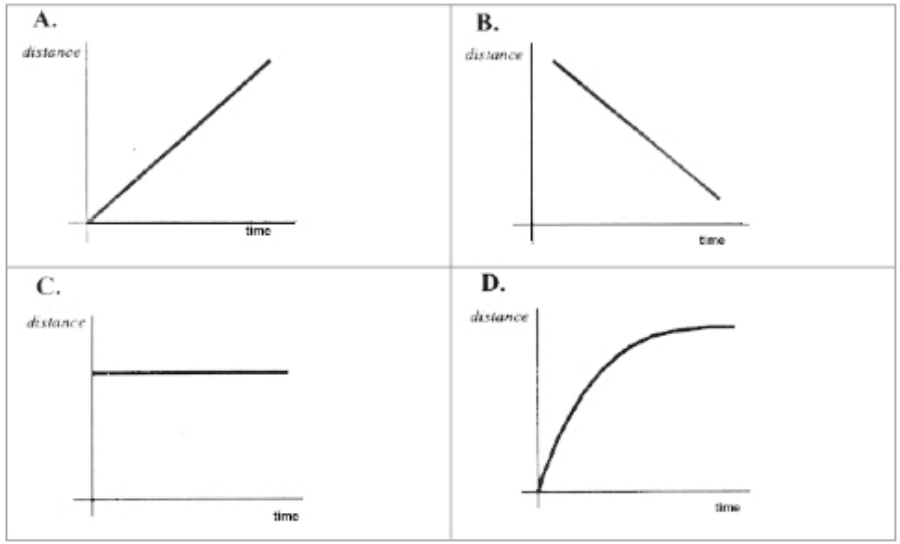
In which of the following graphs below are both runners moving at the same speed? Explain your answers

_____

The distance-time graphs below represent the motion of a car. Match the descriptions with the graphs. **Explain your answers.**

Descriptions:

1. The car is stopped.
2. The car is traveling at a constant speed.
3. The speed of the car is decreasing.
4. The car is coming back.



Graph A matches description _____ because _____.

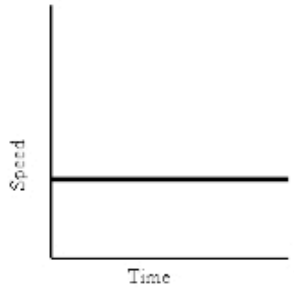
Graph B matches description _____ because _____.

Graph C matches description _____ because _____.

Graph D matches description _____ because _____.

SPEED-TIME GRAPHS

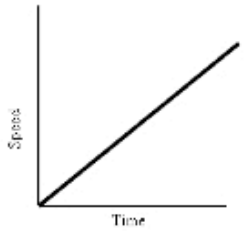
Speed-Time graphs are also called Velocity-Time graphs.



Speed-Time graphs look much like Distance-Time graphs. Be sure to read the labels!! Time is plotted on the X-axis. Speed or velocity is plotted on the Y-axis.

A straight horizontal line on a speed-time graph means that speed is constant. It is not changing over time.

A straight line does not mean that the object is not moving!

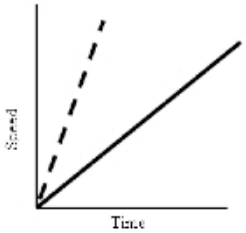


This graph shows increasing speed. The moving object is **accelerating**.

This graph shows decreasing speed. The moving object is **decelerating**.

Additional notes: _____

What about comparing two moving objects at the same time?



Both the dashed and solid line show increasing speed.

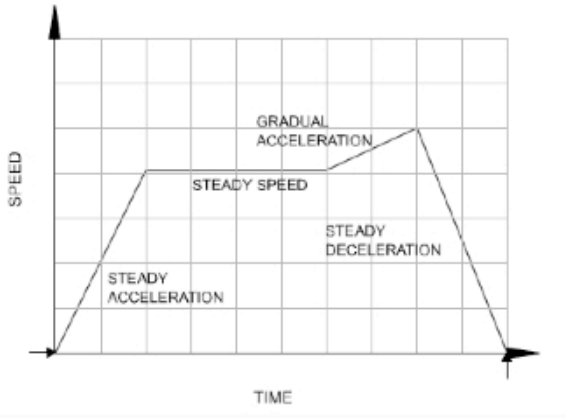
Both lines reach the same top speed, but the solid one takes longer.

The dashed line shows a greater acceleration.

Summary:

A speed - time graph shows us how the speed of a moving object changes with time.

- The steeper the graph, the greater the acceleration.
- A horizontal line means the object is moving at a constant speed.
- A downward sloping line means the object is slowing down.



(Graph from:
http://www.bbc.co.uk/schools/gcsebitesize/physics/forces/speedvelocityaccelerationfhrev2.shtml)

Additional notes: _____

Speed, Distance, Time Worksheet. SHOW THE FORMULA & YOUR WORK!

1. Jared rides his bike for 3 hrs at a speed of 40 km/h. What distance did he travel?

2. The Surf- Rider Train travels at a speed of 30 mph and travel a distance of 240 miles. How long did it take the train to complete it's journey?

3. Mrs. Gillum in her mini travels a distance of 540 km in 6 hours. What speed did she travel at?

4. Samuel is a runner. He runs the 100 m sprint in 10.6 s. What speed did he travel at? (in m/s)

5. Mr.Lulay travels on his Harley 20 km in 4 hrs. What speed did the Mr.Lulay travel at?

6. The distance between two cities is 144 km, it takes Mr. Power 3 hours to travel between these cities. What speed did I travel at?

7. A train travels from the downtown San Diego to Long Beach, a distance of 576 km away in 6 hrs. The coach is only allowed to travel at a maximum speed of 90km/h. Did the coach break the speed limit?

8. At the equator, the earth spins a distance of 25,992miles every day. What speed does the Earth spin at in mph? (a hint… how many hours in a day?)

9. Lauren walks 100 m in half a minute. What must her speed have been to travel this distance?

10. A mouse runs a distance of 2 meters in 15 seconds. What is it's speed?

11. Jim travelled at a speed of 18km/h for 2 hours. What was the distance covered?

12. Mr. Bill was told his dinner would be ready at 6:00pm. He left the job site at (noon) 12:00pm and traveled in his car at an average speed of 45 mph to his house 300 miles away. Did Mr. Bill make it home in time for the dinner Mrs G had waiting for him?

13. A whale swims at a constant speed of 8m/s for 17s. What distance did it travel?

14. Sebastian writes down his jog times for each day.
Mon – 15 min Tue – 10 min Wed – 12 min Thu – 5 min Fri – No jog.
He jogs at a constant speed of 9km/h. Work out the distance he jogs each day.
On which day did he jog the furthest?

15. How long does it take to drive a distance of 260 miles at a speed of 65mph?

16. How long does it take to travel a distance of 672km at a speed of 96km/h?

17. Scripps Ranch is a distance of 135 miles away from Joshua Tree National Park. If I travelled at a constant speed of 45mph. How long would it take me to get there?

18. A beetle travels at a speed of 9cm/s., it travels a distance of 108 cm before it is caught in a jar. How long did the beetle run for?