KEY

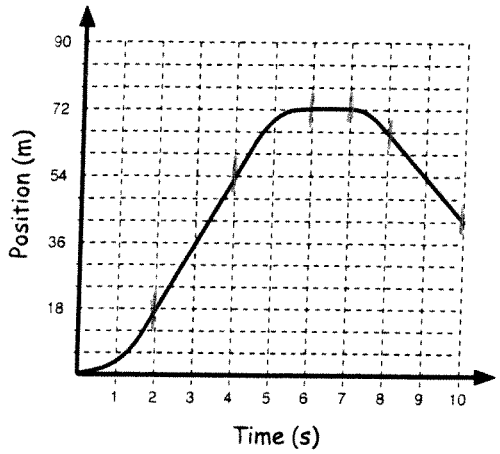
Name:

Date:

Graphical Analysis of Motion

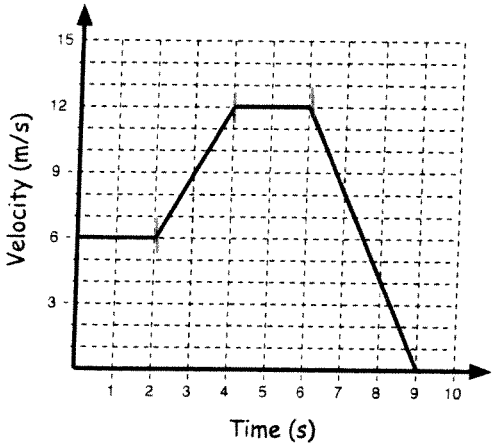
Part 1: Concepts:

1. The graph below shows the position vs time for an object in motion. Give a description of what the object is doing during each of the intervals listed in the table below:



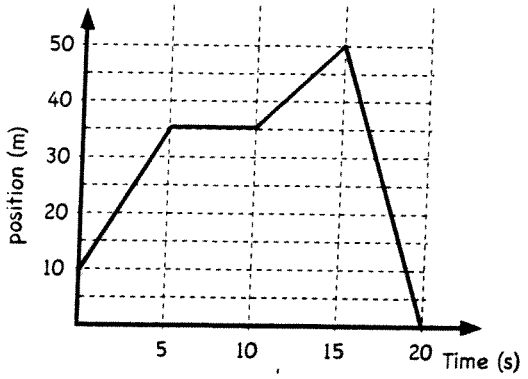
Region #	Start Time (s)	End Time (s)	Description of Motion
1	0	2	speeding up forward
2	2	4	constant v forward
3	4	6	slowing down forward
4	6	7	rest
5	7	8	speeding up backwards
6	8	10	constant v backward

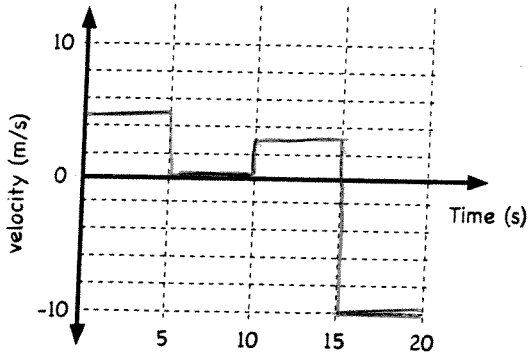
2. The graph below shows the velocity vs time for an object in motion. Give a description of what the object is doing during each of the intervals listed in the table below



Region #	Start Time (s)	End Time (s)	Description of Motion
1	0	2	constant V forward (6m/s)
2	2	4	speeding up forward
3	4	6	constant v forward (12m/s)
4	6	9	slowing down forward

3. The graph below is a graph of position versus time. Use this graph to create a graph of velocity vs. time.





$\frac{35-10m}{5s} = 5 m/s$ $\quad \frac{50-35}{5} = 3 m/s$ $\quad \frac{0-50}{5} = -10$

1: Motion

Worksheet B: Interpreting Motion Graphs

Name_____

AP/Inquiry Physics

ANSWER QUESTIONS 1 AND 2 IN COMPLETE SENTENCES

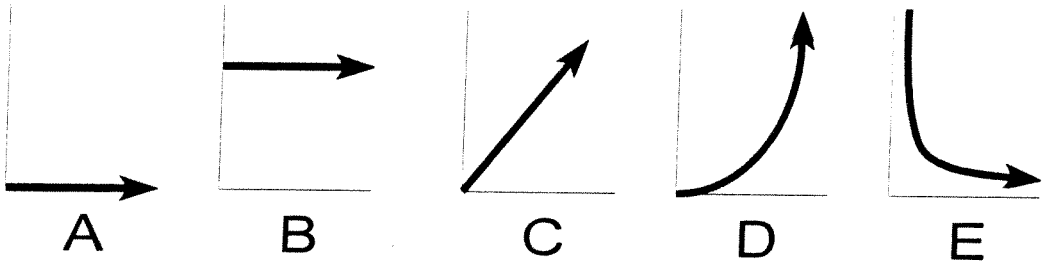
1. What does the slope of a distance vs. time graph indicate about an object's motion?

velocity

2. What does the slope of a speed vs. time graph indicate about an object's motion?

acceleration

Questions 3 - 8 refer to the following generic graph shapes. Write the letter corresponding to the appropriate graph in the blank at the left of each question.



C 3. Which shape fits a **distance** vs. time graph of an object moving at constant (non-zero) speed?

B 4. Which shape fits a **speed** vs. time graph of an object moving at constant (non-zero) speed?

A, B 5. Which *two* shapes fit a **distance** vs. time graph of a motionless object?

A 6. Which shape fits a **speed** vs. time graph of a motionless object?

D 7. Which shape fits a **distance** vs. time graph of an object that is speeding up at a steady rate?

C 8. Which shape fits a **speed** vs. time graph of an object that is speeding up at a steady rate?

_____ 9. Which of the following units is equivalent to (meters per second) per second?
a) m b) m/s c) m/s^2 d) m/s^3

_____ 10. Which of the following units correspond to the slope of a distance vs. time graph?
a) m b) s c) m/s d) m/s^2

_____ 11. Which of the following units correspond to the slope of a speed vs. time graph?
a) m/s b) m•s c) m/s^2 d) m^2/s^2

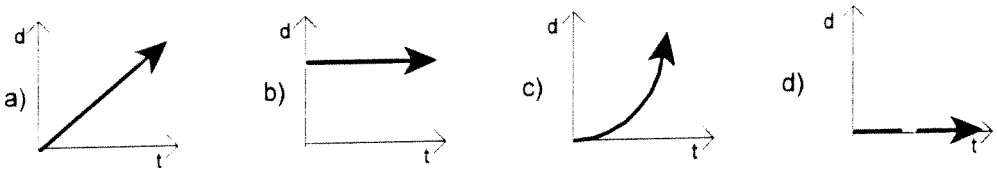
CONTINUED...

The table below gives distance and time data for a moving object. Pay attention to how the **time intervals** are changing as the distance rises in 20 m increments.

Distance (m)	Time (s)
0	0
20	4.5
40	6.3
60	7.7
80	8.9
100	10

speeding up b/c each successive interval takes less time

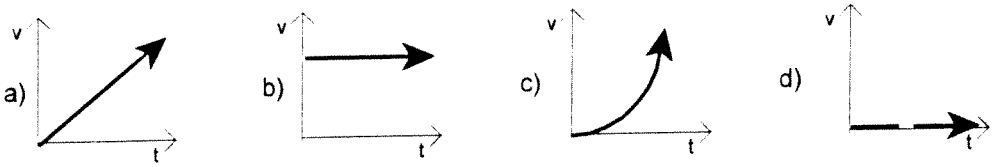
C 12. Which of the following **distance** vs. time graphs corresponds to the table data?



C 13. Which of the following descriptions matches the graph you selected in question 12?

a) A motionless object.
b) An object moving at a constant speed.
c) An object undergoing constant, positive acceleration.
d) An object undergoing constant, negative acceleration.

A 14. Which of the following **speed** vs. time graphs corresponds to the table data?

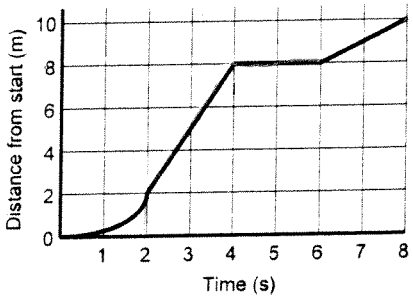


C 15. Which of the following descriptions matches the graph you selected in question 14?

a) A motionless object.
b) An object moving at a constant speed.
c) An object undergoing constant, positive acceleration.
d) An object undergoing constant, negative acceleration.

BEWARE: If your answers to questions 13 and 15 are different from each other, you are claiming that the same object can have two distinct motions simultaneously. Ask yourself, "Is that reasonable?"

16. A woman walks away from a starting point in a straight line. A distance vs. time graph for her motion is shown at right.



a. Describe the woman's motion between 0 and 2 seconds.

speeding up

b. Fill out the table below. You do not *have* to show your work.

Time Interval	Woman's Speed (m/s)
2 to 4 seconds	3 m/s
4 to 6 seconds	0 m/s
6 to 8 seconds	1 m/s

$\frac{8-2}{2}$ = 3

$\frac{10-8}{2}$ = 1

Describing Motion Graphically

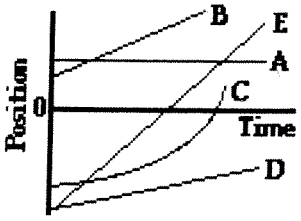
Study **Lessons 3 and 4** of the **1-D Kinematics** chapter at **The Physics Classroom**:

http://www.physicsclassroom.com/Class/1DKin/1DKinTOC.html

MOP Connection: Kinematic Graphing: sublevels 1-11 (emphasis on sublevels 9-11)

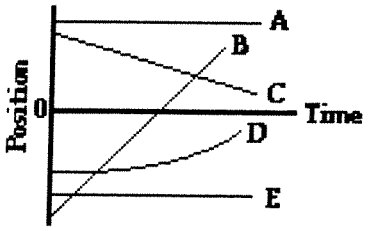
1. The slope of the line on a position vs. time graph reveals information about an object's velocity. The magnitude (numerical value) of the slope is equal to the object's speed and the direction of the slope (upward/+ or downward/-) is the same as the direction of the velocity vector. Apply this understanding to answer the following questions.

   a. A horizontal line means rest.
   b. A straight diagonal line means constant V forward.
   c. A curved line means speed up forward.
   d. A gradually sloped line means constant V forward (slow)
   e. A steeply sloped line means constant V forward (fast)



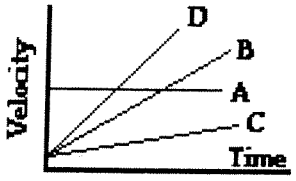
2. The motion of several objects is depicted on the position vs. time graph. Answer the following questions. Each question may have less than one, one, or more than one answer.

   A, E a. Which object(s) is(are) at rest?
   D b. Which object(s) is(are) accelerating?
   A, E c. Which object(s) is(are) not moving?
   ____ ~~X~~ Which object(s) change(s) its direction?
   B e. Which object is traveling fastest?
   C? f. Which moving object is traveling slowest?



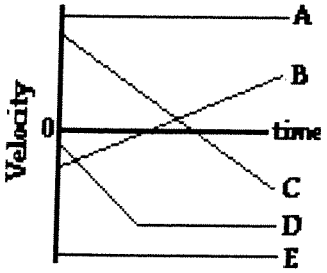
3. The slope of the line on a velocity vs. time graph reveals information about an object's acceleration. Furthermore, the area under the line is equal to the object's displacement. Apply this understanding to answer the following questions.

   a. A horizontal line means constant V.
   b. A straight diagonal line means speeding up.
   c. A gradually sloped line means speeding up lower rate
   d. A steeply sloped line means speeding up higher rate

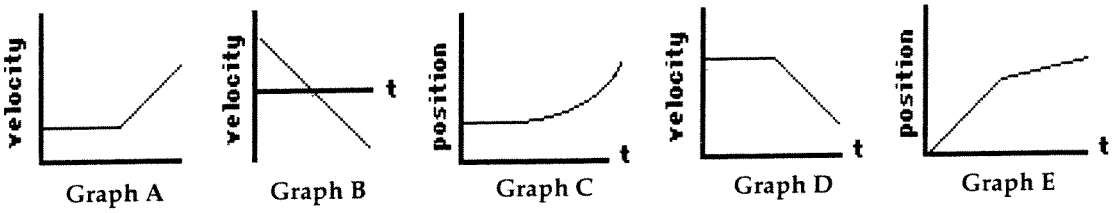


4. The motion of several objects is depicted by a velocity vs. time graph. Answer the following questions. Each question may have less than one, one, or more than one answer.

   NONE a. Which object(s) is(are) at rest?
   B, C, D b. Which object(s) is(are) accelerating?
   NONE c. Which object(s) is(are) not moving?
   B, C d. Which object(s) change(s) its direction?
   B e. Which accelerating object has the smallest acceleration?
   C f. Which object has the greatest acceleration?



5. The graphs below depict the motion of several different objects. Note that the graphs include both position vs. time and velocity vs. time graphs.

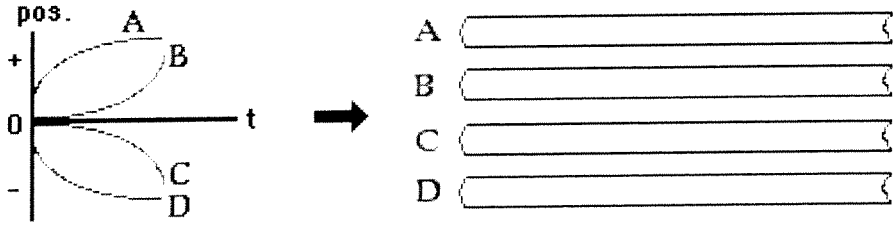


Graph A Graph B Graph C Graph D Graph E

The motion of these objects could also be described using words. Analyze the graphs and match them with the verbal descriptions given below by filling in the blanks.

Verbal Description	Graph
a. The object is moving fast with a constant velocity and then moves slow with a constant velocity.	E
b. The object is moving in one direction with a constant rate of acceleration (slowing down), changes directions, and continues in the opposite direction with a constant rate of acceleration (speeding up).	B
c. The object moves with a constant velocity and then slows down.	D
d. The object moves with a constant velocity and then speeds up.	A
e. The object maintains a rest position for several seconds and then accelerates.	C

Consider the position-time graphs for objects A, B, C and D. On the *ticker tapes* to the right of the graphs, construct a dot diagram for each object. Since the objects could be moving right or left, put an arrow on each *ticker tape* to indicate the direction of motion.



Consider the velocity-time graphs for objects A, B, C and D. On the *ticker tapes* to the right of the graphs, construct a dot diagram for each object. Since the objects could be moving right or left, put an arrow on each *ticker tape* to indicate the direction of motion.