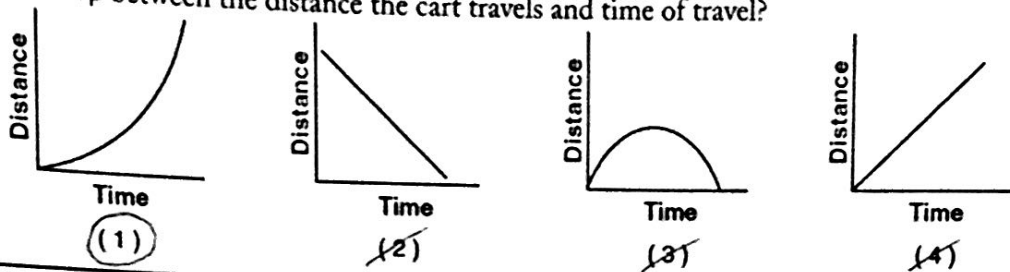# Kinematics-Motion Graphs

1. A cart travels with a constant nonzero acceleration along a straight line. Which graph best represents the relationship between the distance the cart travels and time of travel?

(1) (2) (3) (4)

Base your answers to questions 2 through 4 on the information below.

A car on a straight road starts from rest and accelerates at 1.0 meter per second² for 10 seconds. Then the car continues to travel at constant speed for an additional 20 seconds.
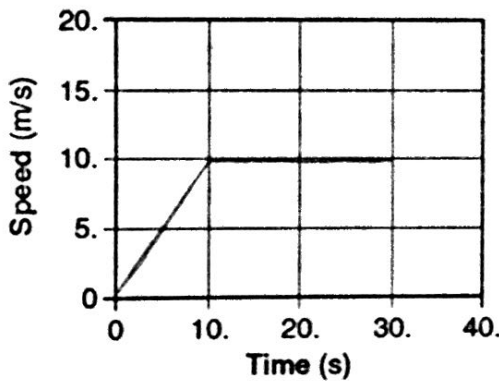
2. Determine the speed of the car at the end of the first 10 seconds.

$$V_f = 1 \, m/s^2 \, (10s) + 0 \, m/s$$

$$= \boxed{10 \, m/s}$$

3. On the grid at below, use a ruler or straightedge to construct a graph of the car's speed as a function of time for the entire 30-second interval.

Speed vs. Time

4. Calculate the distance the car travels in the first 10 seconds. [Show all work, including the equation and substitution with units.]

$$x_f = \frac{1}{2}(1 \, m/s^2)(10s)^2 + 0 \, m/s(10s) + 0 \, m$$

$$= \boxed{50 \, m}$$

5. A student throws a baseball vertically upward and then catches it. If vertically upward is considered to be the positive direction, which graph best represents the relationship between velocity and time for the baseball? [Neglect friction.]

(1) (3) (2) (4)
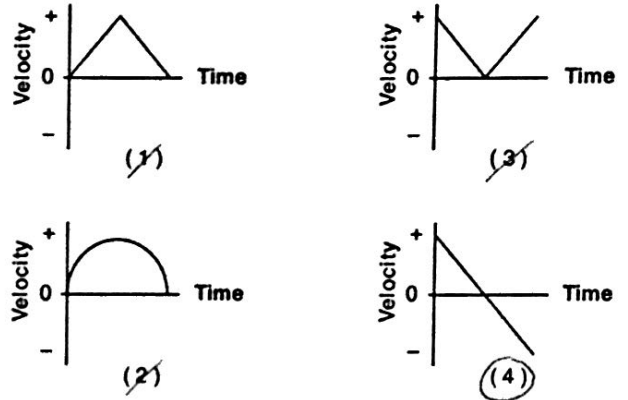
6. The graph below represents the displacement of an object moving in a straight line as a function of time.
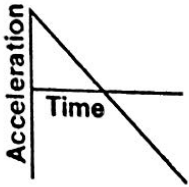
Displacement vs. Time
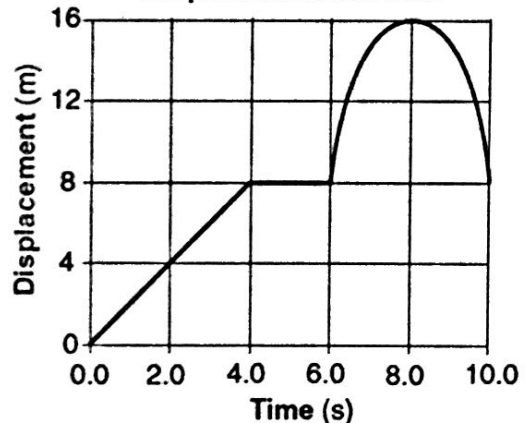
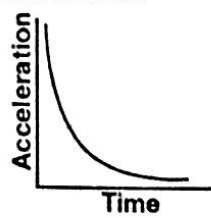What was the total distance traveled by the object during the 10-second time interval?
1. 0 m
2. 8 m
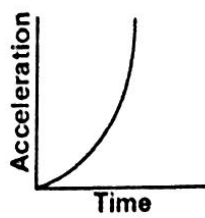3. 16 m
4. 24 m

Kinematics-Motion Graphs

7. Which graph best represents the relationship between the acceleration of an object falling freely near the surface of Earth and the time that it falls?
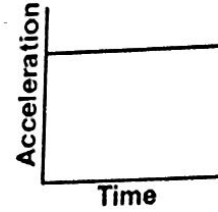
(1)   (2)   (3)   (4)
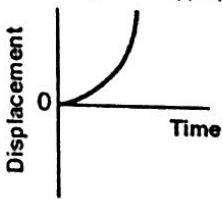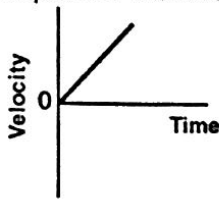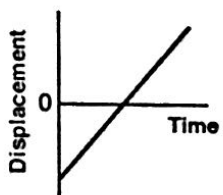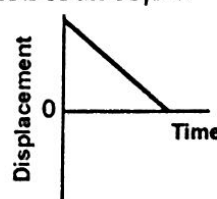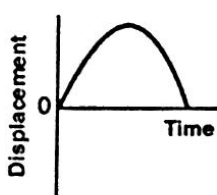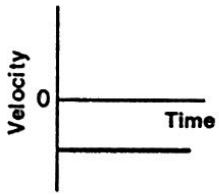
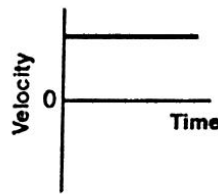8. Which pair of graphs represent the same motion of an object?

(1)   (3)

(2)   (4)

9. The graph below represents the velocity of an object traveling in a straight line as a function of time.
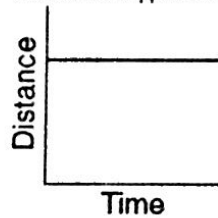
Velocity vs. Time
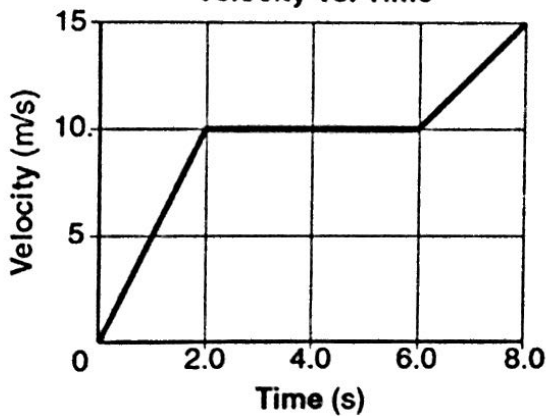
Determine the magnitude of the total displacement of the object at the end of the first 6 seconds.
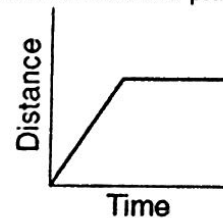
$(4s \times 10^{m}/s) + \frac{1}{2}(2s)(10^{m}/s)$

$40m + 10m = \boxed{50m}$
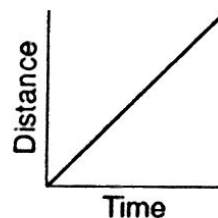
10. Which graph best represents the motion of a block accelerating uniformly down an inclined plane?

(1)   (3)

(2)   (4)

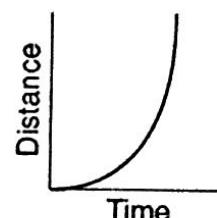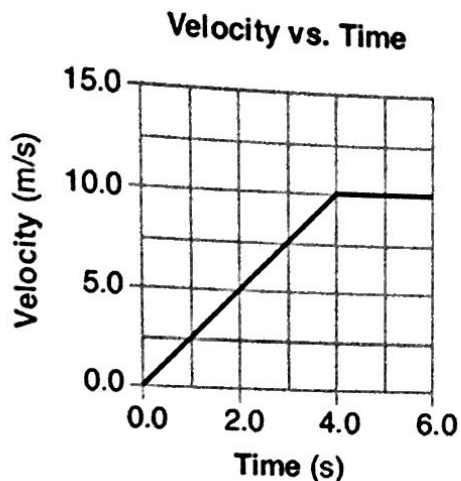Name: _____   Period: _____

Kinematics-Motion Graphs

Base your answers to questions 11 and 12 on the graph below, which represents the motion of a car during a 6-second time interval.

Velocity vs. Time

11. What is the acceleration of the car at t=5.0 seconds?
    1. 0.0 m/s²
   2. 2.0 m/s²
    3. 2.5 m/s²
    4. 10 m/s²

12. What is the total distance traveled by the car during this 6-second interval?
    1. 10 m
    2. 20 m
    3. 40 m
    4. 60 m

13. Which graph best represents the relationship between the velocity of an object thrown straight upward from Earth's surface and the time that elapses while it is in the air? [Neglect friction.]
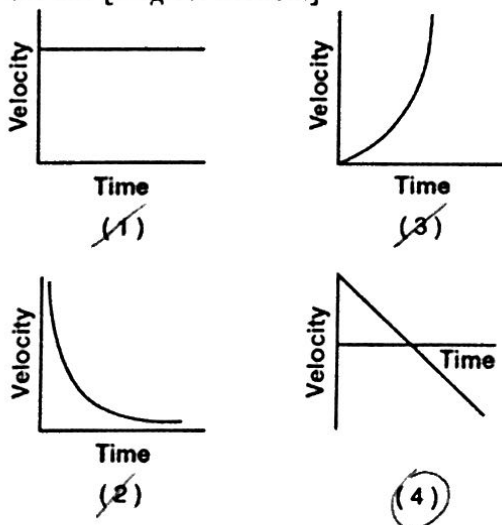
14. The graph below shows the relationship between the speed and elapsed time for an object falling freely from rest near the surface of a planet.

Speed vs. Time
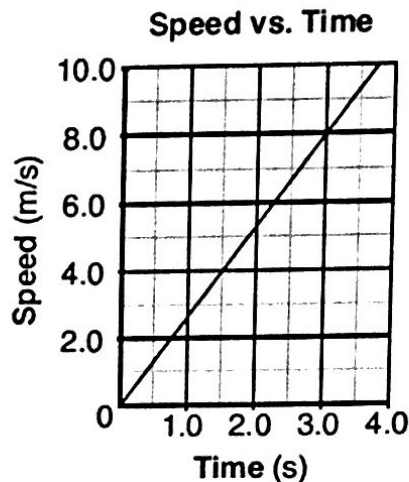
What is the total distance the object falls during the first 3 seconds?
    1. 12 m
    2. 24 m
    3. 44 m
    4. 72 m

15. The graph below represents the relationship between speed and time for an object moving along a straight line.

Speed vs. Time
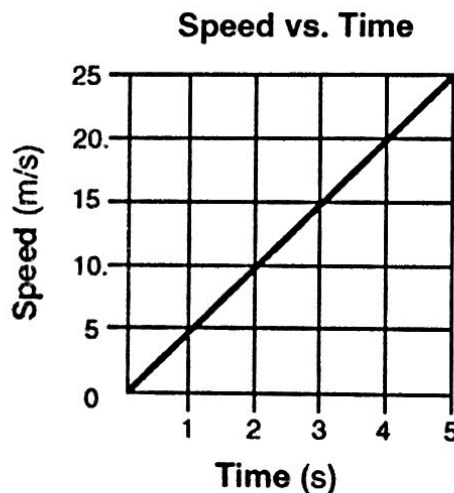
What is the total distance traveled by the object during the first 4 seconds?
    1. 5 m
    2. 20 m
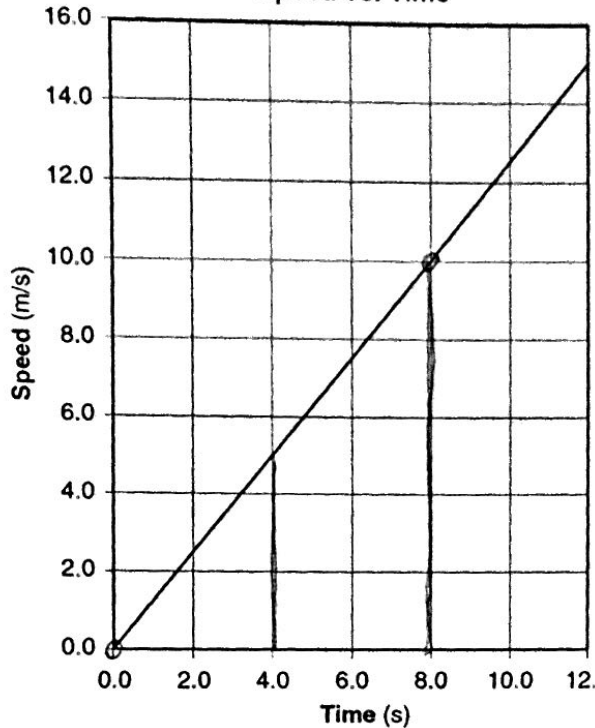   3. 40 m
    4. 80 m

Kinematics-Motion Graphs

Base your answers to questions 16 and 17 on the graph below, which shows the relationship between speed and elapsed time for a car moving in a straight line.

Speed vs. Time

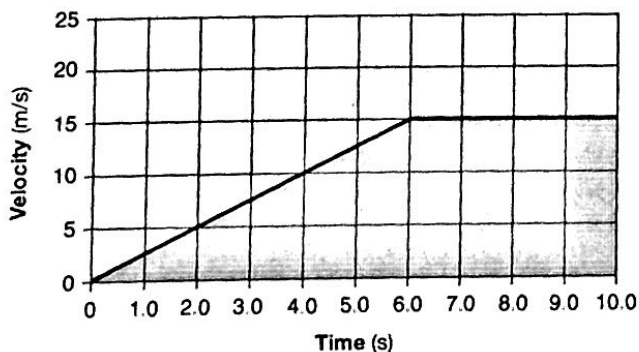16. Determine the magnitude of the acceleration of the car. $\dfrac{10-0 \ m/s}{8-0 \ s} = \boxed{1.25 \ m/s^2}$

17. Calculate the total distance the car traveled during the time interval 4.0 seconds to 8.0 seconds. [Show all work, including the equation and substitution with units.] $V_f = 1.25 \ m/s^2(4s) + 0 = 5 \ m/s$

$(4s \times 5 \ m/s) + (\frac{1}{2}(4s)(5 \ m/s)) = 20m + 10m$

$= \boxed{30m}$

Base your answers to questions 18 through 20 on the graph below, which represents the relationship between velocity and time for a car moving along a straight line, and your knowledge of physics.

Velocity vs. Time

18. Determine the magnitude of the average velocity of the car from t=6.0 seconds to t=10.0 seconds.

$\boxed{15 \ m/s}$

(doesn't change)

19. Determine the magnitude of the car's acceleration during the first 6.0 seconds.

$\dfrac{15 \ m/s}{6 \ s} = \boxed{2.5 \ m/s^2}$

20. Identify the physical quantity represented by the shaded area on the graph.

$\frac{1}{2}(6s \times 15 m/s) + (4s \times 15 \ m/s)$

$= 45m + 60m = \boxed{105m}$