Science 10 Motion Unit Review

Answer Key

Conceptual Questions

1. Explain the difference between uniform motion and non-uniform motion.

   Uniform motion is in a straight line with a constant speed. (ie. constant velocity)

2. What is the difference between a vector quantity and a scalar quantity?

   A vector includes both magnitude and direction

   A scalar is only magnitude.

3. What information can you obtain from a position-time graph?

   - Position of an object
   - Velocity over a time interval.
   - Distances and displacements travelled.

4. If you initial position and final position are the same, what is your displacement?

   Displacement is zero

5. If a position-time graph has a slope of zero, how would you describe the motion of the object described by the graph?

   The object is not moving

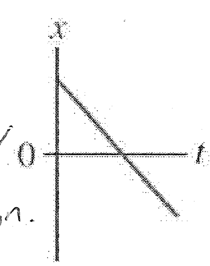
6. Give an example when an object's average velocity is zero but its average speed is not zero.

   An object moves forward, then back to its original position.

7. When an object is moving at a constant positive velocity, what would its position-time graph look like?

   It would have a positive slope

8. Describe the motion of the following position-time graph.

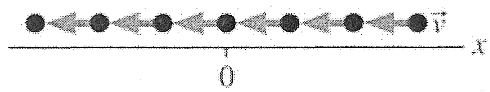


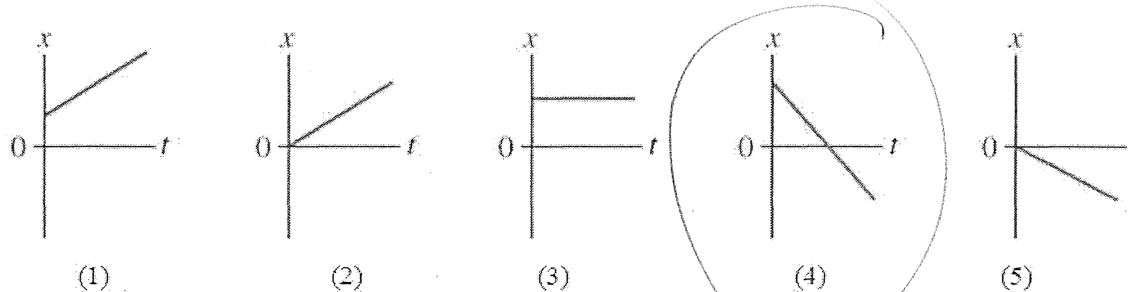
   Moving backwards/down/left/in the negative direction.

   Has a negative velocity.

9. Which position-time graph represents the motion shown in the diagram?

Motion diagram

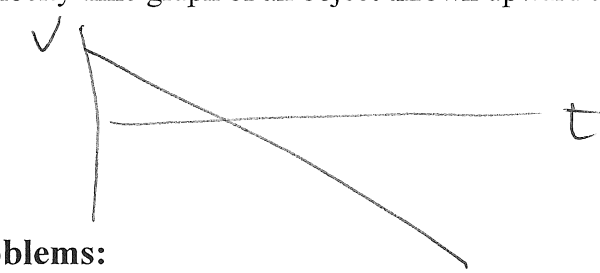




10. What information can you get from a velocity-time graph?

- Velocity at a point
- Changes of velocity
- acceleration over a time interval

11. Draw the velocity time graph of an object thrown upward and accelerated by gravity.



Application Problems:

1. A boat took 250 seconds to travel 2300m north. What was the boat's average velocity?

$\vec{v} = \frac{\Delta \vec{d}}{t} = \frac{2300 N}{250} = $ 9.2 m/s N

2. Convert 210m/s into km/h. Convert 78km/h into m/s.

210 m/s × 3.6 = 756 km/h

78 km/h ÷ 3.6 = 21.7 m/s

3. If you drive your car with an average velocity of 34m/s N, what would your displacement be if you drove for 1300s?

$\vec{d} = \vec{v} \times t = 34 \text{ m/s} \times 1300 \text{ s} = $ 44200 m N

4. An airplane flies with an average velocity of 780km/h south for 6.5 hours. What would the plane's final position be if its initial position was 1200km north of a special marker.

$\vec{v} = \frac{\Delta \vec{d}}{t}$ $\Delta \vec{d} = \vec{v} t$ $\vec{d}_f - \vec{d}_i = \vec{v} t$ $\vec{d}_f = \vec{v} t + \vec{d}_i$

$\vec{d}_f = -780 km/h \times 6.5h + 1200km = \boxed{-3870km}$

or 3870km South of the marker

5. A train's initial velocity is 50km/h East. If its velocity changes to 60km/h East, what is the change in velocity of the train?

$\Delta \vec{v} = \vec{v}_f - \vec{v}_i = 60 km/h\ E - 50 km/h\ E = \boxed{10 km/h\ E}$

6. A car moving west at 20m/s strikes a concrete wall and rebounds to the east at 2m/s. What is the car's change in velocity and the direction of the acceleration?

$\Delta \vec{v} = \vec{v}_f - \vec{v}_i = 2m/s - (-20m/s) = 22 m/s\ E$

Acceleration is in the East direction.

7. A stationary skier starts to ski down the hill with an average acceleration of 3.4m/s^2 for 15s. What is the skier's final velocity?

$\vec{a} = \frac{\Delta \vec{v}}{t}$

$\Delta \vec{v} = \vec{a} \cdot t = 3.4 m/s^2 \times 15s = 51 m/s$

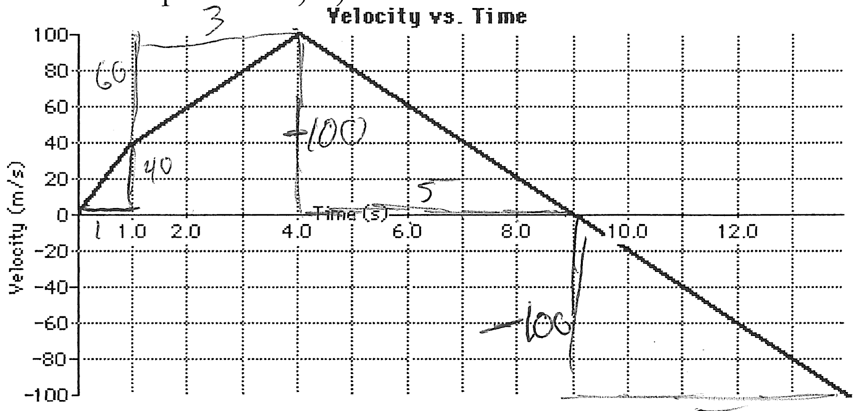
$\boxed{51 m/s \text{ down hill}}$

8. How much time is required to accelerate from 35m/s South to 55m/s North with an acceleration of 8m/s^2 North?

$\vec{a} = \frac{\Delta \vec{v}}{t}$

$t = \frac{\Delta \vec{v}}{a} = \frac{55-(-35)}{8} = \boxed{11.25 s}$

9. The velocity-time graph represents the motion of a car. Read the graph and answer the questions a)-d).



a. During which time interval was it moving the fastest?

0 - 1s

b. At what time(s) was its velocity 60m/s North?

2s and 6s

c. During which time interval was it slowing down?

4.0s - 9.0s

d. Calculate the average acceleration for the following time intervals: 0-1s, 1-4s, 4-9s, 9-14s

Rise / Run

0-1s: $\frac{40}{1} = 40 m/s^2$ | 1-4s: $\frac{60}{3} = 20 m/s^2$ | 4-9s: $\frac{-100}{5} = -20 m/s^2$ | 9-14s: $\frac{-100}{5} = -20 m/s^2$

10. A skateboarder is moving with a velocity of 5m/s East. If his velocity doubles in the same direction in 5 seconds, what is his acceleration?

$\vec{a} = \frac{\Delta \vec{v}}{t} = \frac{10 m/s - 5 m/s}{5} = 1 m/s^2$ East

11. A rock is thrown into the air with an initial velocity of 15m/s up. What is the velocity of the rock 0.5 seconds later?

$\vec{a} = \frac{\Delta \vec{v}}{t}$ $\Delta \vec{v} = \vec{a}t$ $\vec{v}_f = \vec{a}t + \vec{v}_i = -9.8(0.5) + 15 =$

$V_f = 10.1 m/s$ up

12. You dropped a ball off a building. The ball's velocity when it reached the ground was 40m/s down. How long did it take to reach the ground?

$t = \frac{\Delta \vec{v}}{\vec{a}} = \frac{-40 m/s - 0 m/s}{-9.8 m/s} = 4.1 s$