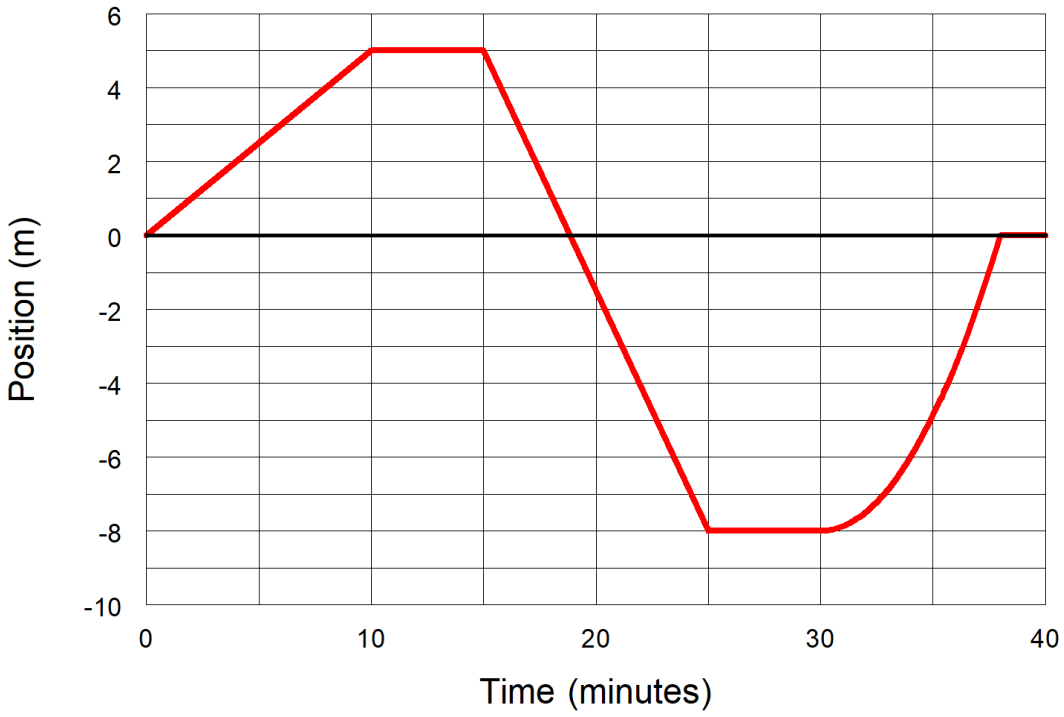
In Motion Review
Answers

Part A – Multiple Choice

1. A
2. D
3. A
4. B
5. D
6. A
7. A
8. D
9. B
10. C

Part B – Long Answer

1. The following position-time graph represents the position of a boy walking along the sidewalk. Positive position is North.



(a) Describe the motion during the following time intervals.

(i) 0 – 10 minutes _____*walking north at a constant velocity*_____

(ii) 10 – 15 minutes _____*stationary*_____

(iii) 20 – 25 minutes _____*walking south at a constant velocity*_____

(iv) 30 – 35 minutes _____*walking north while speeding up*_____

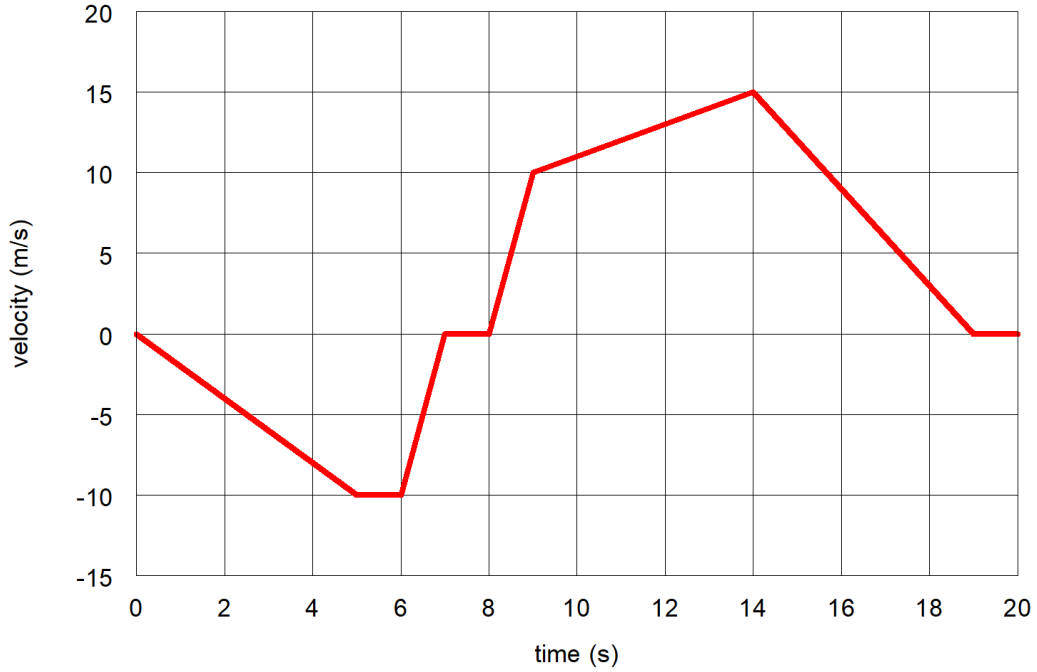
(b) Calculate the boy's velocity for the first 10 minutes.

$\Delta\vec{d} = 5 - 0 = 5\text{ m}$

$\Delta t = 10 - 0 = 10\text{ minutes} \times 60\ \frac{\text{seconds}}{\text{minute}} = 600\text{ seconds}$

$\vec{v} = \frac{\Delta\vec{d}}{\Delta t} = \frac{5\text{ m}}{600\text{ s}} = 0.008\text{ m/s}$

2. The following velocity-time graph represents the movement of a toy car. The positive direction is east.



(a) Describe the motion during the following time intervals:

(i) 0-5 s *speeding up while traveling west*

(ii) 5-6 s *traveling west at a constant velocity*

(iii) 6-7 s *slowing down while traveling west*

(iv) 7-8 s *stationary*

(v) 14-19 s *slowing down while traveling east*

(b) Calculate the acceleration of the car during the time interval 14 – 19 s.

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t} = \frac{0-15}{19-14} = \frac{-15}{5} = -3 \text{ m/s}^2$$

3. A car traveling 30 km/h brakes and slides on an icy surface (k = 0.25 m/s). Calculate the distance required to stop ignoring any reaction time.

$$30\ \frac{\text{km}}{\text{h}} \times \frac{1000\ \text{m}}{3600\ \text{s}} = 8.33\ \text{m/s}$$

$$d = kv^2 = (0.25)(8.33)^2$$
$$d = 17.34\ \text{m}$$

4. A cyclist travels 12 meters in 2 seconds at a constant speed. If k = 0.2, what distance does the cyclist need to stop?

$$\vec{v} = \frac{\Delta\vec{d}}{\Delta t} = \frac{12}{2}$$
$$\vec{v} = 6\ \text{m/s}$$

$$d = kv^2 = (0.2)(6)^2$$
$$d = 7.2\ \text{m}$$

5. Describe how seatbelts help protect the passengers of a moving vehicle. Your written response should refer to Newton's first law of motion as well as momentum and impulse.

In a collision, the passengers will continue to move forward due to Newton's first law of motion. The seat belt prevents this from occurring. The seat belt also has tensioners on it to increase the time of the collision on the passenger. The car will undergo a large momentum change. This means that there is a large impulse. Increasing the time of the collision on the passenger will lower the force.