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# S10 Unit B: Accelerated Motion Problems

Name: Key!

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1. A car is stopped at a red light. The light turns green and the car accelerates. After 6.00 s the car is travelling at a rate of 4.25 m/s. Determine the acceleration of the car.

| variables list | formula | substitution (with units) and algebra |
|---|---|---|
| $t = 6s$<br>$\vec{v} = 4.25 m/s$<br>$\vec{a} = ?$ | $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$<br>Formula<br>$-0.5$ | $\vec{a} = \frac{4.25 m/s}{6s} = 0.708 (m/s^2)$<br>units $\Rightarrow -0.5$<br>sol $\Rightarrow -0.5$ |

2. A golf ball is sitting on a tee. At a time 0.53 s after the ball is hit it is travelling with a speed of 65.0 km/h. What is the acceleration of the ball during that period?

| variables list | formula | substitution (with units) and algebra |
|---|---|---|
| $t = 0.53s$<br>$\vec{v} = 65 km/h$<br>$\div 3.6$<br>$= 18.0\overline{5} m/s$<br>$\vec{a} = ?$ | $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$ | $\vec{a} = \frac{18.0\overline{5} m/s}{0.53s} = 34. m/s^2$ |

3. A car is moving at a speed of 50.0 km/h and it accelerates to 60.0 km/h in a period of 4.5 s in order to pass another vehicle. What is the acceleration of the car?

| variables list | formula | substitution (with units) and algebra |
|---|---|---|
| $\vec{v}_i = 50 km/h$<br>$\div 3.6$<br>$13.8\overline{9} m/s$<br>$\vec{v}_f = 60 km/h$<br>$\div 3.6$<br>$16.\overline{6} m/s$<br>$t = 4.5s$ | $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$ | $\vec{a} = \frac{(16.\overline{6} m/s - 13.8\overline{9} m/s)}{4.5s}$<br>$= 0.62 m/s^2$ |

4. A bike starts from rest and obtains a speed of 2.00 m/s while accelerating at a rate of 0.50 $m/s^2$. What amount of time elapsed during this acceleration?

| variables list | formula | substitution (with units) and algebra |
|---|---|---|
| $\vec{v}_i = 0$<br>$\vec{v}_f = 2\,m/s$<br>$\vec{a} = 0.5\,m/s^2$<br>$t = ?$ | $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$ | $0.5\,m/s^2 = \frac{2\,m/s}{t}$<br>$t = \frac{2\,m/s}{0.5\,m/s^2} = 4.0\,s$ |

5. A track athlete runs at a velocity of 8.1 m/s, then slows down to 4.1 m/s. Her acceleration is at a rate of -0.62 $m/s^2$. How long did this change in velocity take?

| variables list | formula | substitution (with units) and algebra |
|---|---|---|
| $\vec{v}_i = 8.1\,m/s$<br>$\vec{v}_f = 4.1\,m/s$<br>$\vec{a} = -0.62\,m/s^2$<br>$t = ?$ | $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$ | $-0.62\,m/s^2 = \frac{(4.1\,m/s - 8.1\,m/s)}{t}$<br>$t = \frac{-4\,m/s}{-0.62\,m/s^2} = 6.5\,s$ |

6. A cannonball is fired from a cannon with an initial velocity of 150 m/s. It has an acceleration of -2.50 $m/s^2$ due to air resistance. Determine the final velocity of the ball after 60 s of movement.

| variables list | formula | substitution (with units) and algebra |
|---|---|---|
| $\vec{v}_i = 150\,m/s$<br>$\vec{a} = -2.50\,m/s^2$<br>$\vec{v}_f = ?$<br>$t = 60\,s$ | $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$ | $-2.5\,m/s^2 = \frac{\vec{v}_f - 150\,m/s}{60\,s}$<br>$-150 = \vec{v}_f - 150$<br>$v_f = 0\,m/s$ |