ACCELERATION PROBLEMS - ANSWERS

1. $\vec{v}_1 = 0$
$\vec{v}_2 = 3\ m/s\ [R]$
$\Delta t = 6\ s$
$\vec{a} = ?$

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

$$= \frac{3\ m/s\ [r]}{6\ s}$$

$$= 0.5\ m/s^2\ [r]$$

∴ the acceleration is $0.5\ m/s^2\ [r]$.

2. $\vec{v}_1 = 0\ m/s$
$\vec{v}_2 = 200\ km/h\ [N]$
$= 55.56\ m/s\ [N]$
$\Delta t = 20\ s$
$\vec{a} = ?$

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

$$= \frac{55.56\ m/s\ [N]}{20\ s}$$

$$= 2.8\ m/s^2\ [N]$$

∴ the airplane has an acceleration of $2.8\ m/s^2\ [N]$

3. $\vec{v}_1 = 10\ km/h\ [W]$
$= 2.8\ m/s\ [W]$
$\vec{v}_2 = 110\ km/h\ [W]$
$= 30.6\ m/s\ [W]$
$\Delta t = 5.0\ s$
$\vec{a} = ?$

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

$$= \frac{30.6\ m/s\ [W] - 2.8\ m/s\ [W]}{5.0\ s}$$

$$= 5.56\ m/s^2\ [W]$$

∴ the speedboat has an acceleration of $5.56\ m/s^2\ [W]$.

Acceleration Problems - Answers

4. $\vec{v}_1 = 3.4\ m/s\ [forward]$
$\vec{v}_2 = 4.8\ m/s\ [forward]$
$\Delta t = 4.5\ s$
$\vec{a} = ?$

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

$$= \frac{4.8\ m/s\ [forward] - 3.4\ m/s\ [forward]}{4.5\ s}$$

$$= 0.31\ m/s^2\ [forward]$$

∴ the cyclist has an acceleration of $0.31\ m/s^2\ [forward]$.

5. $\vec{v}_1 = 13\ m/s\ [S]$
$\vec{v}_2 = 0\ m/s$
$\Delta t = 0.3\ s$
$\vec{a} = ?$

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

$$= \frac{-13\ m/s\ [S]}{0.3\ s}$$

$$= -43.3\ m/s\ [S]$$

∴ the hockey puck has an acceleration of $-43.3\ m/s\ [S]$.

6. * to find slope/acceleration:

$$a = \frac{Rise}{Run} = \frac{\Delta v}{\Delta t}$$ ← choose any two v on the line / ← choose any two t on the line

a) $\vec{\Delta v} = 600\ km/h\ [N]$
$= \frac{600000\ m}{3600\ s}$
$= 166.7\ m/s\ [N]$
$\Delta t = 10\ s$
$\vec{a} = ?$

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

$$= \frac{166.7\ m/s\ [N]}{10\ s}$$

$$= 16.67\ m/s^2\ [N]$$

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6b $\Delta\vec{v} = 30\ m/s$ [forward]
$\Delta t = 2.5\ s$
$\vec{a} = ?$

$$\vec{a} = \frac{\Delta\vec{v}}{\Delta t}$$
$$= \frac{30\ m/s\ [\text{forward}]}{2.5\ s}$$
$$= 12\ m/s^2\ [\text{forward}]$$

c) $\Delta\vec{v} = 15\ m/s$ [forward]
$\Delta t = 2.0\ s$
$\vec{a} = ?$

$$\vec{a} = \frac{\Delta\vec{v}}{\Delta t}$$
$$= \frac{15\ m/s\ [\text{forward}]}{2.0\ s}$$
$$= 7.5\ m/s^2\ [\text{forward}]$$

d) $\Delta\vec{v} = 15\ km/h\ [N]$
$= 4.2\ m/s\ [N]$
$\Delta t = 2.5\ s$
$\vec{a} = ?$

$$\vec{a} = \frac{\Delta\vec{v}}{\Delta t}$$
$$= \frac{4.2\ m/s\ [N]}{2.5\ s}$$
$$= 1.7\ m/s^2\ [N]$$

7. $\vec{v}_1 = 7\ m/s$ [forward]
$\vec{v}_2 = 25\ m/s$ [forward]
$\Delta t = 3\ s$
$\vec{a} = ?$

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$
$$= \frac{25\ m/s\ [\text{forward}] - 7\ m/s\ [\text{forward}]}{3\ s}$$
$$= 6\ m/s^2\ [\text{forward}]$$

∴ the car has an acceleration of $6\ m/s^2$ [forward].

Acceleration Problems- Answers

8a) Acceleration: 0 to 10s; 30 to 45s
Deceleration (Negative Acceleration): 10 to 20s

b) From 20s to 30s it is constant velocity

c) The acceleration would be zero. This is because
$\Delta V = 0$, $\therefore a = \frac{\Delta V}{\Delta t}$
$= \frac{0\ m/s}{10s}$
$= 0\ m/s^2$

d) $\Delta t = 10s$
$\vec{V}_1 = 20\ m/s$ [forward]
$\vec{V}_2 = 25\ m/s$ [forward]
$\vec{a} = ?$

$\vec{a} = \frac{\vec{V}_2 - \vec{V}_1}{\Delta t}$
$= \frac{25\ m/s\ [forward] - 20\ m/s\ [forward]}{10s}$
$= 0.5\ m/s^2$ [forward]