Acceleration Assignment

Equations:

Acceleration = $\frac{\text{Final velocity} - \text{Initial velocity}}{\text{Time}}$ Time = $\frac{\text{Final Velocity} - \text{Initial Velocity}}{\text{Acceleration}}$

1. The Concorde jetliner achieves a lift-off speed of 112m/s in 20.0s, starting from rest. What is the acceleration?

2. A motorboat accelerated from rest to a final speed of 6.0m/s in a time of 3.0s. What is the acceleration of the motorboat?

$v_i = 0\,m/s$ $\quad \vec{a} = \frac{v_f - v_i}{t}$

$v_f = 6.0\,m/s$ $\quad = \frac{6.0 - 0\ m/s}{3.0\,s}$ $\quad \vec{a} = 2.0\,m/s^2$

$t = 3.0\,s$

$\vec{a} = ?$

3. A bottle-nosed dolphin is cruising along at 2.2m/s, and accelerates to 9.7m/s in 15s. What is the dolphin's acceleration?

$v_i = 2.2\,m/s$ $\quad \vec{a} = \frac{v_f - v_i}{t}$

$v_f = 9.7\,m/s$ $\quad = \frac{9.7\,m/s - 2.2\,m/s}{15\,s} = \frac{7.5\,m/s}{15\,s} = 0.5\,m/s^2$

$t = 15\,s$

$\vec{a} = ?$

4. A driver is traveling at 12.0m/s, and sees a light turn red. The driver applies the brakes, and the car accelerates at $-6.20\,m/s^2$ until it stops. How long does it take the car to stop?

$v_i = 12.0\,m/s$ $\quad t = \frac{\Delta v}{\vec{a}}$

$v_f = 0\,m/s$ $\quad = \frac{0\,m/s - 12.0\,m/s}{-6\,m/s^2} = \frac{-12.0\,m/s}{-6\,m/s^2} = 1.94\,s$

$\vec{a} = -6.20\,m/s^2$

$t = ?$

5. The velocity of a train is 26.4m/s. At an acceleration of $-1.50\,m/s^2$, how much time is required for the train to decrease its velocity to 9.72m/s?

$v_i = 26.4\,m/s$ $\quad t = \frac{\Delta v}{\vec{a}}$

$v_f = 9.72\,m/s$ $\quad = \frac{9.72\,m/s - 26.4\,m/s}{-1.50\,m/s^2} = \frac{-16.68\,m/s}{-1.50\,m/s^2} = 11.12\,s$

$\vec{a} = -1.50\,m/s^2$

$t = ?$

6. A skier, starting from rest, accelerates at $1.6\,m/s^2$. How fast is the skier going after 5.0s?

$v_i = 0\,m/s$ $\quad \vec{a} = \frac{v_f - v_i}{t}$

$\vec{a} = 1.6\,m/s^2$

$t = 5.0\,s$ $\quad 5\left(1.6\,m/s\right) = \left(\frac{v_f - 0\,m/s}{5.0\,s}\right)5$

$v_f = ?$

$8\,m/s = v_f$

7. A water balloon is dropped from a building. It starts at rest and accelerates at 9.8m/s^2 due to gravity. How fast is the balloon going after 3 seconds?

$V_i = 0$
$\vec{a} = 9.8 m/s^2$
$t = 3s$
$V_f = ?$

$\vec{a} = \frac{V_f - V_i}{t}$

$3(9.8 m/s^2) = \left(\frac{V_f - 0 m/s}{3s}\right)3$

$29.4 m/s = V_f$

8. A roller coaster car rapidly picks up speed as it rolls down a slope. As it starts down the slope, its speed is 4 m/s. But 3 seconds later, at the bottom of the slope, its speed is 22 m/s. What is its average acceleration?

$V_i = 4 m/s$
$V_f = 22 m/s$
$t = 3s$

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

$= \frac{22-4}{3} = \frac{18}{3} = 6 m/s^2$

9. A cyclist accelerates from 0 m/s to 8 m/s in 3 seconds. What is his acceleration? Is this acceleration higher than that of a car which accelerates from 0 to 30 m/s in 8 seconds?

a) $V_i = 0 m/s$
$V_f = 8 m/s$
$t = 3s$
$\vec{a} = ?$

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

$= \frac{8}{3}$

$= 2.67 m/s^2$

b) $V_i = 0 m/s$
$V_f = 30 m/s$
$t = 8s$
$\vec{a} = ?$

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

$= \frac{30}{8}$

$= 3.75 m/s^2$

No

10. A car advertisement states that a certain car can accelerate from rest to 70 km/h in 7 seconds. Find the car's average acceleration.

$V_i = 0 km/h$
$V_f = 70 km/h$
$t = 7s$
$\vec{a} = ?$

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

$= \frac{70 km/h}{7s}$

$= 70 km/h/s$

14. A lizard accelerates from 2 m/s to 10 m/s in 4 seconds. What is the lizard's average acceleration?

$V_i = 2 m/s$
$V_f = 10 m/s$
$t = 4s$

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

$= \frac{8 m/s}{4s} = 2 m/s^2$

12. If a Ferrari, with an initial velocity of 10 m/s, accelerates at a rate of 50 m/s/s for 3 seconds, what will its final velocity be?

$V_i = 10 m/s$
$\vec{a} = 50 m/s^2$
$t = 3s$
$V_f = ?$

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

$3(50 m/s^2) = \left(\frac{V_f - 10 m/s}{3s}\right)3$

$+10 \quad 150 = V_f - 10 m/s \quad +10 m/s$

$160 m/s = V_f$