Key

Review for T1: Motion

1. While rushing to a global emergency, Superman flies the first 3200 km at a speed of 1600 km/hr. A stomachache brought on by a bad Taco Bell burrito limits his speed to 550 km/hr for the next 1500 km. What is his average speed (in km/hr) for the trip?

$s_1 = 1600$ km/hr, $d_1 = 3200$ km, $t_1 = ?$ → $s_2 = 550$ km/hr, $d_2 = 1500$ km, $t_2 = ?$

$s = \frac{d}{t}$ $t = \frac{d}{s}$

$t_1 = \frac{3200\ km}{1600\ km/hr} = 2\ hr$

$t_2 = \frac{1500\ km}{550\ km/hr} = 2.7\overline{2}\ hr$

$s_{avg} = \frac{d_1 + d_2}{t_1 + t_2} = \frac{3200 + 1500\ km}{2 + 2.72\ hr}$

994 km/hr

2. Big League baseball pitchers can routinely throw a fastball at a horizontal speed of 160 km/hr as verified by a radar gun. How long does the ball take to reach home plate which is 19.4 meters away?

$s = 160$ km/hr, $d = 19.4$ m, $t = ?$

$\frac{160\ km}{1\ hr} \left| \frac{1000\ m}{1\ km} \right| \frac{1\ hr}{3600\ s} = 44.\overline{4}\ m/s$

$s = \frac{d}{t}$ $t = \frac{d}{s} = \frac{19.4\ m}{44.4\ m/s}$

0.437 s

3. On average, a blink lasts about 0.1 seconds. How far does a MIG-25 "Foxbat" fighter (airplane) travel in **miles** during the pilot's blink if the plane's average velocity is 2210 miles/hour?

$t = 0.1\ s = 2.7E{-}5\ hr$, $s = 2210$ mi/hr, $d = ?$

$\frac{0.1\ s}{} \left| \frac{1\ hr}{3600\ s} \right. = 2.7E{-}5\ hr$

$s = \frac{d}{t}$ $d = s \cdot t = (2210\ mi/hr)(2.7E{-}5\ hr)$

0.0613 mi

4. The distance from the Earth to the most remote known galaxies is 3.8×10^{25} m. How long in years does it take light from these galaxies to reach the Earth? Express your answer in scientific notation. (light travels at 186,000 mi/s)

$d = 3.8E25\ m$, $t = ?$ (yrs), $s = 186{,}000\ mi/s = 3E8\ m/s$

$\frac{186{,}000\ mi}{1\ s} \left| \frac{1609\ m}{1\ mi} \right. = 3E8\ m/s$

$s = \frac{d}{t}$

$t = \frac{d}{s} = \frac{3.8E25\ m}{3E8\ m/s} = 1.2\overline{6}E17\ s \left| \frac{1\ hr}{3600\ s} \right| \frac{1\ day}{24\ hr} \left| \frac{1\ yr}{365\ day} \right.$

4.02E9 yr

5. A person on a diet might lose 3 pounds per week. Express this in grams per second.

$\frac{3\ lb}{1\ wk} \left| \frac{453.6\ g}{1\ lb} \right| \frac{1\ wk}{7\ day} \left| \frac{1\ day}{24\ hr} \right| \frac{1\ hr}{3600\ s}$

2.25E-3 g/s

6. In a farewell performance Super Fly performs his famous stunt. He has been winged by injuries from the first several attempts, so the cars have been replaced with golf carts which start the stunt 3000 meters apart. One of the carts is moving at 10 m/s and the other is moving at 5 m/s. If Super Fly flies at 50 m/s, what is the total distance that he covers in the stunt?

NOT ON TEST

7. You travel 1500 m at an average velocity of 25 m/s and then travel in the **opposite** direction with an average velocity of 35 m/s for 10 seconds. What is your velocity for the entire trip?

$\Delta x_1 = 1500\,m$ $\quad \vec{v}_1 = 25\,m/s$ $\quad t_1 = ? = 60\,s$

$\Delta x_2 = ? = -350\,m$ $\quad \vec{v}_2 = -35\,m/s$ $\quad t_2 = 10\,s$

$v_{avg} = \frac{\Delta x_{Total}}{t_{Total}} = \frac{1500\,m + (-350\,m)}{60\,s + 10\,s}$

$\bar{v} = \frac{\Delta x}{t}$ $\quad t = \frac{\Delta x}{\bar{v}} = \frac{1500\,m}{25\,m/s}$

$\Delta x = \vec{v} \cdot t = (-35\,m/s)(10\,s)$

$= \frac{1150\,m}{70\,s}$

16.43 m/s

8. The peregrine falcon is the fastest of flying birds (and, as a matter of fact, is the fastest living creature). A falcon can fly 1.73 km downward in 25 s. What is the average velocity of a peregrine falcon?

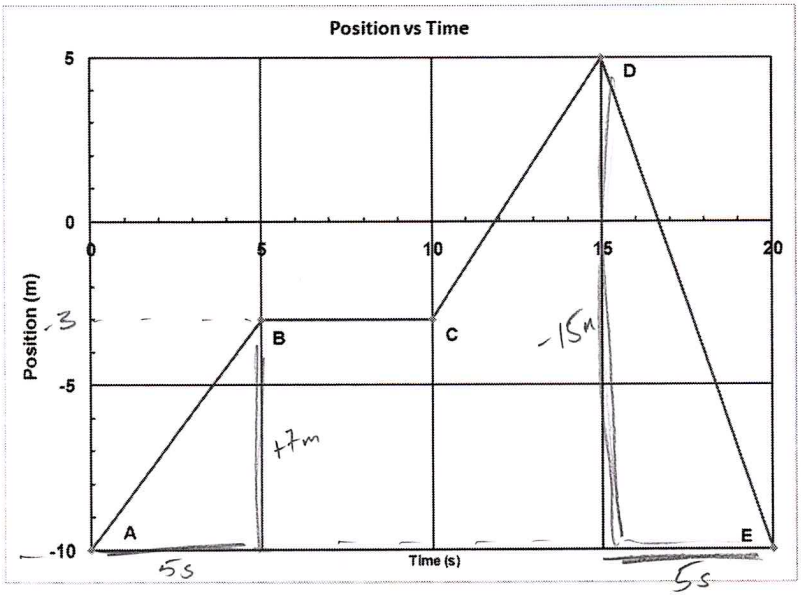
$\Delta x = -1.73\,km = -1730\,m$

$t = 25\,s$

$v = ?$

$v = \frac{\Delta x}{t} = \frac{-1730\,m}{25\,s}$

-69.2 m/s



What is the displacement from point A to point B?

$\Delta x = x_2 - x_1 = -3 - (-10) =$ 7m

What is the average velocity from point A to point B?

$\bar{v} = \frac{\Delta x}{t} = \frac{7\,m}{5\,s} =$ 1.4 m/s

What is the average velocity from point D to point E?

$\bar{v} = \frac{\Delta x}{t} = \frac{-15\,m}{5\,s} =$ -3 m/s

What is the average velocity from point A to point E?

A & E are both @ -10 m

$\Delta x = 0$ m $\therefore$ $v_{avg} = 0$ m/s