Ch 1 # 3

$T = 2\pi\sqrt{\frac{l}{g}} \rightarrow \sqrt{\frac{L}{L/T^2}} = \sqrt{T^2} = T$ ← WE ARE LEFT WITH UNITS OF TIME AS WE SHOULD.

Ch 1 # 14

(A)

$$\frac{2.437 \times 10^4 \cdot 6.5211 \times 10^9}{5.37 \times 10^4} = 2.96 \times 10^9$$

↑ only ~~Fou~~ 3 SIGNIFICANT FIGURES.

(B)

$$\frac{(3.14159 \times 10^2)(27.01 \times 10^4)}{1234 \times 10^6} = 6.876 \times 10^{-2}$$

↑ NOTE 4 SIGNIFICANT FIGURES.

16

(A) $348 \cancel{\text{MILES}} \cdot \frac{1.609\ \text{Km}}{1\ \cancel{\text{mile}}} = \underline{569[redacted]\ \text{Km}}$

$348 \cancel{\text{MILES}} \cdot \frac{1.609\ \cancel{\text{Km}}}{1\ \cancel{\text{MILE}}} \cdot \frac{1000\ \text{m}}{1\ \cancel{\text{Km}}} = \underline{5.60 \times 10^5\ \text{m}}$

$348 \cancel{\text{MILES}} \cdot \frac{1.609\ \cancel{\text{Km}}}{1\ \text{MILE}} \cdot \frac{1000\ \cancel{\text{m}}}{1\ \text{Km}} \cdot \frac{100\ \text{cm}}{1\ \cancel{\text{m}}} = \underline{5.60 \times 10^7\ \text{cm}}$

(B) $1612\ \cancel{\text{ft}} \cdot \frac{1\ \text{m}}{3.281\ \text{ft}} = \underline{491.3\ \text{m}}$

$491.3\ \cancel{\text{m}} \cdot \frac{1\ \text{Km}}{1000\ \cancel{\text{m}}} = \underline{.4913\ \text{Km}}$

$491.3\ \text{m} \cdot \frac{100\ \text{cm}}{1\ \text{M}} = \underline{491.3 \times 10^2\ \text{cm}}$

16 CONT.

(C) $20{,}320\ \cancel{ft} \cdot \dfrac{1\,m}{3.281\ \cancel{ft}} = \underline{6193.23\,m}$

$6193.23\,\cancel{m} \cdot \dfrac{100\,cm}{1\,\cancel{m}} = \underline{6.19323 \times 10^{5}\,cm}$

$6193.23\,\cancel{m} \cdot \dfrac{1\,Km}{1000\,\cancel{m}} = \underline{6.193\,Km}$

(D) $8{,}200\,\cancel{ft} \cdot \dfrac{1\,m}{3.281\,\cancel{ft}} = \underline{2499\,m}$

$2499\,\cancel{m} \cdot \dfrac{100\,cm}{\cancel{m}} = \underline{2.499 \times 10^{5}\,cm}$

$2499\,m \cdot \dfrac{1\,Km}{1000\,m} = \underline{2.499\,Km}$

27. DENSITY OF WATER $\equiv \rho = \dfrac{MASS}{VOLUME} = \dfrac{1\times10^{-3}\,Kg}{1\,cm^3} = 1\times10^{-3}\,\dfrac{Kg}{cm^3}$

A) CONVERTING TO m^3

$1\times10^{-3}\,\dfrac{Kg}{cm^3} \cdot \dfrac{100\,cm}{m} \cdot \dfrac{100\,cm}{m} \cdot \dfrac{100\,cm}{m} = 1\times10^{3}\,\dfrac{Kg}{m^3}$

$m = \rho V = 1\times10^{3}\,\dfrac{Kg}{m^3} \cdot 1\,m^3 = \underline{1\times10^{3}\,Kg}$

B) CELL $- \rho = 1\times10^{3}\,\dfrac{Kg}{m^3} \cdot \dfrac{1\times10^{-6}\,m}{\mu m} \cdot \dfrac{1\times10^{-6}\,m}{\mu m} \cdot \dfrac{1\times10^{-6}\,m}{\mu m} = 1\times10^{-15}\,\dfrac{Kg}{\mu m^3}$

$m = \rho V = 1\times10^{-15}\,\dfrac{Kg}{\mu m^3} \cdot 1\,\mu m^3 = \underline{1\times10^{-15}\,Kg}$ ← ASSUMING CELL IS A CUBE

KIDNEY

$m = \rho V = 1\times10^{3}\,\dfrac{Kg}{m^3} \cdot \dfrac{4}{3}\pi(.04\,m)^3 =$ 2.7[redacted] Kg

FLY

$m = 1\times10^{3}\,\dfrac{Kg}{m^3} \cdot \pi(1\times10^{-3}\,m)^2(4\times10^{-3}\,m) = \boxed{1.3\times10^{-5}\,Kg}$

50. THE AVERAGE HAMBURGER I WOULD GUESS IS ABOUT 1/4 LB.

$\therefore$ 50×10^9 ~~BURGERS~~ $\cdot \dfrac{.25 \text{ LB}}{\cancel{\text{BURGER}}} = 12.5 \times 10^9$ LB

NOT SURE WHAT A COW WIEGHS THESE DAYS BUT I WOULD GUESS ABOUT 400 LBS. LETS SAY 1/3 OF THIS IS EDIBLE MEAT, WE HAVE 133.33 $\dfrac{\text{LB'S}}{\text{COW}}$

$$\frac{12.5 \times 10^9 \text{ LB}}{133.33 \ \frac{\text{LB'S}}{\text{COW}}} = \boxed{9.38 \times 10^7 \text{ COWS}}$$

53. THERE ARE ABOUT 7 MILLION PEOPLE IN NYC SUPPOSE THERE ARE ABOUT 500 THEATERS IN NYC & THEY EACH EMPLOY 1 PIANO TUNER. ALSO SUPPOSE THERE ARE ABOUT 1000 SCHOOLS IN NYC. EACH HAS A MUSIC DEPT. PERHAPS THERE IS 1 TUNER TO EVERY 10 SCHOOLS. THEN I WOULD GUESS THAT THERE ARE 100,000 HOMES WITH PIANO'S. SUPPLY & DEMAND SUGGESTS THERE WOULD NEED TO BE ABOUT 1 TUNER PER 100 HOMES WITH PIANO'S. SINCE PIANO'S ONLY NEED TO BE TUNED ONCE OR TWICE A YEAR.

$\therefore$ $500 + 100 + 1000 \approx \underline{\underline{1600}}$

Ch. 2

1. TOTAL TRIP: 102 MINUTES

a) 30 MIN $\Rightarrow \frac{30}{102} = .294$

b) 12 MIN $\Rightarrow \frac{12}{102} = .118$

c) 45 MIN $\Rightarrow \frac{45}{102} = .441$

d) 15 MIN $\Rightarrow \frac{15}{102} = .147$

FRACTIONS OF TRIP

$$\bar{V} = \left[\left(80\tfrac{Km}{h} \times .294\right) + \left(100\tfrac{Km}{h} \times .118\right) + \left(40\tfrac{Km}{h} \times .441\right) + \left(0 \times .147\right)\right]$$

$$\boxed{\bar{V} = 52.96\tfrac{Km}{h}}$$

(B) $\bar{V} = \frac{\Delta x}{\Delta t} \Rightarrow \Delta x = \bar{V}\Delta t = \left(52.96\tfrac{Km}{h}\right)\left(102\text{MIN} \cdot \frac{1\text{Hr}}{60\text{MIN}}\right)$

$$\boxed{\Delta x = 90\text{ Km}}$$

7. (A) $\bar{V} = \frac{\Delta x}{\Delta t} = \frac{4m}{1s} = 4\frac{m}{s}$

(B) $\bar{V} = \frac{-2m}{4s} = \frac{-1}{2}\frac{m}{s}$

(C) $\bar{V} = \frac{-4m}{4s} = -1\frac{m}{s}$

(D) $\bar{V} = \frac{0m}{5s} = 0\frac{m}{s}$

8. A (a) $\bar{V} = \frac{\Delta x}{\Delta t} = \frac{.25 \text{ mile}}{25.2 s} = .0099 \frac{\text{mile}}{s}$

(b) $\bar{V} = \frac{.25 mi}{24 s} = .010 \frac{\text{mile}}{s}$

(c) $\bar{V} = \frac{.25 mi}{23.8 s} = .0105 \frac{\text{mile}}{s}$

(d) $\bar{V} = \frac{.25 mi}{23 s} = .0108 \frac{\text{mile}}{s}$

B $\bar{A} = \frac{\Delta V}{\Delta t} = \frac{V_f - V_i}{\Delta t} = \frac{.0108 \frac{mi}{s} - 0 \frac{mi}{s}}{25.2 + 24.0 + 23.8 + 23} = \underline{1.13 \times 10^{-4} \frac{mi}{s^2}}$

22. A (a) $\bar{A} = \frac{\Delta V}{\Delta t} = \frac{0}{5} = 0$

(b) $\bar{A} = \frac{16}{10} = 1.6 \ m/s^2$

(c) $\bar{A} = \frac{16}{20} = .8 \ m/s^2$

B INSTANTANEOUS ACCELERATIONS ARE SLOPES

2 s: Slope = 0, $\bar{A} = 0$

10 s: Slope $= \frac{\Delta y}{\Delta x} = \frac{16}{10} = 1.6 \frac{m}{s^2}$, $\bar{A} = 1.6 \frac{m}{s^2}$

18 s: Slope = 0, $\bar{A} = 0$

30. (A) 3 PHASES - 1. ACCELERATION - $a = \frac{V - V_0}{t}$

$$t_1 = \frac{20\,m/s - 0\,m/s}{2\,m/s^2} = 10\,s$$

2. CONSTANT SPEED - $20\,s = t_2$

3. DECELERATION - $5\,s = t_3$

$t_1 + t_2 + t_3 = \underline{35\,s}$

(B) $\bar{V} = \frac{\Delta x}{\Delta t}$ ← MUST FIND TOTAL DISPLACEMENT ΔX.

PHASE 1: $\Delta x_1 = \underbrace{V_0}_{=0} t + 1/2\, a t^2 = (0)(10) + 1/2(2\,m/s^2)(10\,s)^2$

$$\Delta X_1 = 100\,m$$

PHASE 2: $\Delta X_2 = V_0 t + 1/2\, a t^2 = (20\,m/s)(20\,s) + 1/2(\cancel{0})(20\,s)^2$

$$\Delta X_2 = 400\,m$$

PHASE 3: $\Delta X_3 = V_0 t + 1/2\, a t^2 = (20\,m/s)(5\,s) + 1/2\, a (5\,s)^2$

NEED a

$$a = \frac{\Delta V}{\Delta t} = \frac{0 - 20\,\frac{m}{s}}{5\,s} = -4\,\frac{m}{s^2}$$

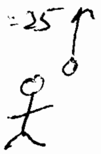
$\therefore \Delta X_3 = 100\,m - \frac{1}{2}(4)(5\,s)^2$

$\Delta X_3 = 100\,m - 50\,m = \underline{\underline{50\,m}}$

$\Delta X = \Delta X_1 + \Delta X_2 + \Delta X_3 = 100\,m + 400\,m + 50\,m = \underline{550\,m}$

43. (A) & (B) $\Delta y = V_0 t + \frac{1}{2} a t^2$ BUT $a = \frac{V - V_0}{t} \rightarrow t = \frac{0 - 25\,m}{-9.8\,m/s}$

$V_0 = 25$



$\Delta y = 25(2.6) - \frac{1}{2}(9.8)(2.6)^2$ $t = 2.6\,s$

$\boxed{\Delta y = 30.9\,m}$

(C) IT TAKES AS LONG COMING BACK DOWN AS IT DID GOING UP. $t = 2.55$.

(D) SAME AS ITS INITIAL VELOCITY $\underline{V_0 = 25\,m/s}$ ← BUT OPP DIRECTION

$V = 14.7\,m/s$ $V = -14.7\,m/s$

59. (A) $V = 14.7\,m/s$

← WHEN THE BALL THROWN UP REACHES THE BALCONY AGAIN IT WILL BE GOING DOWN AT 14.7 m/s, JUST LIKE THE FIRST BALL. THERE FORE THE TIME DIFF IS JUST HOW LONG IT TAKES THE UPWARD BALL TO GO UP & COME BACK TO BALCONY.

$t = \frac{V - V_0}{a} = \frac{0 - 14.7\,m/s}{-9.8\,m/s^2} = 1.5\,s \cdot 2 = \underline{3\,s}$ ← UP & DOWN

(B) $V^2 = V_0^2 + 2a\Delta x = [-14.7\,\frac{m}{s}]^2 + (9.8)(2)(19.6\,m)$

$V^2 = 600.25$

$\boxed{V = -24.5\,m/s}$ ⇐ FOR Both.

(C) UP BALL – $\Delta y = V_0 t + \frac{1}{2} a t^2$

$= (14.7\,\frac{m}{s})(.8\,s) - \frac{1}{2}(9.8\,\frac{m}{s^2})(.8\,s)^2$

$= 8.624\,m$ ← i.e GOES UP 8.624 m

DOWN BALL – $\Delta y = (-14.7\,\frac{m}{s})(.8\,s) - \frac{1}{2}(9.8\,\frac{m}{s^2})(.8\,s)^2$

$\Delta y = -14.896$ ← i.e GOES DOWN 14.896 m

$\therefore$ 8.624 m + 14.896 m APART = $\underline{23.52\,m}$

61. (A) KATHY OVERTAKES STAN WHEN SHE CATCHES UP TO HIM WHICH IS WHEN $\Delta X_{KATHY} = \Delta X_{STAN}$.

KATHY

$$\Delta X_K = V_0 t + \tfrac{1}{2} a t^2$$
$$= \tfrac{1}{2}(4.9 \tfrac{m}{s^2})(t^2)$$

STAN

$$\Delta X_S = V_0 t + \tfrac{1}{2} a t^2$$
$$\Delta X_S = \tfrac{1}{2}(3.5 \tfrac{m}{s^2})(t+1)^2$$

STAN GETS EXTRA SECOND

$$\therefore \cancel{\tfrac{1}{2}}(4.9)t^2 = \cancel{\tfrac{1}{2}} \cdot 3.5\,(t+1)^2$$
$$4.9t^2 = 3.5\left[t^2 + 2t + 1\right]$$
$$4.9t^2 = 3.5t^2 + 7t + 3.5$$
$$1.4t^2 - 7t - 3.5 = 0$$

QUADRATIC EQN.

$$t = \frac{7 \pm \sqrt{7^2 + 4(1.4)(3.5)}}{2(1.4)} = \boxed{5.46},\ -\cancel{.438}$$

NO NEG. TIMES.

(B) $\Delta X = \tfrac{1}{2}(4.9 \tfrac{m}{s^2})(5.46)^2 = \underline{73.04\,m}$

KATHY

(C) $V^2 = V_0^2 + 2aS = 2(4.9 \tfrac{m}{s^2})(73.04\,m) = \underline{715.79}$

$$\boxed{V = 26.75 \tfrac{m}{s}}$$

STAN

$V^2 = V_0^2 + 2aS = 2(3.5 \tfrac{m}{s^2})(73.04\,m) = \underline{22.61 \tfrac{m}{s}}$

62. (A) SINGLE SPLASH MEANS THEY HIT SIMULTANEOUSLY

$$\Delta x = V_0 t + \frac{1}{2} a t^2$$

$$-50\,m = \left(-2\,\frac{m}{s}\right)t - \frac{1}{2}\cdot 9.8\,t^2$$

$$4.9t^2 + 2t - 50 = 0$$

$$t = \frac{-2 \pm \sqrt{4 + 4(4.9)(50)}}{2(4.9)} = 3\,s$$

(B) $-50\,m = V_0(2\,s) - \frac{1}{2}\cdot 9.8(2\,s)^2$ ← THROWN 1s LATER.

$$\boxed{-15.2\,\frac{m}{s} = V_0}$$

(C) STONE 1 – $V^2 = V_0^2 + 2a\Delta x$

$$= \left(-2\,\frac{m}{s}\right)^2 + 2(9.8)(50)$$

$$\boxed{V = -31.3\,m/s}$$

STONE 2 – $V^2 = V_0^2 + 2a\Delta x$

$$= \left(-15.2\,\frac{m}{s}\right)^2 + 2(9.8)(50\,m)$$

$$\boxed{V = -34.8\,m/s}$$

7. If woman is 3 meters above saddle:

$\Delta x = V_0 t + \frac{1}{2} a t^2$

$-3m = -\frac{1}{2} \cdot 9.8 \cdot t^2$

$t^2 = .61 s^2$

$t = .78s$ ← It will take .78 s for her to fall.

Now how far does horse travel in .78 s?

$\Delta x = V \Delta t = (10 \, m/s)(.78 s) = 7.8m$

∴ Horse must be 4m away. (horizontally

(B) Already answered: