# Dimensional analysis #1

Name____KEY_____

**Show all set-ups!!**

Given the following information:

1 quark = 2.9 whos  1 whos = 5 mabees  1 bug = 3.7 quarks  1 kuz = 3.2 mabees

Change:

1.) 3.0 quark to bug → $3.0\ q \times \frac{1\ b}{3.7\ q} = 0.81081081\ b$

q → b

1.__0.81 b_____

2.) 1.3 mabees to quarks → $1.3\ m \times \frac{1\ w}{5\ m} \times \frac{1\ q}{2.9\ w} = 0.089655172\ q$

m → w → q

2.__ 0.090 q_____

3.) 7.0 whos to bugs → $7.0\ w \times \frac{1\ q}{2.9\ w} \times \frac{1\ b}{3.7\ q} = 0.652376514\ b$

w → q → b

3.__0.65 b_____

4.) 8.75 kuz to quarks → $8.75k \times \frac{3.2\ m}{1\ k} \times \frac{1\ w}{5\ m} \times \frac{1\ q}{2.9\ w} = 1.931034483\ q$

k → m → w → q

4.__1.93 q_____

5. 2.5 bug to kuz → $2.5\ b \times \frac{3.7\ q}{1\ b} \times \frac{2.9\ w}{1\ q} \times \frac{5\ m}{1\ w} \times \frac{1\ k}{3.2\ m} = 41.9140625\ k$

b → g → w → m → k

5.__42 k_____

6.) $2.0 \times 10^{-3}$ quarks to mabees → $2.0 \times 10^{-3}\ q \times \frac{2.9\ w}{1\ q} \times \frac{5\ m}{1\ w} =$

q → w → m → k

6._0.029 m_____

7.) 900. quarks to whos → $900\ q \times \frac{2.9\ w}{1\ q} = 2610\ w$

q → w

7.__2610 w_____

8.) $4.8 \times 10^5$ kuz to mabees → $4.8 \times 10^5\ k \times \frac{3.2\ m}{1\ k} = 1536000\ m$

k → m

8._$1.5 \times 10^6$ m_____

9.) 205 mabees to whos → $205\ m \times \frac{1\ w}{5\ m} = 41\ w$

m → w

9.___41.0 w_____

10.) 15 $bug^2$ to $quarks^2$ → $15\ b^2 \times \frac{3.7^2\ q^2}{1^2\ b^2} = 205.35\ q^2$

$b^2 \rightarrow q^2$

10._210_$q^2$_____

11.) 2.5 $mabees^2$ to $kuz^2$ → $2.5\ m^2 \times \frac{1^2\ k^2}{3.2^2\ m^2} = 0.24\ k^2$

$m^2 \rightarrow k^2$

11.___0.24 $k^2$_____

12.) $1.50 \times 10^3$ $kuz^2$ to $bug^2$ → $k^2 \rightarrow m^2 \rightarrow w^2 \rightarrow q^2 \rightarrow b^2$

$1500\ k^2 \times \frac{3.2^2\ m^2}{1^2\ k^2} \times \frac{1^2\ w^2}{5^2\ m^2} \times \frac{1^2\ q^2}{2.9^2\ w^2} \times \frac{1^2\ b^2}{3.7^2\ q^2} = 5.336441625\ b^2$

12._5.34 $b^2$_____

# DIMENSIONAL ANALYSIS

Set up and solve the following problems using dimensional analysis. Be sure to express your results to the proper number of significant figures.

1. How many seconds are there in 1.2 weeks?
2. How many centimeters are there in 4.38 feet?
3. How many meters did you run if the distance run was $6.59 \times 10^5$ inches?
4. What is the mass of a suitcase, in pounds, if it weighs 19.5 kilograms?
5. If a recipe calls for 37 grams of sugar, how many pounds does that correspond to?
6. Express a volume of 589 $cm^3$ in $ft^3$ and $in^3$.
7. How many liters are equal to 39 $in^3$?
8. If a car travels at $4.45 \times 10^4$ ft/hr, what would its speed be in meters/min?
9. What is the density of a substance if it has a mass of 59.2 grams and a volume of 17.0 mL?
10. Calculate the density of a liquid, in grams/$cm^3$, if it has a mass of 23.2 grams and occupies a cube with dimensions of 1.3 cm × 5.6 cm × 2.3 in.
11. If a liquid has a density of 1.04 g/mL, what would its density be in lb/$in^3$?
12. What volume, in liters, would 88.9 grams of a substance occupy if its density is 2.38 g/mL?
13. What is the mass, in pounds, of 389 mL of a gas that has a density of 1.29 g/L?
14. Convert 37°C to °F and K.
15. Which temperature is the coldest?
    a) −12°C  b) 18°F  c) 248K

1. $1.2 \text{ weeks} \left| \frac{7 \text{ days}}{1 \text{ wk}} \right| \frac{24 \text{ hr}}{1 \text{ day}} \left| \frac{60 \text{ min}}{1 \text{ hr}} \right| \frac{60 \text{ sec}}{1 \text{ min}} = 725760$ there is an exact # of seconds

2. $4.38 \text{ ft} \left| \frac{12 \text{ in}}{1 \text{ ft}} \right| \frac{2.54 \text{ cm}}{1 \text{ in}} = 134 \text{ cm}$

3. 16,700 m
4. 43.0 lb
5. 0.082 lb
6. 35.9 $in^3$, 0.0208 $ft^3$
7. 0.64 L
8. 226 m/min
9. 3.49 g/mL
10. 23.2 g / 43 $cm^3$ = 0.55 g/$cm^3$
11. 0.0376 lb/$in^3$
12. 0.0374 L
13. 0.00111 lb
14. 99°F, 310 K
15. a) −12°C  b) −7.8°C  c) −25°C

c) is coldest

KEY

# Dimensional Analysis Practice Problems

1) 0.56kg = ? mg

$$0.56\text{ kg} \times \frac{1000\text{ g}}{1\text{ kg}} \times \frac{1\text{ mg}}{0.001\text{ g}} = 560{,}000\text{ mg}$$

2) 1.2ng = ? g

$$1.2\text{ ng} \times \frac{10^{-9}\text{ g}}{1\text{ ng}} = 1.2\times10^{-9}\text{ g}$$

3) 2.0 in = ? mm (1in = 2.54 cm)

$$2.0\text{ in} \times \frac{2.54\text{ cm}}{1\text{ in}} \times \frac{0.01\text{ m}}{1\text{ cm}} \times \frac{1\text{ mm}}{0.001\text{ m}} = 51\text{ mm}$$

4) 500ft = ? m

$$500\text{ ft} \times \frac{12\text{ in}}{1\text{ ft}} \times \frac{2.54\text{ cm}}{1\text{ in}} \times \frac{0.01\text{ m}}{1\text{ cm}} = 154.2\text{ m} \rightarrow 200\text{ m}$$

5) 10μL = ? cc (1mL = 1cm$^3$ = 1 cc)

$$10\mu\text{L} \times \frac{10^{-6}\text{ L}}{1\ \mu\text{L}} \times \frac{1\text{ mL}}{0.001\text{ L}} \times \frac{1\text{ cc}}{1\text{ mL}} = 0.01\text{ cc}$$

6) 3 wk = ? min

$$3\text{ wk} \times \frac{7\text{ day}}{1\text{ wk}} \times \frac{24\text{ hr}}{1\text{ day}} \times \frac{60\text{ min}}{1\text{ hr}} = \frac{30240}{30{,}000}\text{ min}$$

7) 50mL = ? cups (1L = 4.226cups)

$$50\text{mL} \times \frac{.001\text{ L}}{1\text{ mL}} \times \frac{4.226\text{ cups}}{1\text{ L}} = \frac{0.2113}{0.2\overline{2}}\text{ cups}$$

8) 5.33km = ? dm

$$5.33\text{ km} \times \frac{1000\text{ m}}{1\text{ km}} \times \frac{1\text{ dm}}{.1\text{ m}} = 53300\text{ dm}$$

9) 123.0 ng = ? Mg

$$123.0\text{ng} \times \frac{10^{-9}\text{ g}}{1\text{ ng}} \times \frac{1\text{ Mg}}{10^{6}\text{ g}} = 1.230\times10^{-13}\text{ Mg}$$

10) 3yds = ? in (1 yd = 3ft)

$$3\text{ yds} \times \frac{3\text{ ft}}{1\text{ yd}} \times \frac{12\text{ in}}{1\text{ ft}} = \frac{108}{100}\text{ in}$$ rounded

CHEM 160

# Worksheet: Dimensional Analysis KEY

1. 9 in → cm

$$\frac{9\ \text{in}}{1} \left| \frac{2.54\ \text{cm}}{1\ \text{in}} \right. = 9 \times 2.54\ \text{cm} = 22.86\ \text{cm} \rightarrow$$

20 cm
1 sig. fig.

2. 29 lb 4 oz → kg

$$29.25\ \text{lb} \left| \frac{0.45359\ \text{kg}}{1\ \text{lb}} \right. = 13.2675075\ \text{kg} \rightarrow$$

13.27 kg
4 sig. fig.

3. $210\ \text{cm} \times \frac{1\ \text{in}}{2.54\ \text{cm}} = 82.67\ \text{in} \rightarrow$

83 in
2 sig. fig

4. $3.05\ \text{m} \times \frac{39.37\ \text{in}}{1\ \text{m}} \times \frac{1\ \text{ft}}{12\ \text{in}} = \frac{3.05 \times 39.37}{12}\ \text{ft} = 10.0\,03917\ \text{ft}$

10.0 ft
3 sig. fig.

5. $14\ \text{gal} \times \frac{3.785\ \text{L}}{1\ \text{gal}} = 52.99\ \text{L} \rightarrow$

53 L
2 sig. fig.

6. $2.5\ \text{yd} \times \frac{1\ \text{yd}}{0.9463\ \text{yd}} =$ 2.6 yd
2 sig. fig

This is less than 3 yd so it was enough.

7. $20\ \text{ha} \times \frac{2.47\ \text{ac}}{1\ \text{ha}} \times \frac{1\ \text{owl}}{3\ \text{ac}} = 16.4666667\ \text{owl} \rightarrow$

20 owl (1 sig. fig.)

8. $8\,\text{ac} \times \frac{1\,\text{ha}}{2.47\,\text{ac}} \times \frac{1\,\text{sheep}}{0.125\,\text{ha}} = \frac{8}{2.47 \times 0.125}\,\text{sheep} =$

25.91093117 sheep → 30 sheep (1 sig fig)

9. 1 pk = 34 g carbs

$6\,\text{days} \times \frac{1\,\text{pk}}{\text{day}} \times \frac{34\,\text{g carb}}{\text{pk}} \times \frac{16\,\text{oz}}{454\,\text{g}} = \frac{6 \times 34 \times 16}{454}\,\text{oz carb} =$

7.189427313 oz carb = 7 oz carb (1 sig. fig.)

10. 9 g fat = 1 bar ; 1 pack = 0.6 dbar ; (a) ? oz fat (b) ? cal

$1\,\text{pack} \times \frac{0.6\,\text{dbar}}{1\,\text{pack}} \times \frac{10\,\text{bar}}{1\,\text{dbar}} \times \frac{9\,\text{g fat}}{1\,\text{bar}} \times \frac{1\,\text{lb}}{453.6\,\text{g}} \times \frac{16\,\text{oz}}{1\,\text{lb}} =$

(a) $\frac{0.6 \times 10 \times 9 \times 16}{453.6}\,\text{oz fat} = 1.904761905\,\text{oz} \approx 2\,\text{oz fat}$

(b) $0.6 \times 10 \times 9\,\text{g fat} \times \frac{9\,\text{Cal}}{1\,\text{g fat}} = 0.6 \times 10 \times 9 \times 9\,\text{Cal} = 486\,\text{Cal}$

500 cal (1 sig. fig)

11. 60 mg vit C = 1 day ; 70 mg vit C = 100 g orange ; 3 oz = 1 orange

$1\,\text{week} \times \frac{7\,\text{day}}{1\,\text{wk}} \times \frac{60\,\text{mg vit C}}{1\,\text{day}} \times \frac{100\,\text{g orange}}{70\,\text{mg vit C}} \times \frac{16\,\text{oz}}{454\,\text{g}} \times \frac{1\,\text{orange}}{3\,\text{oz}} =$

$\frac{7 \times 60 \times 100 \times 16}{70 \times 454 \times 3}\,\text{oranges} =$ 7 oranges (1 sig. fig.)

12. 5 mg tar = 1 cig ; 0.4 mg nic = 1 cig. ; 20 cig. = 1 pk

$80\,\text{oz} \times \frac{28.35\,\text{g}}{1\,\text{oz}} \times \frac{1\,\text{mg}}{10^{-3}\,\text{g}} \times \frac{1\,\text{cig}}{5\,\text{mg tar}} \times \frac{1\,\text{pk}}{20\,\text{cig}} =$ 2,000 pk (1 sig. fig.)

12. cont. how many pcks of cig. = 1 g nicotine

$$1\ g\ \text{nic} \times \frac{1\ \text{cig}}{0.4\ \text{mg nic}} \times \frac{1\ \text{mg}}{10^{-3}\ g} \times \frac{1\ \text{pk}}{20\ \text{cig}} =$$

$$\frac{1}{0.4 \times 10^{-3} \times 20}\ \text{pk} = 125\ \text{pk} \rightarrow \text{100 pk (1 sig. fig.)}$$

13. 60 mi/hr. what dist. equals 1 sec.

1 sec → dist (ft).

$$1\ \text{sec} \times \frac{1\ \text{hr}}{60\ \text{sec}} \times \frac{1\ \text{hr}}{60\ \text{min}} \times \frac{60\ \text{mi}}{1\ \text{hr}} \times \frac{5280\ \text{ft}}{1\ \text{mi}} =$$

$$\frac{60 \times 5280}{60 \times 60}\ \text{ft} = 88\ \text{ft} \rightarrow \text{90 ft (1 sig. fig.)}$$