Chapter 1 Homework Answer key

Section 1.2

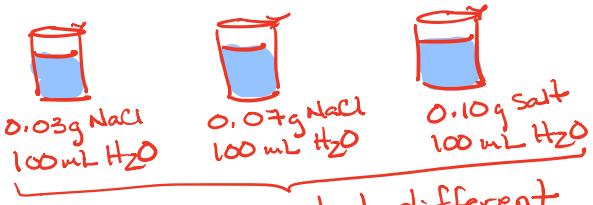
8) Why is an objects mass rather than weight used to indicate the amount of matter it contains?

Weight is a force that is proportional to gravity. Thus objects weigh differently in in different gravitational fields (moon vs earth). Mass is independent of gravity- Same mass on the moon as on earth.

11) How does a homogeneous mixture differ from a pure substance? How are they similar?

Differ in ratios

Homogeneous mixture

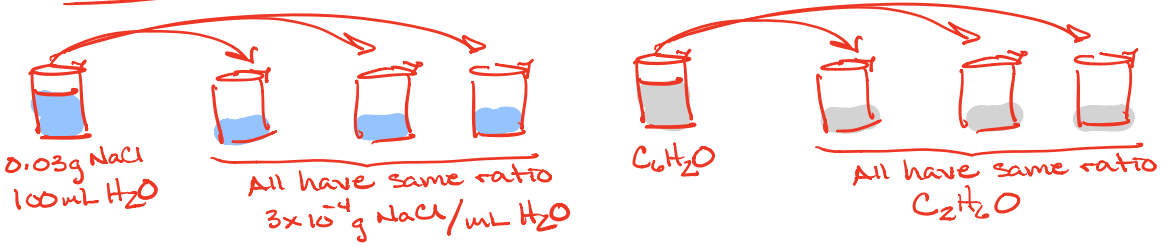


All homogeneous but different ratios of salt to water

Pure substance

Always same ratio

Similar in Consistent within Sample



13) How do molecules of elements and molecules of compounds differ? In what ways are they similar?

Similar in that they both have multiple atoms bound in chemical bond.

Molecules of Elements

H_2, O_2, N_2, S_8, P_4

Molecules of Compounds

H_2O, CO_2, $C_6H_{12}O_6$

Differ in that Elements have single element (Single Symbol) while Compounds have 2 or more elements

Molecules of Elements

H_2, O_2, N_2, S_8, P_4

Molecules of Compounds

H_2O, CO_2, $C_6H_{12}O_6$

16) Classify each as element, Compound, Mixture

a) Copper Cu Element

b) water H_2O Compound

c) nitrogen N Element

d) Sulfur S Element

e) air $O_2, N_2, CO_2, \ldots$ Mixture

f) Sucrose $C_{12}H_{24}O_{11}$ Compound

g) a substance composed of molecules each of which contains 2 iodine atoms I_2 Element

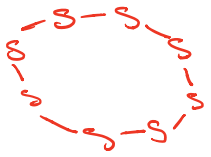
h) gasoline 100's of Compounds ⇒ Mixture

18) A Sulfur atom and a Sulfur Molecule are not identical. What is the difference?

Sulfur Atom

S

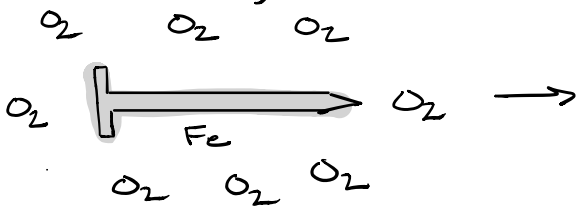
Sulfur Molecule

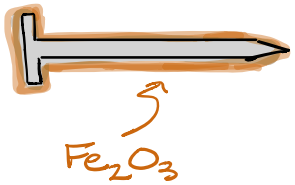


$\equiv S_8$

23) When elemental iron corrodes it combines with oxygen in the air to form red brown iron(III) oxide called rust.

a) If a shiny nail with an initial mass of 23.2g is weighed after being coated in rust, would you expect the mass to increase, decrease, or remain the same? Explain.





Nail weighed w/ just Fe. Oxygen not part of nail

Now all Fe still present but w/ oxygen bound to it ⇒ Increase in mass

b) If the mass of the iron nail increases to 24.1g, what mass of oxygen combined with iron?

24.1g − 23.2g = 0.9g oxygen

Section 1.3

27) Classify each of the following as physical or Chemical change

a) Condensation of Steam — Physical

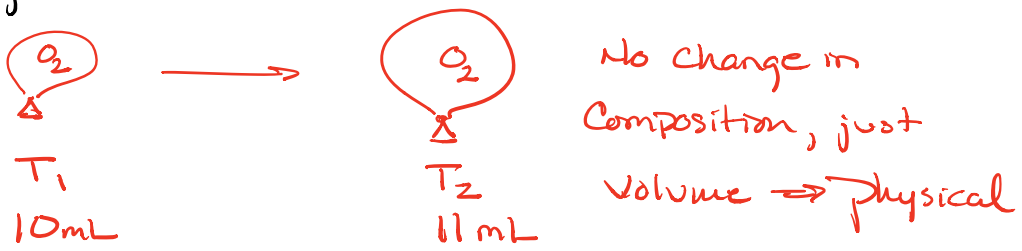
b) Burning of gasoline — Chemical

c) Souring of Milk — Chemical

d) Dissolving of Sugar in water — Chemical

e) Melting of gold — Physical

29) The volume of a sample of oxygen gas changed from 10mL to 11mL as the temp changed. Is this a physical or Chemical Change.



No change in Composition, just Volume ⇒ physical

Section 1.4

38) Give the name and symbol of the prefixes used with SI units to indicate multiplication by the following exact quantities.

a) 10^3 kilo k

b) 10^{-2} Centi c

c) 0.1 deci d

d) 10^{-3} milli m

e) 1,000,000 = 10^6 Mega M

f) 0.000001 = 10^{-6} micro μ

39) Give the name of the prefix and the quantity indicated by the following symbols.

a) c Centi 10^{-2}

b) d deci 10^{-1}

c) G Giga 10^9

d) k kilo 10^3

e) m milli 10^{-3}

f) n nano 10^{-9}

g) p pico 10^{-12}

h) T Tera 10^{12}

40) A large piece of jewelry has a mass of 132.6 g. A graduated cylinder initially contains 48.6 mL of water. When submerged in the graduated cylinder, the volume increases to 61.2 mL

a) Determine the density of the jewelry

Volume jewelry = 61.2 mL − 48.6 mL = 12.6 mL

$$\text{Density} = \frac{\text{mass}}{\text{vol}} = \frac{132.6\ \text{g}}{12.6\ \text{mL}} = \boxed{10.5\ \text{g/mL}}$$

b) Assuming the jewelry is made from a single substance, what is the jewelry likely made of? Explain.

Look at Table 1.4 Ag has density of 10.5 g/mL

⟹ Material most likely Silver (Ag)

Section 1.5

45) Express each in scientific notation w/ correct sig figs.

a) 711.0 7.110×10^{2}

b) 0.239 2.39×10^{-1}

c) 90743 9.0743×10^{4}

d) 134.2 1.342×10^{2}

e) 0.05499 5.499×10^{-2}

f) 10000.0 1.00000×10^{4}

g) 0.00000073859 2

$= 7.38592 \times 10^{-8}$

47) Indicate whether each of the following can be determined exactly or must be measured.

a) The number of seconds in hour Def exact

b) The number of pages in book Counted exact

c) The number of grams in your weight measured

d) The number of g in 3kg Def exact

e) The volume of H_2O you drink in a day measured

f) The distance from SF to Kansas City measured

49) How many Sig figs are contained in each of the following?

a) 53 cm 2

b) 2.05×10^8 m 3

c) 86,002 J 5

d) 9.740×10^4 m/s 4

e) $10.0613\ m^3$ 6

f) 0.17 g/mL 2

g) 0.88400 s 5

51) Round each to 2 sf

a) 0.436 0.44

b) 9.000 9.0

c) 27.2 27

d) 135 140 or 1.4×10^2 Round even

e) 1.497×10^{-3} 1.5×10^{-3}

f) 0.445 0.44 Round even

53) Perform Calc & Report w/ proper Sig Figs

a) $\overset{3}{628} \times \overset{3}{342} = 214776 = 2.14 \times 10^5$

b) $\overset{3}{5.63} \times 10^{\overset{2}{2}} \times \overset{2}{7.4} \times 10^{\overset{3}{3}} = 4166200 = 4.2 \times 10^6$

c) $\dfrac{\overset{3}{28.0}}{\underset{5}{13.483}} = 2.076689164 = 2.08$

d) $\overset{4}{8119} \times \overset{2}{0.000023} = 0.186737 = 0.19$

e) $14.98 + 27340 + 84.7593$

$$\begin{array}{r} 14.98 \\ 27340 \\ +\quad 84.7593 \\ \hline 27439.7393 \end{array} = 2.744 \times 10^4$$

f) $42.7 + 0.259$

$$\begin{array}{r} 42.7 \\ +\ 0.259 \\ \hline 42.959 \end{array} = 43.0 \text{ or } 4.30 \times 10^1$$

Section 1.6

57) write conversion factors as ratios

Pull these from table 1.6

a) yards in 1 meter $\quad \frac{1.0936\ \text{yd}}{1\ \text{m}}$

b) liters in 1 qt $\quad \frac{0.94635\ \text{L}}{1\ \text{qt}}$

c) lbs in 1 kg $\quad \frac{2.2046\ \text{lbs}}{1\ \text{kg}}$

59) The label on a soft drink bottle gives volume in 2 units: 2.0 L & 67.6 fl oz. Use the information to derive a conversion factor. How many Sig figs can you keep

$$\frac{67.6\ \text{fl oz}}{2.0\ \text{L}} \quad (3,\ 2) = \frac{33.8\ \text{fl oz}}{1\ \text{L}} = \boxed{\frac{34\ \text{fl oz}}{1\ \text{L}}}$$

or

$$\frac{2.0\ \text{L}}{67.6\ \text{fl oz}} = 0.029\,58\,58 = \boxed{\frac{0.030\ \text{L}}{1\ \text{fl oz}}}$$

(65) The diameter of a red blood cell is about 3×10^{-4} in. Convert to cm.

1

$$3 \times 10^{-4} \text{ in} \times \frac{2.54 \text{ cm}}{1 \text{ in}} \quad \text{(exact)} = 7.62 \times 10^{-4} \text{ cm}$$

$$= 7 \times 10^{-4} \text{ cm}$$

(67) Is a 197-lb weight lifter light enough to compete in a class limited to those weighing 90 kg or less?

Road map

lb → g → kg

3 4

$$197 \text{ lbs} \times \frac{453.6 \text{ g}}{1 \text{ lb}} \times \frac{1 \text{ kg}}{1000 \text{ g}} \quad \text{(exact)} = 89.3592 \text{ kg}$$

$$= 89.4 \text{ kg}$$

yes 89.4 is < 90kg

71) Use Scientific notation to express each in SI base unit.

a) $0.13\,g \times \frac{1\,kg}{1000\,g} = 1.3 \times 10^{-4}\,kg$

b) $232\,Gg \times \frac{1 \times 10^{9}\,g}{1\,Gg} \times \frac{1\,kg}{1000\,g} = 2.32 \times 10^{8}\,kg$

c) $5.23\,pm \times \frac{1 \times 10^{-12}\,m}{1\,pm} = 5.23 \times 10^{-12}\,m$

d) $86.3\,mg \times \frac{1\,g}{1000\,mg} \times \frac{1\,kg}{1000\,g} = 8.63 \times 10^{-5}\,kg$

e) $37.6\,cm \times \frac{1\,m}{100\,cm} = 3.76 \times 10^{-1}$

f) $54\,\mu m \times \frac{1 \times 10^{-6}\,m}{1\,\mu m} = 5.4 \times 10^{-5}$

g) $1\,Ts \times \frac{1 \times 10^{12}\,s}{1\,Ts} = 1 \times 10^{12}\,s$

h) $27\,ps \times \frac{1 \times 10^{-12}\,s}{1\,ps} = 2.7 \times 10^{-11}\,s$

I) $0.15\,mK \times \frac{1\,K}{1000\,mK} = 1.5 \times 10^{-4}\,K$

* Remember that for grams ⇒ kg = base unit!

73) Gasoline is sold by the liter in many countries. How many liters are required to fill a 12.0 gal gas tank?

Road Map

gal $\longrightarrow$ L

$$12.0\,\text{gal} \times \frac{3.785\,\text{L}}{1\,\text{gal}} = 45.42\,\text{L} = \boxed{45.4\,\text{L}}$$

77) Make the conversion indicated

a) 120. m $\rightarrow$ ft

Road Map

m $\rightarrow$ cm $\rightarrow$ in $\rightarrow$ ft

$$120.\,\text{m} \times \frac{100\,\text{cm}}{1\,\text{m}} \times \frac{1\,\text{in}}{2.54\,\text{cm}} \times \frac{1\,\text{ft}}{12\,\text{in}} = 393.7007874\,\text{ft}$$

$$\boxed{394\,\text{ft}}$$

b) 19565 ft $\rightarrow$ km

Road Map

ft $\rightarrow$ in $\rightarrow$ cm $\rightarrow$ m $\rightarrow$ km

$$19565\,\text{ft} \times \frac{12\,\text{in}}{1\,\text{ft}} \times \frac{2.54\,\text{cm}}{1\,\text{in}} \times \frac{1\,\text{m}}{100\,\text{cm}} \times \frac{1\,\text{km}}{1000\,\text{m}}$$

$$= 5.968412\,\text{km}$$

$$\boxed{= 5.9684\,\text{km}}$$

c) $8.5\text{ in} \times 11\text{ in}$ in cm^2

Road map

$\text{in}^2 \rightarrow \text{cm}^2$

$$(8.5\text{ in} \times 11\text{ in}) \times \frac{2.54^2\ \text{cm}^2}{1^2\ \text{in}^2} = 603.2246\ \text{cm}^2$$

$$= 600\ \text{cm}^2 = \boxed{6.0 \times 10^2\ \text{cm}^2}$$

d) $161\ \text{in}^3 \rightarrow \text{L}$

Road Map

$\text{in}^3 \rightarrow \text{cm}^3 \rightarrow \text{mL} \rightarrow \text{L}$

$$161\ \text{in}^3 \times \frac{2.54^3\ \text{cm}^3}{1^3\ \text{in}^3} \times \frac{1\ \text{mL}}{1\ \text{cm}^3} \times \frac{1\ \text{L}}{1000\ \text{mL}} = 2.638317304\ \text{L}$$

$$= \boxed{2.64\ \text{L}}$$

e) $5.6 \times 10^{15}\ \text{ton} \rightarrow \text{kg}$

Road Map

$\text{ton} \rightarrow \text{lbs} \rightarrow \text{g} \rightarrow \text{kg}$

$$5.6 \times 10^{15}\ \text{tons} \times \frac{2000\ \text{lbs}}{1\ \text{ton}} \times \frac{453.6\ \text{g}}{1\ \text{lbs}} \times \frac{1\ \text{kg}}{1000\ \text{g}} =$$

$$5.08032 \times 10^{18}\ \text{kg}$$

$$\boxed{5.1 \times 10^{18}\ \text{kg}}$$

f) 32.0 lbs → kg

Road map

lbs → g → kg

$$32.0\ \text{lbs} \times \frac{453.6\ \text{g}}{1\ \text{lbs}} \times \frac{1\ \text{kg}}{1000\ \text{g}} = 14.5152\ \text{kg}$$

(3 sig figs; 4 sig figs; def)

$$= \boxed{14.5\ \text{kg}}$$

g) 5.00 grain → mg (1 grain = 0.00229 oz)

Road map

grain → oz → lbs → g → mg

$$5.00\ \text{grain} \times \frac{0.00229\ \text{oz}}{1\ \text{grain}} \times \frac{1\ \text{lbs}}{16\ \text{oz}} \times \frac{453.6\ \text{g}}{1\ \text{lbs}} \times \frac{1000\ \text{mg}}{1\ \text{g}}$$

(3 sig figs; def; 4 sig figs; def)

$$= 324.6075\ \text{mg}$$

$$= \boxed{325\ \text{mg}}$$

81) An instructor is preparing an experiment, he requires 225 g of phosphoric acid. The only container available is a 150-mL Erlenmeyer flask. Is it large enough to contain the acid whose density is 1.83 g/mL?

Road Map

g → mL

$$225\text{ g Phosphoric acid} \times \frac{1\text{ mL}}{1.83\text{ g}} = 122.9508197\text{ mL}$$

= 123 mL

yes 150-mL flask will hold it.

91) Calculate these volumes

a) Volume 29 g Iodine $d = 4.93\text{ g/cm}^3$

Road map

g → cm

$$29\text{ g } I_2 \times \frac{1\text{ cm}^3}{4.93\text{ g}} = 5.882352941\text{ cm}^3$$

$$= 5.9\text{ cm}^3$$

b) Volume 3.28 g hydrogen $d = 0.089\text{ g/L}$

Road map

g → L

$$3.28\text{ g } H_2 \times \frac{1\text{ L}}{0.089\text{ g}} = 36.853933\text{ L} = 37\text{ L}$$

93) Convert 2966 °C to °F & K

°C → °F

$$2966\,^{\circ}C \times \frac{180\,^{\circ}F}{100\,^{\circ}C} + 32\,^{\circ}F = 5370.8\,^{\circ}F$$

$$= \boxed{5371\,^{\circ}F}$$

°C → K

$$2966\,^{\circ}C + 273.15\,K = 3239.15\,K$$

$$= \boxed{3239\,K}$$

95) Convert −10 °F to °C & K

↖ no decimal = 1 SF

°F → °C

$$(-10\,^{\circ}F - 32\,^{\circ}F) \times \frac{100\,^{\circ}C}{180\,^{\circ}F} = -23.333\overline{3}\,^{\circ}C$$

$$= \boxed{-20\,^{\circ}C}$$

°C → K

$$-23.333\overline{3}\,^{\circ}C + 273.15 = 249.816666\overline{6}\,K$$

↑ good to 10 place

$$= \boxed{250\,K}$$

97) $-28.1\,^{\circ}F$ to $^{\circ}C$ & K

$^{\circ}F \rightarrow {}^{\circ}C$

$$(-28.1\,^{\circ}F - 32\,^{\circ}F) \times \frac{100\,^{\circ}C}{180\,^{\circ}F} = -33.388\,^{\circ}C$$

$$= \boxed{-33.4\,^{\circ}C}$$

$^{\circ}C \rightarrow K$

$$-33.388\,^{\circ}C + 273.15 = 239.7611\,K$$

good to tenths

$$= \boxed{239.8\,K}$$