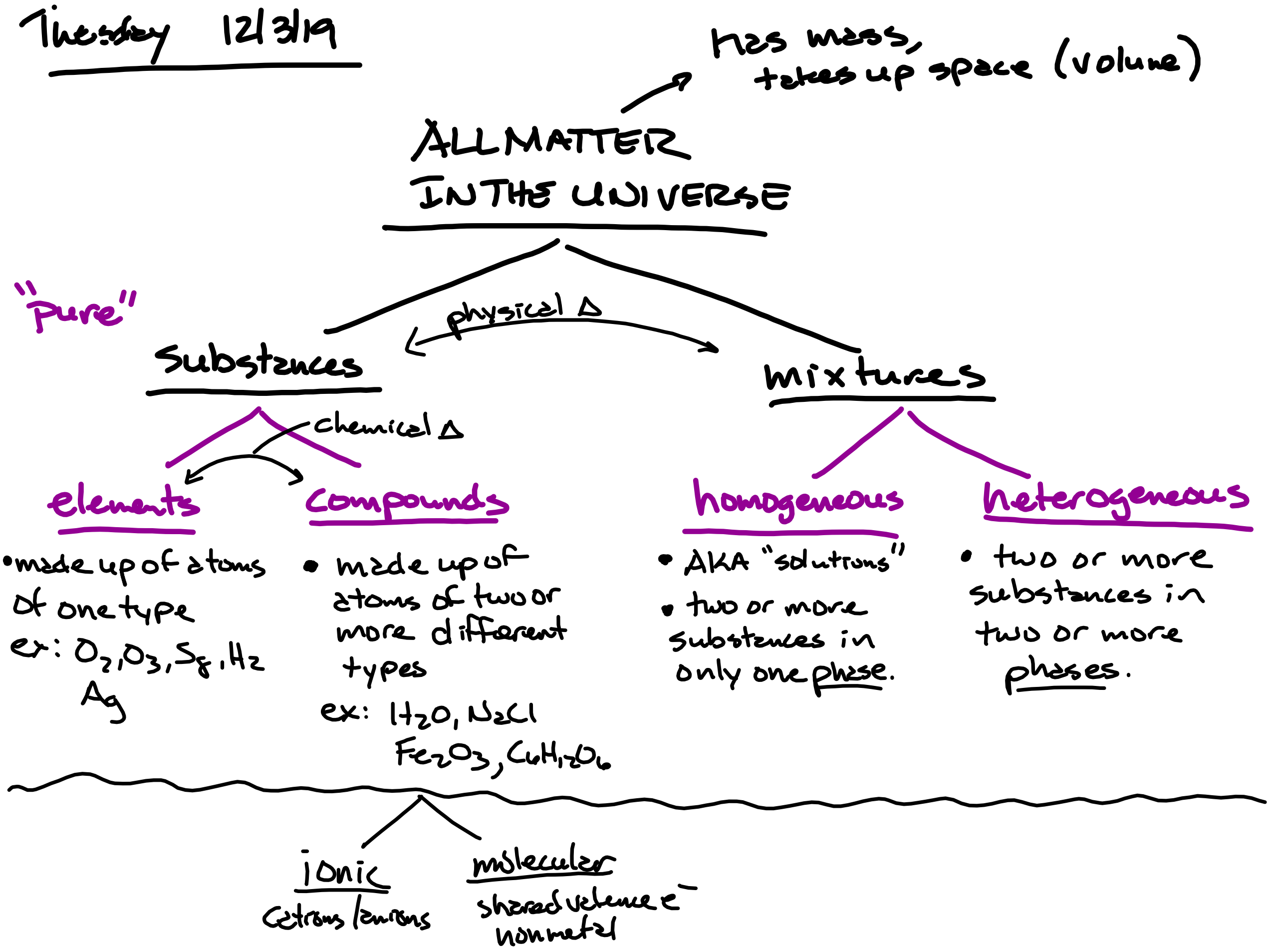
1st	3rd	5th	95 students
A - 11	A-11	A-9	31-A
B-7	B-8	B-6	21-B
C-12	C- 9	C-6	27-C
D- 3	D-6	D-6	15-D
F- 2	F-1	F-1	4-F
80.9%	78.4%	77.4%	

Tuesday 12/3/19



has mass, takes up space (volume)

ALL MATTER IN THE UNIVERSE

"pure" substances

physical Δ

mixtures

chemical Δ

elements
- made up of atoms of one type
- ex: O_2, O_3, S_8, H_2, Ag

compounds
- made up of atoms of two or more different types
- ex: H_2O, NaCl, Fe_2O_3, $C_6H_{12}O_6$

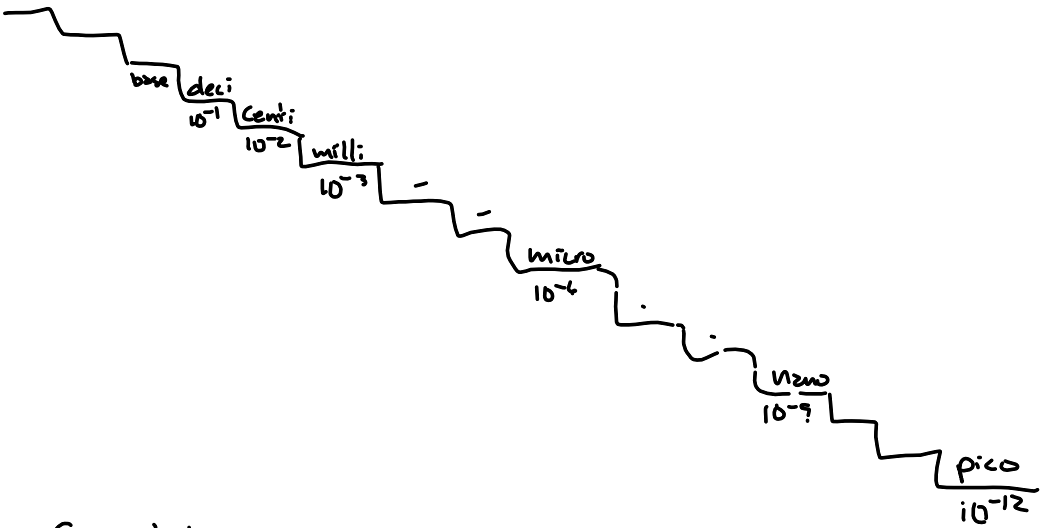
homogeneous
- AKA "solutions"
- two or more substances in only one phase.

heterogeneous
- two or more substances in two or more phases.

ionic
cations/anions

molecular
shared valence e^-
nonmetal

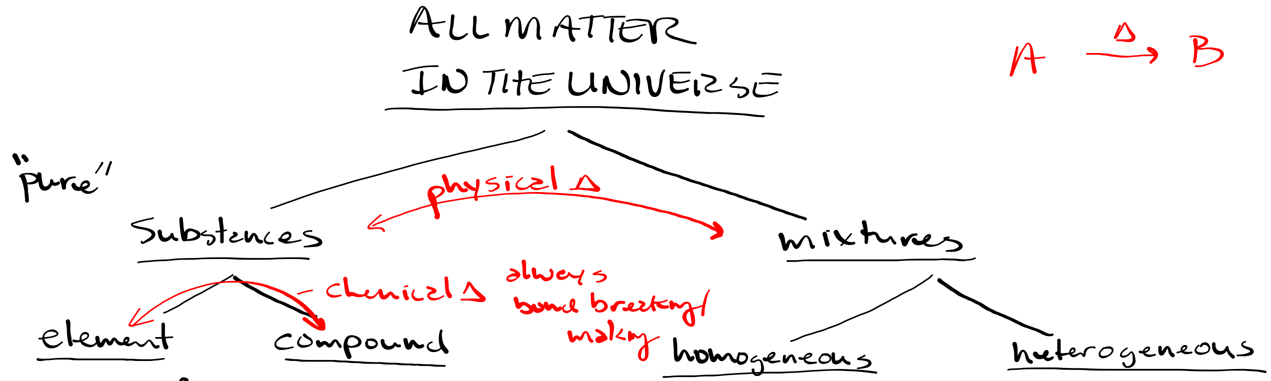
*phase = a region of constant composition.



Convert 1.0 mi → cm

$$1.0\,\cancel{mi} \times \frac{5280\,\cancel{ft}}{1\,\cancel{mi}} \times \frac{12\,\cancel{in}}{1\,\cancel{ft}} \times \frac{2.54\,cm}{1\,\cancel{in}} =$$

Tuesday 12/3/19



- element: • made up of only one type of atom.
- compound: • made up of two or more types of atoms
- homogeneous: • two or more substances in one phase.*
- heterogeneous: • two or more substances, 2 or more phases.

ex: O_2, O_3, Cl_2, Au, P_4

ex: H_2O, $NaCl$, Fe_2O_3, $C_6H_{12}O_6$

* phase - a region of constant composition.

Chem 1A Homework Due Monday

Read: 1.2-1.3

Do: 6-17 (all) p.27

3 moles A_2 (g)

2 moles $B(g)$

5 moles $C(g)$

---

mole fraction of A_2 $\Rightarrow$ $\frac{3\text{mol } A_2}{3\text{mol } A_2 + 2\text{mol } B + 5\text{mol } C} =$

$$P_{total} = P_{A_2} + P_B + P_C$$

$$\downarrow$$

$$P_{A_2} = \chi_{A_2} P_{total}$$

$$\chi$$

$$P_B = \overset{\text{mole fraction}}{\chi_B} P_{total}$$

$$P_C = \chi_C P_{total}$$

Homework Due Tuesday 12/10/19

Read: 2.1 (Scientific Method)

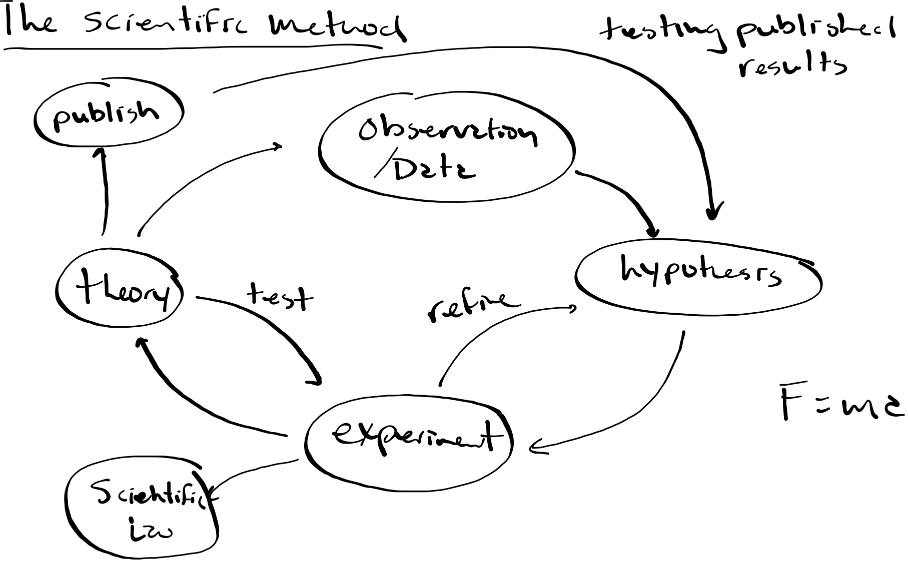
Do: 1-5 p.35

Monday 12/9/19

The Book

observation
↓
hypothesis
↓
experiment
↓
theory
↓
publish

The scientific method



$F = ma$

hypothesis - a testable statement with an explanation "Why"?

"guess" ↑ "educated" ↑

Scientific law - a concise statement that summarizes the results of many experiments $F = ma$ $F_G = G\frac{m_1 m_2}{r^2}$

FACT

theory - AKA 'model' → an extensively tested explanation of why experiments give the results they do.

→ can never be proven, only disproven
→ must predict the results of future experiments
→ tend to change/be refined as new results are obtained.

Physical & chemical properties of matter

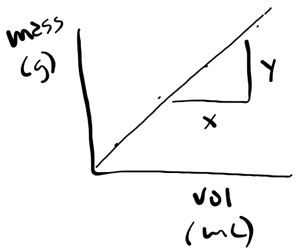
A

Physical	Chemical
density	· reactivity
boiling point / melting point	· acid / base characteristics
color, shape, size	· functional group type eg. alcohol, ketone, hydrocarbon oxidizer, reducer etc.
magnetic susceptibility	
hardness	
polarity / charge	

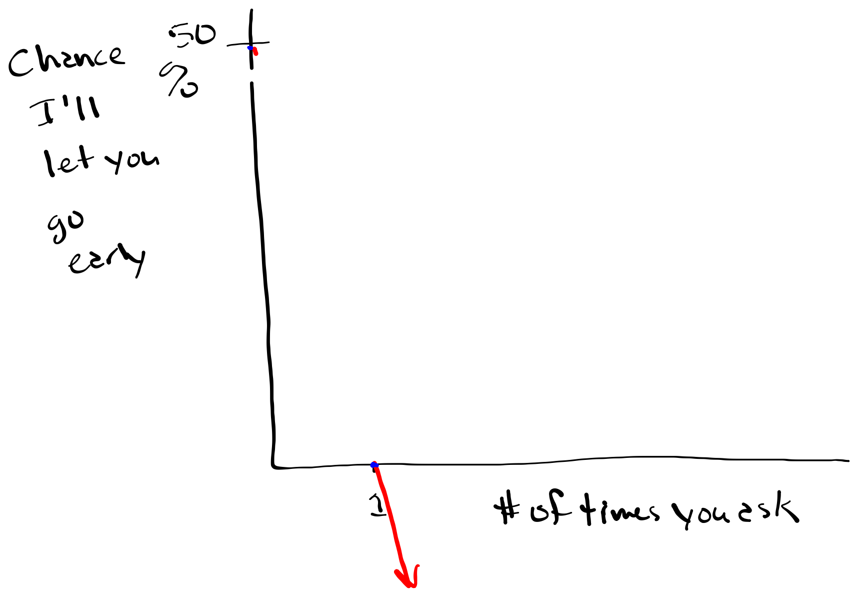
Evidence of a chemical change

- color change
- heat absorbed/evolved
- new substance formed
  e.g. - bubbled, formation of precipitate
- density
- light emitted
- not reversible
- bond making / breaking

Intensive properties of matter – characteristics of matter that do not change depending on the sample size.
ex: density, color, mp, bp, polarity
specific heat capacity



Extensive prop. of matter → characteristics of matter that do change as sample size changes.
ex: mass, fuel content, calories (food)
volume, surface area


Chance I'll let you go early
50 %
1
# of times you ask

Tuesday 12/10/19

The SI System of Units & Dimensional Analysis

Seven Base Units

quantity	Name	symbol
length	meter	m
mass	Kilogram	kg
time	second	s
x electric current	ampere	A
temperature	Kelvin	K
amount of substance	mole	mol
x luminous intensity	candela	cd

m^3 = vol

Wed: 12/11/19

$+ \; - \; \times \; \div \; \sqrt[3]{x}$

The SI system Units and prefixes

0.0×10^0

prefix	abbrev.	what it dues	how many in 1 base unit
Mega	M	1,000,000 x ___ 10^6 x	$\frac{1}{1,000,000}$
Kilo	k	1,000 x ___ 10^3	$\frac{1}{1,000}$
"base"	~	1	1
deci	d	$\frac{1}{10}$ x ___ 10^{-1} ___	10 (10^1)
centi	c	$\frac{1}{100}$ x ___ 10^{-2} x ___	100 (10^2)
milli	m	$\frac{1}{1000}$ x ___ or 10^{-3} x ___	1000 (10^3)
micro	"mu" μ	$\frac{1}{1,000,000}$ x ___ or 10^{-6} x ___	1,000,000 (10^6)
nano	n	$\frac{1}{10^9} = \frac{1}{1,000,000,000}$ x ___ 10^{-9} x ___	1,000,000,000 (10^9)
pico	p	$\frac{1}{1,000,000,000,000}$ x ___ 10^{-12} x ___	1,000,000,000,000 (10^{12})

have

76.0 in long

31.8 in wide

$\boxed{1\,\text{in} = 2.54\,\text{cm}}$

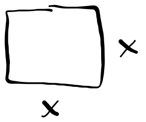
$\frac{1\,\text{in}}{2.54\,\text{cm}}$ or $\frac{2.54\,\text{cm}}{1\,\text{in}}$

A B

$76.0\,\text{in} \rightarrow \text{cm} \rightarrow \text{m}$

$76.0\,\cancel{\text{in}} \times \frac{2.54\,\cancel{\text{cm}}}{1\,\cancel{\text{in}}} \times \frac{1\,\text{m}}{100\,\cancel{\text{cm}}} = 1.93\,\text{m}$

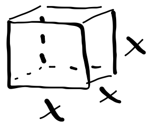
x > $1.56\,\text{m}^2$



$31.8\,\text{in} \times \frac{2.54\,\text{cm}}{1\,\text{in}} \times \frac{1\,\text{m}}{10^2\,\text{cm}} = 0.808\,\text{m}$

method 2

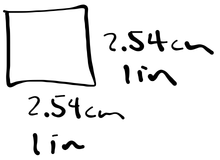
$x \cdot x = ?$



$V = x^3$

$76.0\,\text{in} \times 31.8\,\text{in} = 2420\,\text{in}^2$

$2420\,\text{in}^2 \rightarrow \text{cm}^2 \rightarrow \text{m}^2$



$2420\,\text{in}^2 \times \left(\frac{2.54\,\text{cm}}{1\,\text{in}}\right)^2 \times \left(\frac{1\,\text{m}}{10^2\,\text{cm}}\right)^2 = 1.56\,\text{m}^2$

The mess of \$100 bill is ~ 1.00g

$$\$18\times10^9 \times \frac{1\ \text{bill}}{\$100} \times \frac{1.00\text{g}}{1\ \text{bill}} \times \frac{1\ \text{kg}}{1000\ \text{g}} \times \frac{2.2\#}{1\ \text{kg}} =$$

396,000 #

200 tons of \$100 bills

Thursday 12/12/19

Determining Significant Zeros

① All non-zero digits are significant

ex: 1.365g 565.3mL 124ft

② Placeholder zeros are NOT significant.

ex: 1sf 100 m 3sf 356 000 L 1sf 0.0005 s

1.00×10^2 m 0.0501

③ "Trapped" zeros ARE significant

ex: 1001 m 356.004 L 5040 m

1.001×10^3 m 3.56004×10^2 L 5.04×10^3 m

④ Zeros to the right of nonzero digits and also to the right of the decimal point ARE significant

ex: 3sf 1.00L 5sf 3.5600g 5sf 5.0050 s

5.0000 s

⑤ Exceptions

i) counting numbers

eggs, people, protons

H_2O

ii) conversion factors used in dimensional analysis problems

12in=1ft

Rules for calculations involving sfs

+/−	x/÷
The number reported has as many DIGITS TO THE RIGHT of D.P. as the value used in calc that had the fewest DIGITS TO THE RIGHT OF D.P.	The number reported has as many s.f.s as did the value used in calculation that had the FEWEST SIG. FIGS

3.650 − 1.40 =

$D = \frac{12.00g}{3.53mL} =$ 3sf

-0.5sf

1000mL → dL

5280 ft = 1 mi

Convert 60. mi/hr → ft/s

$$\frac{60.\,\cancel{mi}}{1\,\cancel{hr}} \times \frac{5280\,ft}{1\,\cancel{mi}} \times \frac{1\,\cancel{hr}}{60\,\cancel{min}} \times \frac{1\,\cancel{min}}{60\,s} = 88\,\frac{ft}{s}$$

$$134\,\text{mmol} \times \frac{1\ \cancel{\text{mol}}}{10^3\ \text{mmol}} = 0.134\,\text{mol}$$

3) $$3500\,\cancel{\mu g} \times \frac{1\ \cancel{g}}{10^6\ \cancel{\mu g}} \times \frac{10^1\ \text{dg}}{1\ \cancel{g}} = 3500 \times 10^{-5}$$

$$3.5 \times 10^{-2}\,\text{dg}$$

from the homework 12/12/19

18,19

18) Known want

$V = 55.1 cm^3$

$D = 6.72 g/cm^3$

$m = ?$

Memorizing dsw

$$D = \frac{m}{V}$$

$$m = V \cdot D$$

$$= (55.1 cm^3)\left(\frac{6.72 g}{1 cm^3}\right)$$

$$m = 370.2 g$$

$$3.70 \times 10^2 g$$

$$55.1 cm^3 \times \frac{6.72 g}{1 cm^3} =$$

19) Known want

$D = 0.824 \frac{g}{mL}$

$m = 0.451 g$

$V = ?$

$$D = \frac{m}{V}$$

$$\boxed{V = \frac{m}{D}} = \frac{0.451 \cancel{g}}{0.824 \frac{\cancel{g}}{mL}} =$$

$$0.451 \cancel{g} \times \frac{1 mL}{0.824 \cancel{g}} = 0.547 mL$$

$$\frac{1}{\frac{1}{x}} = x \qquad \frac{\frac{1}{x}}{1} = \frac{1}{x}$$

22) Known want

$^{2}D_{Au} = 19.3 g/cm^3$ $V = ?$ $\frac{1}{\frac{1}{x}} = x$ $\frac{\frac{1}{x}}{1} =$

$m = 0.715 kg \times \frac{10^3 g}{1 kg} = 715 g$

$\frac{V \cdot \cancel{D}}{\cancel{D}} = \frac{m}{\cancel{V}} \cdot \frac{\cancel{V}}{D}$

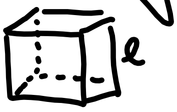
$0.715 \cancel{kg} \times \frac{10^3 \cancel{g}}{1 \cancel{kg}} \times \frac{1 \, \boxed{cm^3}}{19.3 \cancel{g}} = \dot{3}\dot{7}.\dot{0}46$

$37.0 cm^3$

$V = \frac{m}{D} = \frac{715 g}{19.3 \frac{g}{cm^3}} =$

$\sqrt[x]{y}$

b)



$\sqrt[3]{V} = \sqrt[3]{l^3}$

$l = \sqrt[3]{V} = \sqrt[3]{37.0 cm^3} = 3.33 cm$

3.5×10^{-4}

$1.0\,\mu g = 0.000001\,g$

$\frac{1.0\,\mu g}{0.000001\,g}$ or $\frac{0.000001\,g}{1.0\,\mu g}$

$19.3\,g \times \frac{10^9\,ng}{1\ \ g} = 19.3 \times 10^9\,ng$

$1.93 \times 10^{10}\,ng$

$$\% \text{ error} = \frac{\left| \text{experimental value} - \text{known value} \right|}{\text{known value}} \times 100\% =$$

from the homework
35-43 p. 65

#38 a) 0.4004 mL 4sf
b) 6000g 1sf
c) 1.00030km 6sf
d) 400. mm 3sf

Perform the following calculatron and report to correct # of significant digits.

a) 9.30m - 9.2980m = 0.00 m

39) $6.078g + 0.3329g = 6.\dot{4}\dot{1}\dot{0}90g$
6.411g

40) 8.2cm - 7.11cm = 1.1 cm

41) $0.8102m \times 3.44m = 2.78709m^2$
$2.79m^2$

$$\frac{ft}{s} \qquad \frac{ft}{min} \qquad \frac{ft}{hr} \qquad \frac{mi}{hr}$$

$$\frac{1200\,\cancel{ft}}{1\,\cancel{s}} \times \frac{60\,\cancel{s}}{1\,\cancel{min}} \times \frac{60\,\cancel{min}}{1\,\enclose{circle}{hr}} \times \frac{1\,mi}{5280\,\cancel{ft}} =$$

$$\frac{1200\,ft}{1\,s} \times \frac{3600\,s}{1\,hr} = 4.32 \times 10^{6}\,\frac{ft}{hr}$$

$$\frac{4.32 \times 10^{6}\,ft}{1\,hr} \times \frac{1\,mi}{5280\,ft} = 818\,\frac{mi}{hr} = 820\,\frac{mi}{hr}$$

from the homework 12/13

1.05 x salary

#35 p.65

$$\%error = \frac{\left| \text{experimental value} - \text{true/known value} \right|}{\text{true/known value}} \times 100\%$$

Student mass = 9.67g

Known mass = 9.82g

$$\frac{\left| 9.67g - 9.82g \right|}{9.82g} \times 100\% =$$

%error = 1.53% error

25)

have

Ⓔ ← 225 million km ⓜ

225×10^6 km

want

time in ⓜⓘⓝ min

for signal to travel E → m

S.O.L. $= 3.00 \times 10^8$ m/s

$$\underset{\cdot}{2}\underbrace{25} \times 10^6 \cancel{km} \times \frac{10^3 \cancel{m}}{1 \cancel{km}} \times \frac{1 \cancel{s}}{3.00 \times 10^8 \cancel{m}} \times \frac{1 \text{ min}}{60 \cancel{s}} = 12.5 \text{min}$$

$\underline{2.25 \times 10^8 \text{ km}}$

8.0 mi → time

Sound 343 m/s

$$8.0\,mi \times \frac{ft}{mi} \times \frac{in}{ft} \times \frac{cm}{in} \times \frac{m}{cm} \times \frac{1\ s}{343\ m} =$$

LIGHT

$$8.0\,mi \times \frac{ft}{mi} \times \frac{in}{ft} \times \frac{cm}{in} \times \frac{m}{cm} \times \frac{1\ s}{3.00 \times 10^8\ m}$$

$60\,m/s \rightarrow mi/\boxed{hr}$

$$\frac{60\,m}{\cancel{s}} \times \frac{60\,\cancel{s}}{1\,\cancel{min}} \times \frac{60\,\cancel{min}}{\boxed{hr}} \times \frac{10^{2}\,\cancel{cm}}{1\,\cancel{m}} \times \frac{1\,\cancel{in}}{2.54\,\cancel{cm}} \times \frac{1\,\cancel{ft}}{12\,\cancel{in}} \times \frac{1\,mi}{5280\,ft} =$$

$$\frac{60\,m}{1\,s} \times \frac{1\,mi}{1.609\times10^{3}\,m} \times \frac{3600\,s}{1\,hr} = 134\,\frac{mi}{hr} \simeq 130\,\frac{mi}{hr} \quad 1.609\times10^{3}\,m = 1\,mi$$

$$1\,mi \times \frac{5280\,ft}{1\,mi} \times \frac{12\,in}{1\,ft} \times \frac{2.54\,cm}{1\,in} \times \frac{1\,m}{100\,cm} = 1.609\times10^{3}\,m/1\,mile$$