1) (a)

$$\left.\left.\begin{array}{ll}\text{WANT} & \text{in}^2\ (\text{area}, A) \\ \text{GIVEN} & \left.\begin{array}{l}1.6\times10^{-5}\,\text{in}\ (\text{thickness}, h) \\ 2.0\ \text{troy oz.}\ (\text{mass}, m)\end{array}\right]\text{volume}, V\end{array}\right]\ \right]\text{Density} = \frac{m}{V}$$

$$V = \boxed{\frac{m}{D} = A\times h} \qquad A = \frac{m}{Dh} = \begin{array}{c|c|c} m & 1 & 1 \\ \hline 1 & D & h\end{array}$$

$$A = \begin{array}{c|c|c|c|c} 2.0\,\cancel{\text{troy oz}} & 31.1\,\cancel{g} & 1\,\text{cm}^3 & 1 & 1^3\ \text{in}^{\cancel{3}\,2} \\ \hline 1 & \cancel{\text{troy oz.}} & 19.3\,\cancel{g} & 1.6\times10^{-5}\,\cancel{\text{in}} & (2.54)^3\,\cancel{\text{cm}^3} \\ 2\,\text{sf} & 3\,\text{sf} & 3\,\text{sf} & 2\,\text{sf} & \text{ex}\end{array} \boxed{= 1.2_{29}\times10^{4}\ \text{in}^2}$$

(b)

$$\left.\left.\begin{array}{ll}\text{WANT} & \text{cm}^2\ (\text{area } A) \\ \text{GIVEN} & \left.\begin{array}{l}\$20.00/\text{tr. oz}\ (\text{cost}, c) \\ \$75.00\ (\text{worth}, w)\end{array}\right]\text{mass} \\ & 1\,\text{tr oz.} = 31.1\,g \quad \text{mass conversion} \\ & 19.3\ \frac{g}{\text{cm}^3}\ \text{density}\end{array}\right]\ \text{Volume}\left(\frac{m}{D}\right) \\ \quad 1.6\times10^{-5}\,\text{in}\ (\text{thickness}, h)\right]\ \text{Area} = \frac{V}{h}$$

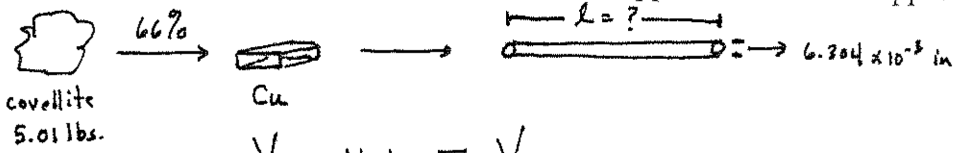
$$V = \boxed{\frac{m}{D} = A\times h} \qquad A = \frac{m}{Dh} = \begin{array}{c|c|c} m & 1 & 1 \\ \hline 1 & D & h\end{array} = \begin{array}{c|c|c} w & 1 & 1 \\ \hline c & D & h\end{array}$$

$$= \begin{array}{c|c|c|c} w & 1 & 1 & 1 \\ \hline 1 & c & D & h\end{array}$$

$$A = \begin{array}{|c|c|c|c|c|c|} \cancel{\$}75.00 & 1\,\cancel{\text{tr. oz}} & 31.1\,\cancel{g} & 1\,\text{cm}^{\cancel{3}\,2} & 1 & 1\,\cancel{\text{in}} \\ \hline 1 & \cancel{\$}20.00 & 1\,\cancel{\text{tr. oz}} & 19.3\,\cancel{g} & 1.6\times10^{-5}\,\cancel{\text{in}} & (2.54)\,\cancel{\text{cm}} \\ 4\,\text{sf} & 4\,\text{sf} & 3\,\text{sf} & 3\,\text{sf} & 2\,\text{sf} & \text{ex}\end{array} = \boxed{\cancel{3.7_{47}\times10^{5}\ \text{cm}^2}}$$

$$1.4_{89}\times10^{5}\ \text{cm}^2$$

② Copper is ductile. How many meters of 34-gauge wire (diameter = 6.304×10^{-3} in) can be produced from copper in 5.01 lb of covellite, an ore of copper that is 66% copper by mass.



$$V_{Cu\ as\ block} = V_{Cu\ as\ wire}$$

$$\frac{mass}{Density} = \pi\left(\frac{d}{2}\right)^2 \ell$$

$$\ell = \frac{mass}{density} \cdot \frac{1}{\pi\left(\frac{d}{2}\right)^2}$$

$$\ell = \underbrace{\frac{5.01\,\cancel{lbs}}{1}\,\frac{0.66}{1}\,\frac{1\,\cancel{Kg}}{2.205\,\cancel{lbs}}\,\frac{1000\,\cancel{g}}{1\,\cancel{Kg}}}_{mass}\,\underbrace{\frac{1\,\cancel{cm^3}}{8.96\,\cancel{g}\,Cu}}_{\frac{1}{density}}\,\frac{1}{\pi}\,\underbrace{\frac{1}{\left(\frac{6.304\times10^{-3}}{2}\,\cancel{in}\right)^2}\,\frac{1\,\cancel{in^2}}{(2.54)^2\,\cancel{cm^2}}}_{\left(\frac{d}{2}\right)^2}\,\frac{1\,m}{100\,\cancel{cm}} = 8.3\times10^{3}\,m$$

3sf 2sf 4sf exact 3sf exact 4sf exact exact

2sF

3) a) WANT gallons (volume, V)

GIVEN density = 1.0 g/mL (D)

4.8 ft (depth, h)

50.0 m × 25.0 m (area A)

$$\boxed{V = A \times h}$$ → we have all that's needed to find V but gallons is the unit.

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

$$\underset{3\,sf}{\frac{50.0\,\cancel{m}}{1}}\Bigg|\underset{3\,sf}{\frac{25.0\,\cancel{m}}{1}}\Bigg|\underset{2\,sf}{\frac{4.8\,\cancel{ft}}{1}}\Bigg|\underset{ex}{\frac{12\,\cancel{in}}{1\,\cancel{ft}}}\Bigg|\underset{ex}{\frac{2.54\,\cancel{cm}}{1\,\cancel{in}}}\Bigg|\underset{ex}{\frac{100^2\,\cancel{cm^2}}{1^2\,\cancel{m^2}}}\Bigg|\underset{ex}{\frac{1\,\cancel{L}}{1000\,\cancel{cm^3}}}\Bigg|\underset{4\,sF}{\frac{1\,gal}{3.785\,\cancel{L}}}$$

$$= \boxed{4.8_{32} \times 10^5\ gal}$$

b) → $m = D \times V$

$$m = \left(\underset{2\,sf}{\frac{1.0\,\cancel{g}}{1\,\cancel{mL}}}\Bigg|\underset{2\,sf}{\frac{4.8_{32} \times 10^5\,\cancel{gal}}{1}}\Bigg|\underset{ex}{\frac{1\,kg}{1000\,\cancel{g}}}\Bigg|\underset{4\,sf}{\frac{3.785\,\cancel{L}}{1\,\cancel{gal}}}\Bigg|\underset{ex}{\frac{1000\,\cancel{mL}}{1\,\cancel{L}}}\right)$$

$$= \boxed{1.8_{29} \times 10^6\ Kg}$$

4)

WANTED: area, cm^2

GIVEN: tensile strength, asbestos $\frac{\text{kg}}{\text{cm}^2}$, $\frac{\text{mass}}{\text{area}}$

" , Al $\frac{\text{lb}}{\text{in}^2}$, $\frac{\text{mass}}{\text{area}}$

" , Steel $\frac{\text{lb}}{\text{in}^2}$, $\frac{\text{mass}}{\text{area}}$

area of Grunerite = 25 mm^2

$$\frac{\text{Mass grunerite}}{\text{area grunerite}} = \frac{\text{mass Al}}{\text{area Al}} = \frac{\text{mass Steel}}{\text{area steel}}$$

↓

Tensile strength Grunerite = $\frac{3.5 \times 10^4 \text{ kg}}{1 \text{ cm}^2}$

Area of Grunerite = 25 mm^2

$$\text{Mass of Grunerite} = T \times A = \frac{3.5 \times 10^4 \text{ kg}}{1 \text{ cm}^2} \left| \frac{25 \text{ mm}^2}{1} \right| \frac{1^2 \text{ cm}^2}{10^2 \text{ mm}^2}$$

$$= 8.7_5 \times 10^3 \text{ kg}$$

So, the Al and Steel areas should be able to handle this mass

Al:

$$\frac{8.7_5 \times 10^3 \cancel{\text{kg}}}{1} \left| \frac{1 \cancel{\text{in}^2}}{2.5 \times 10^4 \cancel{\text{lb}}} \right| \frac{2.205 \cancel{\text{lb}}}{1 \cancel{\text{kg}}} \left| \frac{(2.54)^2 \text{ cm}^2}{1^2 \cancel{\text{in}^2}} \right. = 4.9_{79} \times 10^0 \text{ cm}^2$$

2sf 2sf 4sf ex

Steel: similar calculation $3.6_{61} \times 10^{-1} \text{ cm}^2$

5) a) WANTED : GRAMS (mass, m)

GIVEN : 3800 m (depth, h)

3.63×10^8 km^2 (area, A)

5.8×10^{-9} $\frac{g}{L}$ (concentration, c)

Volume (A×h)

Volume, $\frac{m}{C}$

$$V = \frac{m}{C} = A \times h \longrightarrow \boxed{m = A \times h \times C}$$

$$m = \begin{array}{|c|c|c}
3.63 \times 10^8 \text{ Km}^2 & 3800.\text{ m} & 5.8 \times 10^{-9} \text{ g} \\ \hline
1 & 1 & 1 \text{ L}
\end{array}$$

$$= \begin{array}{|c|c|c|c|c|c}
3.63 \times 10^8 \cancel{\text{km}^2} & (1000)^2 \cancel{\text{m}^2} & 3800.\cancel{\text{m}} & (100)^3 \text{ cm}^3 & 1 \cancel{\text{L}} & 5.8 \times 10^{-9} \text{ g} \\ \hline
1 & 1^2 \cancel{\text{km}^2} & 1 & 1^3 \cancel{\text{m}^3} & 1000 \text{ cm}^3 & 1 \cancel{\text{L}} \\
3\text{sf} & \text{ex} & 4\text{sf} & \text{ex} & \text{ex} & 2\text{sf}
\end{array}$$

$$= \boxed{8.0_{00} \times 10^{12} \text{ g}}$$

$$= \begin{array}{|c|c|}
3.63 \times 3.800 \times 5.8 & 10^8 \times 10^6 \times \cancel{10^3} \times 10^6 \times 10^{-9} \\ \hline
1 & \cancel{10^3}
\end{array}$$

b) WANTED : m^3 (volume, V)

GIVEN: $8.0_{00} \times 10^{12}$ g (mass, m)

LOOK UP DENSITY 19.3 $\frac{g}{cm^3}$

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

$$V = \begin{array}{c|c|c}
8.0_{00} \times 10^{12} \cancel{\text{g}} & 1 \cancel{\text{cm}^3} & 1^3 \text{ m}^3 \\ \hline
1 & 19.3 \cancel{\text{g}} & (100)^3 \cancel{\text{cm}^3}
\end{array} = \boxed{4.1_{45} \times 10^5 \text{ m}^3}$$

c)
$$\begin{array}{c|c|c}
8.0_{00} \times 10^{12} \text{ g} & 1 \text{ tr oz.} & \$892.00 \\ \hline
1 & 31.1 & \text{tr oz}
\end{array} = \boxed{\$2.2_{95} \times 10^{14}} \quad !$$

⑥ If a raindrop weighs 65 mg on average and 5.1 x 10^5 raindrops fall on a lawn every minute, what mass (in lbs) of rain falls on the lawn in 1.5 hours?

$$\text{mass} = \frac{\text{mass}}{\cancel{\text{raindrop}}} \times \frac{\cancel{\text{raindrops}}}{\cancel{\text{time}}} \times \frac{\cancel{\text{time}}}{1}$$

$$\text{mass} = \begin{array}{c|c|c||c|c|c||c|} 65\ \cancel{\text{mg}} & 5.1\times10^5\ \cancel{\text{raindrops}} & 1.5\ \cancel{\text{hr}} & 1\ \cancel{\text{g}} & 1\ \cancel{\text{kg}} & 2.205\ \text{lbs} & 60\ \cancel{\text{min}} \\ \hline 1\ \cancel{\text{raindrop}} & \cancel{\text{minute}} & 1 & 1000\ \cancel{\text{mg}} & 1000\ \cancel{\text{g}} & 1\ \cancel{\text{kg}} & 1\ \cancel{\text{hr}} \\ 2\text{sf} & 2\text{sf} & 2\text{sf} & \text{ex} & \text{ex} & 4\text{sf} & \text{ex} \end{array}$$

$$\text{mass} = \boxed{6.6 \times 10^3\ \text{lbs.}}$$

From Silberberg, Principles of General Chemistry 1st Ed.