1. The pressure of the earth's atmosphere in Denver is 7.5 lbs/in². What is the pressure when expressed in g/mm²? (2.54 cm = 1 in., 2.205 lb = 1 kg)

\[
\frac{7.5 \text{ lbs}}{\text{in}^2} \times \frac{1 \text{ kg}}{2.205 \text{ lb}} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \left(\frac{1 \text{ in}}{2.54 \text{ cm}}\right)^2 \times \left(\frac{1 \text{ cm}}{10 \text{ mm}}\right)^2 = 15.7 \text{ g/mm}^2
\]

2. On the Rankine temperature scale (°R), water boils at 672.7°R and freezes at 491.7°R. Calculate the normal human body temperature using this temperature scale. On the Celsius scale, normal human body temperature could typically be 37.1°C, and water boils at 100.0°C and freezes at 0.00°C.

\[
\frac{672.7°R}{100°R} + \frac{37.1°C}{100°C} = 558.48°R
\]

3. It is estimated that neptunium is relatively common in the earth's crust, occurring in amounts of 8 g / metric ton. A metric ton is 1000 kg. At this concentration, what mass of neptunium (ng) is present in 15.5 mg of the earth's crust? (1 ng=10⁹ g; 1 µg=10⁶ g)

\[
\frac{8 \text{ g NP}}{\text{M. ton crust}} \times \frac{1 \text{ M. ton}}{1000 \text{ kg}} \times \frac{1 \text{ kg}}{1 \times 10^{12} \text{ mg}} = 6 \times 10^{-9} \text{ g NP/M g crust} \times \frac{15.5 \text{ mg}}{12.4 \text{ mg}} = 1.24 \times 10^{-7} \text{ g NP}
\]

4. Some drums of uranium hexafluoride were lost in the Houston Ship Channel, which is known for its warm water (about 25°C). The melting point of uranium hexafluoride is 148°F. In what physical state is the uranium hexafluoride in these drums?

\[
T_F = T_C \times \left(\frac{9°F}{5°C}\right) + 32°F
\]

\[\text{A)} \quad \text{solid} \]
\[\text{B)} \quad \text{liquid} \]
\[\text{C)} \quad \text{gas} \]
\[\text{D)} \quad \text{a mixture of solid and liquid} \]
\[\text{E)} \quad \text{not enough information} \]
5. A monolayer containing $5.12 \times 10^{-5}$ g of oleic acid has an area of 10.0 cm$^2$. The density of oleic acid is 0.895 g/mL. What is the thickness of the monolayer (the length of an oleic acid molecule)? (1mL=1cm$^3$)

\[
\frac{0.895 \text{ g}}{1 \text{ cm}^3} \times \frac{1 \text{ mL}}{1 \text{ cm}^3} = 0.895 \text{ cm} \\
\frac{0.572 \text{ cm}}{0.0714 \text{ cm}}
\]

6. A sample of chemical X is found to contain 5.0 grams of oxygen, 10.0 grams of carbon, and 20.0 grams of nitrogen. The law of definite proportion would predict that a 70 gram sample of chemical X should contain how many grams of oxygen?

10 g oxygen

7. Consider the following two compounds: H$_2$O and H$_2$O$_2$. According to the law of multiple proportions, the ratio of hydrogen atoms per gram of oxygen in H$_2$O to hydrogen atoms per gram of oxygen in H$_2$O$_2$ is

A) 1:1  
B) 2:1  
C) 1:2  
D) 2:2  
E) 4:1

\[
\frac{2 \text{ H per 16 g O}}{1} = \frac{1}{8} : \frac{1}{16} \\
\frac{2 \text{ H per 32 g O}}{1} = 2 : 1
\]

8. You are given a compound with the formula MCl$_3$, in which M is a metal. You are told that the metal ion has 26 electrons. What is the identity of the metal?

\[\text{M}^{2-} = 26 \]

\[\text{M} = 29\]

9. How many protons, neutrons and electrons, in that order are present in the anion formed by one atom of $^{124}$Te?

A) 53, 74, 54  
B) 52, 72, 53  
C) 54, 72, 53  
D) 53, 72, 54  
E) 54, 74, 54
10. Silver has two naturally occurring isotopes with the following isotopic masses

\[ ^{107}_{47}Ag = 106.90509 \quad ^{109}_{47}Ag = 108.9047 \]

The fractional abundance of the heavier of the two isotopes is closest to

A) 0.25
B) 0.45
C) 0.55
D) 0.75
E) exactly the same as the heavier isotope

11. Which pair of elements would you expect to exhibit the greatest similarity in their physical and chemical properties?

A) C, Si
B) O, P
C) K, Ca
D) H, He
E) Si, P

12. List the diatomic molecules.

13. Element X reacts with sodium to form an ionic compound with the formula Na₂X. Element X must be a member of which group?

A) 1A
B) 3A
C) 5A
D) 6A
E) 7A

14. Name the following compounds:

a. Ca(OH)₂ calcium hydroxide
b. H₃PO₄ phosphoric acid
c. H₃PO₃ phosphorous acid
d. NH₄C₂H₂O₂ ammonium acetate
e. Sn(CO₃)₂ tin (IV) carbonate

15. Write the formula for the following compounds:

a. perchloric acid  \( HClO₄ \)
b. hypochlorous acid  \( HClO \)
c. pentaphosphorus diox ide  \( P₅O₂ \)
d. chromium (VI) phosphite  \( Cr₂(PO₃)₇ \)
e. aluminum cyanide  \( Al(\text{CN})₃ \)