24. From Avogadro's hypothesis, volume ratios are equal to molecule ratios at constant temperature and pressure. Therefore, we can write a balanced equation using the volume data, $Cl_2 + 3\ F_2 \rightarrow 2\ X$. Two molecules of X contain 6 atoms of F and two atoms of Cl. The formula of X is ClF_3 for a balanced equation.

25. $\frac{1.188}{1.188} = 1.000$; $\frac{2.375}{1.188} = 1.999$; $\frac{3.563}{1.188} = 2.999$

The masses of fluorine are simple ratios of whole numbers to each other, 1:2:3.

26. Hydrazine: 1.44×10^{-1} g H/g N; Ammonia: 2.16×10^{-1} g H/g N

Hydrogen azide: 2.40×10^{-2} g H/g N

Let's try all of the ratios:

$$\frac{0.216}{0.144} = 1.50 = \frac{3}{2};\quad \frac{0.144}{0.0240} = 6.00;\quad \frac{0.216}{0.0240} = 9.00$$

All the masses of hydrogen in these three compounds can be expressed as simple whole number ratios. The g H/g N in hydrazine, ammonia, and hydrogen azide are in the ratios 6:9:1.

30. **Since electrons move about the nucleus at an average distance of about 1×10^{-8} cm, then the diameter of an atom is about 2×10^{-8} cm. Let's set up a ratio:**

$$\frac{\text{diameter of nucleus}}{\text{diameter of atom}} = \frac{1\ \text{mm}}{\text{diameter of model}} = \frac{1 \times 10^{-13}\ \text{cm}}{2 \times 10^{-8}\ \text{cm}},\ \text{Solving:}$$

diameter of model = 2×10^5 mm = 200 m

34. sodium -Na; beryllium -Be; manganese -Mn; chromium -Cr; uranium -U

42. a. Six; Be, Mg, Ca, Sr, Ba, Ra

b. Five; 0, S, Se, Te, Po

c. Four; Ni, Pd, Pt, Uun

d. Six; He, Ne, Ar, Kr, Xe, Rn

44. a. $^{42}_{22}$Ti: 22 protons, 42-22 = 20 neutrons;

Since the overall charge is neutral then the number of electrons = number of protons = 22.

b. $^{64}_{30}$Zn: 30 protons, 34 neutrons, 30 electrons

c. $^{76}_{32}$Ge: 32 protons, 44 neutrons, 32 electrons

d. $^{86}_{36}$Kr: 36 protons, 50 neutrons, 36 electrons

e. $^{75}_{33}As$: 33 protons, 42 neutrons, 33 electrons

f. $^{41}_{19}K$: 19 protons, 22 neutrons, 19 electrons

52.

Symbol	Number of protons in nucleus	Number of neutrons in nucleus	Number of electrons	Net charge
$^{238}_{92}U$	92	146	92	0
$^{40}_{20}Ca^{2+}$	20	20	18	2+
$^{51}_{23}V^{3+}$	23	28	20	3+
$^{89}_{39}Y$	39	50	39	0
$^{79}_{35}Br^{-}$	35	44	36	1-
$^{31}_{15}P^{3-}$	15	16	18	3-

58. The metallic character decreases from left to right.

62. a. mercury(I) oxide b. iron(III) bromide
c. cobalt(II) sulfide d. titanium(IV) chloride

66. a. barium sulfite b. sodium nitrite
c. potassium permanganate d. potassium dichromate

72. a. SF_2 b. SF_6 c. NaH_2PO_4

d. Li_3N e. $Cr_2(CO_3)_3$ f. SnF_2

g. $NH_4C_2H_3O_2$ h. NH_4HSO_4 i. $Co(NO_3)_3$

j. Hg_2Cl_2; Mercury(I) exists as Hg_2^{2+} ions.

k. $KClO_3$ l. NaH