3. A compound which contains one atom of X and two atoms of Y for each three atoms of Z is made by mixing 5.0 g of X, 1.15×10^{23} atoms of Y and 0.03 g-atoms of Z. If only 4.40 g of the compound results, then the value of atomic mass of Y divided by 10 is (The atomic masses of X and Z are 60 and 80, respectively.)

4. Recent controversial efforts to generate energy via 'cold fusion' of deuterium atoms have centred on the remarkable ability of palladium metal to absorb as much as 1120 times its own volume of deuterium gas at 1atm and 0°C. The number of deuterium atoms per 10 atoms of Pd in a piece of fully saturated Pd metal is (Density of Pd = 11.8 g/ml and atomic mass of Pd = 106.2)

5. A solution contains 0.18 g/ml of a substance 'X', whose molecular mass is 64,000. It is found that 0.27 ml of oxygen at 760 mm and 300 K will combine with the amount of 'X' contained in 1 ml of the solution. The number of oxygen molecules combined with each molecule of 'X' is ($R = 0.08$ L-atm/K-mol)

6. The number of ethoxy groups in an organic compound can be determined by the reactions:

   $R(OCH_2CH_3)_x + xHI \rightarrow R(OH)_x + xCH_3CH_2I$

   $CH_3CH_2I + Ag^+ + H_2O \rightarrow CH_3CH_2OH + AgI(s)$

   When 37 g of organic compound (molar mass = 176 g/mol) was treated as above, 148 g AgI was precipitated out. How many ethoxy groups are present in each molecule of the organic compound? (Ag = 108, I = 127)

7. A given sample of pure iron gains 10% of its weight on partially rusting to form Fe_2O_3. If the fraction of the iron converted to Fe_2O_3 is 'x', then the value of 30 times 'x' is (Fe = 56)

8. A sample of iron ore contains FeS and non-volatile inert impurity, only. Roasting of this ore converts all FeS into Fe_2O_3 and a 4% loss in weight was observed. If the mass per cent of FeS in the ore is 'x', then the value of $\frac{x}{11}$ is (Fe = 56)

9. A volume of 50 ml of a gaseous mixture of hydrogen and hydrogen chloride was exposed to sodium amalgam. The volume decreased to 40 ml. If 10 ml of the same mixture is mixed with 5 ml of gaseous ammonia and then exposed to water, what will be the final volume (in ml) of gas left? All the volumes are measured at the same temperature and pressure.

10. A 1.174 g sample of special grade steel was treated appropriately with Chugaev's reagent by which nickel was precipitated as nickel dimethylglyoxime, $NiC_8H_{14}O_4N_4$. The dried precipitate weighed 0.2136 g. The percentage of nickel in the steel being analysed is (Ni = 58.7)

11. An amount of 2.5×10^{-3} mole of an ion A^{n+} exactly requires 1.5×10^{-3} moles of MnO_4^- for the oxidation of A^{n+} to AO_3^- in acid medium. What is the value of n?

12. A quantity of 1 g dry green algae absorbs 5.0×10^{-3} moles of CO_2 per hour by photosynthesis. If the carbon atoms were all stored after photosynthesis as starch $(C_6H_{10}O_5)_n$, how long (in hours) would it take for algae to increase its own weight by 81%, assuming photosynthesis taking place at a constant rate?