13. Consider the production of tetraethyl lead according to the reaction:

$4C_2H_5Cl + 4NaPb \rightarrow (C_2H_5)_4Pb + 4NaCl + 3Pb$

How many kilograms of ethyl chloride is required to produce enough tetraethyl lead (density = 6.48 g/ml) needed per litre of aviation fuel using 2 ml of tetraethyl lead per litre of fuel. (Pb = 208)

14. In one process of water proofing, a fibre is exposed to $(CH_3)_2SiCl_2$ vapour. The vapour reacts with hydroxyl groups on the surface of the fabric or with traces of water to form the waterproofing film $[(CH_3)_2SiO]_n$, by the reaction:

$n(CH_3)_2SiCl_2 + 2nOH^- \rightarrow 2nCl^- + nH_2O + [(CH_3)_2SiO]_n$

where n stands for a large integer. The waterproofing film is deposited on the fabric layer upon layer. Each layer is 3.7 Å thick (the thickness of the $(CH_3)_2SiO$ group). How much $(CH_3)_2SiCl_2$ (in g) is needed to waterproofing one side of a piece of fabric, 5.0 m by 4.0 m, with a film 200 layer thick? The density of film is $\frac{150}{129}$ g/ml. (Si = 28)

15. A magnesium ribbon, when burnt in air, left an ash containing MgO and Mg_3N_2. The ash was found to consume 0.6 mole of HCl, when it was taken in solution, according to the reactions:

$MgO + 2HCl \rightarrow MgCl_2 + H_2O$

$Mg_3N_2 + 8HCl \rightarrow 3MgCl_2 + 2NH_4Cl$

The solution so obtained was treated with excess of NaOH, when 0.1 mole of NH_3 was evolved. The mass (in g) of magnesium burnt is

16. A sample of $SF_5OF(g)$ was contained in a glass vessel at 117°C and a pressure of 380 mm. A quantity of N_2F_4 that was added brought the total pressure to 160 mm. The reaction that occurred produced a variety of products like NF_3, NO, SiF_4 (by the reaction with glass), SF_6, SO_2F_2, SOF_4, SF_5ONF_2 and NO_2. The yield of SF_5ONF_2 was 40 mole per cent with respect to the reactant SF_5OF. All of the SF_5OF and N_2F_4 were consumed in the reaction. What was the mass of SF_5ONF_2 produced (in g) if the volume of the vessel was 1.642 L?

17. An amount of 5 millimoles of $LiAlH_4$ was treated with 20 millimoles of *t*-butylalcohol. A total of 15 millimoles of hydrogen was evolved for the reaction:

$LiAlH_4 + 3(CH_3)_3COH \rightarrow Li[(CH_3)_3CO]_3AlH + 3H_2$

The addition of an excess of another alcohol, methanol, to the above reaction mixture caused the fourth H atom of the $LiAlH_4$ to be replaced according to the equation:

$Li[(CH_3)_3CO]_3AlH + CH_3OH \rightarrow Li[(CH_3)_3CO]_3(CH_3O)Al + H_2$

How many millimoles of H_2 was evolved due to the addition of CH_3OH?

18. To analyse cast iron for its sulphur content, a 6.4 g portion of the iron was weighed out for analysis and treated as follows: it was dissolved in hydrochloric acid, the hydrogen sulphide evolved from iron sulphide was distilled off and made to be absorbed by a solution of a cadmium salt, after which CdS was treated with an excess of a solution of $CuSO_4$, and the CuS precipitated formed was ignited. As a result, 0.795 g of an ignited CuO precipitate was obtained. Calculate the percentage content of sulphur in the cast iron. (Cu = 63.5)