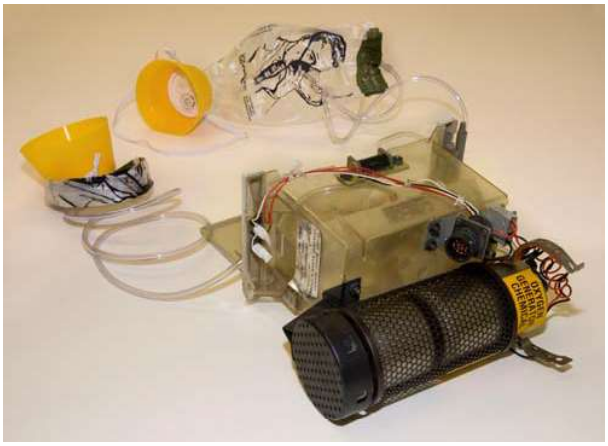
5. This question is about emergency oxygen supplies

Rather than carrying heavy high-pressure oxygen cylinders, most aeroplanes rely on chemically generated oxygen in the event of an emergency.



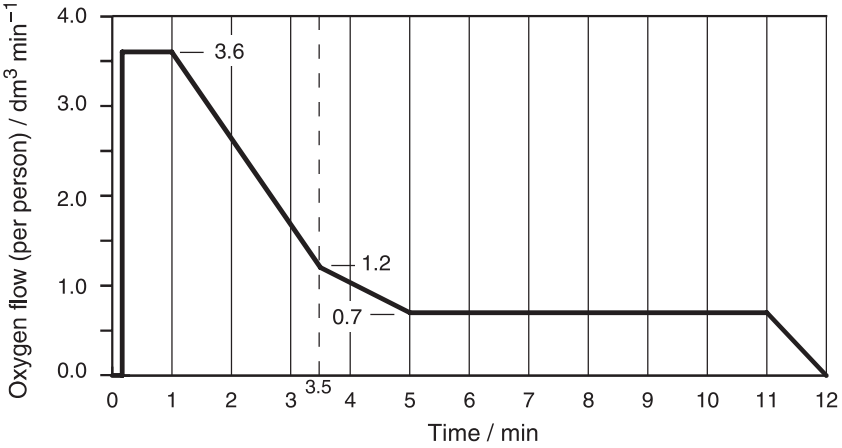
These generators are typically composed of a mixture of sodium chlorate(V), $NaClO_3$, iron filings and barium peroxide, BaO_2. Once initiated, the sodium chlorate(V) undergoes thermal decomposition producing oxygen gas. The iron combines with some of the oxygen to produce enough heat to sustain the reaction.

(a) Write a balanced equation for the decomposition of sodium chlorate(V).

The barium peroxide removes toxic side products which include chlorine and chloric(I) acid, HClO. Barium chloride and oxygen are common products in these two reactions.

(b) Write a balanced equation for the reaction between **i)** barium peroxide and chlorine and **ii)** barium peroxide and chloric(I) acid.

When a mask is deployed, the flow rate of oxygen gas is designed to change over time as the aeroplane falls to a safe altitude. Shown below is the manufacturer's specification for the flow rate from one such oxygen generator.



Ten seconds after being activated, the flow rate is at its maximum of 3.6 dm^3 min^{-1}. This lasts for approximately 50 seconds before falling as shown in the graph.

(c) Use the graph to estimate the total volume of oxygen produced by the generator.

(d) Calculate the mass of sodium chlorate needed to produce 60 dm^3 of oxygen.
[Assume 1 mol of any gas occupies 24.0 dm^3 at r.t.p.]

A portable, self-contained closed-circuit breathing apparatus contains a chemical supply of oxygen similar to that in an aeroplane. It also contains a means to remove exhaled carbon dioxide. Very often potassium superoxide (KO_2) is used for this. KO_2 reacts with water, liberating further oxygen, and the by-product of this reaction absorbs the CO_2.

(e) Write down the oxidation state of the oxygen in **i)** CO_2 **ii)** BaO_2 and **iii)** KO_2.

(f) Give the equations for the reactions **i)** between potassium superoxide and water and **ii)** between the by-product and carbon dioxide.