1. a) On a plane, pulling down on one oxygen mask removes the firing pin of the generator igniting a mixture of sodium chlorate and iron powder, opening the oxygen supply for all the masks in the compartment.

The reaction is the following:

$NaClO_3 + Fe \rightarrow NaCl + FeO + O_2$

A 15 minute supply of oxygen is provided for each passenger.

According to **NASA** the average person needs **639 L** of O_2 per day, measured at 20.0 ^oC and 100.0 kPa.

Alibaba.com sells sodium chlorate for $650/1000kg. Fe powder is $1/kg. If all of the oxygen on airplanes came from sodium chlorate how much would it cost in chemicals to provide 4.00×10^2 passengers with oxygen for 15 minutes?

b)The oxygen is consumed in respiration according to:

$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6H_2O + 6\ CO_2$

The energy released for respiration is -3.81 kcal/g of $C_6H_{12}O_6$ (glucose). You can work with kcal—note that a so-called food Calorie = 1kcal)

How many kcal are consumed by the average person if NASA is assuming if the average person supposedly needs **639 L** of O_2 per day, measured at 20.0 ^oC and 100.0 kPa?

<u>Solutions</u>:

1. For 1 day and 1 passenger,

n_{O2} = PV/(RT) = 100 kPa*639 L/(8.31 LkPa/(Kmole)*293K) = 26.244 moles

26.244 moles/day*(day/24h)*(h/60 min) * 15 min = 0.27337 moles

1:1 ratio

0.27337 moles Fe * 55.8 g/mole =15.2544 g = 15.2544 g*$1/1000 g = $0.015	0.27337 moles $NaClO_3$* (23.0 + 35.5 + 48.0)g/mole = 29.113 g = 29.113 g * $0.650/1000 g = $0.0189
Total cost per passenger = $0.0339 For 400 passengers: $13.57	

2. n = 26.244 moles of oxygen per day, using PV = nRT(see number 1)

   26.244 moles of oxygen(1 mol $C_6H_{12}O_6$/6 mol oxygen) = 4.374 moles $C_6H_{12}O_6$

   4.374 moles $C_6H_{12}O_{6*}$ (180 g/mole)* 3.81 kcal/g = 3.00 X 10^3 kcal

   (By the way 1 kcal = 4.19 kJ, so it 's equivalent to 1.26 X 10^4 kJ)