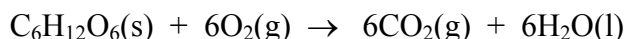


Work through the ChemCAL module "*Behaviour of Gases*"

1. The main energy-producing reaction in all oxygen-using living organisms is oxidation of glucose:



- (a) Using the data below, calculate the standard enthalpy of combustion of glucose.

$$\Delta_f H^\circ_{298}, \text{ in kJ mol}^{-1}: \quad \text{C}_6\text{H}_{12}\text{O}_6(\text{s}) -1285; \quad \text{CO}_2(\text{g}) -393; \quad \text{H}_2\text{O}(\text{l}) -285$$

- (b) Calculate the standard free energy change for this reaction, ΔG° (298 K), given $\Delta S^\circ = 181 \text{ J K}^{-1} \text{ mol}^{-1}$ for this reaction at 298 K.
- (c) In a living cell, energy from glucose combustion is partly used to synthesise the energy-storage molecule, ATP:



Assuming the efficiency of ATP synthesis is 41%, calculate the number of mole of ATP produced per mole of glucose oxidised.

- (d) In the above equation for the synthesis of ATP, what is the significance of the positive sign of ΔG° ?
2. Determine the volume occupied by 4.0 g of O_2 gas at STP. (STP is 'standard temperature and pressure' corresponding to 1 atm and 0 °C)
3. A piece of solid carbon dioxide, with a mass of 7.8 g, is placed inside a sealed container of air at a pressure of 740 mmHg. The container has a volume of 1.2 L and the temperature is 25 °C. What would be the partial pressure of carbon dioxide and the total pressure inside the container after all the carbon dioxide has vaporised?
4. A sample of nitrogen gas was collected over water at 20 °C and a total pressure of 1.00 atm. The vapour pressure of water under these conditions is 17.5 mmHg. If a total volume of 645 mL was collected, what mass of nitrogen was contained in the sample?