**Ideal gas equation & combustion**

**Qn**. Butane is a component of LPG. Last year in Victoria, 454 million tonnes of butane was combusted in

 car engines.

1. Write a thermochemical equation for the complete combustion of butane.
2. Calculate the volume of CO2 produced from the complete combustion of 454 million tonnes of butane at

 **i**. SLC

 **ii**. 322 0C and 2.00 atm pressure.

1. Calculate the energy released by this combustion.

**Solution**

1. 2C4H10(g) + 13O2(g) 🡪 8CO2(g) + 10H2O(l)

 From **data book**

 kJ g-1  kJ mol-1



**Thermochemical equation is**

1. 2C4H10(g) + 13O2(g) 🡪 8CO2(g) + 10H2O(l) ∆*H* = - 5760 kJ mol-1

 Show H2O as **H2O(l)** to match advice of **Data book. Negative sign** needs to be shown

1. **i**. **mass** butane = 454000000 tonnes = 454000000000000 g = 4.54 × 1014 g

 *n*(butane) =  = 7.83×1012 mol

 *n*(CO2) = 4*n*(butane) = 3.13 ×1013 mol

 volume CO2 at **SLC** = *n* ×24.8 = 3.13 ×1013 × **24.8** = 7.76 ×1014 L

**ii**. **Pressure** 2.00 atm =  = 202.6 kPa **pressure conversion from data book**

 **Temperature =** 322 + 273 = 595 K



 **volume** CO2 =  = 7.65 ×1014 L

1. **E = n × molar heat of combustion** = 7.83×1012 × 2880 = 2.26×1016 kJ