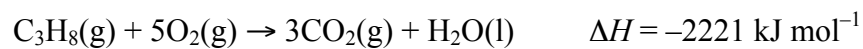


- What quantity of heat is released when 15.2 g of propane ( $\text{C}_3\text{H}_8$ ) is burnt according to the following equation?



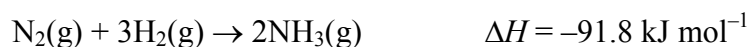
**The molar mass of  $\text{C}_3\text{H}_8$  is  $(3 \times 12.01 \text{ (C)} + 8 \times 1.008 \text{ (H)}) \text{ g mol}^{-1} = 44.094 \text{ g mol}^{-1}$ . Hence, a mass of 15.2 g corresponds to:**

$$\text{number of moles} = \frac{\text{mass}}{\text{molar mass}} = \frac{15.2 \text{ g}}{44.094 \text{ g mol}^{-1}} = 0.345 \text{ mol}$$

**As 2221 kJ of heat are generated by burning one mole, this quantity generates:**

$$\text{heat} = (0.345 \text{ mol}) \times (2221 \text{ kJ mol}^{-1}) = 766 \text{ kJ}$$

- How much heat is evolved when 907 g of ammonia is produced according to the following equation? (Assume the reaction occurs at constant pressure.)



The molar mass of ammonia,  $\text{NH}_3$ , is  $14.01 \text{ (N)} + 3 \times 1.008 \text{ (H)} = 17.034 \text{ g mol}^{-1}$ .

Thus, the number of moles of ammonia is:

$$\text{number of moles} = \frac{\text{mass (in g)}}{\text{molar mass (in g mol}^{-1}\text{)}} = \frac{907 \text{ g}}{17.034 \text{ g mol}^{-1}} = 53.2 \text{ mol}$$

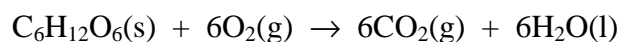
The chemical equation shows that when *two* moles are produced,  $\Delta H = -91.8 \text{ kJ mol}^{-1}$  and so half this value is evolved when *one* mole is produced.

Hence, 53.2 mol will produce:

$$\text{heat produced} = 91.8 \text{ kJ mol}^{-1} \times 0.5 \times 53.2 \text{ mol} = 2440 \text{ kJ} = 2.44 \text{ MJ}$$

Answer: 2440 kJ or 2.44 MJ

- The balanced equation for the complete oxidation of glucose to carbon dioxide and water is given below.



Calculate the mass of carbon dioxide produced by the complete oxidation of 1.00 g of glucose.

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**3**

**The molar mass of glucose is:**

$$(6 \times 12.01 (\text{C})) + (12 \times 1.008 (\text{H})) + (6 \times 16.00 (\text{O})) = 180.156$$

$$1.0 \text{ g of glucose corresponds to } \frac{\text{mass}}{\text{molar mass}} = \frac{1.00}{180.156} = 0.00555 \text{ mol}$$

**From the chemical equation, oxidation of 1 mol of glucose leads 6 mol of CO<sub>2</sub>. Hence the number of moles of CO<sub>2</sub> produced is 6 × 0.00555 = 0.0333 mol.**

$$\text{The molar mass of CO}_2 \text{ is } (12.01 (\text{C})) + (2 \times 16.00 (\text{O})) = 44.01$$

**Therefore, the number of mass of CO<sub>2</sub> produced is:**

$$\text{mass} = \text{number of moles} \times \text{molar mass} = 0.0333 \times 44.01 = 1.47 \text{ g}$$

Answer: **1.47 g**

Calculate the volume of this mass of carbon dioxide at 0.50 atm pressure and 37 °C.

**The ideal gas law gives PV = nRT, hence:**

$$V = \frac{nRT}{P} = \frac{(0.0333) \times (0.08206) \times (273+37)}{(0.50)} = 1.69 \text{ L}$$

Answer: **1.69 L**