

Exercise

- measure rate of evaporation

time				
mass				

- measure rate of combustion

$$\frac{\Delta m}{\Delta t} = \frac{0.4 \text{ g}^2}{30 \text{ s}^2} = \underline{\hspace{2cm}}$$

- find M.W. of ethanol



$$2 \cdot \text{C} = 2 \cdot 12 = 24$$

$$1 \cdot \text{O} = 1 \cdot 16 = 16$$

$$6 \cdot \text{H} = 6 \cdot 1 = 6$$

$$\underline{\hspace{10em}} \quad \Sigma \quad \underline{46} = \text{M.W.}$$

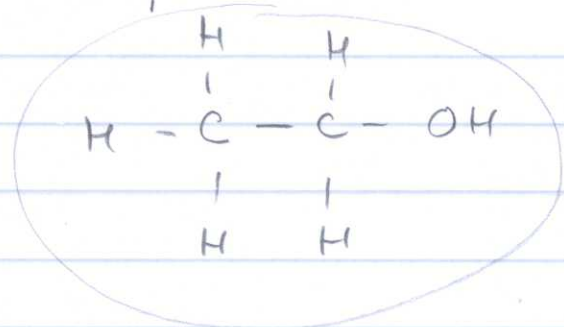
- find  $\Delta H$  released in the reaction:

a) write down the reaction:



number of atoms must balance!

b) find bond energies



1 C-O :	358
1 O-H :	467
1 C-C :	347
5 C-H :	5 \cdot 413 = 2065
$\Sigma$	<u>3237</u> $\frac{\text{kJ}}{\text{mol}}$

(2)

three oxygen:  $3 \text{ O}=\text{O}$ ,  $3 \cdot 495 = 1485$

$$\Sigma \text{ reactants} = 4722 \text{ kJ/mol}$$

CO<sub>2</sub>:  $2 \cdot 358 = 716 \times 2 = 1432$

H<sub>2</sub>O:  $2 \cdot 467 = 934 \times 3 = 2802$

$$\Sigma \text{ products} = 4234 \text{ kJ/mol}$$

$$\Delta U = 488 \text{ kJ/mol}$$

- what is the volume of the gas produced by 1 mol.

2 mol gas is produced

$$V = \frac{nRT}{p} = \frac{2 \text{ mol} \cdot 8.3 \text{ J/mol} \cdot \text{deg} \cdot 300 \text{ K}}{10^5 \text{ N/m}^2}$$

$$= 2.2490 \cdot 10^{-5} \text{ m}^3$$

$$= 2.249 \text{ l} \approx \underline{50 \text{ l}}$$

- work done by pushing away the atmosphere:

$$p \cdot \Delta V = p \cdot V = 4.98 \text{ kJ}$$

$$\Delta G = \Delta U - p \cdot \Delta V \approx \underline{483.2 \text{ kJ/mol}}$$

what is missing?

- the combustion rate in mol

③

$$R_{\text{comb}} = \frac{\Delta m}{\Delta t} = \frac{0.4 \text{ g}}{30 \Delta} = \frac{0.4 \cdot \frac{1}{46} \text{ mol}}{30 \Delta}$$

$$1 \text{ mol} = 46 \text{ g}, \text{ so } 1 \text{ g} = \frac{1}{46} \text{ mol}$$

- Rate of energy release.

$$\frac{\Delta U}{\Delta t} = \frac{\Delta m}{\Delta t} \cdot \frac{\Delta U}{\Delta m}$$

$$= \frac{0.4 \text{ mol}}{46 \cdot 30 \cdot \Delta} \cdot \frac{483 \text{ kJ}}{\text{mol}}$$