

# KINETICS REVIEW - KEY.

1a)

43.2g	1 mol H <sub>2</sub> O	7 moles O <sub>2</sub>	32.0g O <sub>2</sub>	= 89.6g O <sub>2</sub>	3.00 mins = 1.80 × 10 <sup>3</sup> seconds
18.0g H <sub>2</sub> O	6 moles H <sub>2</sub> O	1 mol O <sub>2</sub>			

$$\frac{89.6g O_2}{1.80 \times 10^3 s} = \underline{\underline{0.498 \frac{g O_2}{s} \text{ consumed}}}$$

1b)

0.045 mol NH <sub>3</sub>	4 moles NO <sub>2</sub>	= 0.045 $\frac{\text{moles}}{s}$ × 15s =	$\frac{0.675 \text{ moles NO}_2}{\text{produced in 15s}} = 0.045 \text{ mol}$
	4 moles NH <sub>3</sub>		

- 2a)
- (i) increase the surface area of solid Fe ⇒ more particles exposed for collision ∴ more overall collisions ∴ more effective collisions ∴ increased rxn rate
  - (ii) increase the conc of HCl(aq) ⇒ more particles in a given volume ∴ more overall collisions ∴ more effective collisions ∴ increased rxn rate
  - (iii) increase temperature
    - more KE in particles ∴ moving faster ∴ more overall and effective coll ∴ inc. rxn rate
    - more KE in particles ∴ collisions harder ∴ higher % of effective coll ∴ inc. rxn rate.
  - (iv) add a catalyst ⇒ higher % of effective collisions ∴ inc rxn rate due to lowered E<sub>a</sub>

b) (i) get mass of Fe(s) before rxn, time the rxn, get mass of Fe after (if any left).

Divide the Δmass of Fe by time

(ii) use a eudiometer tube to collect H<sub>2</sub> gas, time the reaction, and divide the volume of H<sub>2</sub> gas formed by time.

3a) rate =  $\frac{\Delta \text{quantity}}{\Delta \text{time}} = \frac{167.12 - 164.51}{30.0 - 0.00} = \frac{2.61}{30.0} = \underline{\underline{0.0870 \frac{g H_2}{s}}}$

b)  $\frac{167.12 - 163.32}{60.0 - 0.00} = \frac{3.80}{60.0} = 0.063333 \frac{g H_2}{s} = \underline{\underline{0.0633 \frac{g H_2}{s}}}$

(c) rate is always decreasing, so the rate early in a reaction is always greater than a rate later in a reaction.

d)

0.063333g H <sub>2</sub>	1 mol H <sub>2</sub>	2 mol Fe	55.8g Fe	= $\underline{\underline{1.2 \frac{g Fe}{s}}}$
	2.0g H <sub>2</sub>	3 mol H <sub>2</sub>	1 mol Fe	

- ④ A decrease in temperature causes a decrease in particle KE
- particles move slower  $\therefore$  less overall collisions  $\therefore$  less effective collisions  $\therefore$  lower rxn rate
  - particles move slower  $\therefore$  collisions not as hard  $\therefore$  lower % of effective coll  $\therefore$  lower rxn rate

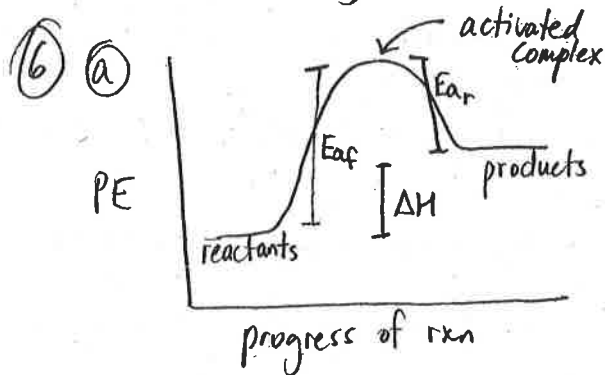
- ⑤ as particles approach:
- KE decreasing due to electron-electron repulsion
  - PE increasing

at collision:

- PE at highest and KE at lowest

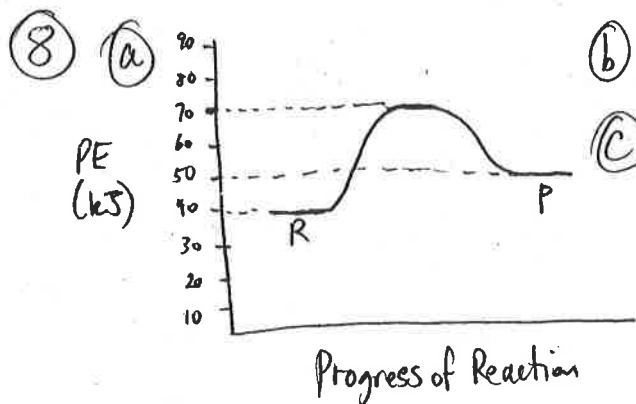
as particles move away:

- PE decreasing as KE increases



- ⑥ (b)  $\Delta H$  positive for fwd rxn (endo)  
 $\therefore$   $\Delta H$  is negative for reverse rxn.

- ⑦ (a)  $E_a$  doesn't change and  $\Delta H$  doesn't change  
 (b)  $E_a$  decreases and  $\Delta H$  doesn't change

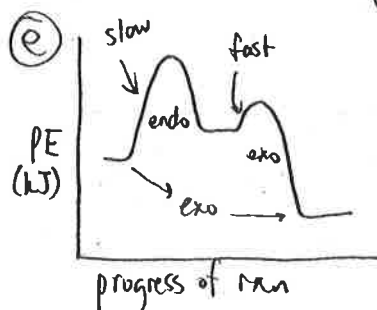


(b)  $E_{a,r} = 20 \text{ kJ}$

(c)  $70 \text{ kJ}$

- (a) gases have more KE than liquids  
 $\therefore$  more overall collisions per unit time AND harder collisions  
 $\therefore$  more effective collisions per unit time  $\therefore$  faster reactions

- ⑩ (a)  $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$   
 (b)  $\text{IO}^-$   
 (c) Yes,  $\text{I}^-$   
 (d) Step 1 (slowest step)



- ⑪ (a)  $\text{O}_3 + \text{NO} \rightarrow \text{NO}_2 + \text{O}_2$   
 (b) No as it's not a reactant in the rate determining step (step 1)  
 (c) Inc  $[\text{O}_3]$  does increase the rate as it's a reactant in step 1 (slowest step).