LIVE: FINAL EXAM PREPARATION P2 09 NOVEMBER 2014

Lesson Description

In this lesson we:

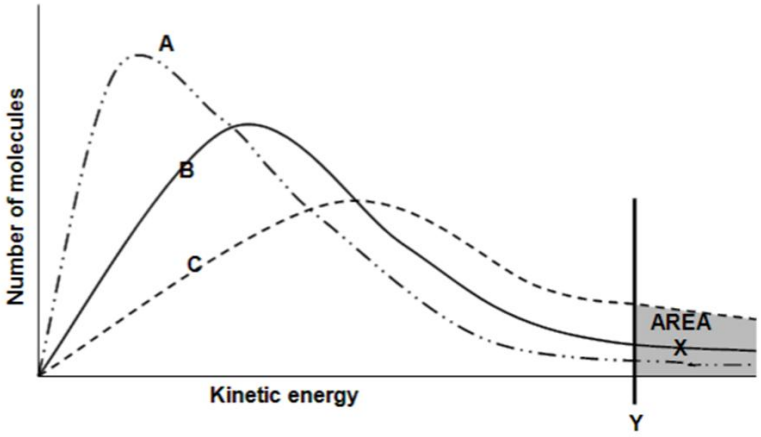
- Revise various questions related to topics tested in the various questions in Paper 2.

Exam Questions

Question 1

(Adapted from EC Prelim Paper 2 – 2014)

Graph B below represents the Maxwell-Boltzman energy distribution curve for a reaction mixture at a temperature of 300oC. Area X represents the number of molecules in the mixture that have enough kinetic energy for the reaction to take place.



1.1. Give a term for the 'minimum energy needed for a reaction to take place', as indicated by Y. (1)

1.2. The temperature of the mixture is now increased to 500^{o}C.

1.2.1. Which ONE of the graph A or C represents the distribution curve of the mixture at this higher temperature? Give a reason for the answer. (2)

1.2.2. Use the collision theory to explain how this increase in temperature will influence the rate of the reaction. (4)

1.3. A catalyst is added to the mixture

1.3.1. Write down the definition of a *positive catalyst*. (2)

1.3.2. How will the above-mentioned action affect the size of area X (shaded area)? Write down only INCREASES, DECREASES or REMAINS THE SAME (1)

1.3.3. Explain your answer to question 1.3.2. (2)

Question 2

(Adapted from North West Province Prelim Paper 2 – 2014)

2.1. Consider the following chemical equation

$$2NO(g) + O_2 \rightleftharpoons 2NO_2(g) \qquad \Delta H = -113 \text{ kJ.mol}^{-1}$$

2.1.1. State Le Chatelier's principle. (2)

2.1.2. Use Le chatelier's principle to explain the effect of an increase in pressure on the amount of NO_2 formed. (4)

2.2. The equation below represents an equilibrium reaction in a sealed 1 dm^3 container:

$$NO_2(g) + NO(g) \rightleftharpoons N_2O(g) + O_2(g) \qquad \Delta H > 0$$

At a certain temperature the K_c value is 3,93. The concentration of each reactant and product in the container at EQUILIBRIUM was:

$[NO_2] = 0,06\ mol.dm^{-3}$ $[N_2O] = 0,18\ mol.dm^{-3}$

$[NO] = 0,29\ mol.dm^{-3}$ $[O_2] = 0,38\ mol.dm^{-3}$

One of the conditions affecting the equilibrium is changed and a NEW equilibrium is established. At the new equilibrium the NO_2 concentration is $0,12\ mol.dm^{-3}$

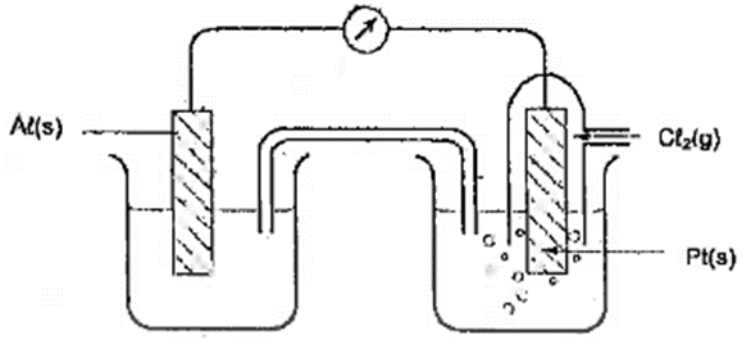
2.2.1. Calculate the K_c value at the NEW equilibrium (8)

2.2.2. Which condition, concentration or temperature, was changed? Give an explanation for the answer. (3)

Question 3

(Adapted from KZN Prelim Paper 2 – 2014)

A galvanic cell is set up with Al / Al^{3+}(aq) and Pt / Cl_2 / Cl^-(aq) half cells under standard conditions as shown below.



3.1. State the standard conditions that apply to this cell. (3)

3.2. is Al the anode or cathode? Give a reason for the answer (2)

3.3. How will the mass of aluminium electrode change while the cell is in operation?

(Write only INCREASES, DECREASES or STAYS THE SAME) (1)

3.4. Write a half reaction to support the answer in 3.3. above (2)

3.5. Write down the:

3.5.1. Formula of the oxidizing agent in this cell (1)

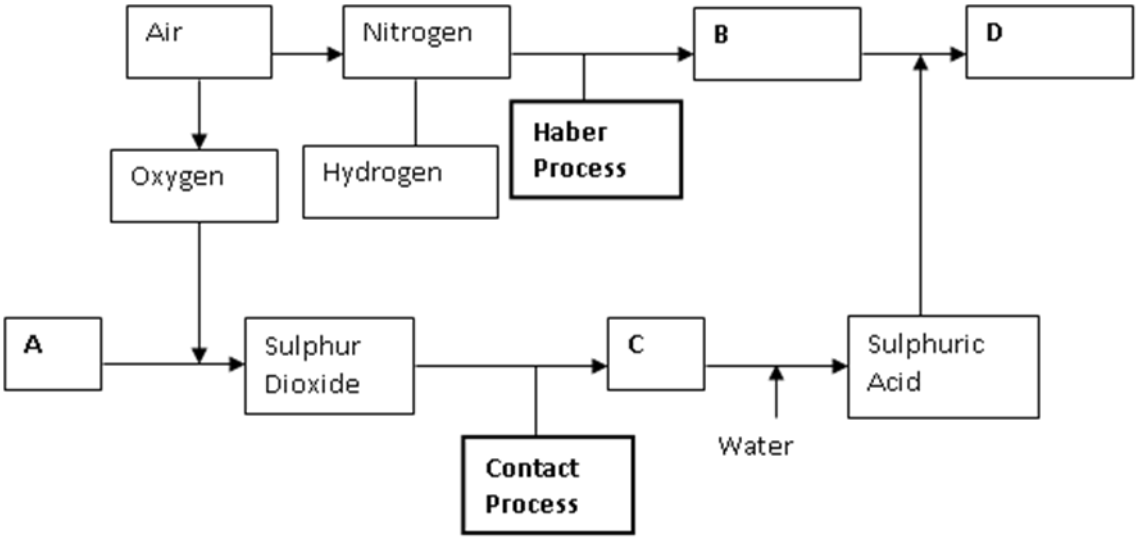
3.5.2. Reduction half reaction (2)

3.5.3. Overall net cell reaction. (3)

Question 4

(Adapted from Limpopo Prelim Paper 2 – 2014)

The flow diagram below represents the processes used to manufacture fertilizer D. Both the Haber and the Contact processes are part of the total process.



Each process uses air for ONE of the starting materials.

4.1. Name the process used to obtain nitrogen industrially. (1)

4.2. Write down the chemical name or formula of the compound represented by the letter.

4.2.1. B (1)

4.2.2. A (1)

4.2.3. D (1)

4.3. Write down the name or formula of the catalyst used in the Contact Process. (1)

4.4. Write down the name of the primary nutrient found in compound D. (1)

4.5. Write down the balanced chemical equation for the reaction which leads to the formation of substance C. (3)

4.6. Give one reason why there is a continuous worldwide demand for fertilisers. (1)

Answers

Question 1

1.1. Activation energy ✓

1.2.1. C ✓

Total area under graphs A and C more or less the same, but more molecules with greater average E_K, therefore area X of graph C greater ✓

1.2.2. Increased temperature therefore increased average kinetic energy of molecules ✓

More of these molecules will have sufficient kinetic energy to react✓

More effective collisions per second / unit time✓

Increased rate of reaction ✓

1.3.1. A catalyst will speed up a chemical reaction ✓ without itself undergoing permanent change. ✓

1.3.2. Increases ✓

1.3.3. A catalyst will create an alternative path of lower activation energy ✓

Line 'Y' moves to the left ✓ - therefore area X increases in size

Question 2

2.1.1. When the equilibrium in a closed system is disturbed, the system will establish a new equilibrium by favouring the reaction that will oppose the disturbance. ✓✓

2.1.2. Increase in pressure ✓ will always favour the reaction with the least number of moles ✓ which is the forward reaction ✓

More NO_2 is produced ✓

2.2.1.

	NO_2	NO	N_2O	O_2
Ratio	1	1	1	1
Initial conc.	0,06	0,29	0,18	0,38 ✓
Change	0,06 ✓	0,06	0,06	0,06 ✓
Equilibrium conc.	0,12 ✓	0,35	0,12	0,32 ✓

$$K_c = \frac{[N_2O][O_2]}{[NO_2][NO]} \checkmark$$

$$= \frac{(0{,}12)(0{,}32)}{(0{,}12)(0{,}35)} \checkmark$$

$$= 0{,}91 \checkmark$$

2.2.2. Temperature ✓

K_c value is less, concentration of reactant increases and concentration of products decreases, it means the reverse reaction is favoured ✓

In an endothermic reaction, decrease in temperature favours the reverse reaction. ✓

Question 3

3.1. T = 298 K ✓

[electrolyte] = 1 $mol.dm^{-3}$ ✓

p (gas) = 1 atm ✓

3.2. Anode ✓

The aluminium is oxidised ✓

3.3. Decreases ✓

3.4. $Al \rightarrow Al^{3+} + 3e^-$

3.5.1. Cl_2

3.5.2. $Cl_2(g) + 2e^- \rightarrow 2Cl^-$ ✓✓

3.5.3. $2Al + 3Cl_2(g)$ ✓ → $2Al^{3+} + 6Cl^-$ ✓ ✓ balanced

Question 4

4.1. By the fractional distillation of liquid air ✓

4.2.1. Ammonia / NH_3 ✓

4.2.2. Sulphur / S ✓

4.2.3. Ammonium sulphate / $(NH_4)_2SO_4$ ✓

4.3. Vanadium pentoxide / V_2O_5 ✓

4.4. Nitrogen ✓

4.5. $2SO_2(g) + O_2(g)$ ✓ ⇌ $2SO_3(g)$ ✓ ✓ balancing

4.6. ***Any one***

Soli cannot replenish nutrients at a fast enough rate to sustain plant growth

Globally a bigger demand of food. ✓✓