

APOLLO

Chemical Equilibrium

FBISE Chemistry Class 11 (HSSC-I)

Domain B: Physical Chemistry

34 questions | questions

Original FBISE question crops. National Curriculum 2022-23 topic.

28.	According to Le Chatelier's Principle, increasing pressure favors the side with:	More moles of gas	Fewer moles of gas	Equal moles of gas	No gaseous molecules
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38.	Which observation indicates that a system has reached equilibrium?	Concentrations of reactants and products keep changing	Concentrations of reactants and products become constant	Concentrations of reactants and products are the same	The forward and backward reactions stop completely
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Scenario for MCQ 61 to 64		A student in a chemistry laboratory prepared different aqueous solutions including HCl, NH ₄ Cl and CH ₃ COOH. During the experiment, the student measured pH values and studied acid-base behavior of different substances.			
63.	The aqueous solution of NH ₄ Cl is acidic because:	NH ₄ ⁺ undergoes hydrolysis producing H ₃ O ⁺	Cl ⁻ produces OH ⁻	NH ₄ Cl is insoluble	Water acts as Lewis acid

Scenario for MCQ 73 to 76		A chemical engineer investigates the Haber process: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{heat}$ The goal is to maximize ammonia production by adjusting reaction conditions.			
73.	To increase ammonia yield, the engineer should use:	Low pressure	High pressure	Low concentration of reactants	Open container

Scenario for MCQ 73 to 76		A chemical engineer investigates the Haber process: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{heat}$ The goal is to maximize ammonia production by adjusting reaction conditions.			
74.	Since the forward reaction is exothermic, lowering the temperature will:	Favor ammonia formation	Favor reactants	Stop equilibrium completely	Reduce the effect of pressure

Scenario for MCQ 73 to 76		A chemical engineer investigates the Haber process: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{heat}$ The goal is to maximize ammonia production by adjusting reaction conditions.			
75.	The equilibrium constant (K_c) for the Haber process depends only on:	Concentration of nitrogen	Pressure applied	Temperature	Amount of catalyst

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76.	The addition of a catalyst in the Haber process will:	Permanently increase ammonia yield	Shift equilibrium to the right	Decrease the reverse reaction rate	Allow equilibrium to be reached faster

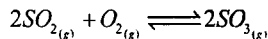
2+2	OR	A chemist tests three different fertilizer salt solutions and records their pH values: Ammonium chloride (NH_4Cl): pH = 5 (Acidic) Sodium carbonate (Na_2CO_3): pH = 11 (Basic) Sodium chloride ($NaCl$): pH = 7 (Neutral) Using the concept of salt hydrolysis, answer the following: why each salt solution shows acidic, basic, or neutral behaviour. Identify the ions responsible for hydrolysis in each case. Name the parent acid and parent base for each salt, and explain how their strengths determine the final pH of the solution.	2+2
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1+3	OR	Describe dynamic equilibrium in terms of reversible physical changes. Why no apparent change is observed even though changes continue at the molecular level.	2+2
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Q8	Using Le Chatelier's principle, explain how operating conditions are used to increase the yield in (a) The Haber process for the manufacture of ammonia. (b) The Contact process for the oxidation of sulfur dioxide to sulfur trioxide.
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$$(N_2 + 3H_2 \rightleftharpoons 2NH_3 + \Delta)$$

(xiii) Calculate K_c for the following reaction at equilibrium at 100°C .

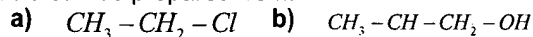

$$[SO_2]=0.59 \text{ M} \quad [O_2]=0.05 \text{ M} \quad [SO_3]=0.259 \text{ M}$$

03

OR

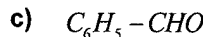
(xiv) Draw Born-Haber cycle for the formation of KCl .
(Calculation is **NOT** required)

Q.4 Describe by giving balanced chemical equations and necessary conditions that how a Carboxylic acid can be prepared from:



2x3

OR



i	Increasing pressure	$C_3H_8 + 5O_2 \rightleftharpoons 3CO_2 + 4H_2O$
ii	Removing SO_3	$2SO_2 + O_2 \rightleftharpoons 2SO_3$
iii	Decreasing temperature	$CO_2 + \Delta \rightleftharpoons CO + \frac{1}{2}O_2$

2x3

Q.5 How can one identify the functional groups in the

Why is Ethene more reactive than Ethane? Write

OR What is dynamic equilibrium? How does it exist between two physical states of a substance? Describe by giving an example.

1+2

How are the elements arranged in different blocks

1.5 + 1.5	OR	Why is the ionization of HF decreased when aqueous solution of its salt is added to it? Briefly explain by applying Le-Chatlier's principle.
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03

Q.4	Explain one physical and one chemical method to recognize a system at equilibrium.
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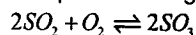
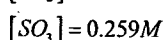
3+3

OR

Write down a chemical reaction between CH_3COOH and CH_3OH with necessary conditions. Also write the mechanism of this reaction.

2+4

Calculate K_p if the following concentrations are found at Equilibrium in given reaction:

 $[SO_2] = 0.59M \quad [O_2] = 0.05M \quad \text{Temperature} = 450^\circ C$ 

(x)	$N_2 + 3H_2 \rightleftharpoons 2NH_3$ This reaction is at equilibrium. What will happen if: a. Ammonia is removed from the mixture b. More nitrogen is added in the mixture	1.5 + 1.5	OR	Write chemical equation for the preparation of alkyl halides: a. From Alkenes b. From Alkanes	1.5 + 1.5
(x)	$N_2 + 3H_2 \rightleftharpoons 2NH_3$ This reaction is at equilibrium. What will happen if: a. Ammonia is removed from the mixture b. More nitrogen is added in the mixture.	1.5 + 1.5	OR	Write chemical equation for the preparation of alkyl halides: a. From Alkenes b. From Alkanes	1.5 + 1.5
(xi)	Derive the relation of Acid dissociation constant K_a			How Lucas test can differentiate between 2° and 3° alcohols	

c. Ethanol into Ethene	
State Le-Chatlier's Principal. How it helps to obtain maximum product in:	2+2 +2
a. Exothermic reactions b. Endothermic reactions	

State the necessary conditions for equilibrium.	
	03

Q.4	How can ethanoic acid be prepared from the following? Write all reagents and conditions with chemical equation: a. Ethanol b. Ethane nitrile c. Ethyl acetate	2x3	OR	Formation of methanol is an important industrial reaction in the processing of new fuels. $CO + 2H_2 \rightleftharpoons CH_3OH \quad \Delta H = -90.7 kJ mol^{-1}$ Explain three factors that can increase the yield of methanol in this reaction.	2x3
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Give two possible ways to recognize equilibrium.	
	03

2x3	OR	Manufacturing of ammonia by Haber's process is represented by the following equation. $N_2 + 3H_2 \rightleftharpoons 2NH_3 \quad \Delta H^\circ = -92.46 kJ mol^{-1}$ Explain three factors that can increase the yield of
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Give two possible ways to recognize an equilibrium.	1.5+ 1.5
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		atoms	atoms	atoms	
10.	Formation of NH_3 is a reversible, exothermic process, what will happen on cooling?	More reactant will be formed	More H_2 will be formed	More N_2 will be formed	More NH_3 will be formed
	The pK_a of CH_3COOH is 4.76. pK_a of the				

First Annual 2025 | Section B Q2(xi) | 3 marks

(xi)	Consider the reaction: $SO_2 + Cl_2 \rightleftharpoons SO_2Cl_2 + \text{heat}$ Propose three changes that will produce the maximum SO_2Cl_2	03
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First Annual 2025 | Section C Q4 OR | 6 marks

OR	By using Le-Chatellier's principle, describe best three conditions to get the maximum yield of Ammonia by Haber's process. $N_2 + 3H_2 \rightleftharpoons 2NH_3 + \Delta H$	2x3
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Second Annual 2025 | Section A Q10 | 1 mark

10. Le Chatelier's Principle explains:	Shifts in equilibrium	Rate of reaction	Limiting reagent	Electrolysis
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Second Annual 2025 | Section B Q2(ix) | 3 marks

(ix)	Consider the following reaction at equilibrium $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ what will happen if: a. Pressure is increased b. Concentration of SO_3 is increased	03
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First Annual 2026 | Section B Q2(xii) OR | 3 marks

1.5 + 1.5	OR	Briefly explain homogeneous equilibria and heterogeneous equilibria. Write one reaction for each.	1.5 + 1.5
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First Annual 2026 | Section C Q4 | 6 marks

Q.4	K_c for the following reaction is 1×10^{-3} at $230^\circ C$. $2ICl_{(g)} \rightleftharpoons Cl_{2(g)} + I_{2(g)}$ 1.6 moles of ICl, 0.05 moles of each I_2 and Cl_2 are present in equilibrium mixture of volume $2dm^3$. After removal of one mole of ICl. Determine the equilibrium concentrations of I_2, Cl_2 and ICl, when the equilibrium is restored	05
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First Annual 2026 | Section B Q2(ix) OR | 3 marks

OR	Write equilibrium constant expression for: $PCl_5 \rightleftharpoons PCl_3 + Cl_2$	03
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First Annual 2026 | Section B Q2(xii) OR | 3 marks

OR	Pressure is one of the factors which disturbs the equilibrium. How change in pressure will affect the following reaction: $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$	03
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(xiv)	Prove that common ion effect is one of the application of Le-Chartier's principle.	03
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