

CLASS 9 • CHEMISTRY

Chapter 6

EQUILIBRIA

85 Solved MCQs

with correct answers highlighted
and detailed explanations

Annual Exam Preparation

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INDEX

Table of Contents

85 MCQs

1	Reversible and Irreversible Changes (Basics)	10 MCQs	2
2	Physical Changes and Hydrated Salts	10 MCQs	7
3	Dynamic Equilibrium	10 MCQs	12
4	Le Chatelier's Principle: Concentration Effects	7 MCQs	17
5	Le Chatelier's Principle: Temperature Effects	8 MCQs	21
6	Le Chatelier's Principle: Pressure Effects	9 MCQs	25
7	Le Chatelier's Principle: Catalyst Effects	6 MCQs	30
8	Industrial Applications and Specific Exercises	10 MCQs	33
9	Key Points and Comprehensive Review	15 MCQs	38

How to use: the correct option is highlighted in green with a tick, and the explanation is given below each question.

SECTION 1

Reversible and Irreversible Changes
(Basics)

10 MCQs

1 Which of the following reactions goes to completion?

Correct Answer: C | Explanation: According to the textbook, when stoichiometric amounts of NaCl and AgNO₃ are used, no reactant species are present at the end. This reaction moves in the forward direction only, making it irreversible (goes to completion).

2 The symbol used to represent a reversible reaction is:

Correct Answer: B | Explanation: The textbook explicitly states that a reversible reaction is denoted by a symbol that has two half arrowheads pointing in opposite directions ($\rightleftharpoons$).

3 In an irreversible reaction, the reaction moves:

A In both forward and backward directions

B Only in the backward direction

C Only in the forward direction



D It stops immediately

Correct Answer: C | Explanation: An irreversible reaction moves in the forward direction only, converting reactants completely into products.

4 Which of the following is an example of a reversible reaction?

A $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$

B $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$



C Burning of magnesium ribbon

D Neutralization of HCl by NaOH

Correct Answer: B | Explanation: The formation of ammonia from nitrogen and hydrogen is a classic reversible reaction shown in the text, where the product (ammonia) decomposes back to reactants under the same conditions.

5 For the reaction $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$, the forward reaction requires:

- A** 1 mole N_2 and 1 mole H_2
- B** 1 mole N_2 and 3 moles H_2 ✓
- C** 3 moles N_2 and 1 mole H_2
- D** 2 moles N_2 and 3 moles H_2

Correct Answer: B | Explanation: The stoichiometric coefficients in the balanced equation show that one mole of nitrogen gas reacts with exactly three moles of hydrogen gas.

6 In a reversible reaction, if a product is continuously withdrawn, the reaction:

- A** Stops immediately
- B** Goes to completion ✓
- C** Reverses completely
- D** Reaches equilibrium instantly

Correct Answer: B | Explanation: If a product is withdrawn (or escapes as a gas), the reaction is forced to go to completion to replace the lost product, as seen in the heating of CaCO_3 in an open container.

7 Heating calcium carbonate in an open container goes to completion because:

- A** CaO escapes
- B** CO₂ escapes into the atmosphere ✓
- C** CaCO₃ melts
- D** Temperature decreases

Correct Answer: B | Explanation: In an open container, the CO₂ produced escapes into the atmosphere as soon as it is formed, shifting the equilibrium completely to the right.

8 Which of the following changes is reversible?

- A** Rusting of iron
- B** Cooking an egg
- C** Heating of CuSO₄·5H₂O ✓
- D** Burning of paper

Correct Answer: C | Explanation: The text highlights that physical changes may also be reversible in nature, using the hydration and dehydration of copper sulphate as a prime example.

9 The color of hydrated copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) is:

A White

B Blue



C Pink

D Purple

Correct Answer: B | Explanation: The textbook explicitly states that copper sulphate pentahydrate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) is an important salt which is blue in color.

10 When blue copper sulphate is heated strongly, it turns:

A Pink

B Purple

C White



D Green

Correct Answer: C | Explanation: Heating drives off the water of crystallization, converting blue hydrated copper sulphate into white anhydrous copper sulphate.

SECTION 2

Physical Changes and Hydrated Salts

10 MCQs

11 What is the chemical formula of anhydrous copper sulphate?

A $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

B CuSO_4



C $\text{CuSO}_4 \cdot 2\text{H}_2\text{O}$

D CuCl_2

Correct Answer: B | Explanation: Anhydrous means "without water." The hydrated form is $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, so removing the 5 water molecules leaves CuSO_4 .

12 When white anhydrous copper sulphate absorbs moisture, it turns:

A Blue



B Pink

C Purple

D Colorless

Correct Answer: A | Explanation: The text states that when white anhydrous copper sulphate absorbs moisture from the atmosphere, it will turn blue again, forming the hydrated salt.

13 The color of hydrated cobalt chloride ($\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$) is:

A Blue

B Pink



C White

D Purple

Correct Answer: B | Explanation: According to the textbook, cobalt chloride hexahydrate ($\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$) is pink in color.

14 When pink cobalt chloride hexahydrate is heated, it converts to anhydrous CoCl_2 which is:

A Pink

B Purple

C Blue



D White

Correct Answer: C | Explanation: Heating drives off the water, changing the pink hexahydrate to blue anhydrous cobalt chloride.

15 What is the color of cobalt chloride dihydrate ($\text{CoCl}_2 \cdot 2\text{H}_2\text{O}$)?

A Blue

B Pink

C Purple



D Colorless

Correct Answer: C | Explanation: The text explains that in the reverse reaction, anhydrous cobalt chloride (blue) first absorbs limited moisture to become a dihydrate, which is purple in color.

16 How many water molecules are in cobalt chloride hexahydrate?

A 2

B 4

C 6



D 5

Correct Answer: C | Explanation: The prefix "hexa" means six, and the formula $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$ confirms this.

17 The conversion of anhydrous cobalt chloride to cobalt chloride hexahydrate requires:

A Heating

B Moisture



C Cooling

D Pressure

Correct Answer: B | Explanation: The reverse reaction shows that blue anhydrous CoCl_2 absorbs moisture (water) to eventually become pink hexahydrate.

18 Which salt is used as an indicator for moisture?

A NaCl

B Anhydrous CuSO_4



C CaCO_3

D AgNO_3

Correct Answer: B | Explanation: White anhydrous copper sulphate turns blue upon absorbing moisture, making it a useful test for the presence of water.

19 The equation $\text{CuSO}_4 \cdot 5\text{H}_2\text{O} \rightleftharpoons \text{CuSO}_4 + 5\text{H}_2\text{O}$ represents a:

A Irreversible chemical change

B Reversible physical change



C Irreversible physical change

D Nuclear change

Correct Answer: B | Explanation: The text classifies this dehydration/hydration cycle as a reversible physical change, driven by heat and moisture.

20 What drives the reaction $\text{CuSO}_4 \cdot 5\text{H}_2\text{O} \rightleftharpoons \text{CuSO}_4 + 5\text{H}_2\text{O}$ to the right?

A Adding water

B Heating



C Cooling

D Adding a catalyst

Correct Answer: B | Explanation: Heating provides the energy to break the bonds holding the water of crystallization, driving the reaction towards the anhydrous form.

SECTION 3 Dynamic Equilibrium

10 MCQs

21 Chemical equilibrium is established in a:

- A Open system
- B Closed system**
- C Vacuum
- D Isolated system only

Correct Answer: B | Explanation: The learning outcomes state that reversible reactions can achieve equilibrium in a closed system where the rates of the forward and backward reactions are equal.

22 At dynamic equilibrium, the rate of the forward reaction is:

- A Greater than the reverse reaction
- B Less than the reverse reaction
- C Equal to the reverse reaction**
- D Zero

Correct Answer: C | Explanation: The text defines dynamic equilibrium as the state where the rate of the forward reaction becomes equal to the rate of the backward reaction.

23 At equilibrium, the concentrations of reactants and products:

A Keep changing rapidly

B Remain constant 

C Become zero

D Are always equal

Correct Answer: B | Explanation: Although reactions continue in both directions, the concentrations of all reacting species remain constant at equilibrium.

24 Why is equilibrium called "dynamic"?

A Because it stops completely

B Because reactions keep going in both directions 

C Because it changes temperature

D Because it only moves forward

Correct Answer: B | Explanation: The reaction does not cease at equilibrium; it keeps going on in both directions, which is why it is called dynamic.

25 For the reaction N_2O_4 (colorless) $\rightleftharpoons$ 2NO_2 (brown), what happens to the color if the mixture is kept in a sealed flask at 100°C ?

A It remains colorless

B It turns brown



C It turns white

D It turns blue

Correct Answer: B | Explanation: The exercise states that N_2O_4 slowly changes to brown-colored NO_2 at 100°C . Even at equilibrium, a mixture of both gases will appear brown.

26 If N_2O_4 (colorless) is kept in a sealed flask at 100°C , the color of the mixture will:

A Intensify indefinitely

B Remain constant at equilibrium



C Fade to colorless

D Turn pink

Correct Answer: B | Explanation: Since it is a sealed flask (closed system), equilibrium is reached. At equilibrium, concentrations remain constant, so the brown color intensity remains constant.

27 Time to reach dynamic equilibrium depends upon:

A The nature of the reaction and conditions ✓

B The size of the container only

C The color of the reactants

D The mass of the catalyst only

Correct Answer: A | Explanation: The text explicitly states that the time a reaction takes to attain equilibrium depends upon the nature of the reaction and the conditions at which it is performed.

28 The formation of ammonia at 400°C with a catalyst reaches equilibrium within:

A Years

B Minutes ✓

C Seconds

D Hours

Correct Answer: B | Explanation: The text notes that the rates of formation and decomposition of ammonia are reasonably fast, reaching equilibrium within minutes.

29 The reaction $2\text{H}_2\text{O}(\text{l}) \rightleftharpoons 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$ takes how long to reach equilibrium?

A 4-5 seconds



B 4-5 minutes

C 4-5 hours

D 4-5 days

Correct Answer: A | Explanation: The textbook specifically highlights this reaction as taking 4-5 seconds to reach the point of equilibrium.

30 In a closed container, $\text{CaCO}_3 \rightleftharpoons \text{CaO} + \text{CO}_2$ reaches equilibrium. What happens to the CO_2 ?

A It escapes

B It reacts with CaO to give back CaCO_3



C It stops forming

D It turns into a liquid

Correct Answer: B | Explanation: In a closed container, the CO_2 cannot escape. It reacts with calcium oxide (CaO) to give back the reactant, establishing dynamic equilibrium.

SECTION 4

Le Chatelier's Principle: Concentration Effects

7 MCQs

31 For $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$, adding more N_2 gas will:

A Shift equilibrium to the left

B Shift equilibrium to the right



C Stop the reaction

D Decrease NH_3 production

Correct Answer: B | Explanation: Adding a reactant (N_2) disturbs the equilibrium. To restore it, the system consumes the added N_2 by shifting the reaction towards the product (right).

32 Withdrawing some NH_3 from the reaction $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ will:

A Shift equilibrium to the right



B Shift equilibrium to the left

C Have no effect

D Increase N_2 concentration

Correct Answer: A | Explanation: Removing a product decreases its concentration. The forward reaction increases to replenish the lost NH_3 , shifting the equilibrium to the right.

33 If we add more product to a system at equilibrium, the reaction will shift:

A Forward

B Backward



C Stop

D Explode

Correct Answer: B | Explanation: According to the text, adding product disturbs the equilibrium, forcing the reaction to shift in the reverse (backward) direction to consume the excess product.

34 For the reaction $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$, adding Cl_2 gas will:

A Shift equilibrium to the right

B Shift equilibrium to the left



C Increase PCl_5 decomposition

D Cause no change

Correct Answer: B | Explanation: Adding Cl_2 (a product) will cause the equilibrium to shift to the left to counteract the increase, consuming Cl_2 and forming more PCl_5 .

35 Removing water from an esterification reaction drives the reaction:

- A** Backward
- B** Forward ✓
- C** To a halt
- D** To form more reactants

Correct Answer: B | Explanation: The exercise states that removing water (a product) as it forms helps get a better yield of ethyl acetate (forward reaction).

36 In the reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$, if N_2 is added, the concentration of H_2 will:

- A** Increase
- B** Decrease ✓
- C** Remain constant
- D** Become zero

Correct Answer: B | Explanation: Adding N_2 shifts the reaction forward, consuming H_2 to form NH_3 . Therefore, the concentration of H_2 will decrease.

37 In the reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$, if NH_3 is removed, the concentration of H_2 will:

A Decrease



B Increase

C Remain constant

D First increase then decrease

Correct Answer: A | Explanation: Removing NH_3 shifts the reaction forward to replace it, which consumes N_2 and H_2 , decreasing their concentrations.

SECTION 5

Le Chatelier's Principle: Temperature Effects

8 MCQs

38 For the reaction $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ with $\Delta H = -92.4$ kJ/mol, the forward reaction is:

A Endothermic

B Exothermic



C Neutral

D Catalytic

Correct Answer: B | Explanation: The negative ΔH value (-92.4 kJ/mol) indicates that heat is released in the forward direction, making it exothermic.

39 In the ammonia synthesis reaction, if the temperature is increased, the equilibrium shifts:

A Forward

B Backward



C Remains unchanged

D Stops

Correct Answer: B | Explanation: Since the forward reaction is exothermic, increasing temperature will push the reaction in the backward (endothermic) direction to absorb the excess heat.

40 Decreasing the temperature of the ammonia synthesis reaction will drive the equilibrium:

A Forward



B Backward

C No effect

D Sideways

Correct Answer: A | Explanation: Lowering the temperature favors the exothermic reaction (forward) to generate heat and restore equilibrium.

41 In an exothermic reaction, heat is written on the:

A Reactant side

B Product side



C Left side

D Top

Correct Answer: B | Explanation: By convention, for an exothermic reaction (releases heat), heat is treated as a product and placed on the right side of the equation.

42 For the reaction $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$ (endothermic), increasing the temperature will:

- A** Shift equilibrium to the left
- B** Shift equilibrium to the right ✓
- C** Stop the reaction
- D** Decrease Cl_2 production

Correct Answer: B | Explanation: The text states this is an endothermic reaction. Increasing temperature favors the endothermic direction (forward) to absorb the added heat, shifting it to the right.

43 If the forward reaction is endothermic, the reverse reaction is:

- A** Endothermic
- B** Exothermic ✓
- C** Neutral
- D** Catalytic

Correct Answer: B | Explanation: Energy must be conserved. If the forward path absorbs heat, the reverse path must release heat.

44 In the reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$, what happens if the temperature is increased?

- A** More NH_3 is formed
- B** Less NH_3 is formed 
- C** NH_3 formation is unaffected
- D** Catalyst is poisoned

Correct Answer: B | Explanation: Increasing temperature shifts the equilibrium backward (towards reactants), resulting in less NH_3 formation.

45 The total energy of the system containing N_2 and H_2 compared to NH_3 (for ammonia synthesis) is:

- A** Lower
- B** Higher 
- C** Equal
- D** Zero

Correct Answer: B | Explanation: The text states that since ΔH is negative, the total energy of the system containing N_2 and H_2 is higher than that of ammonia.

SECTION 6

Le Chatelier's Principle: Pressure Effects

9 MCQs

46 Change of pressure disturbs the equilibrium of only those gaseous reactions where:

A Number of moles of reactants equals products

B Number of moles of reactants differs from products



C No gases are involved

D A catalyst is present

Correct Answer: B | Explanation: The textbook specifies that pressure changes only affect equilibria where there is a difference in the total number of moles of gas on the reactant and product sides.

47 In the reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$, how many moles of reactant gas are there?

A 2

B 3

C 4



D 1

Correct Answer: C | Explanation: 1 mole of N_2 + 3 moles of H_2 = 4 moles of reacting gases.

48 In the reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$, how many moles of product gas are there?

A 1

B 2



C 3

D 4

Correct Answer: B | Explanation: The balanced equation shows 2 moles of NH_3 gas are produced.

49 If pressure is increased on the ammonia synthesis reaction, the equilibrium shifts:

A To the left

B To the right



C No shift

D Stops

Correct Answer: B | Explanation: Increasing pressure shifts the equilibrium to the side with fewer moles of gas. Reactants have 4 moles, products have 2. So it shifts right (forward).

50 The formation of ammonia is favored at:

A Low pressure

B High pressure ✓

C Standard pressure

D Zero pressure

Correct Answer: B | Explanation: Since the forward reaction reduces the number of gas molecules (4 to 2), high pressure favors the forward reaction, increasing ammonia yield.

51 For the reaction $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$, what happens if the gas mixture is compressed?

A Shifts right

B Shifts left ✓

C No change

D Explodes

Correct Answer: B | Explanation: Reactants: 1 mole. Products: 2 moles. Increasing pressure (compressing) shifts equilibrium to the side with fewer moles, which is the left (reactants).

52 If the pressure is decreased for the reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$, the equilibrium will:

A Shift right

B Shift left



C Remain unchanged

D Stop

Correct Answer: B | Explanation: Decreasing pressure shifts the equilibrium towards the side with more moles of gas (4 moles on the left).

53 Which reaction is unaffected by a change in pressure?

A $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$

B $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$

C $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$



D $\text{CaCO}_3 \rightleftharpoons \text{CaO} + \text{CO}_2$

Correct Answer: C | Explanation: In $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$, there are 2 moles of gas on both sides. Since there is no difference in the number of gas moles, pressure changes do not affect the equilibrium.

54 In the reaction $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$, increasing pressure will:

A Shift right

B Shift left



C No effect

D Increase CO_2

Correct Answer: B | Explanation: Only gases are affected by pressure. Reactants have 0 moles of gas, products have 1 mole (CO_2). Increasing pressure shifts to the side with fewer gas moles (left).

SECTION 7

Le Chatelier's Principle: Catalyst Effects

6 MCQs

55 A catalyst affects a reversible reaction by:

- A** Shifting equilibrium to the right
- B** Shifting equilibrium to the left
- C** Increasing both forward and backward rates equally ✓
- D** Decreasing the yield of products

Correct Answer: C | Explanation: The textbook emphasizes that a catalyst increases both the rates of forward and backward reactions equally.

56 The presence of a catalyst in a reversible reaction:

- A** Increases the time to reach equilibrium
- B** Decreases the time to reach equilibrium ✓
- C** Changes the equilibrium position
- D** Is consumed in the reaction

Correct Answer: B | Explanation: Since it speeds up both forward and reverse reactions, a catalyst decreases the time taken by the reaction to attain the state of equilibrium.

57 Does a catalyst change the position of equilibrium?

- A** Yes, it shifts it forward
- B** Yes, it shifts it backward
- C** No, it does not change the position
- D** Depends on the catalyst



Correct Answer: C | Explanation: A catalyst speeds up the attainment of equilibrium but does not favor either direction, so the final equilibrium concentrations remain the same.

58 In the Haber process, the catalyst used is:

- A** Vanadium pentoxide
- B** Iron
- C** Nickel
- D** Platinum



Correct Answer: B | Explanation: The chemical equation provided in the text for ammonia synthesis specifically lists "Fe" (iron) as the catalyst.

59 Catalysts are used in industrial reactions primarily to:

- A** Increase yield
- B** Save time and energy ✓
- C** Shift equilibrium
- D** Change the state of matter

Correct Answer: B | Explanation: By decreasing the time to reach equilibrium, catalysts save time and consequently energy in industrial processes, even though they do not increase the theoretical yield.

60 At the stage of dynamic equilibrium, adding a catalyst will:

- A** Increase the forward rate only
- B** Increase the reverse rate only
- C** Increase both rates equally ✓
- D** Have no effect on the rates

Correct Answer: C | Explanation: The text explicitly states that at dynamic equilibrium, a catalyst increases both the rates of forward and back reactions equally.

SECTION 8

Industrial Applications and Specific Exercises

10 MCQs

61 The Haber process is used for the industrial production of:

- A Urea
- B Ammonia** ✓
- C Sulphuric acid
- D Ethyl acetate

Correct Answer: B | Explanation: The "Interesting Information" section identifies the industrial production of ammonia via the Haber process.

62 In the Haber process, ammonia gas is converted into liquid form to:

- A Increase pressure
- B Drive the reaction to completion** ✓
- C Slow down the reaction
- D Act as a catalyst

Correct Answer: B | Explanation: The text states that ammonia is converted to liquid form to easily drive the reaction to completion (by removing the product).

63 The preparation of ethyl acetate is commercially important because it is used as:

A A fertilizer

B A thinner in the paint industry ✓

C A fuel

D A catalyst

Correct Answer: B | Explanation: The textbook exercise states that ethyl acetate is used as a thinner in the paint industry.

64 In the preparation of ethyl acetate ($\text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$), the catalyst used is:

A Iron

B Dilute H_2SO_4 ✓

C Heat

D Nickel

Correct Answer: B | Explanation: The equation provided in the exercise shows "dil. H_2SO_4 " (dilute sulphuric acid) as the catalyst.

65 To get a better yield of ethyl acetate, what should be removed from the reaction mixture?

A Ethyl alcohol

B Acetic acid

C Water



D Sulphuric acid

Correct Answer: C | Explanation: The exercise asks for a method to withdraw water from the reaction mixture to drive the equilibrium forward and improve the yield.

66 The reaction $\text{C(s)} + \text{H}_2\text{O(g)} \rightarrow \text{CO(g)} + \text{H}_2\text{(g)}$ produces:

A Water gas



B Ammonia

C Urea

D Methane

Correct Answer: A | Explanation: The text describes this reaction and explicitly labels the product mixture ($\text{CO} + \text{H}_2$) as "water gas".

67 In the methanation reaction $\text{CO(g)} + 3\text{H}_2\text{(g)} \rightleftharpoons \text{CH}_4\text{(g)} + \text{H}_2\text{O(g)}$, the catalyst commonly used is:

A Fe

B Ni



C V_2O_5

D Pt

Correct Answer: B | Explanation: The textbook marks this equilibrium with a catalyst above the arrow. In industry, finely divided nickel (Ni) is the standard catalyst for methanation.

68 Vast deposits of coal are available in Thar, Sindh. This coal can be used to generate:

A Water gas

B Electricity



C Ammonia

D Ethyl acetate

Correct Answer: B | Explanation: The text states, "Vast deposits of coal are available in Thar, Sindh. This coal can be used to generate electricity."

69 In the reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$, what happens if the pressure is increased?

- A** Reaction stops
- B** Shifts towards products ✓
- C** Shifts towards reactants
- D** Catalyst deactivates

Correct Answer: B | Explanation: This reaction has 4 moles of gas on the left and 2 on the right. High pressure shifts equilibrium to the side with fewer moles of gas.

70 Which of the following will NOT change the position of equilibrium of a reversible reaction?

- A** Adding a reactant
- B** Changing temperature
- C** Adding a catalyst ✓
- D** Changing pressure (unequal gas moles)

Correct Answer: C | Explanation: A catalyst speeds up the forward and reverse reactions equally, so the system simply reaches equilibrium faster. The other three factors actually shift the position of equilibrium.

SECTION 9

Key Points and Comprehensive Review

15 MCQs

71 Which statement is TRUE about reversible reactions?

- A They always go to completion
- B Products can react to give back reactants
- C They only occur in open systems
- D They stop entirely at equilibrium

Correct Answer: B | Explanation: The key points state that in reversible reactions, products react to give back the reactants.

72 A reversible reaction can be forced to go to completion by:

- A Adding a catalyst
- B Removing a product as it is formed
- C Decreasing temperature
- D Increasing the volume of the container

Correct Answer: B | Explanation: Key Point 2 explicitly states that a reversible reaction may be forced to go to completion if one or all of the products are withdrawn from the reaction mixture as soon as they are formed.

73 Which of the following is NOT a characteristic of dynamic equilibrium?

A Forward and reverse rates are equal

B Concentrations remain constant

C The reaction has stopped entirely



D It exists in a closed system

Correct Answer: C | Explanation: At dynamic equilibrium, the reaction does not stop. It continues in both directions at equal rates.

74 The value of the equilibrium constant is changed by a change in:

A Concentration

B Pressure

C Temperature



D Catalyst

Correct Answer: C | Explanation: Only a change in temperature alters the value of the equilibrium constant. Changes in concentration or pressure merely shift the position of equilibrium, and a catalyst has no effect on it.

75 In the reaction $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$ (endothermic), what happens if the temperature is increased?

A Shifts left

B Shifts right



C No effect

D Stops

Correct Answer: B | Explanation: For endothermic forward reactions, increasing temperature shifts the equilibrium to the right (forward) to absorb the heat.

76 If we add Cl_2 to the PCl_5 equilibrium mixture, what happens?

A More PCl_5 is formed



B More PCl_3 is formed

C Nothing happens

D The reaction stops

Correct Answer: A | Explanation: Adding Cl_2 (a product) shifts the reaction to the left (reverse), forming more PCl_5 .

77 For the reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$, if pressure is increased, the yield of ammonia:

- A** Decreases
- B** Increases
- C** Remains the same
- D** Becomes zero

Correct Answer: B | Explanation: High pressure favors the forward reaction (fewer moles), increasing the yield of ammonia.

78 The time a reaction takes to reach equilibrium depends on:

- A** The container's color
- B** The nature of the reaction and conditions
- C** The mass of the reactants
- D** The volume of the catalyst

Correct Answer: B | Explanation: Key Point 6 states it depends upon the nature of the reaction and the conditions at which the reversible reaction is performed.

79 A reversible chemical system may be disturbed by:

- A** Adding a reactant
- B** Changing temperature
- C** Changing pressure (if gases are involved)

D All of the above



Correct Answer: D | Explanation: Key Point 7 summarizes that adding or withdrawing reactants and products, changing temperature, and changing pressure (for gases) can all disturb the system.

80 Which of the following is an irreversible reaction?

- A** $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$
- B** $\text{CaCO}_3 \rightleftharpoons \text{CaO} + \text{CO}_2$
- C** $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$
- D** $\text{CuSO}_4 \cdot 5\text{H}_2\text{O} \rightleftharpoons \text{CuSO}_4 + 5\text{H}_2\text{O}$



Correct Answer: C | Explanation: The formation of AgCl is shown as a one-way reaction that goes to completion.

81 The catalyst in a reversible reaction:

A Increases the yield of the product

B Decreases the time to reach equilibrium ✓

C Shifts equilibrium to the right

D Is consumed during the reaction

Correct Answer: B | Explanation: A catalyst speeds up both forward and reverse reactions equally, helping the system reach equilibrium faster without changing the final yield.

82 If the pressure on the reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ is decreased, the equilibrium will shift:

A To the right

B To the left ✓

C No change

D It will stop

Correct Answer: B | Explanation: Lowering pressure shifts the equilibrium towards the side with more moles of gas. The left side has 4 moles, the right has 2. So it shifts left.

83 In the reaction $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ carried out in an open container, the reaction goes to completion because:

- A** CaO escapes
- B** CO_2 escapes
- C** CaCO_3 is solid
- D** Temperature is high

Correct Answer: B | Explanation: In an open container, gaseous CO_2 escapes into the atmosphere, preventing the reverse reaction from occurring and driving the reaction to completion.

84 The color change from blue to white upon heating copper sulphate is an example of:

- A** A chemical change only
- B** A reversible physical change
- C** An irreversible chemical change
- D** A nuclear change

Correct Answer: B | Explanation: The text classifies hydration/dehydration of salts as reversible physical changes.

85 The addition of water to white anhydrous copper sulphate turns it:

A Pink

B Blue



C Purple

D Colorless

Correct Answer: B | Explanation: Adding water (moisture) reverses the reaction, turning white anhydrous CuSO_4 back to blue hydrated $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

CHAPTER 6 • COMPLETE

Well Done!

Keep Learning

Revise the explanations, practise the key ideas of dynamic equilibrium and Le Chatelier's principle, and go into your exam with confidence.

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