	INDIAN SCHOOL AL WADI AL KABIR	
Class: XI	**DEPARTMENT: SCIENCE 2022-23** **SUBJECT: CHEMISTRY**	**Date of completion:** **II week of February, 2023**
Worksheet No: 09 with answers	**TOPIC: EQUILIBRIUM**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT	**CLASS & SEC:**	**ROLL NO.**

MULTIPLE CHOICE QUESTIONS

1. The concentration of hydrogen ion in a sample of soft drink is 0.001M. what is its pH?

(i) -1 (ii) 3 (iii) -3 (iv) 1

2. PCl_5, PCl_3 and Cl_2 are at equilibrium at 500 K and having concentration 1.6 M PCl_3, 1.6M Cl_2 and 1.4 M PCl_5. Kc for the reaction, $PCl_5 \rightleftharpoons PCl_3 + PCl_5$ is ……

(i) 1.8 $molL^{-1}$ (ii) 1.8 $Lmol^{-1}$

(iii) 1.2 $molL^{-1}$ (iv) 1.2 $Lmol^{-1}$

3. When hydrochloric acid is added to cobalt nitrate solution at room temperature, the following reaction takes place and the reaction mixture becomes blue. On cooling the mixture, it becomes pink. On the basis of this information mark the correct answer.

$$\underset{\text{(pink)}}{[Co(H_2O)_6]^{3+}}(aq) + 4Cl^-(aq) \rightleftharpoons \underset{\text{(blue)}}{[CoCl_4]^{2-}}(aq) + 6H_2O(l)$$

(i) $\Delta H > 0$ for the reaction (ii) $\Delta H < 0$ for the reaction

(iii) $\Delta H = 0$ for the reaction (iv) The sign of ΔH cannot be predicted.

4. Acidity of BF_3 can be explained on the basis of which of the following concepts?

(i) Arrhenius concept (ii) Bronsted Lowry concept

(iii) Lewis concept (iv) Bronsted Lowry as well as Lewis concept.

5. In which of the following reactions, the equilibrium remains unaffected on addition of small amount of argon at constant volume?

(i) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

(ii) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

(iii) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

(iv) The equilibrium will remain unaffected in all the three cases.

6. For the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, the value of K is 50 at 400 K and 1700 at 500 K. Which of the following options is not correct?

(i) The reaction is endothermic
(ii) The reaction is exothermic
(iii) If $NO_2(g)$ and $N_2O_4(g)$ are mixed at 400 K at partial pressures 20 bar and 2 bar respectively, more $N_2O_4(g)$ will be formed.
(iv) The entropy of the system increases.

7. Identify the strongest acid from the following:

(i) CH_4 (ii) NH_3

(iii) H_2O (iv) HF

Assertion Reason Type

a. Both Assertion and Reason are correct statements, and Reason is the correct explanation of the Assertion.

b. Both Assertion and Reason are correct statements, but Reason is not the correct explanation of the Assertion.

c. Assertion is correct but Reason is wrong statement.

d. Assertion is wrong but Reason is correct statement.

8. ***Assertion (A) :*** Increasing order of acidity of hydrogen halides is HF <HCl<HBr< HI

Reason (R) : While comparing acids formed by the elements belonging to the same group of periodic table, H–A bond strength is a more important factor in determining acidity of an acid than the polar nature of the bond.

9. ***Assertion (A):*** The ionisation of H_2S in water is low in the presence of hydrochloric acid.

Reason (R): Hydrogen sulphide is a weak acid.

10. ***Assertion (A):*** In the dissociation of PCl_5 at constant pressure and temperature addition of helium at equilibrium increases the dissociation of PCl_5.

Reason (R): Helium removes Cl_2 from the field of action.

Read the given passage and answer the questions that follow:

The equilibrium constant helps in predicting the direction in which a given reaction will proceed at any stage. For this purpose, we calculate the **reaction quotient *Q***. The reaction quotient, *Q* is defined in the same way as the equilibrium constant *Kc* except that the concentrations in *Qc* are not necessarily equilibrium values.

11. Write an equation for Q_C for a general reaction:

$$a\,A + b\,B \rightleftharpoons c\,C + d\,D$$

12. In which direction does the reaction proceed if *Q*c < *Kc?*

13. What is the relationship between *Q*c and *Kc* if a reaction is at equilibrium?

14. Write any two applications of equilibrium constants.

15. What is the relationship between ΔG^o and K_C?

Question – Answer Type:

16. State Le Chatelier's principle. (1)

17. What is the concentration of H_3O^+ and OH^- ions in water at 298K? (1)

18. State Henry's law. (1)

19. Define common ion effect. (1)

20. What is a Buffer solution? Give an example. (1)

21. Differentiate between Homogeneous and heterogeneous equilibria. Give examples. (2)

22. Arrange the following in the increasing order of acidic strength: (2)

i) HBr, HCl, HF, HI
ii) H_2O, HF, CH_4, NH_3

23. What do you mean by dibasic acids and diacidic bases. Give examples. (2)

24. State Law of chemical equilibrium and write an expression for K_c for the reaction. (2)

$$4NO(g) + 6H_2O(g) \rightleftharpoons 4NH_3(g) + 5O_2(g)$$

25. The ionization of hydrochloric in water is given below: (2)

$$HCl(aq) + H_2O\ (l) \rightleftharpoons H_3O^+\ (aq) + Cl^-\ (aq)$$

Label two conjugate acid-base pairs in this ionization.

26. Give the definitions for acids in terms of: (3)

i) Arrhenius concept
ii) Bronsted-Lowry concept
iii) Lewis concept

27. Describe the effect on the equilibrium of the exothermic reaction: (3)

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

a) addition of H_2 b) increasing temperature c) Increasing pressure

28. Calculate the pH of: (3)

a) 0.01 M HCl b) 1 M HNO_3 c) 0.001M KOH

29. PCl_5, PCl_3 and Cl_2 are at equilibrium at 550K and having concentration (3)

$[PCl_3] = [Cl_2] = 1.6$ M and $K_c = 2.0$. Calculate $[PCl_5]$

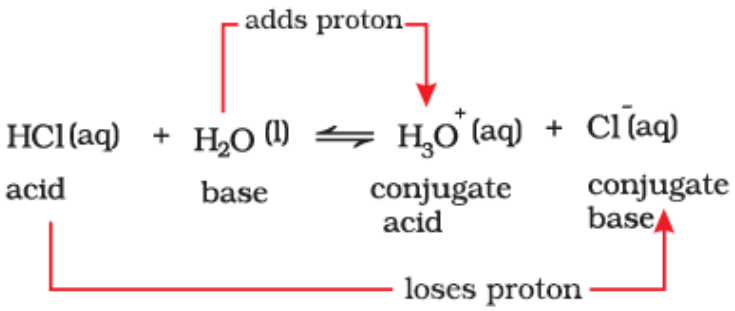
$$PCl_5 \rightleftharpoons PCl_3 + Cl_2$$

30. The values of K_{sp} of two sparingly soluble salts $Sr(OH)_2$ and AuCN are 4.0×10^{-6} and 1×10^{-8} respectively. Which salt is more soluble? Explain. (3)

ANSWERS

1.	ii
2.	i
3.	i
4.	iii
5.	iv
6.	ii
7.	iv
8.	a
9.	b
10.	d
11.	$Q_c = [C]^c[D]^d / [A]^a[B]^b$
12.	Net reaction goes from left to right
13.	$Qc = Kc$
14.	Predicting the Extent of a Reaction, Predicting the Direction of the Reaction, Calculating Equilibrium Concentrations (Any two)
15.	$\Delta G^o = -2.303RT \log Kc$
16.	A change in any of the factors that determine the equilibrium conditions of a system will cause the system to change in such a manner so as to reduce or to counteract the effect of the change.

17.	1×10^{-7} mol L^{-1}
18.	The mass of a gas dissolved in a given mass of a solvent at any temperature is proportional to the pressure of the gas above the solvent.
19.	A shift in equilibrium on adding a substance that provides more of an ionic species already present in the dissociation equilibrium.
20.	The solutions which resist change in pH on dilution or with the addition of small amounts of acid or alkali are called Buffer Solutions. Eg:- A mixture of acetic acid and sodium acetate, A mixture of ammonium chloride and ammonium hydroxide etc.
21.	In a homogeneous system, all the reactants and products are in the same phase. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ Equilibrium in a system having more than one phase is called heterogeneous equilibrium. $H_2O(l) \rightleftharpoons H_2O(g)$
22.	i) HF < HCl < HBr < HI ii) $CH_4 < NH_3 < H_2O < HF$
23.	Dibasic acids have two ionizable protons per molecule of the acid. Eg:- H_2SO_4 Diacidic bases have two ionizable OH^- per molecule of the base. Eg:- $Ca(OH)_2$
24.	At a given temperature, the product of concentrations of the reaction products raised to the respective stoichiometric coefficient in the balanced chemical equation divided by the product of concentrations of the reactants raised to their individual stoichiometric coefficients has a constant value. This is known as the Equilibrium Law or Law of Chemical Equilibrium. $K_c = \frac{[NH_3]^4[O_2]^5}{[NO]^4[H_2O]^6}$

25.	
26.	i) According to Arrhenius theory, acids are substances that dissociates in water to give hydrogen ions and bases are substances that produce hydroxyl ions ii) According to Brönsted-Lowry theory, acid is a substance that is capable of donating a hydrogen ion H^+ and bases are substances capable of accepting a hydrogen ion, H^+. iii) According to Lewis theory, acid as a species which accepts electron pair and base which donates an electron pair.
27.	a) Equilibrium shifts to the right (Product side). b) Equilibrium shifts to the left (Reactant side). c) Equilibrium shifts to the right (Product side).
28.	pH = - log $[H^+]$ a) -2 b) 0 c) 11
29.	$[PCl_5] = \frac{[PCl_3][Cl_2]}{K_c}$ $= \frac{1.6 \times 1.6}{2}$ = 1.28 M

30.	For $Sr(OH)_2$, molar solubility, $4S^3 = 4.0 \times 10^{-6}$ $S = 1 \times 10^{-2}$ For AuCN, molar solubility, $S^2 = 1 \times 10^{-8}$ $S = 1 \times 10^{-4}$ Since molar solubility of $Sr(OH)_2$ is greater than that of AuCN, **$Sr(OH)_2$ is more soluble.**

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