INDIAN SCHOOL AL WADI AL KABIR

Class: XI	**Department: SCIENCE 2021 – 22** **SUBJECT : CHEMISTRY**	**Date of submission:** **13.12.2021**
Worksheet No: 11 **WITH ANSWERS**	**Chapter: EQUILIBRIUM**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT	**CLASS & SEC:**	**ROLL NO.**

MULTIPLE CHOICE QUESTIONS

1. In a reversible chemical reaction at equilibrium, if the concentration of any one of the reactants is doubled, then the equilibrium constant will
   a. also be doubled
   b. be halved
   c. remains the same
   d. becomes one-fourth.

2. Among the following the weakest Bronsted base is
   a. F^-
   b. Cl^-
   c. Br^-
   d. I^-

3. The relationship between Kc and Kp is

   $Kp = Kc(RT)^{\Delta n}$

   What would be the value of Δn for the reaction, $NH_4Cl\ (s) \rightleftharpoons NH_3\ (g) + HCl\ (g)$

   a. 1 b. 0.5 c. 1.5 d. 2

4. 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.

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

   a. $\Delta H > 0$ for the reaction
   b. $\Delta H < 0$ for the reaction
   c. $\Delta H = 0$ for the reaction
   d. The sign of ΔH cannot be predicted.

5. The reaction quotient Qc is used to

   a. predict the direction of the reaction.
   b. calculate the equilibrium concentraton

c. calculate the equilibrium constant.
d. predict the extent of a reaction on the basis of its magnitude.

6. Which of the following are electrolytes?

i. Sugar solution
ii. Sodium chloride
iii. Acetic acid
iv. Starch solution

a. i and iv
b. ii and iii
c. ii and iv
d. I and iii

7. Acidity of BF_3 can be explained on the basis of which of the following concepts?
a. Arrhenius concept
b. Bronsted Lowry concept
c. Lewis concept
d. Bronsted Lowry as well as Lewis concept.

Questions 8 - 10 are *Assertion Reason* type questions

a. If both *Assertion* and *Reason* are correct and *Reason* is the correct explanation of *Assertion*.
b. If both *Assertion* and *Reason* are correct but *Reason* is not the correct explanation of *Assertion*.
c. If *Assertion* is correct and *Reason* is wrong.
d. If *Assertion* is wrong and *Reason* is correct.

8. Assertion: An aqueous solution of ammonium acetate can act as a buffer.
. Reason: Acetic acid is a weak acid and NH4OH is a weak base.

9. Assertion: Increasing order of acidity of hydrogen halides is HF <HCl<HBr< HI
Reason: 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.

10. Assertion: The ionisation of H_2S in water is low in the presence of hydrochloric acid.
Reason: Hydrogen sulphide is a weak acid.

2 Marks Questions

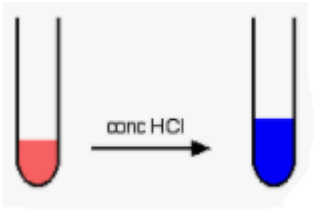
11. The ionization of hydrochloric in water is given below:

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

Label two conjugate acid-base pairs in this ionization.

12. $[Co(H_2O)_6]^{2+}$ (aq) + $4Cl^-$ (aq) $\rightleftharpoons$ $[CoCl_4]^{2-}$ (aq) + $6H_2O$ (l) $\quad \triangle H = +ve$

(pink) (blue)



Predict the colour change in the above reaction in the following situations.

i. When [H_2O] is removed –

ii. When $AgNO_3$ is added –

iii. When pressure is increased –

iv. When temperature is decreased -

13. State Law of chemical equilibrium and write an expression for K_c for the reaction.

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

3 Marks Questions

14. 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.

15. Describe the effect on the equilibrium of the exothermic reaction:

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

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

16. Calculate the pH of:
a. 0.01 M HCl b. 1 M HNO_3 c. 0.001M KOH

5 Marks Questions

17. a. What is a Buffer solution? Give an example.
b. Differentiate between Homogeneous and heterogeneous equilibria. Give examples

c. PCl_5, PCl_3 and Cl_2 are at equilibrium at 550K and having concentration

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

$$PCl_5 \rightleftharpoons PCl_3 + Cl_2$$

18. a. If pH of a solution is 7, calculate its pOH value.
b. The value of Kc for the reaction $2A \rightleftharpoons B + C$ is 2×10^{-3}. At a given time, the composition of the reaction mixture is A = B = C = 3×10^{-4} M. In which direction the reaction will proceed?

c. The equilibrium constant for the reaction $H_2O + CO \rightleftharpoons H_2 + CO_2$ is 0.44 at 1260K. What will be the value of the equilibrium constant for the reaction?

$2H_2 (g) + 2CO_2 (g) \rightleftharpoons 2CO(g) + 2H_2O (g)$ at 1260 K

PASSAGE BASED QUESTIONS

Chemical equilibrium is the state in which both reactants and products are present in concentrations which have no further tendency to change with time, so that there is no observable change in the properties of the system.

Le Châtelier's principle predicts the behaviour of an equilibrium system when changes to its reaction conditions occur. Chemical equilibrium can be homogeneous or heterogeneous.
The type of equilibrium involving ions in aqueous solution is called ionic equilibrium.
Acids, bases and salts come under the category of electrolytes and may act as either strong or weak electrolytes.
The extent of dissociation of an acid depends on the strength and polarity of the H-A bond.

19. The correct increasing order of acidic character of the species is

a. $HF < H_2O = NH_3 < CH_4$
b. $CH_4 = NH_3 < H_2O <HF$
c. $HF > H_2O > NH_3 > CH_4$
d. $CH_4 < NH_3 < H_2O < HF$

20. The concentration of hydrogen ion in a sample of soft drink is 10^{-3} M. What is its pH?

a. -3

b. 3

c. -1

d. 10

21. The solubility of AgCl _____ when NaCl is added to a saturated solution of AgCl.

a. decreases
b. increases
c. remains same
d. increases and then decreases

22. Predict the direction for the following equilibrium reaction in the given situation.

$2HI (g) \rightleftharpoons H_2 (g) + I_2 (g)$ $\triangle H$ = -ve

Colourless purple

i. When [HI] is increased

ii. When p is decreased

iii. When temperature is increased

iv. When a catalyst is added.

a. i – forward, ii – backward, iii – backward, iv – forward

b. i – backward, ii – backward, iii – backward, iv – No change

c. i – forward, ii – No change, iii – backward, iv – No change

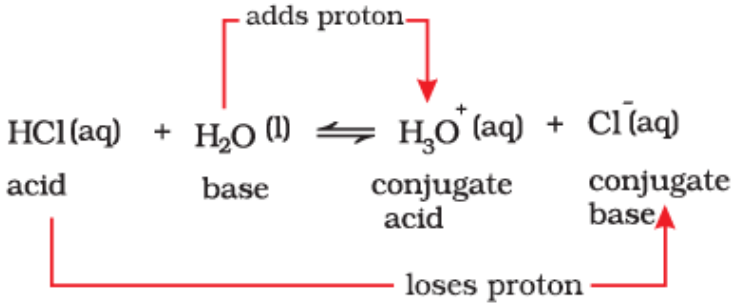
d. i – forward, ii – forward, iii – backward, iv – No change

23. What generalisation can you make about the following reaction.

$H_2(g) + Br_2(g) \rightleftharpoons 2HBr\ (g)$ at 300 K

$K_c > 5.4 \times 10^{18}$

a. The products predominate over reactants
b. The reaction proceeds nearly to completion.
c. The high value of K is suggestive of a high concentration of products.
d. All of the above.

Q.No:	Answers	Marks
1	c	1
2	d	1
3	d	1
4	a	1
5	a	1
6	b	1
7	c	1
8	d	1
9	a	1
10	b	1
11		2
12	i – blue , ii – pink , iii – No effect , iv – pink	2
13	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	2

	the Equilibrium Law or Law of Chemical Equilibrium. $$K_c = \frac{[NH_3]^4[O_2]^5}{[NO]^4[H_2O]^6}$$	
14	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.**	3
15	a. Equilibrium shifts to the right (Product side). b. Equilibrium shifts to the left (Reactant side). c. Equilibrium shifts to the right (Product side).	3
16	$pH = - \log [H^+]$ a. -2 b. 0 c. 11	3
17	**a.** 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 b. 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. $H_2O(l) \rightleftharpoons H_2O(g)$ c. $[PCl_5] = \frac{[PCl_3][Cl_2]}{K_c}$ $= \frac{1.6 \times 1.6}{2}$	1 2 2

	= 1.28 M	
18	a. pH + pOH = 14 pH = 7 given then pOH = 14 -7 = 7. b. $Qc=[B][C]/[A]^2$ Qc – 1 This suggests that Qc is greater than Kc so the reaction will proceed in reverse reaction. c. The reaction is reversed and also doubled $Kc = \left(\frac{1}{0.44}\right)^2 = \underline{\underline{5.16}}$	1 2 2
19	d	1
20	b	1
21	a	1
22	c	1
23	d	1

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