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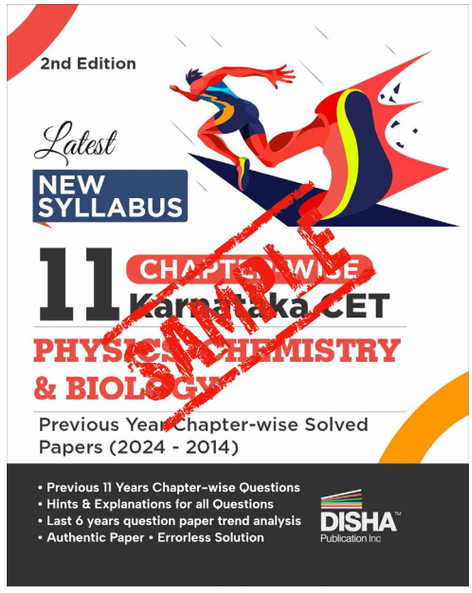

ISBN - 978-9362251664

MRP- 240/-

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Chapter

6

Equilibrium

1. At 500 K, for a reversible reaction **[2023]**

$A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$

in a closed container,

$K_C = 2 \times 10^{-5}$. In the presence of catalyst, the equilibrium is attaining 10 times faster. The equilibrium constant K_C in the presence of catalyst at the same temperature is

(a) 2×10^{-4} (b) 2×10^{-6}

(c) 2×10^{-10} (d) 2×10^{-5}

2. A weak acid with pK_a 5.9 and weak base with pK_b 5.8 are mixed in equal proportions. pH of the resulting solution is **[2023]**

(a) 7.005 (b) 7.5 (c) 7 (d) 7.05

3. 1 mole of HI is heated in a closed container of capacity of 2 L. At equilibrium half a mole of HI is dissociated. The equilibrium constant of the reaction is **[2022]**

(a) 0.25 (b) 0.35 (c) 1 (d) 0.5

4. Which among the following has highest pH? **[2022]**

(a) 1 M H_2SO_4 (b) 0.1 M NaOH

(c) 1 M HCl (d) 1 M NaOH

5. For the reaction **[2021]**

$A(g) + B(g) \rightleftharpoons C(g) + D(g)$; ΔH = Q kJ

The equilibrium constant cannot be disturbed by

(a) addition of A

(b) addition of D

(c) increasing of pressure

(d) increasing of temperature.

6. K_a values for acids H_2SO_3, HNO_2, CH_3COOH and HCN are respectively 1.3×10^{-2}, 4×10^{-4}, 1.8×10^{-5} and 4×10^{-10}, which of the above acids produce stronger conjugate base in aqueous solution? **[2021]**

(a) H_2SO_3 (b) HNO_2

(c) CH_3COOH (d) HCN

7. The conjugate base of NH_3 is **[2020]**

(a) NH_4OH (b) NH_2OH

(c) NH_2^- (d) NH_4^+

8. Which of the following is the strongest base? **[2020]**

(a) Cl^- (b) OH^-

(c) CH_3O^- (d) CH_3COO^-

9. Solubility of AgCl is least in **[2019]**

(a) 0.1 M NaCl (b) pure water

(c) 0.1 M $BaCl_2$ (d) 0.1 M $AlCl_3$

10. The relationship between K_p and K_c is $K_p = K_c(RT)^{\Delta n_g}$. What would be the value of Δn for the reaction, $NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$? **[2018]**

(a) 1 (b) 0.5 (c) 1.5 (d) 2

11. Acidity of BF_3 can be explained on which of the following concepts? **[2018]**

(a) Arrhenius concept

(b) Bronsted Lowry concept

(c) Lewis concept

(d) Bronsted Lowry as well as Lewis concept

12. The reaction quotient, 'Q_c' is useful in predicting the direction of the reaction. Which of the following is incorrect? **[2017]**

(a) If $Q_c > K_c$, the reverse reaction is favoured.

(b) If $Q_c < K_c$, the forward reaction is favoured.

(c) If $Q_c > K_c$, forward reaction is favoured.

(d) If $Q_c = K_c$, no reaction occur.

13. The equilibrium constant for the reaction, $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ is 4×10^{-4} at 2000 K. In presence of a catalyst, the equilibrium is attained ten times faster. Therefore, the equilibrium constant in presence of catalyst at 2000 K is **[2017]**

(a) 4×10^{-3} (b) 40×10^{-4}

(c) 4×10^{-4} (d) 4×10^{-2}

14. In the reaction,

$$Fe(OH)_3(s) \rightleftharpoons Fe^{3+}(aq) + 3OH^-(aq),$$

if the concentration of OH^- ions is decreased by 1/4 times, then the equilibrium concentration of Fe^{3+} will increase by **[2016]**

(a) 8 times (b) 16 times

(c) 64 times (d) 4 times.

15. Equilibrium constants K_1 and K_2 for the following equilibria

(1) $NO(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO_2(g)$

(2) $2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$

are related as: **[2016]**

(a) $K_1 = \sqrt{K_2}$ (b) $K_2 = \frac{1}{K_1}$

(c) $K_1 = 2K_2$ (d) $K_2 = \frac{1}{K_1^2}$

16. The pair of compound which cannot exist together in solution is **[2015]**

(a) $NaHCO_3$ and H_2O

(b) Na_2CO_3 and NaOH

(c) $NaHCO_3$ and NaOH

(d) $NaHCO_3$ and Na_2CO_3

17. In presence of HCl, H_2S results the precipitation of group-2 elements but not group-4 elements during qualitative analysis. It is due to **[2015]**

(a) higher concentration of H^+

(b) lower concentration of H^+

(c) higher concentration of S^{2-}

(d) lower concentration of S^{2-}

18. One mole of ammonia was completely absorbed in one litre solution each of (1) 1 M HCl, (2) 1 M CH_3COOH and (3) 1 M H_2SO_4 at 298 K. The decreasing order for the pH of the resulting solutions is

(Given : K_b (NH_3) = 4.74) **[2014]**

(a) 2 > 3 > 1 (b) 1 > 2 > 3

(c) 2 > 1 > 3 (d) 3 > 2 > 1

19. For the equilibrium,

$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$; K_p = 1.64 atm at 1000 K 50 g of $CaCO_3$ in a 10 litre closed vessel is heated to 1000 K. Percentage of $CaCO_3$ that remains unreacted at equilibrium is

(Given : R = 0.082 L atm K^{-1} mol^{-1}) **[2014]**

(a) 40 (b) 50 (c) 60 (d) 20

ANSWER KEYS																			
1	(d)	**2**	(d)	**3**	(a)	**4**	(d)	**5**	(a,b,c)	**6**	(d)	**7**	(c)	**8**	(c)	**9**	(d)	**10**	(d)
11	(c)	**12**	(c)	**13**	(c)	**14**	(c)	**15**	(d)	**16**	(c)	**17**	(d)	**18**	(c)	**19**	(c)		

Chapter

6

Equilibrium

1. **(d)** The value of the equilibrium constant is not affected by the presence of a catalyst. It is the rate constant that changes.

2. **(d)** $pH = \frac{1}{2}pK_w + \frac{1}{2}pK_a - \frac{1}{2}pK_b$

$= \frac{1}{2}[pK_w + pK_a - pK_b]$

$= \frac{1}{2}(14 + 5.9 - 5.8) = 7.05$

3. **(a)** $2HI \rightleftharpoons H_2 + I_2$

At eqm. $1 - \frac{1}{2} = \frac{1}{2}\ \frac{1}{4}\ \frac{1}{4}$

$[H_2] = \frac{1}{2} \times \frac{1}{2}$ mol/L

$[H_2] = \frac{1}{4} \times \frac{1}{2} mol/L; [I_2] = \frac{1}{4} \times \frac{1}{2} mol/L$

$K_c = \frac{[H_2][I_2]}{[HI]^2} = \frac{\frac{1}{8} \times \frac{1}{8}}{\left(\frac{1}{4}\right)^2} = \frac{4 \times 4}{8 \times 8} = \frac{1}{4} = 0.25$

4. **(d)** H_2SO_4 and HCl are acids, so pH will be lower than 7. Since 1 mole of NaOH dissociates to give 1 mole of Na^+ and OH^- ions in aqueous solution.

NaOH = $[OH^-]$ = 0.1

pOH = $-\log[OH^-] = -\log[0.1] = 1$

pH = 14 – 1 = 13

For 1 M NaOH, $[OH^-] = 1$

pOH = $-\log[OH^-] = 0$

$\Rightarrow$ pH = 14

5. **(a, b, c)** According to van't Hoff equation, temperature is the only factor which can change the equilibrium constant while pressure and concentration can affect the equilibrium only.

6. **(d)** Acidic strength = K_a

The conjugate base of a weakest acid is strongest. Since HCN is having least K_a value, this is the weakest acid and gives strongest base.

7. **(c)** Conjugate base is formed by removal of a proton.

Hence conjugate base of NH_3 is NH_2^-.

$NH_3 \xrightarrow{-H^+} NH_2^-$

8. **(c)** CH_3O^- is the strong conjugate base of CH_3OH (weak acid).

9. **(d)** Concentration of common ion

$\propto \frac{1}{\text{solubility}}$

In 0.1 M $AlCl_3$, the concentration of common ion *i.e.*, Cl^- is high, therefore AgCl will be least soluble in this solution.

10. **(d)** $K_p = K_c (RT)^{\Delta n_g}$

Δn_g = sum of the stoichiometric coefficient of gaseous products – sum of stoichiometric coefficients of gaseous reactants

$\Delta n_g = 2 - 0 = 2$

11. **(c)** According to Lewis concept, acid can accept a pair of electrons and base can donate a pair of electrons. Thus, as BF_3 has six electrons in its valence shell, so it can accept an electrons pair and acts as Lewis acid.

12. **(c)**

(a) If $Q_c > K_c$, the reaction will proceed from right to left *i.e.*, reverse reaction is favoured.

(b) If $Q_c < K_c$, the reaction will proceed from left to right *i.e.*, forward reaction is favoured.

(d) If $Q_c = K_c$, the reaction is already at equilibrium and no reaction occurs.

13. **(c)** Equilibrium constant is independent of the presence of catalyst. This is so because the catalyst affects the rates of forward and backward reactions equally.

14. **(c)** $K_c = [x]\ [3x]^3$ ...(i)

When concentration of OH^- ions is decreased by $\frac{1}{4}$ times,

$K_c = [x'][\frac{3x}{4}]^3$ ...(ii)

Equating eq. (i) and (ii)

$$x \times (3x)^3 = x' \left(\frac{3x}{4}\right)^3$$

$64x = x'$

15. (d) $NO(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO_2(g)\, K_1$ ...(i)

$2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g); K_2$ ...(ii)

Equation (ii) can be obtained by multiplying equation (i) by 2 and reversing it. Therefore, K_1 and K_2 are related as $K_2 = \frac{1}{K_1^2}$

16. (c) $NaHCO_3$ being an acidic salt will react with NaOH.

$NaHCO_3 + NaOH \rightarrow Na_2CO_3 + H_2O$

17. (d) Dissociation of H_2S is suppressed in presence of HCl due to common ion effect. This decreases the S^{2-} ion concentration and hence, only group II radicals having low solubility product are precipitated.

18. (c) $\xrightarrow[CH_3COOH > HCl > H_2SO_4]{\text{Decreasing order of pH}}$

$\xrightarrow[\text{Increasing acidic strength}]{(2)\quad (1)\quad (3)}$

19. (c) For the reaction,

$CaCO_3(s) \Rightarrow CaO(s) + CO_2(g)$

$K_c = [CO_2]$ or $K_p = P_{CO_2}$

No. of moles of $CaCO_3(s)$

$$= \frac{\text{Mass}}{\text{Mol. mass}} = \frac{50}{100} = 0.5$$

Applying ideal gas equation, PV = nRT

$1.64 \times 10 = n \times 0.082 \times 1000$

No. of moles of CO_2, n = 0.2

No. of moles of unreacted $CaCO_3 = 0.5 - 0.2$

= 0.3 % of unreacted $CaCO_3$

$$= \frac{0.3}{0.5} \times 100 = 60\%$$

Chapter

4

Animal Kingdom

1. Identify, the phylum which shows the following characteristics: **[2024]**

1. Animals are exclusively marine, radially symmetrical and diploblastic.
2. Body bears eight external rows of ciliated comb plates which help in locomotion.
3. Digestion is both extracellular and intracellular.
4. Reproduction only by sexual modes.

(a) Coelenterate (b) Mollusca
(c) Arthropoda (d) Ctenophora

2. Flame cells present in the members of platyhelminths are specialized to perform, **[2023]**

(a) Respiration and Osmoregulation
(b) Osmoregulation and Circulation
(c) Osmoregulation and Excretion
(d) Respiration and Excretion

3. Function of contractile vacoule im Amoeba is **[2023]**

(a) Digestion and excretion
(b) Excretion and osmoregulation
(c) Digestion and respiration
(d) Osmoregulation and movements

4. Different types of respiratory organs like gills, book gills, book lungs and trachea are present in **[2022]**

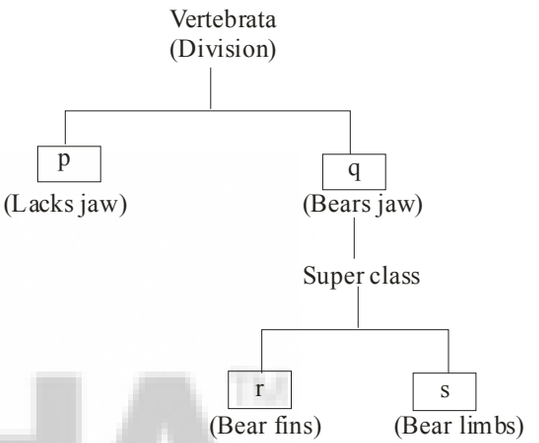
(a) arthopods (b) sponges
(c) annelids (d) molluscus

5. Identify the correct statements / regarding class aves. **[2021]**

I. Forelimbs are modified into wings and hindlimbs are modified for walking and swimming.
II. Heart is completely four chambered.
III. They are homeotherms.
IV. They are oviparous and development is direct.

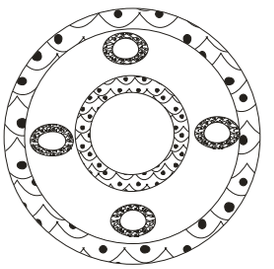
(a) Both I and III (b) Both I and IV
(c) I, II and III (d) All are correct

6. Observe the following simplified scheme and choose the correct option that matches with the letters given in the boxes. **[2020]**



(a) *p* -Agnatha, *q* - Gnathostamata, *r*- Tetrapoda, *s*- Pisces,
(b) *p* -Agnatha, *q*-Gnathostamata, *r* -Pisces, *s*- Tetrapoda,
(c) *p*-Gnathostamata, *q*-Agnatha, *r*- Tetrapoda, *s*- Pisces,
(d) *p*-Tetrapoda, *q*-Pisces, *r*-Gnathostamata, *s*-Agnatha,

7. Which of the following phyla possess body cavity as shown in the diagram below? **[2019]**



(a) Annelida (b) Porifera
(c) Aschelminthes (d) Coelenterata

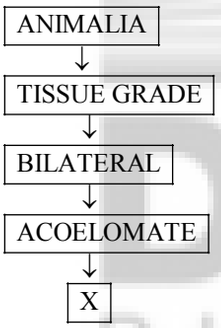
8. Match the animals of Column I with their respective classes in Column II and choose the correct answer. **[2018]**

Column I	**Column II**
(A) *Aptenodytes*	(p) Aves
(B) *Hemidactylus*	(q) Chondrichthyes
(C) *Carcharodun*	(r) Mammalia
(D) *Pteropus*	(s) Reptilia
	(t) Osteichthyes

Select the code for the correct answer from the options given below.

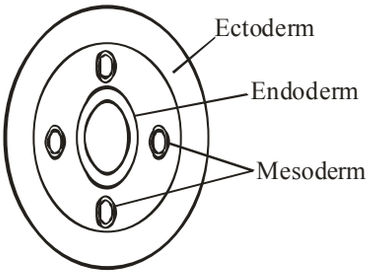
	(A)	**(B)**	**(C)**	**(D)**
(a)	(t)	(q)	(s)	(p)
(b)	(p)	(s)	(r)	(q)
(c)	(t)	(p)	(q)	(r)
(d)	(p)	(s)	(q)	(r)

9. Identify the Phylum X. **[2015]**



(a) Hemichordata
(b) Aschelminthes
(c) Platyhelminthes
(d) Ctenophora

10. The kind of coelom reprensented in the diagram given below is characteristic of **[2014]**



(a) round worm
(b) earthworm
(c) tape worm
(d) cockroach.

ANSWER KEYS																			
1	(d)	**2**	(c)	**3**	(b)	**4**	(a)	**5**	(d)	**6**	(b)	**7**	(c)	**8**	(d)	**9**	None	**10**	(a)

Chapter

4

Animal Kingdom

1. **(d)** Phylum ctenophora exhibit the mentioned features.
2. **(c)** Flame cells present in the members of platyhelminthes are specialized to perform osmoregulation and excretion.
3. **(b)** Function of contractile vacoule im Amoeba is excretion and osmoregulation.
4. **(a)** Respiratory organs like gills, book gills, books lungs and trachae are present in arthopods.
5. **(d)** Members of class Aves are homeothermic or warm-blooded. Their forelimbs are modified into wings and help in flying while hind limbs or legs are well adapted for perching, walking and swimming, The heart of the birds is four - chambered. They are oviparous and fertilisation takes place internally. Therefore all statements are correct.
6. **(b)** The correct option that matches with letters are:
   p – Agantha
   q – Gnasthostamata
   r – Pisces,
   s – Tetrapoda
7. **(c)** Pseudocoelomate body cavity is shown in the figure. This is found in aschelminthes or roundworms.
8. **(d)** *Aptenodytes*, commonly known as Penguin belongs to the Class Aves. *Hemidactlylus*, commonly known as house lizard, belongs to class Reptilia. *Carcharodon* commonly known as Great white shark, belongs to the super class Pisces and class Chondricthyes. *Pteropus*, commonly known as flying fox, belongs to the class Mammalia.
9. All the given options are incorrect
   Hemichordata, Aschelminthes and Platyminthes show organ system level of organisation, i.e., Organ get associated to form functional systems, each system concerned with a specific physiology function. Ctenophores have tissue grade level of organisation but are biradially symmetrical, i,e., (radial + bilateral).
10. **(a)** The given figure depicts a pseudocoelom. Round worms which belongs to Phyllum Aschelminthes. They are bilaterally symmetrical, triploblastic and pseudocoelomate animals.