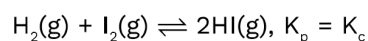


Equilibrium

1. **Assertion (A):** For the reaction,



Reason (R): K_p of all gases reactions is equal to K_c .

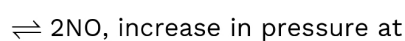
- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

2. **Assertion (A):** A net reaction can occur only if a system is not at equilibrium.

Reason (R): All reversible reactions occur to reach a state of equilibrium.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

3. **Assertion (A):** For the reaction, $\text{N}_2 + \text{O}_2$



equilibrium has no effect on the reaction.

Reason (R): Σ moles of gaseous product $- \Sigma$ moles of gaseous reactant = 0.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

4. **Assertion (A):** The reaction quotient, Q has the same form as the equilibrium constant K_{eq} , and is evaluated using any given concentrations of the species involved in the reaction, and not necessarily equilibrium concentrations.

Reason (R): If the numerical value of Q is not the same as the value of equilibrium constant, a reaction will occur.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

5. **Assertion (A):** If the equation for a reaction is reversed, the equilibrium constant is inverted and if the equation is multiplied by 2, the equilibrium constant is squared.

Reason (R): The numerical value of an equilibrium constant depends on the way the equation for the reaction is written.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

6. **Assertion (A):** $K_p = K_c$ for all reactions.

Reason (R): At constant temperature, the pressure of the gas is not proportional to the concentration.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false



7. **Assertion (A):** A catalyst does not influence the values of equilibrium constant.

Reason (R): Catalysts influence the rate of both forward and backward reactions equally.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

8. **Assertion (A):** For

$\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$. If more Cl_2 is added the equilibrium will shift in backward direction hence equilibrium constant will decrease.

Reason (R): Addition of inert gas to the equilibrium mixture at constant volume, alter the equilibrium.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

9. **Assertion (A):** For a reaction at equilibrium, the Gibb's free energy of reaction is minimum at constant temp. and pressure.

Reason (R): The Gibb's free energy of both reactants and products increases and become equal at equilibrium.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

10. **Assertion (A):** If $Q_P < K_P$ reaction moves in direction of products.

Reason (R): Reaction quotient is defined in the same way as equilibrium constant at any stage of the reaction.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

11. **Assertion (A):** Among HCl , H_2SO_4 and HClO_4 , HClO_4 is the strongest acid.

Reason (R): HClO_4 ionizes to maximum extent when dissolved in glacial acetic acid.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

12. **Assertion (A):** pH of x M HCl is less than pH of x M CH_3COOH .

Reason (R): The degree of ionization of HCl and CH_3COOH are equal at infinite dilution.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

13. Assertion (A): The degree of dissociation of a weak base increases on dilution.

Reason (R): The value of K_b increases on dilution

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

14. Assertion (A): The conjugate acid base pair differ by a proton.

Reason (R): NH_2^- and NH_4^+ are conjugate acid base pair.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

15. Assertion (A): Phenolphthalein is used as an indicator in the titration of weak acid with NaOH.

Reason (R): Near the end point, the pH of the solution is alkaline due to hydrolysis of anion.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

16. Assertion (A): The degree of dissociation of CH_3COOH is more in a solution which is basic than in water.

Reason (R): K_a of CH_3COOH increases in basic solution.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

17. Assertion (A): Addition of HCl (aq.) to HCOOH (aq.) decrease to ionization of HCOOH (aq.).

Reason (R): Due to common ion effect of H^+ , ionization of HCOOH decrease.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

18. Assertion (A): pH of 10^{-7} M HCl is less than 7 at 25°C .

Reason (R): At very low concentration of HCl, contribution of H^+ from water is considerable.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

19. **Assertion (A):** Solubility of sparingly soluble salt decreases due to common ion effect.

Reason (R): Solubility product constant does not depend on common ion effect.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

20. **Assertion (A):** Solubility of AgCl in $\text{NH}_3(\text{aq.})$ is greater than in pure water.

Reason (R): When AgCl dissolve in $\text{NH}_3(\text{aq.})$, complex ion formation

$\text{Ag}(\text{NH}_3)_2^+$ takes place and solubility equilibria of AgCl shifted in forward direction.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

21. **Assertion (A):** H_3PO_3 is a dibasic acid and its salt Na_3PO_3 does not exist.

Reason (R): Being dibasic nature, only two H are replaceable.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

22. **Assertion (A):** The aqueous solution of $\text{CF}_3\text{COO}^-\text{Na}^+$ is more basic than the

aqueous solution of $\text{CH}_3\text{COO}^-\text{Na}^+$ for same concentration of salt.

Reason (R): The salt derived from weak acid and strong base hydrolyses to generate acidic solution.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
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- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

23. **Assertion (A):** According to principle of common ion effect, the solubility of HgI_2 is expected to be less in an aqueous solution of KI than in water. But HgI_2 dissolves in an aqueous solution of KI to form a clear solution.

Reason (R): Iodide ion, I^- is highly polarizable.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
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- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

24. **Assertion (A):** pH of HCl solution is less than that of acetic acid solution of the same concentration.

Reason (R): In equimolar solutions, the number of titrable protons present in HCl acid is less than that present in acetic acid.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false



25. **Assertion (A):** On increasing temperature pH of H_2O decreases.

Reason (R): At high temperature water become acidic.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

26. **ASSERTION (A):** The dissociation constant of polyprotic acid are in the order $K_1 > K_2 > K_3$.

REASON (R): The $[H^+]$ furnished in 1st step of dissociation exerts common ion effect to reduce 2nd dissociation and so on.

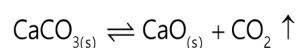
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- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

27. **Assertion (A):** A catalyst (positive) decreases energy of activation of the reaction without changing the position of equilibrium.

Reason (R): By changing the concentration of any of the reactant or product species, the position of equilibrium may change but equilibrium constant will remain the same provided temperature remains constant.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

28. **Assertion (A):** The equilibrium (given below) attained in a closed vessel remains unaltered by the addition of $CaCO_{3(s)}$



Reason (R): The active mass of a solid is a constant and independent of its mass and is always taken to be unity.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
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- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

29. **Assertion (A):** Addition of inert gas to an equilibrium mixture at constant pressure does not effect the equilibrium.

Reason (R): Addition of inert gas at constant pressure decreases the volume of equilibrium mixture.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

30. **Assertion (A):** At an equilibrium $A(g) + 2B(g) \rightleftharpoons C(g)$ if substantial amount of water is added to the mixture and stated that only $A(g)$ gets dissolved to a certain extent in water then equilibrium shifts towards forward direction.

Reason (R): On decreasing the volume of reaction mixture and keeping rest of things same the equilibrium shifts to a direction having more number of gaseous molecules.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false



ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	3	1	1	2	1	4	1	4	3	2	1	2	3	3	1	3	1	1	2	1
Que.	21	22	23	24	25	26	27	28	29	30										
Ans.	1	4	2	3	3	1	2	1	4	4										