

Equilibrium — CBSE Pattern Test 2

Class 11 Chemistry · 90 minutes · 40 marks · Sections A–D with answer key · Narayan Gurukul Academy

Test 2 — CBSE Pattern (90 minutes, 40 marks)

Class 11 Chemistry · Equilibrium · Narayan Gurukul Academy (ClassApna)

General Instructions: (1) This paper has four sections — Section A (1×10), Section B (2×4), Section C (3×4) and Section D (5×2) — total 40 marks. Time allowed: 90 minutes.

(2) All questions are compulsory. No overall choice is given; internal choice, where allowed, is clearly marked.

(3) For MCQ questions choose the single correct option; for VSA answers write a single line.

(4) Take $g = 10 \text{ m/s}^2$. All symbols carry their usual meaning. Use of a calculator is not permitted.

Section A — MCQ & VSA ($10 \times 1 = 10$ marks)

- Equilibrium is dynamic because
 - both reactions continue at equal rates
 - reactions stop
 - only the forward reaction occurs
 - only the backward reaction occurs
- The value of the equilibrium constant depends on
 - temperature
 - pressure
 - initial concentration
 - catalyst
- According to Lewis theory, a base is a
 - electron pair donor
 - proton donor
 - electron pair acceptor
 - proton acceptor
- For a weak acid, the ionisation constant K_a is
 - $\frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$
 - $\frac{[\text{HA}]}{[\text{H}^+][\text{A}^-]}$
 - $\frac{[\text{H}^+]}{[\text{HA}]}$
 - $\frac{[\text{A}^-]}{[\text{HA}]}$
- The relation between K_a and K_b for a conjugate acid-base pair is
 - $K_a \times K_b = K_w$
 - $K_a + K_b = K_w$
 - $K_a = K_b$
 - $K_a/K_b = K_w$
- An acidic buffer is a mixture of
 - a weak acid and its salt with a strong base
 - a strong acid and its salt
 - two weak acids
 - two strong acids
- A sparingly soluble salt precipitates when
 - the ionic product exceeds K_{sp}

- (B) the ionic product is less than K_{sp}
 (C) the ionic product equals zero
 (D) the solution is dilute
8. The common ion effect causes the solubility of a sparingly soluble salt to
 (A) decrease
 (B) increase
 (C) remain constant
 (D) become zero
9. State Ostwald's dilution law.
10. What is the common ion effect?

Section B — Short Answer I ($4 \times 2 = 8$ marks)

11. Write the expression for the equilibrium constant K_c for a general reaction $aA + bB \rightleftharpoons cC + dD$.
12. For a reaction with an increase in the number of moles of gas, what is the effect of increasing pressure?
13. What is the conjugate base of H_2O ?
14. How does the degree of dissociation of a weak acid change on dilution?

Section C — Short Answer II ($4 \times 3 = 12$ marks)

15. Explain the dynamic nature of equilibrium and distinguish between reversible and irreversible reactions.
16. State Le Chatelier's principle and apply it to explain the conditions used in the Haber process.
17. Explain the Arrhenius, Bronsted–Lowry and Lewis concepts of acids and bases with examples, and explain conjugate acid-base pairs.
18. Explain salt hydrolysis for the four types of salts with one example each and state whether the resulting solution is acidic, basic or neutral.

Section D — Long Answers ($2 \times 5 = 10$ marks)

19. State Ostwald's dilution law and derive the expression for the degree of dissociation of a weak electrolyte. Calculate the pH of a 0.1 M acetic acid solution ($K_a = 1.8 \times 10^{-5}$).
20. Define the solubility product. Calculate K_{sp} of AgCl given its solubility is $1.3 \times 10^{-5} \text{ mol L}^{-1}$, and calculate its solubility in 0.01 M NaCl given $K_{sp} = 1.8 \times 10^{-10}$.

Answer Key (Marking Scheme)

- Q1 — (A) both reactions continue at equal rates. Q2 — (A) temperature. Q3 — (A) electron pair donor. Q4 — (A) $\frac{[H^+][A^-]}{[HA]}$.
- Q5 — (A) $K_a \times K_b = K_w$. Q6 — (A) a weak acid and its salt with a strong base. Q7 — (A) the ionic product exceeds K_{sp} . Q8 — (A) decrease.
- Q9 — $\alpha = \sqrt{K_a/c}$ for a weak electrolyte.
- Q10 — The suppression of the ionisation of a weak electrolyte by the addition of a strong electrolyte containing a common ion.
- Q11 — $K_c = \frac{[C]^c[D]^d}{[A]^a[B]^b}$.
- Q12 — The equilibrium shifts backwards (towards fewer moles of gas).
- Q13 — OH^- .

Q14 — It increases.

Q15 — Dynamic nature and reversible/irreversible distinction as in notes.

Q16 — High pressure and moderate temperature favour NH_3 .

Q17 — Three concepts with conjugate pairs as in notes.

Q18 — Four types of salt hydrolysis as in notes.

Q19 — $\alpha = \sqrt{(\text{Ka}/c)}$; $\text{pH} \approx 2.87$.

Q20 — $K_{\text{sp}} = 1.69 \times 10^{-10}$; solubility in 0.01 M NaCl $\approx 1.8 \times 10^{-8}$ M.