Q1. Which of the following will produce a buffer solution when mixed in equal volumes?
(a) 1 mol dm⁻³ NH₄OH and 0.1 mol dm⁻³ HC1
(b) 0.05 mol dm⁻³ NH₄OH and 0.1 mol dm⁻³ HC1
(c) 1 mol dm⁻³ NH₄OH and 0.05 mol dm⁻³ HC1
(d) 1 mol dm⁻³ CH₃COONa and 0.1 mol dm⁻³ NaOH

Sol: (c) In (c), all HC1 will be neutralized and NH_4Cl will be formed. Also, some NH_4OH will be left un neutralized. Thus, the final solution will contain NH_4OH and NH_4Cl and hence will form a buffer.

Q2. In which of the following solvents is silver chloride most soluble?
(a) 0.1 mol dm⁻³ AgNO₃ solution
(b) 0.1 mol dm⁻³ HC1 solution
(c) H₂0
(d) Aqueous ammonia

Sol: (d) Silver chloride forms a soluble complex with aqueous ammonia.
$AgCl + 2NH_3 \rightarrow [Ag(NH_3)_2]Cl$

Q3. What will be the value of pH of 0.01 mol dm⁻³ CH₃COOH (K.ₐ -74 x 10⁻⁵)?
(a) 3.4
(b) 3.6
(c) 3.9
(d) 3.0

Q4. Kₐ for CH₃COOH is 1.8 x 10⁻⁵ and K_b for NH₄OH is 1.8 x 10⁻⁵. The pH of ammonium acetate will be
(a) 7.005
(b) 4.75
(c) 7.0
(d) Between 6 and 7

Sol: (c) Ammonium acetate is a salt of weak acid and weak base.

Q5. Which of the following options will be correct for the stage of half completion of the reaction A ⇌B.
(a) ΔG° = 0
(b) ΔG° > 0
(c) ΔG° < 0
(d) ΔG° = -RT In 2

Sol: (a) A ⇌B
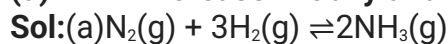ΔG° = -RT In K
At the stage of half completion of reaction [A] = [B],
Therefore, K =1. Thus, ΔG° = 0.

Q6. On increasing the pressure, in which direction will the gas phase reaction proceed to re-establish equilibrium, is predicted by applying the Le Chatelier's principle. Consider the reaction,
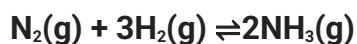
N$_2$(g) + 3H$_2$(g) $\rightleftharpoons$ 2NH$_3$(g)
Which of the following is correct, if the total pressure at which the equilibrium is established, is increased without changing the temperature?
(a) K will remain same
(b) K will decrease
(c) K will increase
(d) K will increase initially and decrease when pressure is very high
Sol: (a) N$_2$(g) + 3H$_2$(g) $\rightleftharpoons$ 2NH$_3$(g)
According to Le Chatelier's principle, at constant temperature, the equilibrium composition will change but K will remain same.

Q7. What will be the correct order of vapour pressure of water, acetone and ether at 30°C? Given that among these compounds, water has maximum boiling point and ether has minimum boiling point.
(a) Water < Ether < Acetone
(b) Water < Acetone < Ether
(c) Ether < Acetone < Water
(d) Acetone < Ether < Water
Sol: (b) Greater the boiling point, less is the vapour pressure. Hence, the correct order of vapour pressures will be:
water < acetone < ether.

Q9. In which of the following reactions, the equilibrium remains unaffected on addition of small amount of argon at constant volume?
(a) H$_2$(g) + I$_2$(g) $\rightleftharpoons$ 2HI(g) '
(b) PCl$_5$(g) $\rightleftharpoons$ PCl$_3$(g) + Cl$_2$(g)
(c) N$_2$(g) + 3H$_2$(g) $\rightleftharpoons$ 2NH$_3$(g)
(d) The equilibrium will remain unaffected in all the three cases.
Sol: (d) The equilibrium will remain unaffected in all three cases on addition of small amount of inert gas at constant volume.