DPP-2 [Vapour Pressure]

Chapter: Solution

"Consistency is the bridge between goals and accomplishment."

TYPE–1 : Basic Concepts of Vapour Pressure

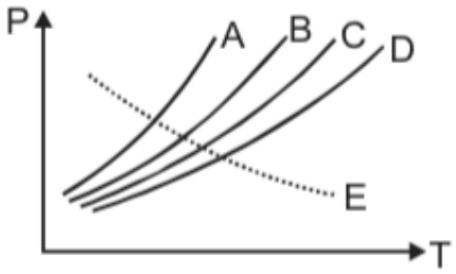
1. **In liquid-gas equilibrium, the pressure of vapours above the liquid is constant at**
   (1) Constant temperature
   (2) Low temperature
   (3) High temperature
   (4) None of these
2. **Vapour pressure is the pressure exerted by vapours**
   (1) In equilibrium with liquid
   (2) In any condition
   (3) In an open system
   (4) In atmospheric conditions
3. **The vapour pressure of water depends upon:**
   (A) Surface area of container
   (B) Volume of container
   (C) Temperature
   (D) All
4. **During evaporation of liquid**
   (1) The temperature of liquid rises
   (2) The temperature of liquid falls
   (3) The temperature of liquid remains unaffected
   (4) The liquid molecules become inert

TYPE–2 : Boiling Point & Vapour Pressure Relationship

1. **The boiling points of C_6H_6, CH_3OH, $C_6H_5NH_2$, and $C_6H_5NO_2$ are 80°C, 65°C, 184°C and 212°C respectively. Which of the following will have highest vapour pressure at room temperature?**
   (1) C_6H_6
   (2) CH_3OH
   (3) $C_6H_5NH_2$
   (4) $C_6H_5NO_2$
2. **The boiling points of C_4H_6, CH_3OH, $C_4H_5NH_2$, and $C_5H_5NO_2$ are 80°C, 65°C, 184°C and 212°C respectively. Which will show highest vapour pressure at room temperature:**
   (1) C_4H_6

(2) CH_3OH
(3) $C_4H_5NH_2$
(4) $C_5H_5NO_2$

3. **The temperature at which the vapour pressure of a liquid equals external pressure is called**
   (1) Freezing point
   (2) Boiling point
   (3) Melting point
   (4) Critical temperature
4. **At higher altitude, the boiling point of water is lowered because**
   (1) Atmospheric pressure is low
   (2) Temperature is low
   (3) Atmospheric pressure increases
   (4) Water solidifies to ice
5. **At higher altitudes, water boils at temperature $< 100°C$ because**
   (A) Temperature at higher altitudes is low
   (B) Atmospheric pressure is low
   (C) The proportion of heavy water increases
   (D) Atmospheric pressure becomes more
6. **Vapour pressure diagram of some liquids plotted against temperature are shown below**



Most volatile liquid
   (1) A
   (2) B
   (3) C
   (4) D
7. **On the basis of intermolecular forces predict the correct order of decreasing boiling points of the compounds:**
   (1) $CH_3OH > H_2 > CH_4$
   (2) $CH_3OH > CH_4 > H_2$
   (3) $CH_4 > CH_3OH > H_2$
   (4) $H_2 > CH_4 > CH_3OH$

TYPE–3 : Volatility & Intermolecular Forces

1. **Among the following substances, the lowest vapour pressure is exerted by:**
   (A) Water

(B) Mercury
(C) Acetone
(D) Ethanol

2. **Which of the following is correct?** **[NSEC-2017]**
A liquid with
(A) low vapour pressure will have a low surface tension and high boiling point
(B) high vapour pressure will have high intermolecular forces and high boiling point
(C) low vapour pressure will have high surface tension and high boiling point
(D) low vapour pressure will have low surface tension and low boiling point

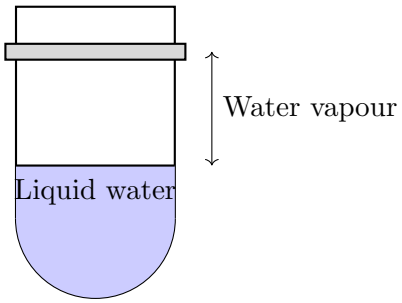
TYPE–4 : Effect of Solute on Vapour Pressure

1. **An aqueous solution is 1.00 molal in KI. Which change will cause the vapour pressure of the solution to increase?**
(1) Addition of water
(2) Addition of NaCl
(3) Addition of Na_2SO_4
(4) Addition of 1.00 molal KI

TYPE–5 : Conceptual & Application Based

1. **A liquid is kept in a closed vessel. If a glass plate (negligible mass) with a small hole is kept on top of the liquid surface, then the vapour pressure of the liquid in the vessel is:**
(A) More than what would be if the glass plate were removed
(B) Same as what would be if the glass plate were removed
(C) Less than what would be if the glass plate were removed
(D) Cannot be predicted

2. **The vapour pressure of water at 20°C is 17.54 mmHg. What will be the vapour pressure of the water in the apparatus shown after the piston is lowered, decreasing the volume of the gas above the liquid to one half of its initial volume (assume temperature constant)?**



(A) 8.77 mmHg
(B) 17.54 mmHg
(C) 35.08 mmHg
(D) Between 8.77 and 17.54 mmHg

TYPE–6 : Numerical Problem

1. **The vapor pressure of water at 80°C is 355 torr. A 100 mL vessel contained water-saturated oxygen at 80°C, the total gas pressure being 760 torr. The contents of the vessel were pumped into a 50.0 mL vessel at the same temperature. What were the partial pressures of oxygen and of water vapor, and what was the total pressure in the final equilibrated state? Neglect the volume of any water which might condense.**

   Ans: $P_{O_2} = 810$ mm Hg, $P_{H_2O} = 355$ mm Hg, $P_{total} = 1165$ mm Hg

   Solution:

   In the 100 mL vessel which contained water-saturated oxygen, the pressure of O_2 gas = 760 – 355 = 405 torr.

   When the contents of this vessel were pumped into a 50 mL vessel at the same temperature, the pressure of oxygen gets doubled (using $P_1V_1 = P_2V_2$):

$$P_{O_2} = 405 \times \frac{100}{50} = 810 \text{ torr}$$

   But pressure of water vapour will remain constant, as some vapour in this 50 mL vessel gets condensed (vapour pressure depends only on temperature, not volume).

   So, $P_{H_2O} = 355$ torr

   Total pressure = 810 + 355 = **1165 torr**