

CHEMISTRY

JEE MAINS
& ADVANCED

CLASS - XII

MODULE - 01

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EXERCISE-IV



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JEE-MAIN

PREVIOUS YEAR'S

- Q.1** 18 g glucose ($C_6H_{12}O_6$) is added to 178.2 g water. The vapour pressure of water (in torr) for this aqueous solution is: **[JEE Main-2016]**
- (1) 7.6 (2) 76.0
(3) 752.4 (4) 759.0
- Q.2** Two reactions R_1 and R_2 have identical pre-exponential factors. Activation energy of R_1 exceeds that of R_2 by 10 kJ mol^{-1} . If k_1 and k_2 are rate constants for reactions R_1 and R_2 respectively at 300 K, then $\ln(k_2/k_1)$ is equal to: ($R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$) **[JEE Main-2017]**
- (1) 8 (2) 12
(3) 6 (4) 4
- Q.3** Liquids A and B form ideal solution in the entire composition range. At 350 K, the vapour pressures of pure A and pure B are $7 \times 10^3 \text{ Pa}$ and $12 \times 10^3 \text{ Pa}$, respectively. The composition of the vapour in equilibrium with a solution containing 40 mole percent of A at this temperature is **[JEE Main-2019 (January)]**
- (1) $X_A = 0.37; X_B = 0.63$ (2) $X_A = 0.28; X_B = 0.72$
(3) $X_A = 0.4; X_B = 0.6$ (4) $X_A = 0.76; X_B = 0.24$
- Q.4** Molecules of benzoic acid (C_6H_5COOH) dimerise in benzene. 'w' g of the acid dissolved in 30g of benzene shows a depression in freezing point equal to 2K. If the percentage association of the acid to form dimer in the solution is 80, then w is :
(Given that $K_f = 5 \text{ K kg mol}^{-1}$, Molar mass of benzoic acid = 122 g mol^{-1}) **[JEE Main-2019 (January)]**
- (1) 2.4 g (2) 1.0 g
(3) 1.5 g (4) 1.8 g
- Q.5** Elevation in the boiling point for 1 molal solution of glucose is 2 K. The depression in the freezing point for 2 molar solution of glucose in the same solvent is 2 K. The relation between K_b and K_f is; **[JEE Main-2019 (January)]**
- (1) $K_b = 1.5 K_f$ (2) $K_b = K_f$
(3) $K_b = 0.5 K_f$ (4) $K_b = 2K_f$
- Q.6** Which one of the following statements regarding Henry's law is not correct? **[JEE Main-2019 (January)]**
- (1) Higher the value of K_H at a given pressure, higher is the solubility of the gas in the liquids
(2) Different gases have different K_H (Henry's law constant) value at the same temperature
(3) The partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution
(4) The value of K_H increases with increase of temperature and K_H is function of the nature of the gas.
- Q.7** The freezing point of diluted milk sample is found to be -0.2°C , while it should have been -0.5°C for pure milk. How much water been added to pure milk to make the diluted sample? **[JEE Main-2019 (January)]**
- (1) 1 cup of water to 2 cups of pure milk
(2) 1 cup of water to 3 cups of pure milk
(3) 1 cup of water to 3 cups of pure milk
(4) 2 cup of water to 3 cups of pure milk
- Q.8** K_2HgI_4 is 40% ionized in aqueous solution. The value of its van't Hoff factor (i) is: **[JEE Main-2019 (January)]**
- (1) 1.6 (2) 1.8
(3) 2.0 (4) 2.2
- Q.9** The vapour pressure of pure liquids A and B are 400 and 600 mmHg, respectively at 298K. On mixing the two liquids, the sum of their initial volumes is equal to the volume of the final mixture. The mole fraction of liquid B is 0.5 in the mixture. The vapour pressure of the final solution, the mole fraction of components A and B in vapour phase, respectively are :- **[JEE Main-2019 (April)]**
- (1) 500 mmHg, 0.5, 0.5 (2) 450 mmHg, 0.4, 0.6
(3) 450 mmHg, 0.5, 0.5 (4) 500 mmHg, 0.4, 0.6
- Q.10** The osmotic pressure of a dilute solution of an ionic compound XY in water is four times that of a solution of 0.01 M $BaCl_2$ in water. Assuming complete dissociation of the given ionic compounds in water, the concentration of XY (in mol L^{-1}) in solution is : **[JEE Main-2019 (April)]**
- (1) 6×10^{-2} (2) 4×10^{-4}
(3) 16×10^{-4} (4) 4×10^{-2}

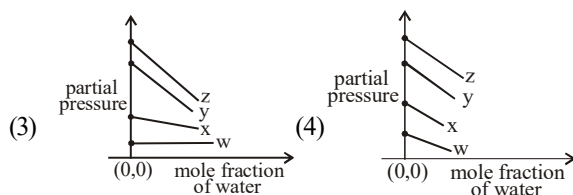
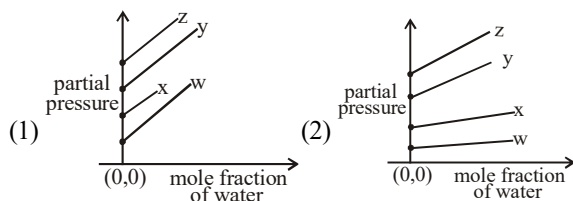
Q.11 Liquid 'M' and liquid 'N' form an ideal solution. The vapour pressures of pure liquids 'M' and 'N' are 450 and 700 mmHg, respectively, at the same temperature. Then correct statement is : **[JEE Main-2019 (April)]**

x_M = Mole fraction of 'M' in solution ;
 x_N = Mole fraction of 'N' in solution ;
 y_M = Mole fraction of 'M' in vapour phase ;
 y_N = Mole fraction of 'N' in vapour phase)

(1) $(x_M - y_M) < (x_N - y_N)$ (2) $\frac{x_M}{x_N} < \frac{y_M}{y_N}$

(3) $\frac{x_M}{x_N} = \frac{y_M}{y_N}$ (4) $\frac{x_M}{x_N} = \frac{y_M}{y_N}$

Q.12 For the solution of the gases w, x, y and z in water at 298K, the Henry's law constants (K_H) are 0.5, 2, 35 and 40 kbar, respectively. The correct plot for the given data is :- **[JEE Main-2019 (April)]**



Q.13 A solution is prepared by dissolving 0.6 g of urea (molar mass = 60 g mol⁻¹) and 1.8 g of glucose (molar mass = 180 g mol⁻¹) in 10 mL of water at 27°C. The osmotic pressure of the solution is : **[JEE Main-2019 (April)]**
 (R = 0.08206 L atm K⁻¹ mol⁻¹)

- (1) 4.92 atm (2) 1.64 atm
 (3) 2.46 atm (4) 8.2 atm

Q.14 Molal depression constant for a solvent is 4.0 kg mol⁻¹ solution of K₂SO₄ is :
 (Assume complete dissociation of the electrolyte) **[JEE Main-2019 (April)]**

- (1) 0.12 (2) 0.36
 (3) 0.18 (4) 0.24

Q.15 At room temperature, a dilute solution of urea is prepared by dissolving 0.60 g of urea in 360 g of water. If the vapour pressure of pure water at this temperature is 35 mmHg, lowering of vapour pressure will be (molar mass of urea = 60 g mol⁻¹) :- **[JEE Main-2019 (April)]**

- (1) 0.027 mmHg (2) 0.028 mmHg
 (3) 0.017 mmHg (4) 0.031 mmHg

Q.16 1 g of non-volatile non-electrolyte solute is dissolved in 100g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1 : 5. The

ratio of the elevation in their boiling points, $\frac{\Delta T_b(A)}{\Delta T_b(B)}$

[JEE Main-2019 (April)]

- (1) 5 : 1 (2) 10 : 1
 (3) 1 : 5 (4) 1 : 0.2

Q.17 At 35°C, the vapour pressure of CS₂ is 512 mm Hg and that of acetone is 344 mm Hg. A solution of CS₂ in acetone has a total vapour pressure of 600 mm Hg. The false statement amongst the following is:

[JEE Main-2020 (January)]

- (1) heat must be absorbed in order to produce the solution at 35°C
 (2) Raoult's law is not obeyed by this system
 (3) a mixture of 100 mL CS₂ and 100 mL acetone has a volume < 200 mL
 (4) CS₂ and acetone are less attracted to each other than to themselves.

Q.18 The ammonia (NH₃) released on quantitative reaction of 0.6 g urea (NH₂CONH₂) with sodium hydroxide (NaOH) can be neutralized by:

[JEE Main-2020 (January)]

- (1) 200 ml of 0.4 N HCl (2) 200 ml of 0.2 N HCl
 (3) 100 ml of 0.1 N HCl (4) 100 ml of 0.2 N HCl

Q.19 Two open beakers one containing a solvent and the other containing a mixture of that solvent with a non volatile solute are together sealed in a container. Over time

[JEE Main-2020 (January)]

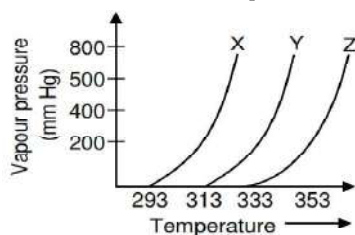
- (1) the volume of the solution decreases and the volume of the solvent increases
 (2) the volume of the solution and the solvent does not change
 (3) the volume of the solution increases and the volume of the solvent decreases
 (4) the volume of the solution does not change and the volume of the solvent decreases

Q.20 Ferrous sulphate heptahydrate is used to fortify foods with iron. The amount (in grams) of the salt required to achieve 10 ppm of iron in 100 kg of wheat is _____.
 Atomic weight : Fe = 55.85 ; S = 32.00 ; O = 16.00

[JEE Main-2020 (January)]

- Q.21** A graph of vapour pressure and temperature for three different liquids X, Y and Z is shown below:

[JEE Main-2020 (January)]



The following inferences are made :

- (A) X has higher intermolecular interactions compared to Y.
 (B) X has lower intermolecular interactions compared to Y.
 (C) Z has lower intermolecular interactions compared to Y.

The correct inference (s) is/are :

- (1)(C) (2)(B)
 (3)(A) and (B) (4)(A)
- Q.22** The molarity of HNO_3 in a sample which has density 1.4 g/mL and mass percentage of 63% is _____. (Molecular Weight of $\text{HNO}_3 = 63$)

[JEE Main-2020 (January)]

- Q.23** How much amount of NaCl should be added to 600 g for water ($\rho = 1.00$ g/mL) to decrease the freezing point of water to -0.2°C ? _____.

[JEE Main-2020 (January)]

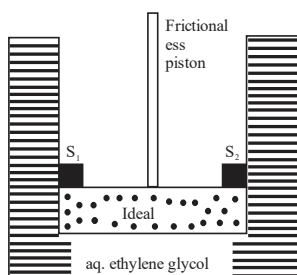
(The freezing point depression constant of water = 2 K kg mol^{-1})

- Q.24** 10.30 mg of O_2 dissolved into a litre of sea water of density 1.03 g/mL. The concentration of O_2 in ppm is ____.

[JEE Main-2020 (January)]

- Q.25** A cylinder containing an ideal gas (0.1 mol of 1.0 dm^3) is in thermal equilibrium with a large volume of 0.5 molal aqueous solution of ethylene glycol at its freezing point. If the stoppers S_1 and S_2 (as shown in the Figure) are suddenly withdrawn, the volume of the gas in litres after equilibrium is achieved will be _____. (Given, $K_f(\text{water}) = 2.0 \text{ K kg mol}^{-1}$, $R = 0.8 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$)

[JEE Main-2020 (January)]



- Q.26** The size of a raw mango shrinks to a much smaller size when kept in a concentrated salt solution. Which one of the following processes can explain this?

[JEE Main-2020 (September)]

- (1) Osmosis (2) Reverse osmosis
 (3) Diffusion (4) Dialysis

- Q.27** An open beaker of water in equilibrium with water vapour is in a sealed container. When a few grams of glucose are added to the beaker of water, the rate at which water molecules [JEE Main-2020 (September)]

- (1) leaves the solution increases
 (2) leaves the vapour increases
 (3) leaves the vapour decreases
 (4) leaves the solution decreases

- Q.28** If 250 cm^3 of an aqueous solution containing 0.73 g of a protein A is isotonic with one litre of another aqueous solution containing 1.65 g of a protein B, at 298 K, the ratio of the molecular masses of A and B is _____ $\times 10^{-2}$ (to the nearest integer).

[JEE Main-2020 (September)]

- Q.29** Henry's constant (in kbar) for four gases α , β , γ and δ in water at 298 K is given below :

[JEE Main-2020 (September)]

	α	β	γ	δ
K_H	50	2	2×10^{-5}	0.5

(density of water = 10^3 kg m^{-3} at 298 K)

This table implies that

- (1) The pressure of a 55.5 molal solution of γ is 1 bar
 (2) Solubility of γ at 308 K is lower than at 298 K
 (3) α has the highest solubility in water at a given pressure
 (4) The pressure of a 55.5 molal solution of δ is 250 bar
- Q.30** The osmotic pressure of a solution of NaCl is 0.10 atm and that of a glucose solution is 0.20 atm. The osmotic pressure of a solution formed by mixing 1 L of the sodium chloride solution with 2 L of the glucose solution is $x \times 10^{-3}$ atm. x is _____. (nearest integer)

[JEE Main-2020 (September)]

Q.31 At 300 K, the vapour pressure of a solution containing 1 mole of n-hexane and 3 moles of n-heptane is 550 mm of Hg. At the same temperature, if one more mole of n-heptane is added to this solution, the vapour pressure of the solution increases by 10 mm of Hg. What is the vapour pressure in mm Hg of n-heptane in its pure state _____? **[JEE Main-2020 (September)]**

Q.32 For Freundlich adsorption isotherm, a plot of $\log(x/m)$ (y-axis) and $\log p$ (x-axis) gives a straight line. The intercept and slope for the line is 0.4771 and 2, respectively. The mass of gas, adsorbed per gram of adsorbent if the initial pressure is 0.04 atm, is _____ $\times 10^{-4}$ g. ($\log 3 = 0.4771$) **[JEE Main-2020 (September)]**

Q.33 A set of solutions is prepared using 180 g of water as a solvent and 10 g of different nonvolatile solutes A, B and C. The relative lowering of vapour pressure in the presence of these solutes are in the order [Given, molar mass of A = 100 g mol⁻¹; B = 200 g mol⁻¹; C = 10,000 g mol⁻¹] **[JEE Main-2020 (September)]**

- (1) A > C > B
- (2) C > B > A
- (3) A > B > C
- (4) B > C > A

Q.34 The elevation of boiling point of 0.10 m aqueous CrCl₃.xNH₃ solution is two times that of 0.05 m aqueous CaCl₂ solution. The value of x is _____.

[Assume 100% ionisation of the complex and CaCl₂, coordination number of Cr as 6, and that all NH₃ molecules are present inside the coordination sphere]

[JEE Main-2020 (September)]

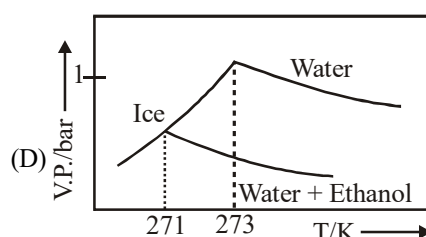
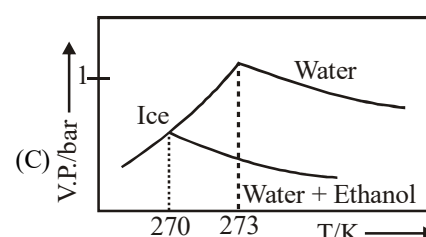
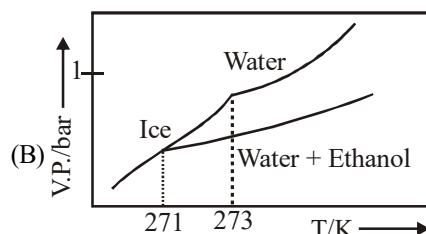
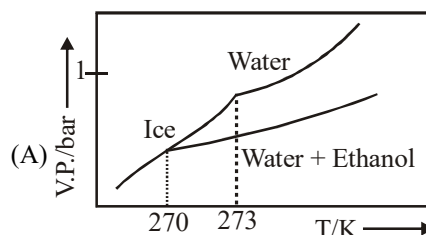
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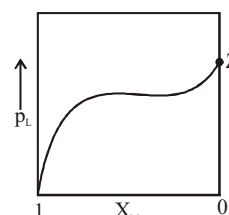
Q.1 Mixture(s) showing positive deviation from Raoult's law at 35°C is(are) **[JEE Advanced-2016]**

- (A) carbon tetrachloride + methanol
- (B) carbon disulphide + acetone
- (C) benzene + toluene
- (D) phenol + aniline

Q.2 Pure water freezes at 273 K and 1 bar. The addition of 34.5g of ethanol to 500 g of water changes the freezing point of the solution. Use the freezing point depression constant of water as 2 K kg mol⁻¹. The figures shown below represent plots of vapour pressure (V.P.) versus temperature (T). [molecular weight of ethanol is 46 g mol⁻¹] Among the following the option representing change in the freezing point is **[JEE Advanced-2017]**



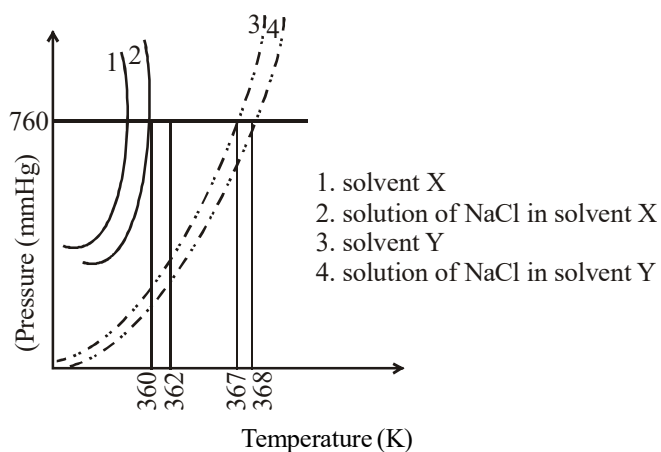
Q.3 For a solution formed by mixing liquids L and M, the vapour pressure of L plotted against the mole fraction of M in solution is shown in the following figure. Here x_L and x_M represent mole fractions of L and M, respectively, in the solution. The correct statement(s) applicable to this system is (are) **[JEE Advanced-2017]**



- (A) The point Z represents vapour pressure of pure liquid M and Raoult's law is obeyed from $x_L = 0$ to $x_L = 1$
- (B) Attractive intermolecular interactions between L-L in pure liquid L and M-M in pure liquid M are stronger than those between L-M when mixed in solution
- (C) The point Z represents vapour pressure of pure liquid M and Raoult's law is obeyed when $x_L \rightarrow 0$
- (D) The point Z represents vapour pressure of pure liquid L and Raoult's law is obeyed when $x_L \rightarrow 1$

- Q.4** Liquids A and B form ideal solution over the entire range of composition. At temperature T, equimolar binary solution of liquids A and B has vapour pressure 45 Torr. At the same temperature, a new solution of A and B having mole fractions x_A and x_B , respectively, has vapour pressure of 22.5 Torr. The value of x_A/x_B in the new solution is ____.
- (Given that the vapour pressure of pure liquid A is 20 Torr at temperature T) **[JEE Advanced-2018]**

- Q.5** The plot given below shows P_iVT curves (where P is the pressure and T is the temperature) for two solvents X and Y and isomolal solutions of NaCl in these solvents. NaCl completely dissociates in both the solvents.



On addition of equal number of moles a non-volatile solute S in equal amount (in kg) of these solvents, the elevation of boiling point of solvent X is three times that of solvent Y. Solute S is known to undergo dimerization in these solvents. If the degree of dimerization is 0.7 in solvent Y, the degree of dimerization in solvent X is ____.

[JEE Advanced-2018]

- Q.6** On dissolving 0.5 g of a non-volatile non-ionic solute to 39 g of benzene, its vapor pressure decreases from 650 mm Hg to 640 mm Hg. The depression of freezing point of benzene (in K) upon addition of the solute is ____.
- (Given data : Molar mass and the molal freezing point depression constant of benzene are 78 g mol^{-1} and $5.12 \text{ K kg mol}^{-1}$, respectively) **[JEE Advanced - 2019]**

- Q.7** Liquids A and B form ideal solution for all compositions of A and B at 25°C . Two such solutions with 0.25 and 0.50 mole fractions of A have the total vapor pressures of 0.3 and 0.4 bar, respectively. What is the vapor pressure of pure liquid B in bar?
- [JEE(Advanced) - 2020]**

ABOUT PHYSICS WALLAH




Alakh Pandey is one of the most renowned faculty in NEET & JEE domain's Physics. On his YouTube channel, Physics Wallah, he teaches the Science courses of 11th and 12th standard to the students aiming to appear for the engineering and medical entrance exams.

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