CHEMISTRY

NCERT - FULL MARKS CHEMISTRY(TAMIL)

COLLIGATIVE PROPERTIES

Problems

1. The vapour pressure of CCl_4 at $30°C$ is 143 mm of Hg.0.5 gm of a nonvolatile non electrolyte substance with molar mass 65 is dissolved in 100 ml of CCl_4. What will be the vapour pressure of the solution. Density of CCl_4 at $30°C = 1.58$ gm per cc.

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2. Dry air was passed successively through a solution of 5 gm of solute dissolved in 80.0 gm of water and through pure water. The loss in weight of the solution was 2.5 gm and that of the pure solvent was 0.04 gm. What is the molecular weight of the solute?

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3. Calculate the vapour pressure of the solution. The molefraction of the solute is 0.25. The vapour pressure of the pure solvent is 0.8atm.

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4. 1.00 g of a non-electrolyte dissolved in 50.5g of benzene lowered its freezing point by 0.40K. The freezing point depression constant of benzene is $5.12\mathrm{K.kg\ mol}^{-1}$. Find the molecular mass of the solute.

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5. What is the freezing point of solution containing 3g of a non-volatile solute in 20g of water. Freezing point of pure water is 273K, K_f of water = 1.86 Kkg/mol. Molar mass of solute is 300 g/mol.

$$T° - T = K_f m$$

6. A solution containing 2.5 g of a non-volatile solute in 100 gm of benzene boiled at a temperature 0.42K higher than at the pure solvent boiled. What is the molecular weight of the solute? The molal elevation constant of benzene is $2.67 \text{ K kg mol}^{-1}$.

7. 0.900g of a solute was dissolved in 100 ml of benzene at $25° C$ when its density is 0.879 g/ml. This solution boiled $0.250° C$ higher than the boiling point of benzene. Molal elevation constant for benzene is $2.52 \text{ K.Kg.mol}^{-1}$. Calculate the molecular weight of the solute.

8. 10g of an organic substance when dissolved in two litres of water gave an osmotic pressure of 0.59 atm, at $7°C$. Calculate the molecular weight of the substance.

9. A 0.5 percent aqueous solution of KCl was found to freeze at 272.76K. Calculate the Van.t Hoff factor and degree of dissociation of the solute at this concentration $\left(K_f \text{ for water} = 1.86 \text{ k.kg.mol}^{-1}\right)$. Normal molar mass of $KCl = 74.5$.

10. The depression in the freezing point of a benzene solution containing 0.784g of Acetic acid dissolved in 100ml of benzene is 0.35k.

Calculate the van.t Hoff factor and the degree of association of the solute at this concentration

$\left(k_f \text{ for benzene} = 5.10 \text{ k.kg.mol}^{-1}, \quad \text{molar mass of acetic acid is } 60.01 \right)$.

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Questions A Choose The Correct Answer

1. ___ denotes the number of particles .

A. Additive

B. Constitutive

C. Colligative

D. None

Answer:

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2. Which has the highest boiling point?

A. 1% NaCl solution

B. 1% Urea solution

C. 1% glucose solution

D. 1% sucrose solution

Answer:

3. In cold countries, ethylene glycol is added to water in the radiators of cars during winters. It results in :

A. Lowering boiling point

B. Reducing viscosity

C. Reducing specific heat

D. Lowering freezing point

Answer:

4. Which of the following 0.1M aqueous solutions will have the lowest freezing point?

    A. Potassium sulphate

    B. Sodium chloride

    C. Urea

    D. Glucose

Answer:

5. The Van.t Hoff factor of 0.005M aqueous solution of KCl is 1.95. The degree of ionisation of KCl is

A. 0.94

B. 0.95

C. 0.96

D. 0.59

Answer:

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1. Relative lowering of vapour pressure is equal to _____ in solution.

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2. A liquid having high vapour pressure has_____ boiling point.

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3. The least count of Beckmann.s thermometer is _____ .

4. Universal gas constant is

5. Semipermeable membrane allows the passage of _____through it.

6. For a deliquescence to occur, the vapour pressure of water in the air must be____than that of the saturated solution.

7. Depression in freezing point is _____pronounced if camphor is used as a solvent in place of water for same amount of solute and solvent.

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8. Every solution behaves as ideal solution _____ .

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9. The osmotic pressures of 0.1M glucose and 0.1M NaCl solutions are _____ .

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10. Solutions that have same osmotic pressure are called solutions.

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1. What are colligative properties?

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2. Define relative lowering of vapour pressure.

▶ **Watch Video Solution**

3. What do you understand by molal elevation of boiling point? What are abnormal solutes?

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4. Addition of non-volatile solute always increases the boiling point of the solution. Why?

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5. Volatile hydrocarbons are not used in the brakes of automobile as lubricant, but non-volatile hydrocarbon are used as lubricants. Why?

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6. Which of the following is not a colligative property ?

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7. Explain the terms osmosis and osmotic pressure.

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8. What are isotonic solutions?

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9. What are the advantages of Berkley-Hartley method?

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10. Explain how the degree of dissociation of an electrolyte may be determined from the measurement of a colligative property.

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Questions Problems

1. The vapour pressure of pure benzene at a certain temperature is 640 mm of Hg. A non-volatile non-electrolyte solid weighing 2.175 g is added

to 39 g of benzene. The vapour pressure of the solution is 600 mm of Hg.

What is molecular weight of solid substance?

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2. Calculate the freezing point of an aqueous solution of a non-electrolyte having an osmotic pressure 2.0 atm at 300 K. $Kf = 1.86$ k.kg.mol^{-1}· $R = 0.0821$ lit.atm.k^{-1} mol^{-1}

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3. What weight of non-volatile solute (urea) NH_2CONH_2 needs to be dissolved in 100 g of water in order to decrease the vapour pressure of water by 25%. What will be the molality of solution?
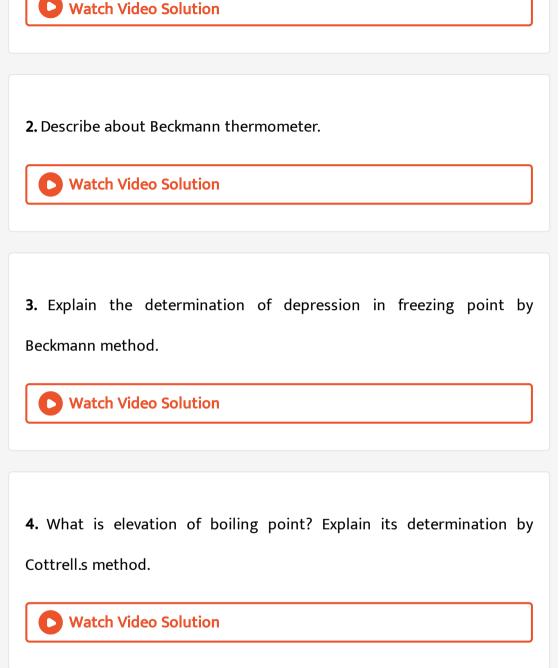
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4. 20 g of sucrose solution in one litre is isotonic with a solution of boric acid containing 1.63 g of boric acid in 450 ml. Find the molecular weight of boric acid.

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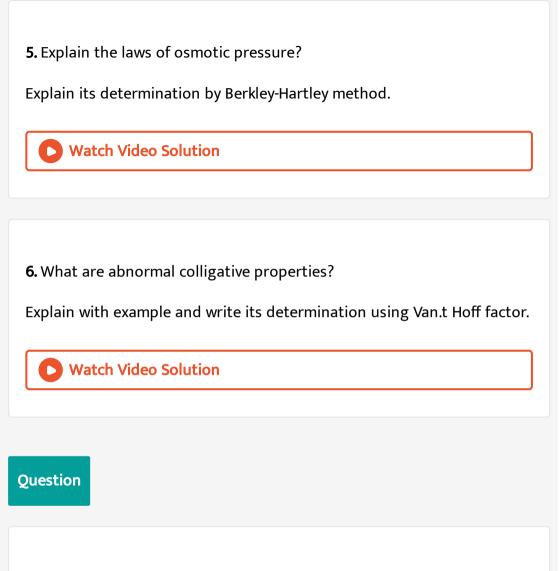**5.** A solution containing 6 gm of a solute dissolved in 250 ml of water gave an osmotic pressure of 4.5 atmosphere at $27°C$. Calculate the boiling point of the solution. The molal elevation constant for water is 0.52

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Questions D Explain Briefly On The Following

1. Explain the determination of relative lowering of vapour pressure by Ostwald- Walker method?

2. Describe about Beckmann thermometer.

3. Explain the determination of depression in freezing point by Beckmann method.

4. What is elevation of boiling point? Explain its determination by Cottrell.s method.

5. Explain the laws of osmotic pressure?

Explain its determination by Berkley-Hartley method.

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6. What are abnormal colligative properties?

Explain with example and write its determination using Van.t Hoff factor.

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Question

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$$T^\circ - T = K_f m$$

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10. The depression in the freezing point of a benzene solution containing 0.784g of Acetic acid dissolved in 100ml of benzene is 0.35k. Calculate the van.t Hoff factor and the degree of association of the solute at this concentration

$\left(k_f \text{ for benzene} = 5.10 \text{ k.kg.mol}^{-1}, \quad \text{molar mass of acetic acid is } 60.01 \right).$

11. Properties which depend only on number of particles present in solution are called

A. Additive

B. Constitutive

C. Colligative

D. None

Answer:

12. Which solution would possess the lowest boiling point

A. 1% NaCl solution

B. 1% Urea solution

C. 1% glucose solution

D. 1% sucrose solution

Answer:

13. In cold countries, ethylene glycol is added to water in the radiators of cars during winters. It results in :

A. Lowering boiling point

B. Reducing viscosity

C. Reducing specific heat

D. Lowering freezing point

Answer:

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14. Which of the following 0.1M aqueous solutions will have the lowest freezing point?

A. Potassium sulphate

B. Sodium chloride

C. Urea

D. Glucose

Answer:

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15. The Van.t Hoff factor of 0.005M aqueous solution of KCl is 1.95. The degree of ionisation of KCl is

    A. 0.94

    B. 0.95

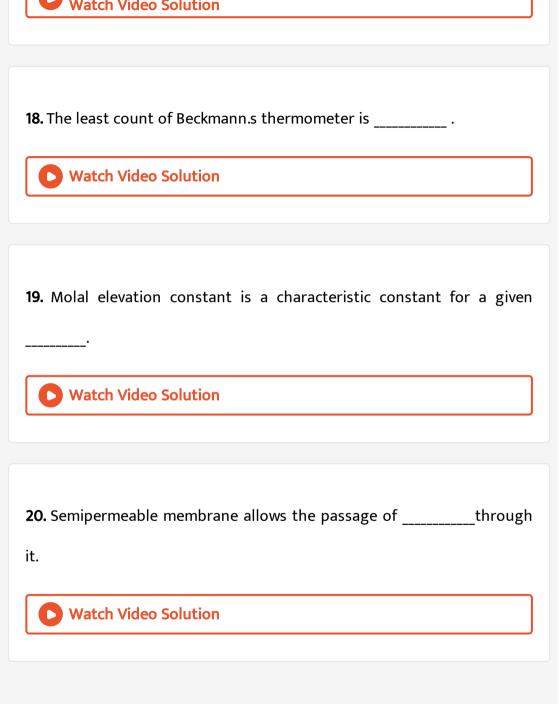   C. 0.96

    D. 0.59

Answer:

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16. Relative lowering of vapour pressure is equal to _____in solution.

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17. A liquid having high vapour pressure has_____boiling point.

18. The least count of Beckmann.s thermometer is _____ .

19. Molal elevation constant is a characteristic constant for a given _____.

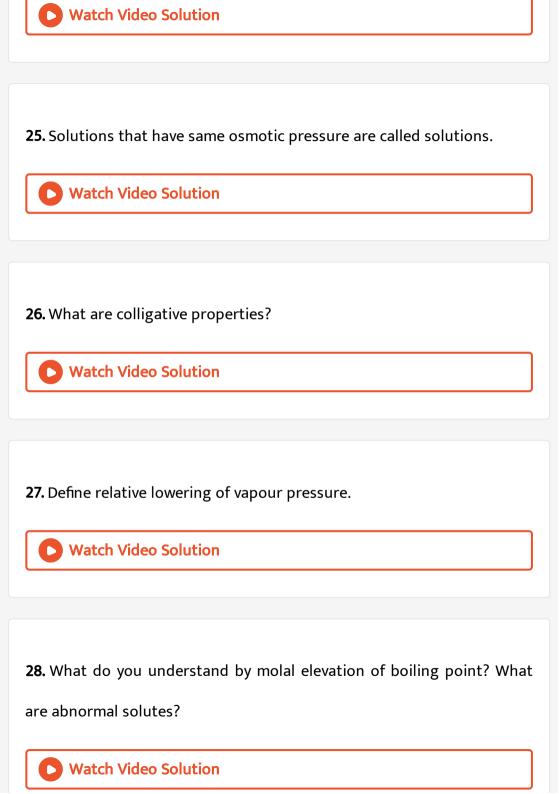**20.** Semipermeable membrane allows the passage of _____through it.

21. For a deliquescence to occur, the vapour pressure of water in the air must be_____than that of the saturated solution.

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22. Depression in freezing point is _____pronounced if camphor is used as a solvent in place of water for same amount of solute and solvent.

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23. Every solution behaves as ideal solution _____ .

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24. The osmotic pressures of 0.1M glucose and 0.1M NaCl solutions are _____ .

25. Solutions that have same osmotic pressure are called solutions.

26. What are colligative properties?

27. Define relative lowering of vapour pressure.

28. What do you understand by molal elevation of boiling point? What are abnormal solutes?

29. Addition of non-volatile solute always increases the boiling point of the solution. Why?

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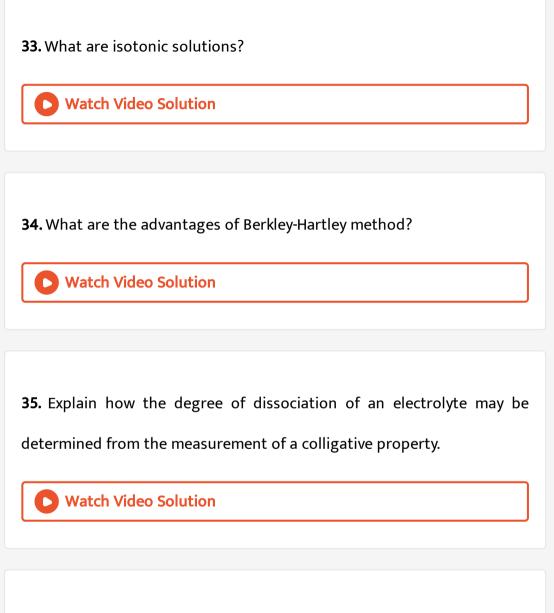**30.** Volatile hydrocarbons are not used in the brakes of automobile as lubricant, but non-volatile hydrocarbon are used as lubricants. Why?

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31. Prove that the depression in freezing point is a colligative property.

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32. Explain the terms osmosis and osmotic pressure.

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33. What are isotonic solutions?

34. What are the advantages of Berkley-Hartley method?

35. Explain how the degree of dissociation of an electrolyte may be determined from the measurement of a colligative property.

36. The vapour pressure of pure benzene at a certain temperature is 640 mm of Hg. A non-volatile non-electrolyte solid weighing 2.175 g is added

to 39 g of benzene. The vapour pressure of the solution is 600 mm of Hg.

What is molecular weight of solid substance?

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37. Calculate the freezing point of an aqueous solution of a non-electrolyte having an osmotic pressure 2.0 atm at 300 K. $Kf = 1.86 \text{ k.kg.mol}^{-1\cdot}$ $R = 0.0821 \text{ lit.atm.k}^{-1} \text{ mol}^{-1}$

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38. What weight of non-volatile solute (urea) NH_2CONH_2 needs to be dissolved in 100 g of water in order to decrease the vapour pressure of water by $25\,\%$. What will be the molality of solution?

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39. 20 g of sucrose solution in one litre is isotonic with a solution of boric acid containing 1.63 g of boric acid in 450 ml. Find the molecular weight of boric acid.

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40. A solution containing 6 gm of a solute dissolved in 250 ml of water gave an osmotic pressure of 4.5 atmosphere at $27°C$. Calculate the boiling point of the solution. The molal elevation constant for water is 0.52
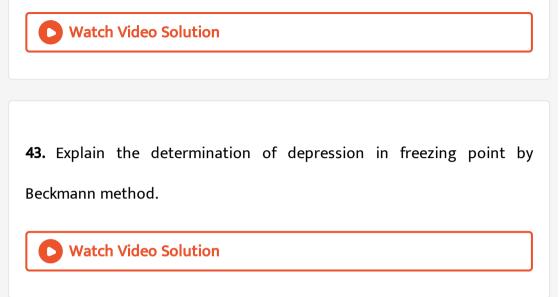
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41. Explain the determination of relative lowering of vapour pressure by Ostwald- Walker method?

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42. Describe about Beckmann thermometer.

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43. Explain the determination of depression in freezing point by Beckmann method.

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44. What is elevation of boiling point? Explain its determination by Cottrell.s method.

> ▶ Watch Video Solution

45. Explain the laws of osmotic pressure?

Explain its determination by Berkley-Hartley method.

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46. What are abnormal colligative properties?

Explain with example and write its determination using Van.t Hoff factor.

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