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NEET 2026 – PREPARATION MATERIAL

SUBJECT : CHEMISTRY

CHAPTER : SOLUTIONS

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1. Concentration Terms

Mass % = (Mass of solute / Mass of solution) × 100
Volume % = (Volume of solute / Volume of solution) × 100
Mole fraction (χ) = n(solute) / [n(solute) + n(solvent)]
Molality (m) = moles of solute / kg of solvent (temperature independe
Molarity (M) = moles of solute / L of solution (temperature dependen
Normality (N) = equivalents of solute / L of solution
Tip: Molality is preferred in colligative properties because it is indepe

2. Vapour Pressure of Solutions

Raoult's Law: pA = pA°·χA , pB = pB°·χB , P = pA + pB
Relative lowering of vapour pressure: Δp/p° = χsolute
Positive deviation → weak solute–solvent (ethanol + water)
Negative deviation → strong solute–solvent (acetone + chloroform)
Tip: Ideal solution → ΔHmix = 0, ΔVmix = 0.

3. Colligative Properties

Relative lowering of vapour pressure: Δp/p° = n2/n1
Elevation of boiling point: ΔTb = Kb·m·i
Depression of freezing point: ΔTf = Kf·m·i
Osmotic pressure: π = iCRT
Water constants: Kf = 1.86 K kg mol■¹, Kb = 0.52 K kg mol■¹

4. Abnormal Molar Mass & van't Hoff Factor

i = Observed colligative property / Calculated colligative property
Dissociation → i > 1 (NaCl in water)
Association → i < 1 (Acetic acid dimer in benzene)

5. Henry's Law

p = KH·x (p = partial pressure, x = mole fraction, KH = constant)
Solubility ↑ with pressure, ↓ with temperature.
Application: soda water bottles.

6. Osmosis & Reverse Osmosis

Osmosis: solvent flows from low conc. → high conc.
Osmotic pressure stops osmosis.
Reverse osmosis: applied pressure > π (used in desalination).

7. Azeotropes

Minimum boiling azeotrope → HCl + water.
Maximum boiling azeotrope → Ethanol + water.

8. Key Formulas

m = (w2·1000)/(M2·w1)
π = iCRT
ΔTb = iKb·m
ΔTf = iKf·m
Δp/p° = χ2
i = Observed molar mass / Calculated molar mass

NEET High-Yield Points

- **Osmotic pressure is most useful for molar mass of polymers & biomolecules.**
- **For electrolytes: colligative properties ↑ due to dissociation.**
- **For associated solutes: colligative properties ↓.**
- **Blood osmotic pressure ≈ 7.65 atm → IV fluids must be isotonic.**
- **At high altitudes: water boils at lower temp due to ↓ external pressure.**
- **ΔTb ∝ molality, ΔTf ∝ molality, π ∝ molarity.**

MCQ's

Q1. Which of the following concentrations is temperature independent?
a) Molarity
b) Molality
c) Normality
d) Volume %
Answer: b) Molality

Q2. Molarity of a solution decreases with increase in:
a) Mass of solute
b) Volume of solvent
c) Temperature
d) Both b and c
Answer: d) Both b and c

Q3. A 1 M NaOH solution means:
a) 1 mole of NaOH in 1 L of solvent
b) 1 mole of NaOH in 1 L of solution
c) 1 mole of NaOH in 100 g of solvent
d) 1 mole of NaOH in 1000 g of solvent
Answer: b) 1 mole of NaOH in 1 L of solution

Q4. Mole fraction of solute in a 1 molal aqueous solution is approximately:
a) 0.018
b) 0.036
c) 0.982
d) 0.964
Answer: a) 0.018

Q5. The vapour pressure of an ideal solution is given by:
a) Dalton's law
b) Raoult's law
c) Henry's law
d) Boyle's law
Answer: b) Raoult's law

Q6. Raoult's law is applicable to:
a) Dilute solutions only
b) Gaseous solutions only
c) Ideal solutions
d) Non-ideal solutions
Answer: c) Ideal solutions

Q7. Which colligative property is used for the determination of molar masses of polymers?
a) Elevation of boiling point
b) Depression of freezing point
c) Osmotic pressure
d) Relative lowering of vapour pressure
Answer: c) Osmotic pressure

Q8. The unit of osmotic pressure is:
a) J mol^{-1}
b) N m^{-2}
c) Pa
d) Both b and c
Answer: d) Both b and c

Q9. The relation between osmotic pressure (π), molar concentration (C), gas constant (R), and temperature (T) is:
a) $\pi = CRT$
b) $\pi = RT/C$
c) $\pi = C/RT$
d) $\pi = C + RT$
Answer: a) $\pi = CRT$

Q10. Depression in freezing point is given by:
a) $\Delta Tf = Kb \cdot m$
b) $\Delta Tf = Kf \cdot m$
c) $\Delta Tf = Kf / m$
d) $\Delta Tf = Kb / m$
Answer: b) $\Delta Tf = Kf \cdot m$

Q11. Which of the following is not a colligative property?
a) Osmotic pressure
b) Relative lowering of vapour pressure
c) Elevation of boiling point
d) Surface tension
Answer: d) Surface tension

Q12. The vapour pressure of pure benzene is 0.850 bar. On adding 0.2 mol of non-volatile solute to 0.8 mol of benzene, the vapour pressure becomes:
a) 0.680 bar
b) 0.850 bar
c) 0.680 atm
d) 0.720 bar
Answer: d) 0.720 bar

Q13. Which solution shows positive deviation from Raoult's law?
a) Acetone + chloroform
b) HCl + water
c) Ethanol + water
d) Acetone + benzene
Answer: d) Acetone + benzene

Q14. Negative deviation from Raoult's law is due to:
a) Weak solute-solvent interaction

b) Strong solute-solvent interaction
c) No solute-solvent interaction
d) None of these
Answer: b) Strong solute-solvent interaction

Q15. Van't Hoff factor (i) accounts for:
a) Ionization only
b) Association only
c) Both ionization and association
d) None of these
Answer: c) Both ionization and association

Q16. For 0.1 M NaCl solution, the expected van't Hoff factor (i) is:
a) 0.5
b) 1
c) 2
d) 3
Answer: c) 2

Q17. For 0.1 M urea solution, the van't Hoff factor (i) is:
a) 0
b) 1
c) 2
d) 3
Answer: b) 1

Q18. The elevation in boiling point is proportional to:
a) Solute mass
b) Solvent mass
c) Molality of solution
d) Molarity of solution
Answer: c) Molality of solution

Q19. The depression in freezing point depends on:
a) Nature of solute
b) Number of solute particles
c) Nature of solvent
d) Both b and c
Answer: b) Number of solute particles

Q20. If 1 mol of NaCl is dissolved in 1 kg of water, the depression in freezing point is:
a) Kf
b) 2Kf
c) 0.5Kf
d) None
Answer: b) 2Kf

Q21. Which property can distinguish between colloids and true solutions?
a) Osmotic pressure
b) Tyndall effect
c) Depression in freezing point
d) Vapour pressure lowering
Answer: b) Tyndall effect

Q22. Which solution is used in intravenous injections?
a) Hypertonic solution
b) Hypotonic solution
c) Isotonic solution
d) Supersaturated solution
Answer: c) Isotonic solution

Q23. If osmotic pressure of 0.01 M solution is 0.25 atm at 27°C, the solute is:
a) Non-electrolyte
b) Strong electrolyte
c) Weak electrolyte
d) None
Answer: b) Strong electrolyte

Q24. The value of van't Hoff factor (i) for K2SO4 in solution is:
a) 2
b) 3
c) 4
d) 1
Answer: b) 3

Q25. Which law relates solubility of a gas with pressure?
a) Raoult's law
b) Henry's law
c) Dalton's law
d) Boyle's law
Answer: b) Henry's law

Q26. According to Henry's law, solubility of a gas in liquid is directly proportional to:
a) Volume of liquid
b) Temperature
c) Pressure of gas
d) Nature of solute
Answer: c) Pressure of gas

Q27. The solubility of a gas decreases with:
a) Increase of pressure
b) Increase of temperature
c) Decrease of temperature
d) None
Answer: b) Increase of temperature

Q28. Soda water bottles are sealed under high pressure to increase solubility of:
a) Oxygen
b) Carbon dioxide
c) Nitrogen
d) Hydrogen
Answer: b) Carbon dioxide

Q29. If the osmotic pressure of 0.1 M solution at 300 K is 2.46 atm, the value of R used is:
a) 0.0821 L atm mol^{-1} K^{-1}
b) 8.314 J mol^{-1} K^{-1}
c) Both

d) None
Answer: a) 0.0821 L atm mol^{-1} K^{-1}

Q30. Osmotic pressure is a:
a) Colligative property
b) Additive property
c) Constitutive property
d) Intensive property
Answer: a) Colligative property

Q31. If two solutions have same osmotic pressure, they are called:
a) Isotonic
b) Hypotonic
c) Hypertonic
d) None
Answer: a) Isotonic

Q32. A solution with lower osmotic pressure than cell sap is:
a) Isotonic
b) Hypotonic
c) Hypertonic
d) None
Answer: b) Hypotonic

Q33. Reverse osmosis is used for:
a) Increasing vapour pressure
b) Purification of water
c) Elevation of boiling point
d) Reducing molality
Answer: b) Purification of water

Q34. Cryoscopic constant is related to:
a) Freezing point depression
b) Boiling point elevation
c) Osmotic pressure
d) Vapour pressure lowering
Answer: a) Freezing point depression

Q35. Ebullioscopic constant is related to:
a) Freezing point depression
b) Boiling point elevation
c) Osmotic pressure
d) Vapour pressure lowering
Answer: b) Boiling point elevation

Q36. Which of the following is dimensionless?
a) Molality
b) Mole fraction
c) Molarity
d) Mass %
Answer: b) Mole fraction

Q37. In ideal solution, ΔH_{mix} = ?
a) Positive

b) Negative
c) Zero
d) None
Answer: c) Zero

Q38. In ideal solution, ΔVmix = ?
a) Positive
b) Negative
c) Zero
d) None
Answer: c) Zero

Q39. Which mixture shows maximum boiling azeotrope?
a) HNO3 + water
b) Ethanol + water
c) Acetone + chloroform
d) HCl + water
Answer: b) Ethanol + water

Q40. Which mixture shows minimum boiling azeotrope?
a) HNO3 + water
b) Ethanol + water
c) Acetone + chloroform
d) HCl + water
Answer: d) HCl + water

Q41. The osmotic pressure of 0.1 M solution at 27°C is:
a) 2.46 atm
b) 0.082 atm
c) 24.6 atm
d) 0.246 atm
Answer: a) 2.46 atm

Q42. The value of Kf depends on:
a) Nature of solute
b) Nature of solvent
c) Temperature of solution
d) Both b and c
Answer: b) Nature of solvent

Q43. Which colligative property is preferred for molar mass determination of biomolecules?
a) Osmotic pressure
b) Depression in freezing point
c) Elevation in boiling point
d) Vapour pressure lowering
Answer: a) Osmotic pressure

Q44. Which property is not a colligative property?
a) Osmotic pressure
b) Viscosity
c) Depression of freezing point

d) Elevation of boiling point
Answer: b) Viscosity

Q45. The osmotic pressure of equimolar solutions of urea, glucose and NaCl are in the ratio:
a) 1 : 1 : 1
b) 1 : 1 : 2
c) 2 : 1 : 1
d) 1 : 2 : 2
Answer: b) 1 : 1 : 2

Q46. The relation between ΔTf and molar mass (M) of solute is:
a) $\Delta T_f \propto M$
b) $\Delta T_f \propto 1/M$
c) $\Delta T_f \propto \sqrt{M}$
d) ΔTf independent of M
Answer: b) $\Delta T_f \propto 1/M$

Q47. Which of the following has maximum vapour pressure at same conditions?
a) 1 M NaCl
b) 1 M KCl
c) 1 M urea
d) 1 M MgCl2
Answer: c) 1 M urea

Q48. Which of the following is correct for an ideal solution?
a) Strong solute-solvent interaction
b) Weak solute-solvent interaction
c) No volume/enthalpy change
d) Both a and b
Answer: c) No volume/enthalpy change

Q49. When NaCl is added to water, freezing point:
a) Increases
b) Decreases
c) Remains constant
d) First increases then decreases
Answer: b) Decreases

Q50. Which of the following solutions will have highest boiling point?
a) 0.1 M NaCl
b) 0.1 M glucose
c) 0.1 M urea
d) 0.1 M sucrose
Answer: a) 0.1 M NaCl

Q51. The depression in freezing point is directly proportional to:
a) Molality of solution
b) Molarity of solution
c) Mole fraction of solvent
d) Temperature of solvent
Answer: a) Molality of solution

Q52. Which solution will show highest osmotic pressure at same concentration?
a) Glucose

b) Urea
c) NaCl
d) Sucrose
Answer: c) NaCl

Q53. At constant temperature, solubility of CO_2 in soft drinks is governed by:
a) Boyle's law
b) Raoult's law
c) Henry's law
d) Dalton's law
Answer: c) Henry's law

Q54. The van't Hoff factor (i) for $Al_2(SO_4)_3$ in dilute solution is:
a) 2
b) 3
c) 4
d) 5
Answer: d) 5

Q55. The colligative properties depend upon:
a) Nature of solute
b) Nature of solvent
c) Number of solute particles
d) Type of interaction
Answer: c) Number of solute particles

Q56. Which of the following is an intensive property?
a) Osmotic pressure
b) Elevation in boiling point
c) Depression in freezing point
d) All of these
Answer: d) All of these

Q57. For dilute solutions, relative lowering of vapour pressure is equal to:
a) Mole fraction of solute
b) Mole fraction of solvent
c) Molality of solution
d) Molarity of solution
Answer: a) Mole fraction of solute

Q58. A solution which boils at constant temperature without change in composition is:
a) Ideal solution
b) Azeotrope
c) Supersaturated solution
d) Dilute solution
Answer: b) Azeotrope

Q59. An azeotrope is a:
a) Binary mixture with constant boiling point
b) Ternary mixture with constant boiling point
c) Mixture that obeys Henry's law
d) Non-ideal solution without deviation
Answer: a) Binary mixture with constant boiling point

Q60. Van't Hoff factor (i) is equal to:
a) Observed colligative property / Calculated colligative property
b) Normality / Molarity
c) Mass of solute / Mass of solvent
d) Observed vapour pressure / Pure vapour pressure
Answer: a) Observed colligative property / Calculated colligative property

Q61. The osmotic pressure of 0.01 M solution at 27°C is (R=0.0821 L atm K^{-1} mol^{-1}):
a) 0.246 atm
b) 2.46 atm
c) 0.082 atm
d) 24.6 atm
Answer: a) 0.246 atm

Q62. In reverse osmosis, pure solvent flows:
a) From low pressure to high pressure side
b) From high pressure to low pressure side
c) From higher concentration to lower concentration
d) Both a and c
Answer: b) From high pressure to low pressure side

Q63. A 0.5 molal aqueous solution of NaCl freezes at (Kf = 1.86 K kg mol^{-1}):
a) –0.93°C
b) –1.86°C
c) –0.465°C
d) –2.0°C
Answer: a) –0.93°C

Q64. Which of the following methods cannot be used for determination of molecular mass?
a) Osmotic pressure
b) Boiling point elevation
c) Freezing point depression
d) Vapour pressure measurement of pure solvent
Answer: d) Vapour pressure measurement of pure solvent

Q65. Cryoscopic constant has unit:
a) K $molal^{-1}$
b) K M^{-1}
c) K L mol^{-1}
d) atm mol^{-1}
Answer: a) K $molal^{-1}$

Q66. If 5% solution of cane sugar is isotonic with 1% solution of urea at same temperature, molecular mass of cane sugar is:
a) 34
b) 60
c) 170
d) 342
Answer: d) 342

Q67. For an electrolyte that dissociates, the value of colligative property is:
a) Lower than expected
b) Higher than expected

c) Same as non-electrolyte
d) Zero
Answer: b) Higher than expected

Q68. For an associated solute, van't Hoff factor (i) is:
a) >1
b) <1
c) =1
d) =0
Answer: b) <1

Q69. In case of ionization, the experimental molar mass is:
a) Lower than true molar mass
b) Higher than true molar mass
c) Equal to true molar mass
d) Cannot be determined
Answer: a) Lower than true molar mass

Q70. In case of association, the experimental molar mass is:
a) Lower than true molar mass
b) Higher than true molar mass
c) Equal to true molar mass
d) Cannot be determined
Answer: b) Higher than true molar mass

Q71. Which solution has maximum depression in freezing point?
a) 0.1 M glucose
b) 0.1 M NaCl
c) 0.1 M $BaCl_2$
d) 0.1 M urea
Answer: c) 0.1 M $BaCl_2$

Q72. Which property is used in desalination of sea water?
a) Osmosis
b) Reverse osmosis
c) Vapour pressure lowering
d) Elevation in boiling point
Answer: b) Reverse osmosis

Q73. The relation between osmotic pressure and temperature is:
a) $\pi \propto T$
b) $\pi \propto 1/T$
c) $\pi \propto \sqrt{T}$
d) Independent of T
Answer: a) $\pi \propto T$

Q74. Which colligative property is least preferred experimentally?
a) Osmotic pressure
b) Relative lowering of vapour pressure
c) Freezing point depression
d) Elevation of boiling point
Answer: b) Relative lowering of vapour pressure

Q75. Which solution will show highest boiling point?
a) 0.1 M glucose
b) 0.1 M urea
c) 0.1 M NaCl
d) 0.1 M sucrose
Answer: c) 0.1 M NaCl

Q76. For a binary solution obeying Raoult's law, plot of p vs mole fraction of solvent is:
a) Curved upward
b) Curved downward
c) Straight line
d) Irregular
Answer: c) Straight line

Q77. The vapour pressure of a solvent decreases by 10 mm Hg on dissolving a solute. Pure solvent pressure is 100 mm Hg. Mole fraction of solute is:
a) 0.01
b) 0.1
c) 0.9
d) 0.99
Answer: b) 0.1

Q78. When a solute dissolves and associates, then:
a) ΔTf decreases
b) ΔTf increases
c) ΔTf remains same
d) None
Answer: a) ΔTf decreases

Q79. The value of Kb for water is 0.52 K $molal^{-1}$. Boiling point of 1 molal urea solution is:
a) 100.52°C
b) 99.48°C
c) 101°C
d) 100°C
Answer: a) 100.52°C

Q80. Which solution is isotonic with 0.1 M urea?
a) 0.1 M glucose
b) 0.1 M NaCl
c) 0.05 M NaCl
d) 0.1 M K_2SO_4
Answer: c) 0.05 M NaCl

Q81. Which of the following solutions deviates positively from Raoult's law?
a) Ethanol + water
b) Acetone + chloroform
c) HCl + water
d) NaOH + water
Answer: a) Ethanol + water

Q82. The vapour pressure of ideal solution varies linearly with:
a) Mass fraction of solute

b) Mass fraction of solvent
c) Mole fraction of solvent
d) Volume fraction of solvent
Answer: c) Mole fraction of solvent

Q83. If osmotic pressure of 0.1 M solution is 2.46 atm, osmotic pressure of 0.2 M solution at same T is:
a) 4.92 atm
b) 2.46 atm
c) 1.23 atm
d) 24.6 atm
Answer: a) 4.92 atm

Q84. The elevation in boiling point of 1 molal NaCl solution is approximately: (Kb = 0.52 K kg mol^{-1})
a) 0.52 K
b) 1.04 K
c) 2 K
d) 0.26 K
Answer: b) 1.04 K

Q85. The value of van't Hoff factor (i) for Na_2SO_4 is:
a) 2
b) 3
c) 4
d) 5
Answer: b) 3

Q86. Which of the following statements is correct?
a) Molarity changes with temperature
b) Molality changes with temperature
c) Mole fraction changes with temperature
d) All of these
Answer: a) Molarity changes with temperature

Q87. Osmosis through semipermeable membrane was first observed by:
a) Graham
b) Pfeffer
c) Raoult
d) van't Hoff
Answer: b) Pfeffer

Q88. The osmotic pressure of 0.1 M solution at 27°C is closest to:
a) 2.4 atm
b) 24 atm
c) 0.24 atm
d) 0.082 atm
Answer: a) 2.4 atm

Q89. Which property is independent of temperature?
a) Molality
b) Molarity
c) Density
d) Osmotic pressure
Answer: a) Molality

Q90. A non-volatile solute is added to water. The vapour pressure of solution will:
a) Increase
b) Decrease
c) Remain constant
d) Become zero
Answer: b) Decrease

Q91. For a solution with positive deviation from Raoult's law, total vapour pressure is:
a) Greater than ideal value
b) Less than ideal value
c) Equal to ideal value
d) Zero
Answer: a) Greater than ideal value

Q92. Which colligative property is most suitable for determination of molar mass of proteins?
a) Osmotic pressure
b) Freezing point depression
c) Boiling point elevation
d) Vapour pressure lowering
Answer: a) Osmotic pressure

Q93. Which of the following is not correct?
a) Osmotic pressure depends on molarity
b) Osmotic pressure increases with T
c) Osmotic pressure decreases with T
d) Osmotic pressure depends on number of solute particles
Answer: c) Osmotic pressure decreases with T

Q94. The osmotic pressure of a solution containing 1 g polymer in 100 mL water is 8.31×10^{-3} atm at 300 K. Molar mass of polymer is:
a) 60,000
b) 30,000
c) 120,000
d) 6,000
Answer: a) 60,000

Q95. For aqueous NaCl solution, the freezing point depression is greater than that for urea because:
a) NaCl is volatile
b) NaCl ionizes
c) NaCl associates
d) NaCl forms complex
Answer: b) NaCl ionizes

Q96. Which of the following shows highest osmotic pressure?
a) 1 M glucose
b) 1 M NaCl
c) 1 M $BaCl_2$
d) 1 M urea
Answer: c) 1 M $BaCl_2$

Q97. Which of the following is a unit of molality?
a) mol kg^{-1}

b) mol L^{-1}
c) g L^{-1}
d) g mol^{-1}
Answer: a) mol kg^{-1}

Q98. Which is dimensionless?
a) Molarity
b) Molality
c) Mole fraction
d) Normality
Answer: c) Mole fraction

Q99. A 0.2 molal solution of NaCl is isotonic with 0.1 molal solution of:
a) Glucose
b) Sucrose
c) Urea
d) All of these
Answer: d) All of these

Q100. If two liquids form an ideal solution, the heat of mixing is:
a) Positive
b) Negative
c) Zero
d) Infinite
Answer: c) Zero

Q101. A 0.2 molal KCl solution shows freezing point depression of 0.74 K. Kf for water is:
a) 3.7 K kg mol^{-1}
b) 1.86 K kg mol^{-1}
c) 0.52 K kg mol^{-1}
d) 2.5 K kg mol^{-1}
Answer: b) 1.86 K kg mol^{-1}

Q102. Which of the following solutions shows negative deviation from Raoult's law?
a) Ethanol + water
b) Acetone + chloroform
c) CCl_4 + benzene
d) Acetone + benzene
Answer: b) Acetone + chloroform

Q103. In an ideal solution, enthalpy change on mixing is:
a) Positive
b) Negative
c) Zero
d) Cannot be predicted
Answer: c) Zero

Q104. Van't Hoff factor (i) for $K_4[Fe(CN)_6]$ is:
a) 2
b) 3
c) 4
d) 5
Answer: a) 2

Q105. Which unit is used for osmotic pressure?
a) atm
b) Pa
c) N m^{-2}
d) All of these
Answer: d) All of these

Q106. Freezing point of 0.1 M NaCl is approximately:
a) –0.186°C
b) –0.372°C
c) –0.52°C
d) –0.93°C
Answer: b) –0.372°C

Q107. Which of the following is not temperature dependent?
a) Molarity
b) Normality
c) Molality
d) Density
Answer: c) Molality

Q108. Which colligative property gives most accurate molar mass of macromolecules?
a) Osmotic pressure
b) Boiling point elevation
c) Freezing point depression
d) Vapour pressure lowering
Answer: a) Osmotic pressure

Q109. At higher altitude, boiling point of water is:
a) Higher
b) Lower
c) Same
d) Unpredictable
Answer: b) Lower

Q110. The depression in freezing point of equimolar urea and NaCl solution is:
a) Same
b) Greater for urea
c) Greater for NaCl
d) Cannot be compared
Answer: c) Greater for NaCl

Q111. Henry's law constant (KH) increases with:
a) Increase of temperature
b) Decrease of temperature
c) Increase of pressure
d) None of these
Answer: a) Increase of temperature

Q112. Van't Hoff equation for osmotic pressure is:
a) $\pi = iCRT$
b) $\pi = RT/iC$
c) $\pi = C/RT$

d) $\pi = iC/RT$
Answer: a) $\pi = iCRT$

Q113. A solution that obeys Raoult's law at all concentrations and temperatures is called:
a) Real solution
b) Ideal solution
c) Azeotrope
d) Non-ideal solution
Answer: b) Ideal solution

Q114. Which colligative property is measured in Pfeffer's method?
a) Vapour pressure
b) Osmotic pressure
c) Boiling point
d) Freezing point
Answer: b) Osmotic pressure

Q115. An isotonic solution has same:
a) Osmotic pressure
b) Concentration
c) Density
d) Vapour pressure
Answer: a) Osmotic pressure

Q116. A 0.5 M NaCl solution and 0.5 M urea solution are:
a) Isotonic
b) Hypotonic
c) Hypertonic
d) Not isotonic
Answer: d) Not isotonic

Q117. Which of the following is correct for hypertonic solution relative to cell sap?
a) Cell shrinks
b) Cell swells
c) Cell remains same
d) None
Answer: a) Cell shrinks

Q118. If vapour pressure of solvent is 500 mm and solution has vapour pressure 480 mm, mole fraction of solute is:
a) 0.02
b) 0.04
c) 0.96
d) 0.98
Answer: b) 0.04

Q119. Boiling point of solution compared to pure solvent is:
a) Higher
b) Lower
c) Same
d) Can be higher or lower
Answer: a) Higher

Q120. Osmotic pressure of 1 M NaCl is approximately (assuming complete dissociation):
a) 24.6 atm
b) 49.2 atm
c) 12.3 atm
d) 2.46 atm
Answer: b) 49.2 atm

Q121. Which concentration term is preferred in colligative property studies?
a) Molality
b) Molarity
c) Normality
d) % solution
Answer: a) Molality

Q122. The relative lowering of vapour pressure is equal to:
a) $\Delta p/p^o$
b) n_1/n_2
c) w_2/w_1
d) p/p^o
Answer: a) $\Delta p/p^o$

Q123. Mole fraction of solute is given by:
a) $n_2 / (n_1 + n_2)$
b) $n_1 / (n_1 + n_2)$
c) $w_2 / (w_1 + w_2)$
d) None
Answer: a) $n_2 / (n_1 + n_2)$

Q124. Which property is independent of nature of solute?
a) Colligative property
b) Surface tension
c) Viscosity
d) Conductivity
Answer: a) Colligative property

Q125. Boiling point elevation is proportional to:
a) Mole fraction of solute
b) Molality of solute
c) Molarity of solute
d) Volume of solvent
Answer: b) Molality of solute

Q126. Osmotic pressure of 0.1 M NaCl at 300 K is:
a) 2.46 atm
b) 4.92 atm
c) 24.6 atm
d) 0.246 atm
Answer: b) 4.92 atm

Q127. Freezing point depression is used to calculate:
a) Molecular mass of solute
b) Vapour pressure
c) Heat capacity

d) Heat of vaporization
Answer: a) Molecular mass of solute

Q128. For an ideal solution:
a) $\Delta H_{mix} = 0, \Delta V_{mix} = 0$
b) $\Delta H_{mix} = 0, \Delta V_{mix} \neq 0$
c) $\Delta H_{mix} \neq 0, \Delta V_{mix} = 0$
d) $\Delta H_{mix} \neq 0, \Delta V_{mix} \neq 0$
Answer: a) $\Delta H_{mix} = 0, \Delta V_{mix} = 0$

Q129. Which of the following pairs shows azeotrope formation?
a) Benzene + Toluene
b) Ethanol + Water
c) $CCl_4 + CHCl_3$
d) $NaCl + H_2O$
Answer: b) Ethanol + Water

Q130. If the degree of dissociation (α) of solute is 0.5, van't Hoff factor (i) for $AB \rightarrow A^+ + B^-$ is:
a) 1.0
b) 1.5
c) 2.0
d) 0.5
Answer: b) 1.5

Q131. Henry's law is obeyed if:
a) Gas reacts with solvent
b) Gas does not react with solvent
c) Gas is highly soluble
d) Gas ionizes
Answer: b) Gas does not react with solvent

Q132. If 5 g of non-volatile solute is dissolved in 95 g water, vapour pressure lowering is:
a) Proportional to 5/95
b) Proportional to 5/100
c) Proportional to 95/5
d) None
Answer: a) Proportional to 5/95

Q133. Colligative properties are due to:
a) Nature of solute
b) Number of solute particles
c) Nature of solvent
d) Interactions
Answer: b) Number of solute particles

Q134. A hypertonic solution has osmotic pressure:
a) Greater than reference solution
b) Less than reference solution
c) Equal to reference solution
d) None
Answer: a) Greater than reference solution

Q135. If solute molecules dimerize in solution, van't Hoff factor is:
a) >1

b) =1
c) <1
d) =0
Answer: c) <1

Q136. The cryoscopic constant depends on:
a) Solvent
b) Solute
c) Both solute and solvent
d) Pressure
Answer: a) Solvent

Q137. Osmotic pressure is more useful than other colligative properties for:
a) Electrolytes
b) Polymers
c) Non-electrolytes
d) Gases
Answer: b) Polymers

Q138. Vapour pressure of solution is always:
a) Greater than solvent
b) Less than solvent
c) Equal to solvent
d) Zero
Answer: b) Less than solvent

Q139. Osmotic pressure of equimolar solutions of glucose, NaCl, and $MgCl_2$ will be in ratio:
a) 1 : 1 : 1
b) 1 : 2 : 3
c) 1 : 2 : 1
d) 1 : 1 : 2
Answer: b) 1 : 2 : 3

Q140. Which concentration term is independent of temperature?
a) Molarity
b) Normality
c) Molality
d) Volume %
Answer: c) Molality

Q141. Depression in freezing point is observed because:
a) Vapour pressure of solution < solvent
b) Vapour pressure of solution > solvent
c) Vapour pressure of solution = solvent
d) None
Answer: a) Vapour pressure of solution < solvent

Q142. Ebullioscopic constant of solvent depends on:
a) Enthalpy of vaporization
b) Enthalpy of fusion
c) Molar mass of solute
d) Concentration of solution
Answer: a) Enthalpy of vaporization

Q143. Which is true for real solutions?
a) They obey Raoult's law
b) They show positive or negative deviations
c) ΔHmix = 0
d) ΔVmix = 0
Answer: b) They show positive or negative deviations

Q144. Boiling point elevation method is less suitable for:
a) Volatile solutes
b) Non-volatile solutes
c) Ionic solutes
d) None
Answer: a) Volatile solutes

Q145. Which of the following is a colligative property?
a) Osmotic pressure
b) Viscosity
c) Surface tension
d) Refractive index
Answer: a) Osmotic pressure

Q146. In ideal solution, A–B interactions are:
a) Stronger than A–A, B–B
b) Weaker than A–A, B–B
c) Equal to A–A, B–B
d) Zero
Answer: c) Equal to A–A, B–B

Q147. Azeotropes form due to:
a) Strong intermolecular attraction
b) Weak intermolecular attraction
c) Either strong or weak attraction
d) No interaction
Answer: c) Either strong or weak attraction

Q148. Osmotic pressure of 0.2 M urea solution at 300 K is:
a) 2.46 atm
b) 4.92 atm
c) 1.23 atm
d) 0.246 atm
Answer: b) 4.92 atm

Q149. Relative lowering of vapour pressure depends on:
a) Number of solute particles
b) Nature of solute
c) Nature of solvent
d) Both b and c
Answer: a) Number of solute particles

Q150. When two miscible liquids are mixed and volume decreases, the solution shows:
a) Positive deviation
b) Negative deviation
c) Ideal behaviour

d) None
Answer: b) Negative deviation

Q151. A 0.2 molal aqueous solution of KCl freezes at –0.744°C. The van't Hoff factor is:
a) 1.0
b) 1.5
c) 2.0
d) 3.0
Answer: b) 1.5

Q152. For dilute solutions, osmotic pressure is proportional to:
a) Volume
b) Concentration
c) Temperature
d) Both b and c
Answer: d) Both b and c

Q153. The osmotic pressure of 0.1 M solution of glucose at 300 K is:
a) 2.46 atm
b) 24.6 atm
c) 0.246 atm
d) 1 atm
Answer: a) 2.46 atm

Q154. In reverse osmosis, pressure is applied:
a) Greater than osmotic pressure
b) Equal to osmotic pressure
c) Less than osmotic pressure
d) Independent of osmotic pressure
Answer: a) Greater than osmotic pressure

Q155. Which of the following statements is correct?
a) Raoult's law relates vapour pressure and mole fraction
b) Raoult's law is valid for ideal solutions only
c) Both a and b
d) None
Answer: c) Both a and b

Q156. Osmotic pressure can be measured with:
a) Pfeffer's method
b) Beckmann thermometer
c) Landsberger method
d) None
Answer: a) Pfeffer's method

Q157. Which of the following solutions will be isotonic with 0.1 M NaCl?
a) 0.1 M glucose
b) 0.05 M Na_2SO_4
c) 0.05 M KCl
d) 0.1 M sucrose
Answer: b) 0.05 M Na_2SO_4

Q158. Freezing point of 1 molal NaCl solution is: (Kf = 1.86 K kg mol^{-1})
a) –1.86°C

b) –3.72°C
c) –0.93°C
d) –0.465°C
Answer: b) –3.72°C

Q159. Which one is a colligative property?
a) Surface tension
b) Osmotic pressure
c) Refractive index
d) Conductivity
Answer: b) Osmotic pressure

Q160. Solubility of gases in liquids decreases with:
a) Increase in temperature
b) Increase in pressure
c) Decrease in pressure
d) Increase in volume
Answer: a) Increase in temperature

Q161. A solution that shows positive deviation from Raoult's law has:
a) Weak solute–solvent interactions
b) Strong solute–solvent interactions
c) No interactions
d) None
Answer: a) Weak solute–solvent interactions

Q162. Which mixture forms minimum boiling azeotrope?
a) HCl + water
b) Ethanol + water
c) Acetone + chloroform
d) Acetic acid + water
Answer: a) HCl + water

Q163. The osmotic pressure of 1 M NaCl solution at 27°C (assuming complete dissociation) is:
a) 24.6 atm
b) 49.2 atm
c) 12.3 atm
d) 2.46 atm
Answer: b) 49.2 atm

Q164. In case of electrolytes, van't Hoff factor is:
a) < 1
b) = 1
c) > 1
d) = 0
Answer: c) > 1

Q165. In case of association of solute, observed colligative property is:
a) Less than expected
b) More than expected
c) Equal to expected
d) None
Answer: a) Less than expected

Q166. Which term is independent of temperature?
a) Molality
b) Molarity
c) Normality
d) Volume %
Answer: a) Molality

Q167. Osmotic pressure is directly proportional to:
a) Molarity
b) Molality
c) Mole fraction
d) Mass fraction
Answer: a) Molarity

Q168. The vapour pressure lowering depends on:
a) Mass of solvent
b) Mass of solute
c) Mole fraction of solute
d) Molarity
Answer: c) Mole fraction of solute

Q169. If ΔTf observed is less than ΔTf calculated, solute molecules have undergone:
a) Association
b) Dissociation
c) Ionization
d) Both b and c
Answer: a) Association

Q170. If ΔTf observed is greater than ΔTf calculated, solute molecules have undergone:
a) Association
b) Dissociation
c) Polymerization
d) Condensation
Answer: b) Dissociation

Q171. The vapour pressure of solution is always _____ than that of pure solvent.
a) Lower
b) Higher
c) Same
d) Zero
Answer: a) Lower

Q172. When equimolar urea and NaCl are dissolved, which solution shows higher colligative property?
a) Urea
b) NaCl
c) Both equal
d) Cannot be predicted
Answer: b) NaCl

Q173. Depression in freezing point is proportional to:
a) Molality of solute
b) Mass of solute
c) Volume of solution

d) Molarity of solution
Answer: a) Molality of solute

Q174. At higher altitude, water boils at lower temperature due to:
a) Decrease in vapour pressure
b) Decrease in atmospheric pressure
c) Increase in vapour pressure
d) Increase in atmospheric pressure
Answer: b) Decrease in atmospheric pressure

Q175. Osmotic pressure of solution containing 1 g polymer in 100 mL water is 8.31×10^{-3} atm at 300 K. Molar mass of polymer is:
a) 60,000
b) 30,000
c) 120,000
d) 6,000
Answer: a) 60,000

Q176. Henry's law constant (KH) for CO_2 in water is high. This means:
a) CO_2 is highly soluble
b) CO_2 is less soluble
c) Solubility independent of pressure
d) Solubility very high
Answer: b) CO_2 is less soluble

Q177. Which of the following is true for isotonic solutions?
a) Same molarity
b) Same osmotic pressure
c) Same molality
d) Same density
Answer: b) Same osmotic pressure

Q178. 1 mol NaCl produces how many particles in solution?
a) 1
b) 2
c) 3
d) 4
Answer: b) 2

Q179. Which law explains depression of freezing point?
a) Raoult's law
b) Henry's law
c) Boyle's law
d) Charles' law
Answer: a) Raoult's law

Q180. Cryoscopic constant of water is:
a) 0.52 K $molal^{-1}$
b) 1.86 K $molal^{-1}$
c) 2.0 K $molal^{-1}$
d) 5.0 K $molal^{-1}$
Answer: b) 1.86 K $molal^{-1}$

Q181. Boiling point elevation constant of water is:
a) 0.52 K $molal^{-1}$
b) 1.86 K $molal^{-1}$
c) 5.0 K $molal^{-1}$
d) 2.0 K $molal^{-1}$
Answer: a) 0.52 K $molal^{-1}$

Q182. Van't Hoff factor for $BaCl_2$ is:
a) 2
b) 3
c) 4
d) 1
Answer: b) 3

Q183. Osmotic pressure of a solution is equal to hydrostatic pressure when:
a) Osmosis stops
b) Osmosis increases
c) Osmosis reverses
d) None
Answer: a) Osmosis stops

Q184. Which property is useful for determining abnormal molecular masses?
a) Osmotic pressure
b) Boiling point elevation
c) Freezing point depression
d) All of these
Answer: d) All of these

Q185. Raoult's law is applicable for:
a) Volatile solutes only
b) Non-volatile solutes only
c) Both volatile and non-volatile solutes
d) Gaseous solutions only
Answer: c) Both volatile and non-volatile solutes

Q186. Osmotic pressure increases if:
a) Temperature decreases
b) Solute concentration increases
c) Solute concentration decreases
d) Solvent decreases
Answer: b) Solute concentration increases

Q187. Which property is not colligative?
a) Osmotic pressure
b) Relative lowering of vapour pressure
c) Depression of freezing point
d) Surface tension
Answer: d) Surface tension

Q188. The number of particles formed on dissociation of Na_2SO_4 is:
a) 2
b) 3
c) 4

d) 1
Answer: b) 3

Q189. Which solution will show maximum osmotic pressure?
a) 0.1 M NaCl
b) 0.1 M $BaCl_2$
c) 0.1 M glucose
d) 0.1 M urea
Answer: b) 0.1 M $BaCl_2$

Q190. Which solution has minimum freezing point?
a) 0.1 M urea
b) 0.1 M glucose
c) 0.1 M NaCl
d) 0.1 M $MgCl_2$
Answer: d) 0.1 M $MgCl_2$

Q191. When vapour pressure of solution is less than pure solvent, freezing point:
a) Increases
b) Decreases
c) Remains same
d) None
Answer: b) Decreases

Q192. Relative lowering of vapour pressure is a:
a) Colligative property
b) Extensive property
c) Intensive property
d) Both a and c
Answer: d) Both a and c

Q193. Osmotic pressure of blood is about:
a) 7.65 atm
b) 0.76 atm
c) 1.2 atm
d) 2.46 atm
Answer: a) 7.65 atm

Q194. Which type of solutions are used in IV fluids?
a) Hypotonic
b) Hypertonic
c) Isotonic
d) Supersaturated
Answer: c) Isotonic

Q195. Which concentration unit is preferred in medicine preparation?
a) Molality
b) Molarity
c) % solution
d) Mole fraction
Answer: c) % solution

Q196. In case of complete ionization, the van't Hoff factor for K_2SO_4 is:
a) 2

b) 3
c) 4
d) 1
Answer: b) 3

Q197. Which of the following pairs is not isotonic?
a) 0.1 M glucose & 0.1 M urea
b) 0.1 M NaCl & 0.1 M glucose
c) 0.1 M NaCl & 0.05 M $CaCl_2$
d) 0.1 M NaCl & 0.05 M Na_2SO_4
Answer: b) 0.1 M NaCl & 0.1 M glucose

Q198. Cryoscopic constant is related to:
a) Depression in freezing point
b) Elevation in boiling point
c) Vapour pressure
d) Osmotic pressure
Answer: a) Depression in freezing point

Q199. For a non-ideal solution, ΔHmix is:
a) 0
b) ≠ 0
c) Always positive
d) Always negative
Answer: b) ≠ 0

Q200. Which property is best for determination of molar mass of proteins?
a) Osmotic pressure
b) Vapour pressure lowering
c) Boiling point elevation
d) Freezing point depression
Answer: a) Osmotic pressure