# đず doubtnut 

India's Number 1 Education App

## CHEMISTRY

## NCERT - NCERT CHEMISTRY(ENGLISH)

## SOLUTION

Solved Examples

1. Calculate the mole fraction of ethylene glycol $\left(\mathrm{C}_{2} \mathrm{H}_{6} \mathrm{O}_{2}\right)$
in a solution containing $20 \%$ of $C_{2} H_{6} O_{2}$ by mass.

## D Watch Video Solution

2. Calculate the molarity of $a$ solution containing $5 g$ of NaOH in 450 mL solution.

## - Watch Video Solution

3. Calculate molality of $2.5 g$ of ethanoic acid
$\left(\mathrm{CH}_{3} \mathrm{COOH}\right)$ in 75 g of benzene.

## - Watch Video Solution

4. If $N_{2}$ gas is bubbled through water at 293 K , how many millimoles of $N_{2}$ gas would dissolve in $1 L$ of water. Assume that $N_{2}$ exerts a partial pressure of 0.987 bar. Given that Henry law constant for $N_{2}$ at 293 K is 76.48 kbar .

## - Watch Video Solution

5. The vapour pressure of chloroform
$(\mathrm{CHCl})_{3}$ and dichlorocethene $\left(\mathrm{CH}_{2} \mathrm{Cl}_{2}\right)$ at 298 K is 200 mmHg and 415 mmHg , respectively. Calculate
a. The vapour pressure of the solution prepared by mixing 25.5 g of $\mathrm{CHCl}_{3}$ and 40 g of $\mathrm{CH}_{2}-\mathrm{Cl}(2)$ at 298 K .
b. Mole fractions of each components in vapour phase.
6. The vapour pressure of pure benzene at a certain temperature is 0.850 bar. A nonvolatile, non-electrolyte solid weighting $0.5 g$ when added to $39.0 g$ of benzene (molar mass
$78 \mathrm{gmol}^{-1}$ ). The vapour pressure of the solution then is 0.845 bar. What is the molar mass of the solid substance?

## - Watch Video Solution

7. $18 g$ of glucose $\left(\mathrm{C}_{6} \mathrm{H}_{12} \mathrm{O}_{6}\right)$ is dissolved in

1 kg of water in a saucepan. At what
temperature will the water boil (at 1 atm) ? $K_{b}$ for water is $0.52 \mathrm{Kkgmol}^{-1}$.

## D Watch Video Solution

8. The boiling a point of benzene is 353.23 K .

When 1.80 g of a non-volatile solute was
dissolved in 90 g of benzene, the boiling point is raised to 354.11 K . Calculate the molar mass of the solute. $K_{b}$ for benzene is 2.53 K kg $m o l^{-1}$.
9. 45 g of ethylene glycol $\mathrm{C}_{2} \mathrm{H}_{6} \mathrm{O}_{2}$ is mixed with $600 g$ of water. Calculate (a) the freezing point depression and (b) the freezing point of solution.

Given $K_{f}=1.86 \mathrm{Kkgmol}^{-1}$.

## D Watch Video Solution

10. 1.0 g of non-electrolyte solute dissolved in
50.0 g of benzene lowered the freezing point of benzene by $0.40 K$. The freezing point
$5.12 \mathrm{kgmol}^{-1}$. Find the molecular mass of the solute.

## D Watch Video Solution

11. $200 \mathrm{~cm}^{3}$ of an aqueous solution of a protein contains 1.26 gof the protein. The osmotic pressure of such a solution at $300 K$ is found to be $2.57 \times 10^{-3}$ bar. Calculate the molar mass of the protein.
12. Two grams of benzoic acid $\left(\mathrm{C}_{6} \mathrm{H}_{5} \mathrm{COOH}\right)$ dissolved in 25.0 g of benzene shows a depression in freezing point equal to $1.62 K$.

Molal depression constant for benzene is
$4.9 \mathrm{Kkg}^{-1} \mathrm{~mol}^{-1}$. What is the percentage association of acid if it forms dimer in solution?

D Watch Video Solution
13. 0.6 mL of acetic acid $\left(\mathrm{CH}_{3} \mathrm{COOH}\right)$ having density $1.06 \mathrm{gmL}^{-1}$ is dissolved in $1 L$ of water. The depression in freezing point observed for this strength of acid was
$0.0205^{\circ}$ C.Calculate the Van't Hoff factor and dissociation constant of the acid. $K_{f}$ for $\left.H_{2} O=1.86 K k g^{-1} \mathrm{~mol}^{-1}\right)$

## D Watch Video Solution

1. Calculate the mass percentage of benzene $\left(C_{6} H_{6}\right)$ and carbon tetrachloride $\left(C C l_{4}\right)$ if $22 g$ of benzene is dissoved in $122 g$ of carbon tetrachloride.

## - Watch Video Solution

2. Calculate the mole fraction of benzene in solution containing $30 \%$ by mass in carbon tetrachloride.
3. Calculate the molarity of each of the following solutions :
$a .30 \mathrm{~g}$ of $\mathrm{Co}\left(\mathrm{NO}_{3}\right)_{2} .6 \mathrm{H}_{2} \mathrm{O}$ in 4.3 L of solution b. 30 mL of $0.5 \mathrm{MH}_{2} \mathrm{SO}_{4}$ diluted to 500 mL .

## D Watch Video Solution

4. Calculate the mass of urea $\left(\mathrm{NH}_{2} \mathrm{CONH}_{2}\right)$
required in making 2.5 kgof 0.25 mol al aqueous solution.
5. Calculate the (a) molality, (b) molarity, and
(c) mole fraction of $K I$ if the density of $20 \%$ ( mass / mass ) aqueous $K I$ is $1.202 g m L^{-1}$.

## D Watch Video Solution

6. $H_{2} S$, a toxic gas with rotten egg like smell, is used for the qualitative analysis.If the solubility of $H_{2} S$ in water at $S T P$ is $0.195 m$, calculate Henry's law constant.

## - Watch Video Solution

7. Henry's law constant for $\mathrm{CO}_{2}$ in water is $1.67 \times 10^{8} \mathrm{~Pa}$ at 298 K . Calculate the quantity of $\mathrm{CO}_{2}$ in 500 mL of soda water when packed under $2.5 \mathrm{atmCO}_{2}$ pressure at 298 K .

## - Watch Video Solution

8. The vapour pressure of pure liquids $A$ and
$B$ is 450 and 700 mmHg , respectively, at

350 K . Find out the composition of the liquid mixture if the total vapour pressure is 600 mmHg . Also find the composition of the vapour phase.

## - Watch Video Solution

9. Vapour pressure of pure water at 298 K is 23.8 mmHg .50 g of urea $\left(\mathrm{NH}_{2} \mathrm{CONH}_{2}\right)$ is dissolved in 850 g of water. Calculate the vapour pressure of water for this solution and its relative lowering.

## Watch Video Solution

10. The boiling point of water at 750 mmHg is
$99.63^{\circ} \mathrm{C}$. How much sucrose is to be added to
500 g of water such that it boils at $100^{\circ} \mathrm{C}$.

## - Watch Video Solution

11. Calculate the mass of ascorbic acid (

Vitamin $C, C_{6} H_{8} O_{6}$ ) to be dissolved in 75 g of acetic acid to lower its melting point by $1.5^{\circ} C . K_{f}=3.9 \mathrm{Kkgmol}^{-1}$

## - Watch Video Solution

12. Calculate the osmotic pressure in pascals exerted by a solution prepared by dissolving
1.0 g of polymer of molar mass 185,000 in 450 mL of water at $37^{\circ} \mathrm{C}$.

## - Watch Video Solution

13. Define the term solution. How many types of solutions are formed ? Write briefly about
each type with an example.

## - Watch Video Solution

14. Give an example of a solid solution in which
the solute is a gas.

## D Watch Video Solution

15. Define the following terms:
a. Mole fraction b. Molality
c. Molarity `d. Mass percentage.
16. Concentrated nitric acid used in the
laboratory work is $68 \%$ nitric acid by mass in aqueous solution. What should be the molarity of such a sample of the acid if the density of solution is $1.504 \mathrm{gmL}^{-1}$ ?

## - Watch Video Solution

17. A solution of glucose in water is labelled as
$10 \operatorname{percent} w / w$, what would be the molality and mole fraction of each component in the solution? If the density of the solution is $1.2 g m L^{-1}$, then what shall be the molarity of the solution?

## - Watch Video Solution

18. Volume of 0.1 MHCl required to react completely with 1 g equimolar mixture of
$\mathrm{Na}_{2} \mathrm{CO}_{3}$ and $\mathrm{NaHCO}_{3}$ is

## - Watch Video Solution

19. Calculate the percentage composition in terms of mass of solution obtained by mixing 300 g of a $25 \%$ and 400 g of a $40 \%$ solution by mass.

D Watch Video Solution
20. An antifreeze solution is prepared from 222.6 g of ethylene glycol $\left[\mathrm{C}_{2} \mathrm{H}_{4}(\mathrm{OH})_{2}\right]$ and 200 g of water. Calculate the molality of the solution. If the density of the solution is $1.072 \mathrm{gmL}^{-1}$ then what shall be the molarity of the solution?

## D Watch Video Solution

21. A sample of drinking water was found to be severely contaminated with chloroform,
$\mathrm{CHCl}_{3}$, supposed to be carcinogen. The level of contamination was 15 ppm (by mass).
(i) Express this in per cent by mass.
(ii) Determine the molality of chloroform in the water sample.

## - Watch Video Solution

22. What role does the molecular interaction play in a solution of alcohol and water ?

## - Watch Video Solution

23. Why do gases always tend to be less soluble in liquids as the temperature is raised?

- Watch Video Solution

24. State Henry's law and mention some important applications?

- Watch Video Solution

25. The partial pressure of ethane over a saturated solution containing $6.56 \times 10^{-2} g$ of ethane is 1 bar. If the solution contains
$5.00 \times 10^{-2} g$ of ethane, then what shall be the partial pressure of the gas?

## D Watch Video Solution

26. What is meant by positive and negative deviations from Raoult's law and how is the
sign of $\Delta_{m i x} H$ related to positive and negative deviations from Raoult's law?

## D View Text Solution

27. An aqueous solution of 2 per cent
(wt. / wt) non-volatile solute exerts a pressure of 1.004 bar at the boiling point of the solvent. What is the molecular mass of the solute?
28. Heptane and octane form ideal solution. At $373 K$, the vapour pressure of the two liquids are $105.2 k P a$ and $46.8 k P a$ respectively. What will be the vapour pressure, in bar, of a mixture of $25 g$ of heptane and $35 g$ of octane?

## D Watch Video Solution

29. The vapour pressure of water is $12.3 k P a$ at $300 K$. Calculate vapour pressure of 1 molal solution of a solute in it.
30. Calculate the mass of a non-volatile solute
( molecular mass 40) which should be dissolved in $114 g$ octane to reduce its vapour pressure to $80 \%$.

## D Watch Video Solution

31. A solution containing $30 g$ of a non-volatile solute exactly in $90 g$ water has a vapour pressure of $2.8 k P a$ at $298 K$. Further $18 g$ of
water is then added to solution, the new vapour pressure becomes $2.9 k P a$ at $298 K$.

Calculate:
(i) molecular mass of the solute,
(ii) vapour pressure of water at $298 K$.

## D View Text Solution

32. A $5 \%$ solution (by mass) of cane sugar in water has freezing point of 271 K . Calculate the freezing point of a $5 \%$ glucose (by mass) in
water. The freezing point of pure water is
273.15 K.

## D Watch Video Solution

33. Two elements $A$ and $B$ form compounds
having molecular formula $A B_{2}$ and $A B_{4}$.

When dissolved in $20 g$ of benzene, 1 gof $A B_{2}$
lowers the freezing point by $2.3 K$, whereas
1.0 g of $A B_{4}$ lowers it by $1.3 K$. The molal depression constant for benzene is
$5.1 \mathrm{Kkgmol}^{-1}$. Calculate the atomic mass of
$A$ and $B$.

## D View Text Solution

34. At $300 \mathrm{~K}, 36 \mathrm{~g}$ of glucose present per litre in its solution had an osmotic pressure 4.98 bar. If the osmotic pressure of solution is 1.52 bar at the same temperature, what would be its concentration.
35. Suggest the most important type of intermolecular attractive interaction in the following pairs :
a. $n$ - Hexane and $n$ - octane
b. $I_{2}$ and $C C l_{4}$
c. $\mathrm{NaClO} \mathrm{O}_{4}$ and water
d. Methanol and acetone
e. Acetonitrile $\left(\mathrm{CH}_{3} \mathrm{CN}\right)$ and acetone
$\left(C_{3} H_{6} O\right)$

## D View Text Solution

36. Based on solute - solvent interactions, arrange the following in order of increasing solubility in $n$ - octane and explain the result.

Cyclohexane, $\mathrm{KCl}, \mathrm{CH}_{3} \mathrm{OH}, \mathrm{CH}_{3} \mathrm{CN}$.

## D Watch Video Solution

37. Among the following compounds, identify which are insoluble, partially soluble, and highly soluble in water?
$a$. Phenol $b$. Toluene
$c$. Formic acid $d$. Ethylene glycol
e. Chloroform $f$. Pentanol

## D Watch Video Solution

38. If the density of some lake water is
$1.25 \mathrm{gmL}^{-1}$ and contains $92 g$ of $N a^{\oplus}$ ions per $k g$ of water, calculate the molality of $N a^{\oplus}$ ions in the lake.

## D View Text Solution

39. If the solubility product of $C u S$ is $6 \times 10^{-16}$, calculate the maximum molarity of
$C u S$ in aqueous solution.

## D Watch Video Solution

40. Calculate the mass percentage of aspirin
$\left(\mathrm{C}_{9} \mathrm{H}_{8} \mathrm{O}_{4}\right)$ in acetonitrile $\left(\mathrm{CH}_{3} \mathrm{CN}\right)$ when
6.5 g of $\mathrm{C}_{9} \mathrm{H}_{8} \mathrm{O}_{4}$ is dissolved in 450 g of
$\mathrm{CH}_{3} \mathrm{CN}$.
41. Nalorphene $\left(\mathrm{C}_{19} \mathrm{H}_{22} \mathrm{NO}_{3}\right)$, similar to morphine, is used to combat withdrawal
symptoms in narcotic users. The dose of nalorphene generally given is 1.5 mg . Calculate the mass of solution of $1.5 \times 10^{-3} \mathrm{~m}$ aqueous solution required for the above dose.

## - Watch Video Solution

42. Calculate the amount of benzoic acid
( $\mathrm{C}_{6} \mathrm{H}_{5} \mathrm{COOH}$ ) required for preparing 250 mL
of $0.15 M$ solution in methanol.

## D Watch Video Solution

43. The depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic acid, and trifluoroacetic acid increases in the order given above. Explain briefly.

D View Text Solution
44. Calculate the depression in the freezing point of water when $10 g$ of
$\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{CHClCOOH}$ is added to 250 g water.
$K_{a}=1.4 \times 10^{-3}, K_{f}=1.86 \mathrm{Kkgmol}^{-1}$.

## D Watch Video Solution

45. 19.5 g of $\mathrm{CH}_{2} \mathrm{FCOOH}$ is dissolved in 500 g
of water. The depression in the freezing point of water observed is $1.0^{\circ} \mathrm{C}$. Calculate the Van't

Hoff factor and dissociation constant of fluoroacetic acid.

## D View Text Solution

46. The vapour pressure of water at $293 K$ is
17.535 mmHg . Calculate the vapour pressure of water at 293 K when 25 g of glucose is dissolved in 450 g of water.
47. Henry's law constant for the molality of methane in benzene at $298 K$ is
$4.27 \times 10^{5} \mathrm{mmHg}$. Calculate the solubility of methane in benzene at $298 K$ under 760 mmHg.

## D Watch Video Solution

48. 100 g of liquid $A\left(\right.$ molar mass $\left.140 \mathrm{gmol}^{-1}\right)$
was dissolved in $1000 g$ of liquid $B$ ( molar
mass $180 \mathrm{gmol}^{-1}$ ). The vapour pressure of
pure liquid $B$ was found to be 500 torr.

Calculate the vapour pressure of pure liquid $A$
and its vapour pressure in the solution if the total vapour pressure of the solution is 475

Torr

## D View Text Solution

49. | $100 x x_{\text {outur }}$ | 0 | 11.8 | 23.4 | 36.0 | 50.8 | 58.2 | 64.5 | 72.1 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathrm{p}_{\text {arotion }} / \mathrm{mm}$ |  |  |  |  |  |  |  |  |
| Hg | 0 | 54.9 | 110.1 | 202.4 | 322.7 | 405.9 | 454.1 | 521.1 |



Vapour pressures of pure acetone and chloroform at 328 K are 741.8 mm Hg and 632.8 mm Hg respectively. Assuming that they form
ideal solution over the entire range of composition.

Plot
$p_{\text {total }}, p_{\text {chloroform }}$, and $p_{\text {acetone }}$ as a function of
$x_{\text {acetone }}$ the experimental data observed for different compositions of mixture is: Plot this data also on the same graph paper. indicate whether it has positive deviation or negative deviation from the ideal solution.

## D View Text Solution

50. Benzene and toluene form ideal solution over the entire range of composition. The
vapour pressure of pure benzene and naphthalene at 300 K are 50.71 mmHg and 32.06 mmHg , respectively. Calculate the mole
fraction of benzene in vapour phase if $80 g$ of benzene is mixed with 100 g of naphthalene.
51. The air is a mixture of a number of gases.

The major components are oxygen and nitrogen with approximate proportion of $20 \%: 79 \%$ by volume at 298 K . The water is in equilibrium with air at a pressure of 10 atm At 298 K if Henry's law constants for oxygen and nitrogen at 298 K are $3.30 \times 10^{7} \mathrm{~mm}$ and
$6.51 \times 10^{7} \mathrm{~mm}$, respectively, calculate the composition of these gases in water.
52. Determine the amount of $C a C l_{2}(\mathrm{i}=2.47)$ dissolved in 2.5 L of water such that its osmotic pressure is 0.75 atm at $27^{\circ} \mathrm{C}$.

## D Watch Video Solution

53. Determine the osmotic pressure of $a$ solution prepared by dissolving $25 m g$ of
$K_{2} S O_{4}$ in $2 L$ of water at $25^{\circ} \mathrm{C}$, assuming that it is completely dissociated.

## D Watch Video Solution



