

# D.A.V. PUBLIC SCHOOL C.G. ZONE

## CHEMISTRY

### CLASS- XII

Maximum Marks: 70

Time allowed : 3hours

#### **General Instructions:**

Read the following instructions carefully.

- (a) There are 33 questions in this question paper with internal choice.
- (b) SECTION A consists of 16 multiple -choice questions carrying 1 mark each.
- (c) SECTION B consists of 5 short answer questions carrying 2 marks each.
- (d) SECTION C consists of 7 short answer questions carrying 3 marks each.
- (e) SECTION D consists of 2 case - based questions carrying 4 marks each.
- (f) SECTION E consists of 3 long answer questions carrying 5 marks each.
- (g) All questions are compulsory.
- (h) Use of log tables and calculators is not allowed.

#### SECTION A

1. Which type of deviation is shown by Carbon tetrachloride and chloroform mixture:

- (a) Negative deviation from Raoult's law
- (b) Ideal solution.
- (c) Positive deviation from Raoult's law
- (d) Both positive and negative deviation.

2. In a lead storage battery-

- (a)  $\text{PbO}_2$  is reduced to  $\text{PbSO}_4$  at the cathode.
- (b)  $\text{Pb}$  is oxidised to  $\text{PbSO}_4$  at the anode.
- (c) Both electrodes are immersed in the same aqueous solution of  $\text{H}_2\text{SO}_4$ .
- (d) All above are true

3. An electrochemical cell behaves like an electrolyte cell when (a)  $E_{\text{cell}} = E_{\text{external}}$

- (b)  $E_{\text{cell}} = 0$
- (c)  $E_{\text{external}} > E_{\text{cell}}$

(d)  $E_{\text{external}} < E_{\text{cell}}$

4. What will happen during the electrolysis of aqueous solution of  $\text{CuSO}_4$  by using platinum electrodes?

(a) Copper will deposit at cathode.

(b) Copper will deposit at anode.

(c) Oxygen will be released at cathode.

(d) Copper will dissolve at anode.

5. The vitamins which can be stored in our body are:

(a) Vitamin A, B, D and E

(d) Vitamin A, C, D and K

(c) Vitamin A, B, C and D

(d) Vitamin A, D, E and K

6. If  $\Delta_o < P$ , then the correct electronic configuration for  $d^4$  system will be?

(a)  $t^2g^4 e_g^0$

(b)  $t^2g^3 e_g^1$

(c)  $t^2g^0 e_g^4$

(d)  $t^2g^2 e_g^2$

7. If the initial concentration of substance A is 1.5 M and after 120 seconds the concentration of substance A is 0.75 M, the rate constant for the reaction if it follows zero - order kinetics is:

(a)  $0.00625 \text{ molL}^{-1}\text{s}^{-1}$

(b)  $0.00625 \text{ s}^{-1}$

(c)  $0.00578 \text{ molL}^{-1} \text{ s}^{-1}$

(d)  $0.00578 \text{ s}^{-1}$

8. Which of the following will give a white precipitate upon reacting with  $\text{AgNO}_3$ ?

(a)  $\text{K}_2 [\text{Pt}(\text{en})_2 \text{Cl}_2]$

(b)  $\text{Co}(\text{NH}_3)_3\text{Cl}_3$

(c)  $[\text{Cr}(\text{H}_2\text{O})_6] \text{Cl}_3$

(d)  $[\text{Fe}(\text{H}_2\text{O})_3\text{Cl}_3]$

9. What is IUPAC name of the ketone A, which undergoes iodoform reaction to give  $\text{CH}_3 \text{CH}=\text{C}(\text{CH}_3)\text{COONa}$  and yellow precipitate of  $\text{CHI}_3$  ?

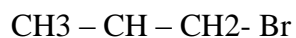
(a) 3-Methylpent-3-en-2-one

(b) 3-Methylbut-2-en- one

(c) 2, 3-Dimethylethanone

(d) 3-Methylpent-4-one

10. Which is the correct IUPAC name for:



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a) 1-Bromo-2-ethylpropane

b) 1-Bromo-2-ethyl-2-methylethane

c) 1-Bromo-2-methylbutane

d) 2-Methyl-1-bromobutane

11. The compound that reacts fastest with Lucas reagent at room temperature is-

(a) butan-1-ol

(b) butan-2-ol

(c) 2 methylpropan-1-ol

(d) 2-methylpropan-2-ol

12. Which of the following statement is true?

(a) molecularity of reaction can be zero or a fraction.

(b) molecularity has no meaning for complex reactions.

(c) molecularity of a reaction is an experimental quantity

(d) reactions with the molecularity three are very rare but are fast.

13. Assertion: O-nitro-phenol is less volatile than p-nitro-phenol.

Reason: there is intra-molecular hydrogen bonding in o- nitro-phenol and intermolecular hydrogen bonding in p-nitro-phenol.

14. Assertion: Cuprous ion ( $\text{Cu}^+$ ) is colourless whereas cupric ion ( $\text{Cu}^{++}$ ) is blue in the aqueous solution.

Reason: Cuprous ion ( $\text{Cu}^+$ ) has unpaired electrons while cupric ion ( $\text{Cu}^{++}$ ) does not.

15. Assertion :  $\text{KMnO}_4$  acts as an oxidising agent in acidic, basic or neutral medium.

Reason : It oxidises ferrous sulphate to ferric sulphate.

16. Assertion: Lowering of vapour pressure is not dependent on the number of species present in the solution.

Reason: Lowering of vapour pressure and relative lowering of vapour pressure are colligative properties.

17. (a) DNA fingerprinting is used to determine paternity of an individual. Which property of DNA helps in the procedure?

(b) What structural change will occur when a native protein is subjected to change in pH?

18. A 5% solution of  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$  (MW = 322) is isotonic with 2% solution of non-electrolytic, non volatile substance X. Find out the molecular weight of X

19. Assign reason for the following:

(a) Copper (I) ion is not known in aqueous solution.

(b) The enthalpies of atomization of transition elements are quite high.

OR

(a) Why Zn metal is not considered as transition element.

(b) why d-block elements show the variable oxidation states.

20. Which is a stronger reducing agents  $\text{Cr}^{2+}$  or  $\text{Fe}^{2+}$  and why?

21. Account for the following:

(a) Arrange each set of compounds in order of increasing boiling points. (i) Bromomethane, (ii) Bromoform, (iii) Chloromethane, (iv) Dibromomethane.

(b) Write the product formed when n-butyl chloride is treated with alcoholic KOH ?

22. Phenol associates in benzene to a certain extent in dimerisation reaction. A solution containing 0.02 kg of phenol in 1.0 kg of benzene has its freezing point depressed 0.69 K . Calculate the degree of association of phenol .(  $K_f = 5.12 \text{ k kg/mol}$  )

OR

2 g of benzoic acid dissolved in 25 g of benzene shows a depression in freezing point equal to 1.62 K. Calculate the % of association of benzoic acid. (Molal depression constant (K<sub>f</sub>) for benzene is 4.9 k kg/mol).

23. Account for the following:

(a) State Henry's law and mention one important application?

(b) Why do gases always tend to be less soluble in liquids as the temperature is raised?

24. You are given four organic compounds "A", "B", "C" and "D". The compounds "A", "B" and "C" form an orange-red precipitate with 2,4 DNP reagent. Compounds "A" and "B" reduce Tollen's reagent while compounds "C" and "D" do not. Both "B" and "C" give a yellow precipitate when heated with iodine in the presence of NaOH. Compound "D" gives brisk effervescence with sodium bicarbonate solution. Identify "A", "B", "C" and "D" given the number of carbon atoms in three of these carbon compounds is three while one has two carbon atoms. Give an explanation for your answer

25. Name the following coordination entities and draw the structures of their Stereoisomers.

(i)  $[\text{Co}(\text{en})_2\text{Cl}_2]^+$

(ii)  $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$

(iii)  $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$  (Atomic numbers Cr = 24, Co = 27)

26. Account for the following:

(a) Haloalkanes undergo substitution reactions while haloarenes undergo electrophilic substitution reactions, Explain.

(b) How do polar solvents help in the first step in S<sub>N</sub>1 mechanism?

OR

(a) What are enantiomers?

(b) Arrange the compounds of each set in order of reactivity towards SN 2 displacement: 2-Bromo,2-methylbutane,1-Bromopentane, 2-Bromopentane.

27. The resistance of conductivity cell filled with 0.1 M KCl solution is 100 Ohm. If the resistance of the same cell when filled with 0.02 M KCl solution is 520 ohm, calculate the conductivity and molar conductivity of 0.02 M KCl solution . Conductivity of 0.1 M KCl solution is  $1.29 \text{ m}^{-1}$

28. The rate constants of a reaction at 200K and 500K are  $0.02\text{s}^{-1}$  and  $0.20\text{s}^{-1}$  respectively. Calculate the value of  $E_a$  (Given  $2.303R = 19.15 \text{ JK}^{-1}\text{mol}^{-1}$ )

29. Read the passage given below and answer the following questions: (1x4 = 4) The phenomenon of the flows of solvent through a semipermeable membrane from pure solvent to the solution is known as osmosis. Semipermeable membranes can be of animal or vegetable origin and these occur naturally such a pig's bladder or parchment or can be synthetic such as cellophane. If the osmosis takes place between the solutions of different concentration, then solvent molecules will move from the solution of low solute concentration to that of higher solute concentration. The flow will continue till the equilibrium is attained. The osmotic pressure of a solution is the excess pressure that must be applied to a solution to prevent osmosis, i.e. to stop the passage of solvent molecules through a semipermeable membrane into the solution. It is shown in figure. It is colligative property as it depends on the number of solute molecules and not on their nature. Osmotic pressure is proportional to the molarity (C) of the solution at a given temperature T. Thus,  $\pi \propto C$ ,  $\pi = CRT$  The osmotic pressure  $\pi$  depends on the molar concentration of the solution ( $\pi = CRT$ ). If two solutions are of equal solute concentration and, hence, have the same osmotic pressure. They are said to be isotonic. If two solutions are of unequal osmotic pressure, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic. The following questions from (i-iv) are multiple choice questions. Choose the most appropriate answer-

(A) At a given temperature, osmotic pressure of the concentrated solution of a substance:

(a) is higher than that of the dilute solution.

(b) is lower than that of dilute solution.

(c) is same as that of dilute solution.

(d) cannot be compared with osmotic pressure of dilute solution.

(B) 0.1 M NaCl and 0.005 M BaCl<sub>2</sub> solutions are separated by a semi-permeable membrane in a container. For this system, choose the correct answer.

(a) there is no movement of any solution across the membrane (b) water flows from BaCl<sub>2</sub> solution to NaCl solution

(c) water flows from NaCl solution to BaCl<sub>2</sub> solution

(d) Osmotic pressure of 0.1 M NaCl is lower than that of BaCl<sub>2</sub> (Assume complete dissociation)

(C) The Osmotic pressure of 0.2 M solution of urea at 27°C ( $R=0.082 \text{ L atm mol}^{-1} \text{ K}^{-1}$ ) is-

(a) 4.92 atm

(b) 1 atm

(c) 0.2 atm

(d) 27 atm

(D) A 6% solution of urea is isotonic with –

(a) 0.05 M solution of Glucose.

(b) 6% solution of Glucose.

(c) 25% solution of Glucose.

(d) 1 M solution of Glucose.

OR

Students are often fascinated by extreme sports such as SCUBA(Self contained underwater Breathing Apparatus)diving .But scuba divers must very conscious of Caisson's disease,



commonly called 'The Bends'. This condition is related more to Henry law which states that more gas will be dissolved in a liquid when the gas is pressurized. Because of the water pressure body tissue absorbs nitrogen gas faster as a diver descends than when ascending to the surface. However if a diver ascend too quickly, nitrogen gas bubbles will form in body tissue rather than being exhaled. These nitrogen bubbles causes severe pain .

(A) A condition that is related to nitrogen solubility at a higher pressure is

(a) Anoxia

(b) Bends

(c) Nausea

(d) None of these

(B) Bends are caused due to

(a) blockage of blood capillaries by N<sub>2</sub> bubbles

(b) blockage of blood capillaries by O<sub>2</sub> bubbles

(c) blockage of blood capillaries by H<sub>2</sub> bubbles

(d) blockage of blood capillaries by CO<sub>2</sub> bubbles

(C) Scuba divers must use air diluted with

(a) Hydrogen

(b) Helium

(c) Neon

(d) Nitrogen

(D) Henry's law applicable only when

(a) The pressure of gas is not too high and temperature is not too low.

- (b) The gas should not undergo any chemical change
- (c) The gas should not undergo association or dissociation in the solution.
- (d) All of these conditions are applicable

30. Read the passage given below and answer the following questions: (1×4 = 4) A phenol contains –OH group(s) directly attached to carbon atom(s) of an aromatic system (C<sub>6</sub>H<sub>5</sub>OH). In phenols, the –OH group is attached to sp<sup>2</sup> - hybridized carbon of an aromatic ring. The carbon – oxygen bond length (136 pm) in phenol is slightly less than that in methanol. This is due to (i) partial double bond character on account of the conjugation of unshared electron pair of oxygen with the aromatic ring and (ii) sp<sup>3</sup> – hybridized state of carbon to which oxygen is attached. It can be prepared by various means or methods. Some important methods are alkali fusion of sulphonates, hydrolysis of diazonium salts, decarboxylation of salicylic acid and from Grignard reagent. Commercially, it is prepared from Dow's process and from cumene. In Dow's process, phenol is obtained when chlorobenzene is heated with 6-8% NaOH at 623 K under 320 atm pressure. Aerial oxidation of cumene produces cumene hydroperoxide which upon subsequent hydrolysis with an aqueous acid gives phenol and propanone. Benzene is sulphonated with oleum and benzene sulphonic acid so formed is converted to sodium phenoxide on heating with molten sodium hydroxide. Acidification of the sodium salt gives phenol. Diazonium salts are hydrolysed to phenols by warming with water or by treating with dilute acids. The following questions from (i-iv) are multiple choice questions. Choose the most appropriate answer –

(A) Which of the following hydrocarbon is used for the worldwide production of phenol?

- (a) Iso-butyl benzene
- (b) Iso-propyl benzene
- (c) Iso-pentyl benzene
- (d) None of the above

(B) The name of the product which is obtained by the decarboxylation of sodium salt of salicylic acid with soda-lime is-

- (a) Phenol
- (b) Toluene
- (c) Benzene
- (d) Benzoic acid

(C) Which of the following reagents is used for the conversion of benzene sulphonic acid to phenol?

- (a)  $\text{CaCO}_3$
- (b)  $\text{NaOH}$ ,  $\text{HCl}$
- (c)  $\text{Ca}(\text{OH})_2$
- (d) None of these

(D) Which of the following can produce phenol?

- (a) Reduction of aniline
- (b) Oxidation of chloro benzene
- (c) Oxidation cumene
- (d) Acidification of chloro benzene

31. (a) Write the structure of the main products when aniline reacts with the following reagents.

- (i)  $\text{Br}_2$  water
- (ii)  $(\text{CH}_3\text{CO})_2\text{O}$ /pyridine

(b) Arrange the following in the increasing order of basicity in the vapour phase  $\text{C}_2\text{H}_5\text{NH}_2$ ,  $(\text{C}_2\text{H}_5)_2\text{N}$ ,  $(\text{CH}_3\text{CH}_2)\text{NH}$

(c) Complete the following:  $\rightarrow$

(i)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2 + \text{CHCl}_3 + \text{KOH (alc)} \rightarrow$

(ii)  $\text{CH}_3\text{CONH}_2 + \text{Br}_2 + \text{KOH}$

OR

(a) Arrange  $1^\circ, 2^\circ, 3^\circ$  amines in the basic strength and aqueous solution. Explain.

(b) Arrange in order of increasing boiling point  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$ ,  $\text{CH}_3\text{CH}_2\text{NHCH}_3$ ,  $(\text{CH}_3)_3\text{N}$ ,

(c) (i) Prepare propylamine by Gabriel phthalimide synthesis

(ii) What happens when benzene diazonium chloride is being heated with  $\text{C}_2\text{H}_5\text{OH}$ ?

32. Account for the following:

A) Write the cell reaction and calculate the emf of the following cell at 298 K

$\text{Cr}/\text{Cr}^{3+} (0.01\text{m}) // \text{Fe}^{2+} (0.01\text{m}) / \text{Fe}$  [Given  $E^\circ_{\text{Cr}^{3+}/\text{Cr}} = -0.74 \text{ V}$  [ $E^\circ_{\text{Fe}^{2+}/\text{Fe}} = -0.44\text{V}$ ]

(B) Apply Kohlrausch law of independent migration of ions, write the expression to determine the limiting molar conductivity of calcium chloride.

OR

(A) Write the cell reaction and calculate the emf of the following cell at 25°C

$\text{Sn}(s)/\text{Sn}^{2+}(0.004\text{m}) // \text{H}^+(0.20\text{m})/\text{H}_2(g) 1 \text{ bar} / \text{Pt}(s)$  (Given  $E^\circ_{\text{Sn}^{2+}/\text{Sn}} = -0.14\text{V}$ ) (B) Define the molar conductivity of a solution and explain how molar conductivity changes with Change in concentration of solution for a weak and strong electrolyte.

33. Attempt any five of the following:

- HCl is not used in acidic medium with potassium permanganate in titration.
- $\text{MnO}$  is basic in nature
- Actinides show the large number of oxidation states.
- Transition elements have high enthalpy of atomisation.
- Oxygen has greater tendency to form d-block compounds.
- $\text{Mn}^{2+}$  and  $\text{Ce}^{4+}$  are stable.
- Irregular variation in  $E^\circ$  value of divalent ion in 3d series.