Blue print - Chemistry

Unit No.	Title	Marks
UnitI	Solid State	
UnitII	Solutions	
UnitIII	Electrochemistry	23
UnitIV	Chemical Kinetics	
UnitV	Surface Chemistry	
UnitVI	General Principles and Processes of Isolation of	
UnitVII	p-Block Elements	19
UnitVIII	d- and f –Block Elements	
UnitIX	Coordination Compounds	
UnitX	Haloalkanes and Haloarenes	
UnitXI	Alcohols, Phenols and Ethers	
UnitXII	Aldehydes, Ketones and Carboxylic Acids	
UnitXIII	Organic Compounds containing Nitrogen	28
UnitXIV	Biomolecules	
UnitXV	Polymers	
UnitXVI	Chemistry in Everyday Life	
	Total	**70**

QUESTION WISE BREAKUP

Type of Question	Mark per Question	Total No. Of Questions	Total Marks
VSA	1	5	05
SA-I	2	5	10
SA-II	3	12	36
VBQ	4	1	04
LA	5	3	15
Total		26	70

Subject: Chemistry

Time- 3 Hours   **MM: 70**

General Instructions:
1. All questions are compulsory.
2. Question numbers 1 to 5 are very short answer questions of one mark each. Answer these in one word or about one sentence each.
3. Question numbers 6 to 10 are short answer question of two marks each. Answer these in about 30 words each.
4. Question numbers 11 to 22 are short answer question of three marks each. Answer these in about 40 words each.
5. Question no. 23 is value based question carrying 4 marks.
6. Question numbers 24 to 26 are long answer question of five marks each. Answer these in about 70 words each.
7. Use log tables, if necessary.

1. A group 14 element is to be converted into n-type semiconductor by doping. To which group should this impurity belong?

2. Why a finely divided substance is more effective as an adsorbent?

3. Why alkyl halides though polar, but are not miscible with water?

4. Write IUPAC name of the following compound: $(CH_3)_2CH—CO—CH (CH_3)_2$

5. Arrange the following in increasing order of basicity:

NH_3, $(CH_3)_2NH$, CH_3NH_2, $(CH_3)_3N$

6. The vapour pressure of pure benzene at a certain temperature is 0.850 bar. A non-volatile, non-electrolyte solid weighing 0.5 g when added to 39.0 g of benzene. Vapour pressure of the solution, then, is 0.845 bar. What is the molar mass of the solid substance?

7. Which of the two is more acidic and why? p-nitrophenol or p-methoxyphenol.

8. a) Name a transition element which does not exhibit variable oxidation states?

b) Why is Cr^{2+} is reducing and Mn^{3+} oxidising when both have d^4 configuration?

9. Give IUPAC name of following compounds:

 i) C_6H_5- $CH_2CH (OH) CH_3$

ii) $NH_2 CH_2CH=CH_2$

10.   Identify the reaction order from each of the following rate constants:

a) $k= 2.3 \times 10^{-5} L \, mol^{-1} s^{-1}$

b) $k= 3 \times 10^{-4} \, s^{-1}$

11. Complete the reaction:

i) $SO_3 + H_2SO_4$ ------->

ii) Cu^{2+} (aq) + NH_3 (aq)----->

iii) Ca_3P_2 +HCl ----->

12. Silver metal crystallizes with a face centre cubic lattice. The length of unit cell is found to be 4.077 x 10^{-8} cm. Calculate atomic radius and density of silver. (atomic mass of Ag = 108u, N_A = 6.02 x 10^{23} mol^{-1})

13. A first order gas reaction $A_2B_2(g)$ -----> 2A(g) + 2B(g) at the temperature 400^oC has the rate constant, k= 2.0 x 10^{-4} s^{-1}. What percentage of $A_2B_2$is decomposed on heating for 900 s.

14. Write short notes on:

   a) Zone refining b) Van Arkel Method c) Depressant in froth floatation

15. i) Explain the variation of chemical adsorption with temperature at constant pressure.

ii) Difference between homogeneous and heterogeneous catalysis

   iv) Define emulsions

16. What is the freezing point of 0.4 molal solution of acetic acid of benzene in which it dimerises to the extent of 80%. Freezing point of benzene is 278.4 K and its molar heat of fusion is 10.042 KJ mol^{-1}.

17. Explain with reason (i) H_2S is less acidic than H_2Te.

   (ii) NH_3 acts as a Lewis base.

   (iii) PCl_5 acts as an electrolyte

18. Define the following by giving suitable examples:

   i) Antacids ii) Antifertility drugs iii) Tranquilizers

19. i) Explain the difference between nylon 6, 6 and nylon-6

   ii) Arrange the following polymers in increasing order of their molecular forces:

   a) Nylon-6 6, Buna-S, Polythene

   b) Nylon-6, Neoprene, Polyvinyl Chloride

20. Arrange the compounds of each set in order of reactivity towards SN^2 reactions:

   (i) 2-bromo-2-methylbutane, 1-bromopentane, 2-bromopentane

   (ii) 1-bromo-3-methylbutane, 2-bromo-2-methylbutane, 3-bromo-2-methylbutane

21. An aromatic compound A on treatment with aques ammonia and heating forms compound B which on heating with Br_2 and KOH forms a compound C of molecular formula C_6H_7N. Write the structures and IUPAC names of the compound A, B and C.

22. i)Explain the geometry if $[NiCl_4]^{2-}$ on the basis of valence bond theory.

    ii)   Give example of hexadentate ligand

23. Shyam had collapsed due to dehydration and was given intravenous saline treatment in the hospital. The osmotic pressure associated with fluid inside the blood cell is equivalent to that of 0.9% (mass/volume).

    (i)What precaution should be taken when saline is given intravenously to patients by doctors?

    (ii)What is meant by 0.9% (weight/volume) saline solution?

    (iii)What are the values associated with the above paragraph?

24. Illustrate the following name reactions:

    (i)   Cannizzaro reaction

    (ii)   Clemmensen reaction

    (b) How would you obtain the following conversions:

    (i) Butanoic acid from Butan -1-ol

    (ii) But-2-enal from ethanol

    iii) Toluene to Benzoic Acid

25. a) How do you account for the reducing behaviour of H_3PO_2 on the basis of its structure?

b) What happens i) when conc. Sulphuric acid is added to calcium fluoride

    ii) Sulphur trioxide is passed through water

    iii)   Hydrochloric acid reacts with finely powdered iron

26. a) When 3 ampere of electricity is passed for 45 minutes 2.0 g of metal is deposited. Find equivalent weight of metal.

    b) Write the Anode and Cathode reactions of recharging the lead storage battery.

    c) State Kohlrausch law of independent migration of ions.

Answer Key

1. Group 15

2. The extent of adsorption increases with increase in surface area.

3. Due to strong H-bonding in water and inability of alkyl halides to break this bond

4. 2,4-Dimethyl pentan-3-one

5. $NH_3 < (CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$

6. Given: $p_1^0 = 0.850$ bar, p= 0.845 bar, $w_2 = 0.5$ g, $w_1 = 39$g

    Here, $M_1 = 78$ g mol^{-1} (By calculating)

    By putting in the formula: $\dfrac{p_1^0 - p}{p_1^0} = \dfrac{w_2 \, X M_1}{w_1 \, X \, M_2}$

    0.850-0.845/0.850= 0.5 X 78/ M_2 X 39

    Thus, $M_2 = 170$ g mol^{-1}

7. p-nitrophenol is more acidic as p-nitrophenoxide ion thus produced stabilized due to electron withdrawing inductive effect of –NO2 group present on the para position. On the other hand, -OCH3 group has electron releasing inductive effect which destabilizes p-methoxyphenoxide ion.

8.   a) Scandium (Z=21)

    b) Cr^{2+} is reducing as it changes from d^4 to d^3 readily i.e. (t_{2g}) with extra stability but as Mn^{2+} changes to Mn^{3+}, this results in extra stability of half-filled configuration.

9. i) 1-phenyl propan-2-ol ii) Prop-2-en-1-amine

10. i) second order reaction ii) first order reaction

11. i) $SO_3 + H_2SO_4 \longrightarrow H_2S_2O_7$

    ii) Cu^{2+} (aq) + $4NH_3$ (aq)$\longrightarrow$[Cu $(NH_3)_4$]$^{2+}$ (aq)

    iii) Ca_3P_2 + 6HCl $\longrightarrow$ $3CaCl_2$ + 2 PH_3

12. Given: a = 4.077 x 10^{-8}cm, Z=4, M=108g mol^{-1}, N_A =6.022 x 10^{23}

    d= Z M/a^3 X N_A

    substituting the values :

    d = 10.58 g cm^{-3}

$r = a/ 2\sqrt{2}$

substituting the values :

$r = 1.44 \times 10^{-8}$ cm

13. Using the formula: $k = 2.303 / t \ \log [R]_o / [R]$

substituting the values : $2 \times 10^{-4} s^{-1} = 2.303 / 900 \ \log [R]_o / [R]$

$\log [R]_o / [R] = 2 \times 10^{-4} \times 900 / 2.303 = 0.0781$

$\log [R] / [R]_o = -0.0781$

$[R] / [R]_o = $ Antilog 1.9219
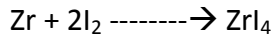
$[R] / [R]_o = 0.835$

$[R] = 0.835 [R]_o$

If, $[R]_o = 100,$

Then, $[R] = 83.5$

$[R]_o - [R] = 100 - 83.5 = 16.5$

i.e. ,16.5 % of initial concentration has changed into products

14. a) This method is based on principle that impurities are more soluble in the molten state than in the solid state of the metal. Eg. Germanium, silicon and Boron are refined by it.

b)This method is very useful for removing all the oxygen and nitrogen present in the form of impurity in metals like Zr and Ti.

$Zr + 2I_2 \ \text{--------} \rightarrow ZrI_4$

   c) It is used to separate two sulphide ores by adjusting proportion of oil to water or by using depressants. Eg. In case of ore having ZnS and PbS, the depressant used is NaCN.

15. i) The chemical adsorption first increases with rise in temperature and then decreases with further rise.

ii) When the reactants and the catalysts are in the same phase the process is said to be homogeneous catalysis. E.g. Hydrolysis of sugar

When the reactants and the catalysts are in the different phase the process is said to be heterogeneous catalysis. E.g. Hydrogenation of vegetable oils

iii) It is a coarse dispersion of one liquid in the other formed by shaking of mixture of two immiscible or partially miscible liquids. E.g. Butter and cream

16. $M = 78$ g mol^{-1} , $T_f = 278.4$ K, $\Delta H_{fus} = 10.042$ kJ mol^{-1}

$K_f = R \ T_f^2 M / 1000 \times \Delta H_{fus}$

K_f = 8.314 x 10^{-3} X $(278.4)^2$ X 78 / 1000 X 10.042 = 5.0 K kg mol^{-1}

$$2CH_3COOH \longrightarrow (CH_3COOH)_2$$

α= i – 1 / (1/n) – 1

0.85 = i – 1 / (1/2) – 1

i = 1-0.425

i = 0.575

ΔT_f = i K_f m

= 0.575 x 5 x 0.4 = 1.15 K

T_f = T_f^O - ΔT_f

= 278.4 K – 1.15 K = 277.25 K

17. i) Due to decrease in bond dissociation enthalpy down the group acidic character increases

ii) Due to one lone pair of electron which is available for donation

iii) In solid state, it exists as ionic solid $[PCl_4]^+$ $[PCl_6]^-$

18. i) It is used for the treatment of hyperacidity. Eg. Zintec

ii) Those drugs which are used to prevent fertilization of egg hence, are useful for population control. E.g. Norethindrone

iii) These are used for treatment of stress, mild or severe neurological disorder. E.g. Equanil

19. i) Nylon 6,6 is condensation polymer of adipic acid and hexamethylene diamine, used in making sheets and bristles for brushes.

Nylon-6 is polymer obtained by heating caprolactum, used in making tyre cords, ropes and fabrics.

iv) a) Polythene < Buna-S < Nylon-6, 6   b)   Neoprene < Polyvinyl Chloride

<Nylon-6

20. 1-Bromopentane > 2-Bromopentane > 2-Bromo-2-methylbutane

and

1-Bromo-3-methylbutane > 3-Bromo-2-methylbutane > 2-Bromo-2-methyl butane

21. I) Since compound C with Molecular formula C6H7N is formed from compound B on treatment with Br2 + KOH(Hoffman bromide rex.), therefore, compound B must be an amide and C must be an amine.(i.e. $C_6H_5NH_2$.)

ii) Since C is aniline, therefore the amide from which it is formed must be benzamide($C_6H_5CONH_2$).

iii) Since compound B is formed from compound A with aq ammonia and heating therefore, compound A must be benzoic acid.(C_6H_5COOH).

22.i) According to VBT, it will have sp^3 hybridisation as it forms outer orbital complex because Cl is weak ligand. It is paramagnetic.

ii) EDTA

23. i) The saline solution should have concentration same as that of the body cells, i.e it should be isotonic. Otherwise, the cells will plasmolysed or swell.

ii) 0.9 g of salt is present in 100 ml of solution.

iii) Use of chemistry and scientific attitude in daily life.

24. (a)(i) reaction   1

(ii) Reaction

1

(b) Reactions with suitable reagents

25. a) In H_3PO_2, two hydrogen atoms are bonded directly to P atom which imparts reducing character to the acid.

b) i) It forms hydrogen fluoride

ii) Oleum is formed

iii) Hydrogen is produced

26 a) Q =I X t

= 3 X 45 X 60= 8100 C

8100 C of electricity deposits 2.0 g of metal

Therefore, 96500 C of electricity deposits = (2.0/8100) X 96500

= 23.82 g of metal

Thus, Eq. Wt. of metal is 23.82 g.

b) Anode: $Pb (s) + SO_4^{2e-} (s)^- \rightarrow PbSO_4(s) + 2 e^-$

Cathode: $PbO_2 (s) + Pb (s) + 2 H_2SO_4 (aq) \rightarrow 2PbSO_4 (s) + 2H_2O (l)$

c) Statement of law