CBSE Board
Class XII Chemistry

Time: 3 Hrs Total Marks: 70

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1. All questions are compulsory.
2. Question nos. **1 to 8** are very short answer questions and carry 1 mark each
3. Question nos. **9 to 18** are short answer questions and carry 2 marks each. Use of calculator is not permitted.
4. Question nos. **19 to 27** are also short answer questions and carry 3 marks each
5. Question nos**. 28 to 30** are long answer questions and carry 5 marks each
6. Use log tables if necessary, use of calculators is not allowed.

Q.1 For the reaction A + B $\rightarrow$ P, doubling the concentration of reactant B has no effect on the overall rate of reaction. What is the order of the reaction with respect to the reactant B?

Q.2 Indicate whether the oxidation of sulphur dioxide into sulphur trioxide with oxygen gas in the presence of nitric oxide gas in a lead-lined flask is a homogeneous or a heterogeneous catalysis. Why is it so?

Q.3 State the oxidation states of chlorine and iodine atoms, respectively, in ClO_4^- ion and IF_7 .

Q.4 Give the state of hybridisation of nickel atoms in the following complexes:

(i) Diamagnetic tetracarbonylnickel (0)

(ii) $[NiCl_6]^{4-}$ ion

Q.5 Write the structure of DDT.

Q.6 Write the names of benzene-ring containing structural isomers that can be written for the molecular formula C_7H_8O.

Q.7 Write IUPAC names of the compounds (i) $(CH_3)_2C{=}CHCOCH_3$ and (ii) $HCOCl$.

Q.8 Write the names of monosaccharides making up the molecules of:

(i) lactose and (ii) sucrose.

Q.9 Atoms of element B form *hcp* lattice and those of the element A occupy 2/3rd of tetrahedral voids. What is the formula of the compound formed by the elements A and B?

Q.10 In fcc arrangement, the corner atoms are of M type and those at the face centres are Z type. What is the empirical formula of the compound?

Q 11.

(a) Define Kohlrausch Law.

(b) The limiting molar conductivities of the cation and anion of univalent electrolyte MX were found to be 120 and 34.5 unit respectively. Calculate the limiting molar conductivity of the solution.

Q.12

(a) For the reaction $2A \rightarrow P$, the concentration of reactant changes from 0.06 molar to 0.04 molar in first 20 minutes, and then to 0.02 molar in the next 20 minutes. What is the average rate of the reaction?

(b) State the order and molecularity of the above stated reaction.

OR

Calculate the half-life period of a first order reaction when the rate constant is 5 $year^{-1}$.

Q.13

(a) Write the units of rate constant for zero order and first order reactions.

(b) What is the effect of temperature on the rate constant of a reaction? How can this temperature effect on rate constant be represented quantitatively?

Q. 14

(a) State the decreasing order of acidity of mineral acids, HI, HBr and HF giving reasons.

(b) Give the difference in the electrical polarity of CO_2 and SO_2 gases. State the reason.

Q.15 Explain the following:

(a) H_3PO_2 and H_3PO_3 act as good reducing agents while H_3PO_4 does not.

(b) Predict the shape of ClF_3 on the basis of VSEPR theory.

Q.16

(a) Write the name of the type of isomerism shown by Au-NCS and Au-SCN molecules.

(b) Write IUPAC name of $[Co(H_2NCH_2CH_2NH_2)_3]_2(SO_4)_3$.

(c) Account for the observation that aqueousTi(III) salt is coloured but Sc(III) salt is colourless.

Q.17

(a) Write the name of the distinguishing test in which a solution of a primary amine in chloroform on being heated with aqueous NaOH gives an offensive odour. Write a chemical equation for the test.

(b) Indicate the sequence of conversions starting from aniline to fluorobenzene.

Q.18 Out of the following, which compound is less basic in each case? Give reason.

(i) Aniline or 4-nitroaniline;

(ii) Aminoethane or ethanamide;

Q.19

(a) What is the cell reaction and the cell emf at 298K of the cell diagrammed below?

$$Zn\left|Zn^{2+}(a = 1.00)\right\|\; Pb^{2+}(a = 1.00)\left|Pb\right.$$

Given $E^o_{\left(Zn^{2+}/Zn\right)} = -0.762V$ and $E^0_{\left(Pb^{2+}/Pb\right)} = -0.126V$

(b) Write any two factors does the electrode potential depend?

Q.20

(a) What are lyophobic colloids?

(b) Describe two methods for purification of sols and colloidal solutions.

Or

(a) Explain the following:

(i) Tyndall effect

(ii) Coagulation

(iii) Electrophoresis

Q.21 In the process of froth floatation, collectors (pine oil) and depressants (NaCN) are used for different purposes. Explain the use of depressants technically and economically beneficial for us. Write any one value related with it.

Q.22

(a) Give one method of preparation of chlorine gas and write the balanced equation.

(b) What happens when ammonia gas is allowed to react with an excess of chlorine gas?

(c) How is bleaching powder prepared?

Q.23 Identify compounds A, B, C and D in the following scheme of conversions m Bromocyclohexane, $C_6H_{11}Br$, was first treated with Mg in dry ether whereupon was formed. When water was added to the reaction mixture containing A, compound B was formed. Boiling compound B with HBr gave compound C. When C was treated with C_2H_5ONa in dry ethanol, D was formed. Write the reactions.

Q.24

(a) Why is phenol less acidic than 2-fluorophenol? Explain.

(b) Suggest a simple physical method for the separation of 2-nitrophenol from 4-nitrophenol.

Q.25

(a) Write the names and molecular formula of sugar unit present in DNA and cellulose.

(b) In what way cellulose is different from amylose starch?

Q.26

(a) Give two points to distinguish between homopolymer and copolymer.

(b) Write the names and formula of the monomers of (i) nylon-6; (ii) natural rubber?

Q.27

(a) Define antacids. Give one example.

(b) Name two widely used antibiotics.

(c) Define broad spectrum antibiotics.

Q.28

(a) Define colligative property

(b) Name one scientific process which is employed for the desalination of sea-water.

(c) The boiling point of benzene is 353.23K at normal pressure. The boiling point of a solution of benzene containing 1.80 g of a non-volatile substance of molar mass 58 g /mol, per 90 g of solvent was found to be 354.11K. Calculate the molal elevation constant for benzene.

OR

(a) Give two characteristics of ideal solutions.

(b) Calculate the boiling point of an aqueous solution of 9 g of glucose per 2000 g of water. Given the $K_b(H_2O)$ = 0.52 K kg /mol.

Q 29.

(a) What is lanthanoid contraction? What are the consequences of lanthanoid contraction?

(b) Actinoid contraction is greater from element to element than lanthanoid contraction. Why?

(c) Why is $K_2Cr_2O_7$ preferred over $Na_2Cr_2O_7$ as an oxidizing agent?

(d) Why do the transition elements exhibit higher enthalpies of atomisation?

OR

(a) Explain

(i) Why Cr is a hard metal whereas Zn is soft.

(ii) Mn possesses various oxidation states. Give the reason to explain it.

(iii) Mn (VII) has no d-electrons for d-d transition. Yet it has a purple colour. Explain.

(b) Name a member of the lanthanoid series which is well known to exhibit +4 oxidation state. Give its electronic configuration also.

(c) Transition and inner transition elements show catalytic activity?

Q 30.

(a) Acetaldehyde is more reactive than benzaldehyde towards Fehling's solution. Explain.

(b) Give the product in the following reaction

$$\text{R-CO-R} \xrightarrow{\text{conc. HCl, Zn/Hg}} \text{X}$$

Name the reaction.

(c) Give reaction for the following conversions:

- (i) Benzaldehyde to benzoic acid.
- (ii) Benzene to benzaldehyde.
- (iii) Propanone to 2-propanol.

OR

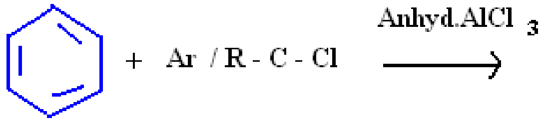
(a) Give one reaction to distinguish ethanal and propanal.

(b) Carry out the following conversions:

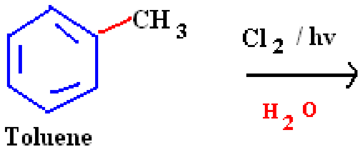
- (i) Acetaldehyde to ethanol.
- (ii) Acetone to 2-methyl-2-propanol.

(c) Write the products of the following reaction:

(i)



(ii)



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Solution

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Solution

Ans.1. The order of the reaction with respect to reactant B is 0. (1)

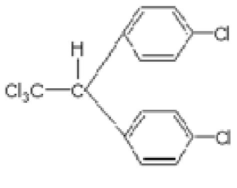
Ans.2. This reaction represents homogeneous catalysis because all the components of the reaction, viz., SO_2, O_2 and NO are in gaseous phase (1)

Ans.3. It is +7 in both cases. (1)

Ans.4.

(i) sp^3 (ii) sp^3d^2 (1)

Ans.5. (1)



D.D.T.

Ans.6. Four structural isomers are possible: (1)

These are 2-methylphenol, 3-methylphenol, and 4-methylphenol, and methoxybenzene (anisole).

Ans.7

(i) 4-Methylpent-3-en-2-one $\left(\frac{1}{2}\right)$

(ii) Methanoyl chloride $\left(\frac{1}{2}\right)$

Ans.8

(i) D-Galactose and D-glucose $\left(\frac{1}{2}\right)$

(ii) D-glucose and D-fructose. $\left(\frac{1}{2}\right)$

Ans.9

The number of tetrahedral voids formed is equal to twice the number of atoms of element B. $\left(\frac{1}{2}\right)$

Only 2/3rd of these are occupied by the atoms of element A.

Hence the ratio of the number of atoms of A and B is

A:B = 2 × (2/3):1 = 4:3 $\left(\frac{1}{2}\right)$

Thus, the formula of the compound is A_4B_3. (1)

Ans. 10

Number of M type atoms in the unit cell = (1/8) x 8 = 1, and $\left(\frac{1}{2}\right)$

Number of Z type atom in the six faces of the unit cell = (1/2) x 6 = 3 $\left(\frac{1}{2}\right)$

Hence, the formula is MZ_3 (1)

Ans.11

a. According to Kohlrausch Law, the limiting molar conductivity of an electrolyte can be represented as the sum of individual contributions of the anion and cation of the electrolyte.

$\Lambda_m^o = \lambda_+^0 + \lambda_-^0$ $\left(\frac{1}{2}\right)$

$= 120\,S\,cm^2\ mol^{-1} + 34.5\,S\,cm^2\ mol^{-1}$

$= 154.5\,S\,cm^2\ mol^{-1}$ $\left(\frac{1}{2}\right)$

Ans. 12

(a) Average rate is defined as the change in molar concentration of reactant (or product) / time interval

Average rate = {(ΔC)/n} /Δt $\left(\frac{1}{2}\right)$

Hence,

Average rate = (1/2) (0.06 – 0.04) M /20 min = 0.0005 or 5.0 x 10^{-4}mol / L min. $\left(\frac{1}{2}\right)$

(b) Molecularity = No. of molecules of reactants shown in a balanced chemical equation.

It is 2 in this case. $\left(\frac{1}{2}\right)$

And the order is 0 because the rate remains constant with the passage of time. $\left(\frac{1}{2}\right)$

OR

Half-life time of a first-order reaction, $t_{1/2} = \frac{0.693}{\text{rate constant}}$ (1)

$$t_{1/2} = \frac{0.693}{5\ \text{year}^{-1}}$$

= 0.1386 year (1)

Ans.13

(a) Unit for zero order reaction is mol $L^{-1}s^{-1}$ and for first order reaction the unit is $time^{-1}$. (1)

(b) The rate constant is nearly doubled with a rise in temperature by 10° for a chemical reaction. $\left(\frac{1}{2}\right)$

The temperature effect on the rate constant can be represented quantitatively by Arrhenius equation,

$$k = Ae^{-E_a/RT}$$ $\left(\frac{1}{2}\right)$

where, k is the rate constant,

A is the Arrhenius factor or the frequency factor,

R is the gas constant,

T is the temperature, and

E_a is the energy of activation for the reaction

Ans. 14

(a) Decreasing order of acidity is: HI > HBr > HCl > HF $\left(\frac{1}{2}\right)$

Reasons:

(i) Larger the size of the halide ion, X^- weaker the H-X bond, hence, easier the ionisation giving H^+ ion;

(ii) Stronger the H-bonding (strongest in HF) weaker the acidity, and

(iii) Very low basicities of Cl^-, Br^- and I^- ions make their hydrogen halides very powerful acids indeed. (1)

(b) Because CO_2 molecule is linear, the sum of its two equal but opposite bond moments is zero. But the shape of SO_2 molecule is angular and therefore the sum of its two bond moments is non zero and hence, it is polar. $\left(\frac{1}{2}\right)$

Ans. 15

(a) The structures of both hypophosphorus acid (I) and phosphorus acid (II) contain weak P-H bonds instead of only OH bonds and therefore act as good H^- donors, that is, reducing agents. On the other hand, orthophosphoric acid (III) does not contain any P-H bond, instead only OH bonds and an oxo bond are present. Therefore, it can't act as a hydride donor. The structures are as shown:

H_2-P(=O)OH H-P(=O)$(OH)_2$ P(=O)$(OH)_3$ (1)

(b)There are a total of 10 valence electrons around Cl atom in ClF_3 (7 from Cl and 3 from the three F's). Of these ten, 6 electrons are as three bonding pairs and the remaining four electrons are as unshared electron pairs. Five pairs of electrons require 5 hybrid orbitals thereby leading to sp^3d hybridisation of Cl (similar to that of P in PCl_5). The three covalently bonded atoms lie at the corners of an equilateral triangle while the two unshared pairs are along the perpendicular plane, one above and the other below it. Thus, the geometry for ClF_3 molecule is bent T-shaped. (1)

Ans.16

(a) It is an example of linkage isomerism. $\left(\frac{1}{2}\right)$

(b) Tris(ethane-1,2-diammine)cobalt(III) sulphate. $\left(\frac{1}{2}\right)$

(c) Ti(III) complex possesses one unpaired electron in its 3d orbital which is responsible for its colour, that is, absorption in the visible region. On the other hand, Sc(III) ion has $3d^0$ configuration and it can't absorb in the visible region. Hence it is colourless and diamagnetic too. (1)

Ans.17

(a) Carbylamine reaction giving RNC having offensive odour.

$RNH_2 + 3NaOH + CHCl_3$ /heat strongly → RNC(alkyl /ary isocyanide) + $3NaCl + 3\,H_2O$ (1)

(b) It is named Balz-Schiemann reaction. The reaction sequence is: (1)

$$C_6H_5NH_2 + NaNO_2 + 2HCl \xrightarrow{273\text{–}278K} C_6H_5N_2Cl + NaCl + 2H_2O$$

$$Ar\overset{+}{N_2}\overset{-}{Cl} + HBF_4 \longrightarrow Ar-\overset{+}{N_2}\overset{-}{BF_4} \xrightarrow{\Delta} Ar-F + BF_3 + N_2$$

Ans.18

(i) The electron withdrawing groups like $-NO_2$, decreases the availability of lone pair electrons at $-NH_2$ group. So, 4-nitroaniline is less basic than aniline. (1)

(ii) Due to resonance, the lone pair of NH_2 group is also shared with C=O group of ethanamide. So, the availability of lone pair on the $-NH_2$ group decreases and thus, ethanamide is less basic than ethanamine. (1)

Ans.19

(a) The cell reaction on left hand electrode is oxidation: $Zn(0) \rightarrow Zn^{2+} + 2e^-$

The right hand electrode reaction is reduction: $Pb^{2+} + 2e^- \rightarrow Pb(0)$

Overall cell reaction: $Zn(0) + Pb^{2+} \rightarrow Zn^{2+} + Pb(0)$ $\left(\frac{1}{2}\right)$

$$E^0_{(cell)} = E^0_{(right\ half\ cell)} - E^0_{(left\ half\ cell)} \quad \left(\frac{1}{2}\right)$$

$$= -0.126 - (-0.762) \quad \left(\frac{1}{2}\right)$$

$$= 0.636\ \text{V} \quad \left(\frac{1}{2}\right)$$

(c) (1)

(i) The chemical nature of the conductor material;

(ii) Activity (concentration) of metal ions in solution, and

(iii) Temperature

Ans. 20.

(a) Lyophobic colloid: The word 'lyophobic' means liquid-hating. Substances like metals, their sulphides, etc., when simply mixed with the dispersion medium do not form the colloidal sol. Their colloidal sols can be prepared only by special methods. Such sols are called lyophobic sols. (1)

(b) Colloidal solutions are purified by two methods.

(i) Dialysis: In this method, the sol is taken in a cellophane bag which is suspended in running distilled water whereby soluble salts are removed. (1)

(ii) Ultrafiltration: Ultrafiltration is the process of separating the colloidal particles from the solvent and soluble solutes present in the colloidal solution by specially prepared filters, which are permeable to all substances except the colloidal particles. (1)

OR

(i) Tyndall effect: The scattering of light bu colloidal particles is called Tyndall effect. This scattering of light illuminates the path of beam in the colloidal dispersion. (1)

(ii) Coagulation: The process of settling of colloidal particles is called coagulation or precipitation of the sol. It may result from prolonged heating, addition of an electrolyte, or from condensation reaction between solute and solvent. (1)

(iii) Electrophoresis: The existence of charge on colloidal particles is confirmed by electrophoresis experiment. When electric potential is applied across two platinum electrodes dipping in a colloidal solution, the colloidal particles move towards one or the other electrode. The movement of colloidal particles under an applied electric potential is called electrophoresis. (1)

Ans. 21

Depressants prevent certain type of particles from forming froth during froth floatation process. Their typical use is to increase the Selectivity of flotation, by preventing one mineral from flotation while allowing other mineral to float unimpeded. (1)

Depressants are used in lesser amounts so are very useful economically and are not very hazardous. (1)

Values associated: Environmental conservation (1)

Ans. 22

(a) Chlorine gas can be prepared by heating powdered manganese dioxide with concentrated hydrochloric acid. The reaction is

$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$ (1)

(b) It gives nitrogen trichloride, an explosive compound.

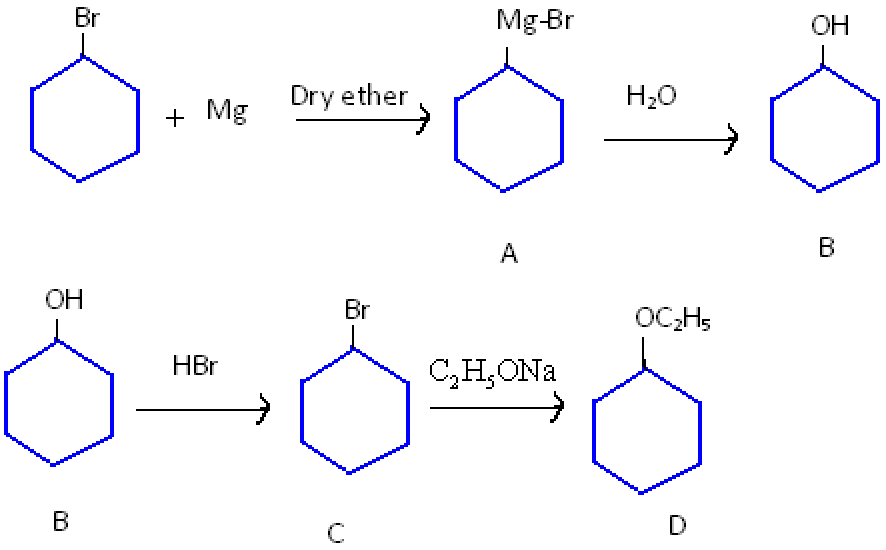
$NH_3 + 3Cl_2(\text{excess}) \rightarrow NCl_3 + 3HCl$ (1)

(c) Bleaching powder is obtained when chlorine gas is allowed to react with dry slaked lime as shown below:

$2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + CaCl_2 + 2H_2O$ (1)

Ans. 23

(a) $A = C_6H_{11}MgBr$; $B = C_6H_{11}OH$; $C = C_6H_{11}Br$; $D = C_6H_{11}OC_2H_5$ (2)



Ans. 24.

(a) Due to the electron withdrawing inductive (–I) effect of fluorine atom in the adjacent position of -OH group, stabilisation of the anion formed from the ionisation of 2-fluorophenol is effective in driving the reaction in the forward direction thereby producing more acidity than for simple phenol. (1)

Also, $o\text{-}F\text{-}C_6H_4O^-$ is more stable than $C_6H_5O^-$

(b) The *ortho* and *para* nitrophenols can be separated by steam distillation because intramolecularly H-bonded *ortho* nitrophenol has lower boiling temperature than the *para* isomer. Therefore, the former isomer is steam-volatile whereas the latter is not. (1)

Ans. 25

(a)

(i) The sugar unit present in DNA is 2-deoxyribose, a 5-ring furanose compound of molecular formula $C_5H_{10}O_4$. (1)

(ii) Cellulose is made up of several D-glucose units, $C_6H_{12}O_6$ a 6-ring pyranose sugar. (1)

(b) In cellulose the β- D-glucose units are linked through $C_1\text{-}O\text{-}C_4$ glycosidic linkage whereas in amylose α- D-glucose units are linked through $C_1\text{-}O\text{-}C_4$ glycosidic linkage. (1)

Ans. 26 (a) (2)

Homopolymer	**Copolymer**
The polymers that are formed by the polymerization of a single monomer are known as homopolymers. In other words, the repeating units of homopolymers are derived only from one monomer.	The polymers whose repeating units are derived from two types of monomers are known as copolymers.
For example, polythene is a homopolymer of ethane.	For example, Buna–S is a copolymer of 1, 3-butadiene and styrene.

(i) Caprolactam, a cyclic amide, $[\text{-NH-CO-}(CH_2)_5\text{-}]$ is the monomer for nylon 6.

(ii) 2-Methyl-1,3-butadiene (also called isoprene), $CH_2{=}C(CH_3)CH{=}CH_2$ is the monomer of rubber. These units are joined in an all-cis configuration. (1)

Ans. 27

(a) Antacids: These are non-toxic metal hydroxides like $Mg(OH)_2$ and $Al(OH)_3$ and find use in the treatment of gastric and peptic ulcers. These can neutralise excess HCl produced in the stomach and can thus relieve irritation and pain. (1)

(b) Penicillin and chloramphenicol (1)

(c) Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria are said to be broad spectrum antibiotics. (1)

Ans.28.

(a) Colligative Property: A colligative property of a system is one which depends only on the number of particles present in solution and not in any way on the mass or chemical nature of the particles. An example of this is elevation in boiling point. (1)

(b) Filtration followed by reverse osmosis. (1)

(c) Molar mass M of the solute = 58 g /mol

Mass of solute = 1.80 g;

Mass of solvent = 90 g

Elevation in boiling point = 354.11 – 353.23 = 0.88K; (1)

$$\Delta T_b = K_b . m \qquad (1)$$

$$= K_b . \frac{\text{mass of solute}}{\text{Molar mass of solute}} \text{ x } \frac{1000}{\text{mass of solvent (g)}}$$

Molal elevation constant, K_b

$$K_b = \frac{\Delta T_b \text{ x Molar mass of solute x Mass of solvent (g)}}{\text{Mass of solute x 1000}}$$

$$= \frac{0.88\text{K x } 58 \text{ x } 90\text{ g}}{1.80 \text{ g x } 1000} \qquad (1)$$

$$= 2.55 \text{ K kg mol}^{-1} \qquad (1)$$

OR

(a) For ideal solutions,

(i) Raoult's law is obeyed over entire range of concentration. (1)

(ii) $\Delta V_{mixing} = 0$ and $\Delta H_{mixing} = 0$. (1)

(b)

$$\Delta T_b = K_b . m \qquad \left(\frac{1}{2}\right)$$

$$= K_b . \frac{\text{mass of solute}}{\text{Molar mass of solute}} \text{ x } \frac{1000}{\text{mass of solvent (g)}} \qquad \left(\frac{1}{2}\right)$$

$$= \frac{0.52 \text{ x } 9 \text{ x } 1000}{180 \text{ x } 2000} \qquad \left(\frac{1}{2}\right)$$

$$= 0.013 \text{ K} \qquad \left(\frac{1}{2}\right)$$

Hence, the solution will boil at 0.013 K above the normal boiling temperature of water, that is, at 373.15K + 0.013K = 373.163 K. (1)

Ans 29.

(a)As we move along the lanthanoid series, the atomic number increases gradually by one. This means that the number of electrons and protons present in an atom also increases by one. As electrons are being added to the same shell, the effective nuclear charge increases. This happens because the increase in nuclear attraction due to the addition of proton is more pronounced than the increase in the interelectronic repulsions due to the addition of electron. Also, with the increase in atomic number, the number of electrons in the 4*f* orbital also increases. The 4*f* electrons have poor shielding effect. Therefore, the effective nuclear charge experienced by the outer electrons increases. Consequently, the attraction of the nucleus for the outermost electrons increases. This results in a steady decrease in the size of lanthanoids with the increase in the atomic number. This is termed as lanthanoid contraction. (1)

Consequences of lanthanoid contraction

(i) There is similarity in the properties of second and third transition series.

(ii) Separation of lanthanoids is possible due to lanthanide contraction.

(iii) It is due to lanthanide contraction that there is variation in the basic strength of lanthanide hydroxides. (Basic strength decreases from La(OH)$_3$ to Lu(OH)$_3$.) (1)

(b) In actinoids, 5*f* orbitals are filled. These 5*f* orbitals have a poorer shielding effect than 4*f* orbitals (in lanthanoids). Thus, the effective nuclear charge experienced by electrons in valence shells in case of actinoids is much more that that experienced by lanthanoids. Hence, the size contraction in actinoids is greater as compared to that in lanthanoids. (1)

(c) $Na_2Cr_2O_7$ is hygroscopic in nature but $K_2Cr_2O_7$ is not so. So it remains pure and is easy to handle. (1)

(d) Because of large number of unpaired electrons in their atoms they have stronger interatomic interaction and hence stronger bonding between atoms resulting in higher enthalpies of atomisation. (1)

OR

(a)

(i) Cr atom with $3d^5 4s^1$ electron configuration has 6 unpaired electrons and thus it can form several strong bonds with its neighbouring Cr atoms. So it is a denser and harder metal than Zn or Cu which have $3d^{10} 4s^n$ (n= 2 for Zn and 1 for Cu) configuration and can't form strong metallic bonds. (1)

(ii) The element Mn (atomic number 25) exhibits 8 oxidation states from 0, +1, +2, ... +8. This is possible because there are 5 electrons in the 3d orbital and 2 in the 4s orbital. (1)

(iii) $KMnO_4$ has Mn in +7 oxidation state. It has no unpaired electron (diamagnetic) and yet it is intensely coloured due to charge transfer from the ligands to the highly electron-deficient metal ion. (1)

(b) Cerium (Z = 58)

Electronic configuration is $4f^1 5d^1 6s^2$ (1)

(c) Transition and inner transition elements as well as their compounds have remarkable catalytic properties. This is so because they generally have incompletely filled penultimate and anti-penultimate shells and can form complexes with reactant molecules. Also, transition and inner transition elements have the ability to adopt multiple oxidation states. (1)

Ans 30.

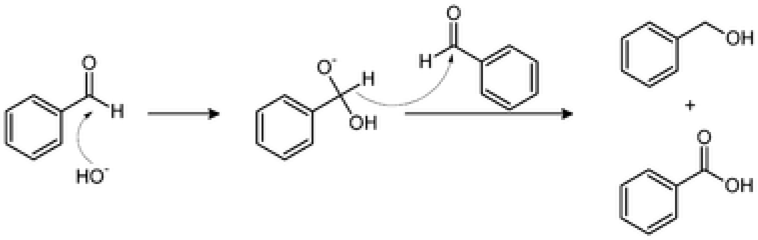
(a) Due to no α- hydrogen, benzaldehyde does not give reaction with Fehling's solution. (1)

(b) RCH_2R. This is Clemmensen reduction. (1)

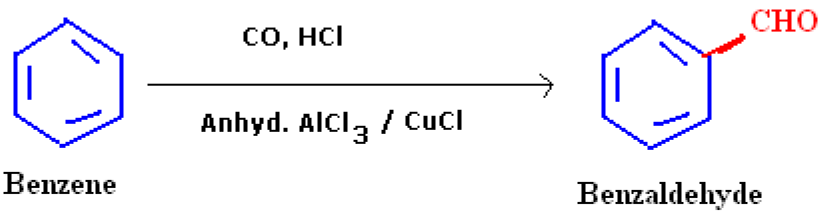
(c)

(i) Benzaldehyde to benzoic acid –

In the presence of a strong conc. base,



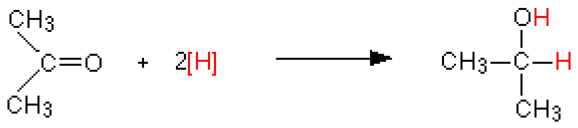
(ii) Benzene to benzaldehyde. (1)



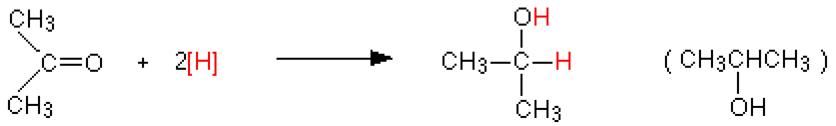
This reaction is called as Gatterman-Koch reaction. (1)

(iii) Propanone to 2-propanol. (1)

Propanone is converted to 2-propanol through reduction reaction.



$$(CH_3)_2C=O + 2[H] \longrightarrow CH_3-\overset{OH}{\underset{CH_3}{C}}-H$$

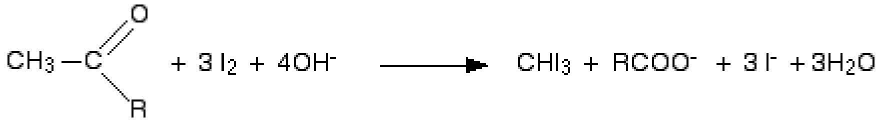


$$(CH_3)_2C=O + 2[H] \longrightarrow CH_3-\overset{OH}{\underset{CH_3}{C}}-H \quad (CH_3\underset{OH}{C}HCH_3)$$

OR

(a)

Iodoform reaction can be used to distinguish between ethanal and propanal. When treated with I_2 and concentrated hot solution of KOH, ethanal forms yellow coloured compound named iodoform or triiodomethane. Propanal doesn't give this reaction. (1)



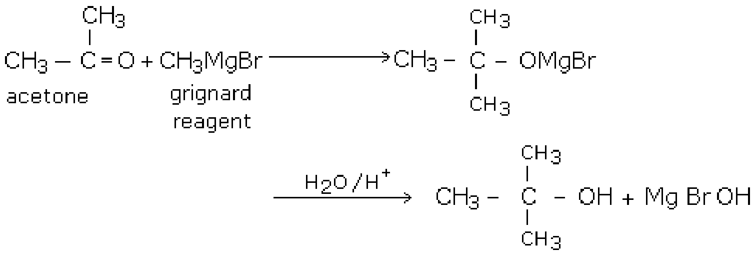
(b)

(i) Ethanol on reduction in presence of nickel catalyst produce ethanol. (1)

$$CH_3CHO + H_2 \xrightarrow[410\ K]{Ni} CH_3CH_2OH\ (ethanol)$$

(ii) Acetone to 2-methyl-2-propanol

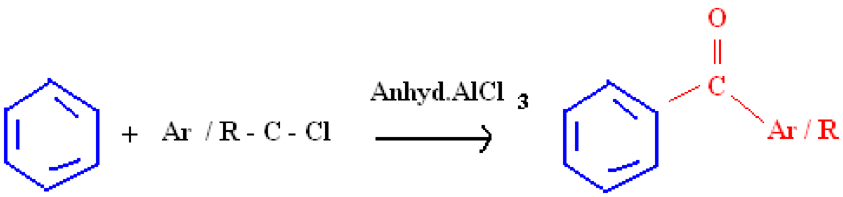
Acetone reacts with methyl magnesium bromide. The hydrolysis of the product formed gives 2-methyl-2-propanol. (1)



$$\underset{\text{acetone}}{CH_3-\overset{\overset{CH_3}{|}}{C}=O} + \underset{\text{grignard reagent}}{CH_3MgBr} \longrightarrow CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-OMgBr \xrightarrow{H_2O/H^+} CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-OH + MgBrOH$$

(c)

(i) (1)



(ii) (1)