DAY FOURTY

Mock Test 3

Instruction

- This question paper contains of 50 Multiple Choice Questions of Chemistry, divided into two Sections; section A and section B.
- Section A contains 35 questions and all questions are compulsory.
- Section B contains 15 questions out of which only 10 questions are to be attempted.
- Each question carries 4 marks.

Section-A

1 **Assertion** Liquid NH_3 is used for refrigeration.
Reason Liquid NH_3 quickly vaporises.
(a) Assertion and Reason are true and Reason is the correct explanation for Assertion.
(b) Assertion and Reason are true but Reason is not a correct explanation for Assertion.
(c) Assertion is true but Reason is false.
(d) Assertion is false but Reason is true.

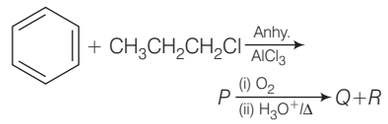
2 3 moles of a perfect gas is expanded isothermally and reversibly from a volume of 1 L to a volume of 10 L at 27°C. The maximum work done is
(a) 190 L atm (b) 170.17 L atm
(c) 192.25 L atm (d) 185.23 L atm

3 Naturally occurring boron consists of two isotopes whose atomic weights are 10.01 and 11.01. The atomic weight of natural boron is 10.81. The percentage of each isotope in natural boron is
(a) 20, 80 (b) 40, 60
(c) 60, 40 (d) 80, 20

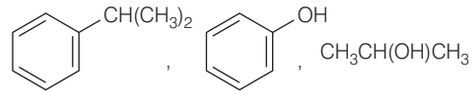
4 Arrange the following compounds in order of increasing dipole moment.
I. Toluene II. *m*-dichlorobenzene
III. *o*-dichlorobenzene IV. *p*-dichlorobenzene
(a) I < IV< II < III (b) IV < I < II < III
(c) IV < I < III < II (d) IV < II < I < III

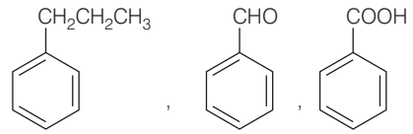
5 If the molecule of HCl were totally polar, the expected value of dipole moment is 6.12 D (dbye), but the experimental value of dipole moment was 1.03 D.
Calculate the percentage of ionic character.
(a) 17 (b) 83 (c) 50 (d) Zero

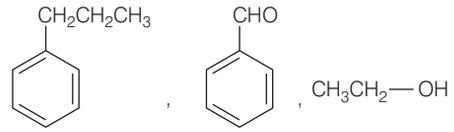
6 Identify the major products *P*, *Q* and *R* in the following sequence of reactions :

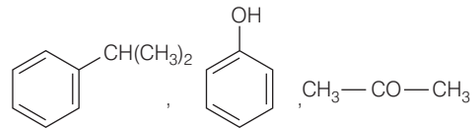


P *Q* *R*

(a) 

(b) 

(c) 

(d) 

7 *AB* is an ionic solid. The ionic radii of A^+ and B^- are respectively r_c and r_a. Lattice energy of *AB* is proportional to
(a) $\frac{r_c}{r_a}$ (b) $(r_c + r_a)$
(c) $\frac{r_a}{r_c}$ (d) $\frac{1}{(r_c + r_a)}$

8 1 mole of N_2H_4 loses 10 moles of electrons to form a new compound *y*. Assuming that all nitrogen appears in the new compound, what is the oxidation state of nitrogen in *y* ? (There is no change in the oxidation state of hydrogen)

(a) + 3 (b) – 3
(c) – 1 (d) + 5

9 A compound formed by elements *X* and *Y*, crystallises in a cubic structure, where *Y* atoms are at the corner of the cube and *X* atoms are at alternate faces. The formula of the compound is

(a) X_2Y (b) XY
(c) XY_2 (d) XY_3

10 The relation between the three types of velocities is (where, α = most probable velocity, v = average velocity and u = rms velocity)

(a) $u < v < \alpha$ (b) $\alpha < v < u$
(c) $\alpha = v = u$ (d) $\alpha \neq v = u$

11 $E°_{Fe^{3+}/Fe} = -0.036$ V, $E°_{Fe^{2+}/Fe} = -0.439$ V. The value of standard electrode potential for the charge,

$$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq) \text{ will be}$$

(a) –0.072 V (b) 0.385 V
(c) 0.770 V (d) –0.270 V

12 Match the metal ions given in Column I with the spin magnetic moments of the ions given in Column II and assign the **correct** code :

Column I		Column II	
A.	Co^{3+}	1.	$\sqrt{8}$ BM
B.	Cr^{3+}	2.	$\sqrt{35}$ BM
C.	Fe^{3+}	3.	$\sqrt{3}$ BM
D.	Ni^{2+}	4.	$\sqrt{24}$ BM
		5.	$\sqrt{15}$ BM

	A	B	C	D
(a)	4	1	2	3
(c)	4	5	2	1

	A	B	C	D
(b)	1	2	3	4
(d)	3	5	1	2

13 A solution of urea in water has a boiling point of 100.130°C. The freezing point of the same solution, (K_f and K_b for water are 1.87°C and 0.520°C, respectively) is

(a) 0.520°C (b) 0.4675°C
(c) – 0.4675°C (d) – 0.520°C

14 Which of the following reagents can be used to separate a mixture of aniline and phenol?

I. Water II. NaOH
III. $NaHCO_3$ IV. HCl
(a) I and II (b) II and III
(c) I and IV (d) II and IV

15 The IUPAC name of the compound is

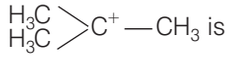
(a) bicyclo [2, 1, 0] pentane
(b) 1,2-cyclopropyl cyclobutane
(c) cyclopentane [4, 3] annulene
(d) 1,2-methylene cyclobutane

16 Which is decreasing order of strength of bases?

$^-OH, \bar{N}H_2, HC \equiv C^-$ and $CH_3CH_2^-$

(a) $H_3CCH_2^- > NH_2^- > HC \equiv C^- > OH^-$
(b) $HC \equiv C^- > CH_3CH_2^- > NH_2^- > OH^-$
(c) $OH^- > NH_2^- > CH \equiv C^- > H_3CCH_2^-$
(d) $\bar{N}H_2 > HC \equiv C^- > OH^- > H_3CCH_2^-$

17 Among the following, the true property about

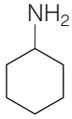
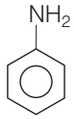
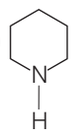


(a) it is non-planar
(b) its C^+ is sp^2-hybridised
(c) an electrophile can attack on its C^+
(d) it does not undergo hydrolysis

18 Which of the following compounds exhibits stereoisomerism?

(a) 2-methylbutene-1 (b) 3-methylbutanoic acid
(c) 3-methylbutyne-3 (d) 2-methylbutanoic acid

19 Which of the following is most basic?

(a) 
(b) 
(c) 
(d) 

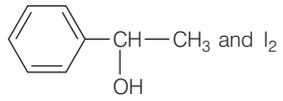
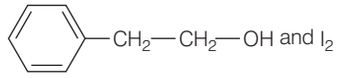
20 The normality of orthophosphoric acid having purity of 70% by weight and specific gravity 1.54 is

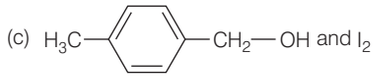
(a) 11 N (b) 22 N (c) 33 N (d) 44 N

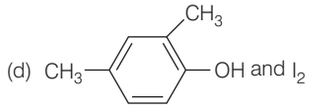
21 The composition of duralumin is

(a) Al-6%, Mg-94%
(b) Cu-23%, Zn-56%, Mn-20%
(c) Cu-50%, Al-40%, Si-10%
(d) Al-95%, Cu-4%, Mn-0.5%, Mg-0.5%

22 Compound *A*, $C_8H_{10}O$, is found to react with NaOI (produced by reacting *Y* with NaOH) and yields a yellow precipitate with characteristic smell.
A and *Y* are respectively.

(a) 
(b) 

(c)  and I_2

(d)  and I_2

23 Which of the following species is not expected to be a ligand?

(a) NO (b) NH_4^+

(c) $NH_2CH_2CH_2NH_2$ (d) CO

24 Total volume of atoms present in a face centred cubic unit cell of a metal is (r = atomic radius)

(a) $\frac{20}{3}\pi r^3$ (b) $\frac{24}{3}\pi r^3$ (c) $\frac{12}{3}\pi r^3$ (d) $\frac{16}{3}\pi r^3$

25 Which is norbide?

(a) Silicon carbide (b) Boron carbide

(c) Carbon carbide (d) Magnesium carbide

26 Epichlorohydrin is

(a) 3-chloropropane

(b) 3-chloropropan-1-ol

(c) 3-chloro-1,2-epoxypropane

(d) None of the above

27 An organic compound of molecular formula $C_4H_{10}O$ does not react with sodium. With excess of HI, it gives only one type of alkyl halide. The compound is

(a) ethoxyethane (b) 2-methoxypropane

(c) 1-methoxypropane (d) 1-butanol

28 Compounds A and C in the following reaction are

$$CH_3CHO \xrightarrow[(ii)\ H_2O]{(i)\ CH_3MgBr} (A) \xrightarrow{H_2SO_4,\ \Delta} (B) \xrightarrow[(ii)\ \text{Oxidation}]{(i)\ \text{Hydroboration}} (C)$$

(a) identical (b) positional isomers

(c) functional isomers (d) optical isomers

29 Philosopher's wool when heated with BaO at 1100°C gives a compound. The compound is

(a) $BaZnO_2$ (b) $Ba + ZnO_2$

(c) $BaCdO_2$ (d) $BaO_2 + Zn$

30 Positive deviation from ideal behaviour takes place because of

(a) molecular interaction between atom and $\frac{pV}{nRT} > 1$

(b) molecular interaction between atom and $\frac{pV}{nRT} < 1$

(c) finite size of atoms and $\frac{pV}{nRT} > 1$

(d) finite size of atoms and $\frac{pV}{nRT} < 1$

31 Which of the following is not a function of protein ?

(a) Nail formation

(b) Skin formation

(c) Muscle formation

(d) Providing energy for metabolism

32 Which of the following does not represent the correct order of properties indicated?

(a) $NH_3 < PH_3 < AsH_3$ (acidic character)

(b) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$ (unpaired electrons)

(c) $Al_2O_3 < MgO < Na_2O < K_2O$ (basic nature)

(d) Li < Be < B < C (IE_1)

33 The geometry and magnetic behaviour of the complex $[Ni(CO)_4]$ are

(a) square planar geometry and paramagnetic

(b) tetrahedral geometry and diamagnetic

(c) square planar geometry and diamagnetic

(d) tetrahedral geometry and paramagnetic

34 K_a for a weak monobasic acid is 1.0×10^{-6}, the pK_b of its conjugate base is

(a) 6.0 (b) 8.0

(c) 1×10^{-8} (d) 1×10^{-6}

35 The pH of a buffer containing equal molar concentrations of a weak base and its chloride (K_b for weak base $= 2 \times 10^{-5}$, $\log 2 = 0.3$) is

(a) 5 (b) 9

(c) 4.7 (d) 9.3

Section-B

36 The time taken for 90% of a first order reaction to complete is approximately

(a) 1.1 times that of half-life (b) 2.2 times that of half-life

(c) 3.3 times that of half-life (d) 4.4 times that of half-life

37 **Assertion** Synthetic fibres like nylon-6, 6 are weak fibres.
Reason They have high molecular weight and high molecular size.

(a) Assertion and Reason are true and Reason is the correct explanation for Assertion.

(b) Assertion and Reason are true but Reason is not a correct explanation for Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

38 Which of the following requires catalyst ?

(a) $S + O_2 \longrightarrow SO_2$ (b) $2SO_2 + O_2 \longrightarrow 2SO_3$

(c) $C + O_2 \longrightarrow CO_2$ (d) All of these

39 One mole of an non-ideal gas undergoes a change of state (2.0 atm, 3.0 L, 95 K → 4.0 atm, 5.0 L, 245 K) with a change in internal energy $\Delta E = 30.0$ L atm . The enthalpy (ΔH) of the process is (in L atm)

(a) 22 (b) 44

(c) 66 (d) 88

40 For a reaction to be spontaneous at all temperatures

(a) ΔG and ΔH should be negative

(b) ΔG and ΔH should be positive

(c) $\Delta G = \Delta S = 0$

(d) $\Delta H < \Delta G$

41 The cell constant of a conductivity cell
(a) changes with change of electrolyte
(b) changes with change of concentration of electrolyte
(c) changes with temperature of electrolyte
(d) remains constant for a cell

42 Match the solid (in Column I) with its example (in Column II) and choose the correct codes given below.

	Column I		Column II
A.	Ionic solid	1.	C (graphite)
B.	Metallic solid	2.	Dry ice
C.	Covalent solid	3.	NaCl
D.	Molecular solid	4.	Fe

Codes

	A	B	C	D		A	B	C	D
(a)	2	1	4	3	(b)	1	2	3	4
(c)	3	4	1	2	(d)	1	3	2	4

43 When initial concentration of the reactant is doubled, the half-life period of a zero order reaction
(a) is tripled (b) is doubled
(c) is halved (d) remains unchanged

44 The resistance of a 0.1 N solution of acetic acid is 250 Ω when measured in a cell of cell constant 1.15 cm^{-1}. The equivalent conductance (in $ohm^{-1}\ cm^2\ equiv^{-1}$) of 0.1 N acetic acid is
(a) 46 (b) 9.2
(c) 18.4 (d) 2.3

45 An alcohol gave Lucas test in about 5 min. When the alcohol was treated with hot concentrated H_2SO_4, it gave an alkene of molecular formula C_4H_8, which on ozonolysis gave C_2H_4O. The structure of alcohol is
(a) $CH_3CHOHCH_2CH_3$ (b) $CH_3CH_2CH_2CH_2OH$
(c) $CH_3CHOHCH_2CH_2CH_3$ (d) $(CH_3)_3C—OH$

46 The lowest vapour pressure at 25°C is of
(a) H_2O (b) CCl_4
(c) $CHCl_3$ (d) C_6H_6

47 The EAN of Zn in $[Zn(OH)_4]^{2-}$ complex is
(a) 16 (b) 26
(c) 36 (d) 46

48 The ionisation energy of *d*-block elements of a given period vary only slightly from one another. This is because of
(a) increase in nuclear charge
(b) decrease in nuclear charge
(c) increase in screening effect
(d) Both (a) and (c)

49 11.2 g of mixture of *M*Cl (volatile) and NaCl gave 28.7 g of white precipitate with excess of $AgNO_3$ solution. 11.2 g of same mixture on heating gave a gas that on passing into $AgNO_3$ solution gave 14.35 g of white precipitate. Hence,
1. ionic mass of M^+ is 18
2. *M*Cl and NaCl are in the 1 : 2 molar ratio
3. mixture has equal mole fraction of *M*Cl and NaCl
4. ionic mass of M^+ is 10

Codes
(a) 1, 2 and 3 are correct (b) 1 and 2 are correct
(c) 2 and 4 are correct (d) 1 and 3 are correct

50 A new carbon bond formation is possible in
1. Cannizzaro's reaction 2. Friedel-Crafts reaction
3. Clemmensen reaction 4. Reimer-Tiemann reaction

Codes
(a) 1, 2 and 3 are correct (b) 1 and 2 are correct
(c) 2 and 4 are correct (d) 1 and 3 are correct

Answers

1	(a)	2	(b)	3	(a)	4	(b)	5	(a)	6	(d)	7	(d)	8	(a)	9	(b)	10	(b)
11	(c)	12	(c)	13	(c)	14	(d)	15	(a)	16	(a)	17	(b)	18	(d)	19	(d)	20	(c)
21	(d)	22	(a)	23	(b)	24	(d)	25	(b)	26	(c)	27	(a)	28	(b)	29	(a)	30	(a)
31	(d)	32	(d)	33	(b)	34	(b)	35	(d)	36	(c)	37	(d)	38	(b)	39	(b)	40	(a)
41	(d)	42	(c)	43	(b)	44	(a)	45	(a)	46	(a)	47	(c)	48	(d)	49	(d)	50	(c)

Hints and Explanations

1 Liquid NH_3 is used for refrigeration because it vaporises quickly and for vaporisation, it takes up heat and cool the refrigerator.

2 $W = 2.303\, nRT \log_{10} \frac{V_2}{V_1}$

$= 2.303 \times 3 \times 0.0821 \times 300 \log_{10} \frac{10}{1}$

$= 170.17$ L atm

3 Let % of isotope with atomic weight $10.01 = x$

% of isotope with atomic weight $11.01 = (100 - x)$

Since, atomic weight

$$= \frac{x \times 10.01 + (100 - x) \times 11.01}{100}$$

$$10.81 = \frac{x \times 10.01 + (100 - x) \times 11.01}{100}$$

$x = 20$

Hence, % of isotope with atomic weight $10.01 = 20$

∴ % of isotope with atomic weight 11.01 $= 100 - 20 = 80$

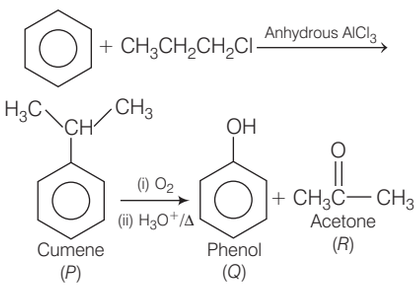
4 Dipole moment of *p*-dichlorobenzene (IV) is zero due to symmetrical structure. μ of C—CH_3 is the less than that of C—Cl. The vector sum of the two C—Cl bonds in the *o*-isomer (bond angle, 60°) is greater than that of the *m*-isomer (bond angle 120°).

5 Percentage ionic character

$$= \frac{\text{experimental value of DM}}{\text{theoretical value of DM}} \times 100$$

$$= \frac{1.03}{6.12} \times 100 = 17\%$$

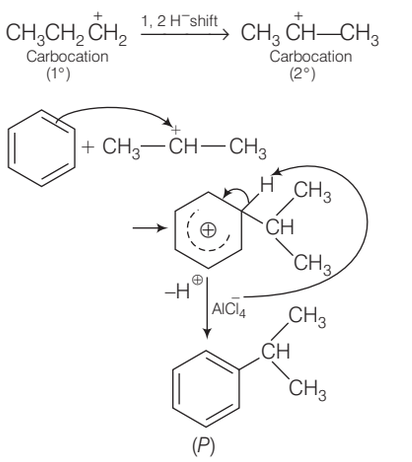
6 The given reaction takes place as follows :



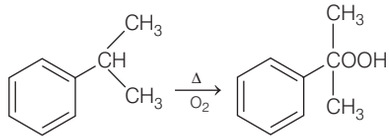
Mechanism

Step I Formation of carbocation

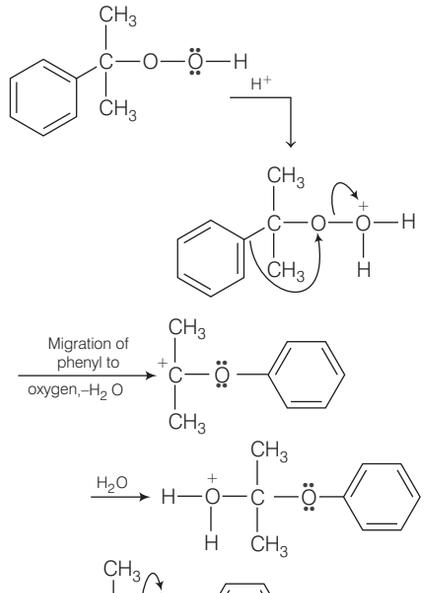
$CH_3CH_2CH_2—Cl + AlCl_3 \longrightarrow CH_3\overset{+}{C}H_2CH_2 + \overline{AlCl}_4$



Step II Electrophilic substitution reaction.



Step III Formation of peroxide



Step IV Hydrolysis of oxidised product formed in step III.

7 The lattice becomes stronger (i.e. the lattice energy *U* becomes more negative), as *r* the interionic distance decreases. *U* is proportional to $\frac{1}{r}$

or $U \propto \frac{1}{(r_c + r_a)}$

8 Oxidation number of N in $N_2H_4 = -2$

Increase in oxidation number of each N atom

$$= \frac{\text{loss of moles of electrons}}{2}$$

$$= \frac{10}{2} = 5$$

Hence, new oxidation number

$= -2 + 5 = +3$

9 Number of atoms *Y* at eight corners of a cubic unit cell

$$= 8 \times \frac{1}{8} = 1$$

Number of atoms *X* present on alternate face of unit cell

$$= 2 \times \frac{1}{2} = 1$$

∴ Formula of compound = *XY*

10 Relation between the three types of velocities :

$$\alpha : v : u = \sqrt{\frac{2RT}{M}} : \sqrt{\frac{8RT}{\pi M}} : \sqrt{\frac{3RT}{M}}$$

$$= \sqrt{2} : \sqrt{\frac{8}{\pi}} : \sqrt{3}$$

$= 1.414 : 1.595 : 1.734$

$= 1 : 1.128 : 1.234$

∴ $\alpha < v < u$

11 Given, $Fe^{3+} + 3e^- \rightarrow Fe$;

$E_1^\circ = -0.036$ V ...(i)

$Fe^{2+} + 2e^- \rightarrow Fe$;

$E_2^\circ = -0.439$ V ...(ii)

We need to calculate

$Fe^{3+} + e^- \rightarrow Fe^{2+}; E_3^\circ = ?$ ...(iii)

We can obtain the (III) by subtracting II from I but E_3°, we cannot obtain that way because electrode potential is intensive property. That's when we determine E_3° calculating

$\Delta G_3 = \Delta G_1 - \Delta G_2$ (ΔG is an extensive)

$\Delta G_3 = 3 \times 0.036\ F - 2 \times 0.439\ F$

$\Delta G = 0.108\ F - 0.878\ F$

$-1 \times F \times E^\circ_3 = -0.770\ F$

$E^\circ_3 = 0.770\ F$

12 **Key Concept** Spin magnetic moment can be calculated as

$$\mu = \sqrt{n(n+2)}\ BM$$

where, μ = magnetic moment

BM = Bohr Magneton (unit of μ)

n = number of unpaired electrons in d-orbital.

The electronic configuration of Co^{3+} is $[Ar]\ 3d^6$.

Here, $n = 4$

$$\mu = \sqrt{4(4+2)} = \sqrt{24}\,BM$$

The electronic configuration of Cr^{3+} is $[Ar] 3d^3$.

Here, $n = 3$

$$\mu = \sqrt{3(3+2)} = \sqrt{15}\,BM$$

The electronic configuration of Fe^{3+} is $[Ar] 3d^5$.

Here, $n = 5$

$$\mu = \sqrt{5(5+2)} = \sqrt{35}\ BM$$

The electronic configuration of Ni^{2+} is $[Ar]\ 3d^8$.

Here, $n = 2$

$$\mu = \sqrt{2(2+2)} = \sqrt{8}\ BM$$

So, the correct option is (c).

13 $\Delta T_b = 100.130 - 100 = 0.130°C$

$K_b = 0.520°C$

$\Delta T_b = \Delta K_b \times$ molality of the solution

$$\text{Molality} = \frac{\Delta T_b}{K_b} = \frac{0.130}{0.520} = 0.25$$

$\Delta T_f = K_f \times$ molality of the solution

$\Delta T_f = 1.87 \times 0.25 = 0.4675°\ C$

Depression in freezing point,

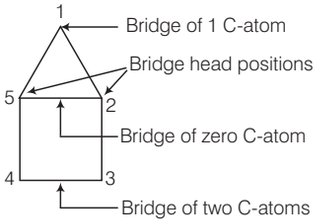
ΔT_f = freezing point of solvent (T_0) – freezing point of solution (T)

$0.4675 = 0 - T$

or, $T = -0.4675°\ C$

14 Aniline (a weak base) dissolves in HCl (a strong acid) while phenol (a weak base) dissolves in NaOH (a strong alkali). Hence, HCl and NaOH can be used for separating the mixture of aniline and phenol.

15 It is alicyclic compound with five carbon atoms, hence it is bicyclo pentane (prefix bicyclo is used because cycloalkane consists of two rings). The bridge head positions are tied together by three bridges of two, one and zero carbon atoms, hence its name is bicyclo (2, 1, 0) pentane.



16 The conjugate acids of ^-OH, $\bar{N}H_2$, $HC{\equiv}C^-$ and $CH_3\bar{C}H_2$ are H_2O, NH_3, $HC{\equiv}CH$ and $CH_3{-}CH_3$ respectively. Their acidic strength is as

$HOH > HC{\equiv}CH > NH_3 > CH_3CH_3$

A strong acid has a weak conjugate base, hence the decreasing order of basic strength is

$CH_3\bar{C}H_2 > \bar{N}H_2 > HC{\equiv}C^- > OH^-$

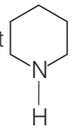
17 The carbon atom in carbocation has sp^2- hybridisation.

These carbocations have trigonal shape with positively charged carbon. Thus, the shape of $\overset{+}{C}H_3$ may be considered as being derived from the overlap of three equivalent $C(sp^2)$ hybridised orbitals with 1s orbital of each of the three hydrogen atoms. Each bond may be represented as $C(sp^2) - H(1s)$ sigma bond.

18 $\overset{4}{C}H_3{-}\overset{3}{C}H_2{-}\overset{2}{*C}H(\overset{|}{CH_3}){-}\overset{1}{C}OOH$

Here, C_2 is chiral. Hence, the molecule is optically active and will exibit stereoisomerism.

19 Electron donors are bases. Since, electron density is highest at



(piperidine), hence, it is most basic.

20 Normality

$$= \frac{\text{weight percentage} \times \text{density} \times 10}{\text{equivalent weight}}$$

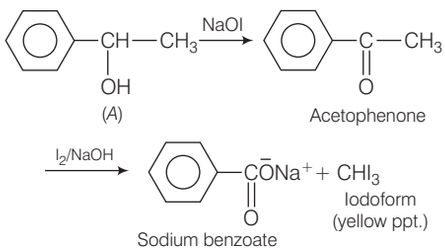
$$= \frac{70 \times 1.54 \times 10}{98/3} = 33\ N$$

21 Duralumin, an alloy used for making aeroplanes, is composed of Al-95%, Cu-4%, Mn-0.5% and Mg-0.5%.

22 Iodoform reaction with sodium hypoiodite is used for the detection of CH_3CO group. Also compounds containing $CH_3CH(OH)$ group shows positive iodoform test as it produces CH_3CO group on oxidation.

Since, among the compounds, $CH_3CH(OH)$ group is given only in the substrate of option (a) hence, it is correct. The reaction of compound A with NaOI is given as follows :

$2NaOH + I_2 \longrightarrow NaOI + NaI + H_2O$



23 Ligand must donate a pair of electron or loosely held electron pair to metal and form a $M-L$ bond.

$:\ddot{N}{=}O,\ \ddot{N}H_2CH_2CH_2\ddot{N}H_2,\ :CO$

NH_4^+ ion has no lone pair of electrons hence, it is not a ligand.

24 Volume of an atom $= \frac{4}{3}\pi r^3$

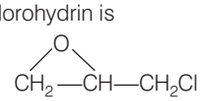
In fcc, number of atoms per unit cell = 4

$\therefore$ Volume of total atoms $= 4 \times \frac{4}{3}\pi r^3$

$= \frac{16}{3}\pi r^3$

25 Norbide is hot pressed boron carbide (B_4C) which is one of the hardest materials known and offers excellent chemical and wear resistance, for demanding applications such as blast nozzles, monument nozzles and armor components.

26 Epichlorohydrin is



It is 3-chloro-1, 2-epoxypropane.

27 As a single alkyl halide is formed on treatment with HI, it must be $C_2H_5OC_2H_5$ (ethoxyethane).

$$C_2H_5OC_2H_5 + 2HI \longrightarrow 2C_2H_5I + H_2O.$$

28 $CH_3CHO \xrightarrow[(ii)\ H_2O]{(i)\ CH_3MgBr}$

$$CH_3-\underset{(A)}{\underset{|}{\overset{OH}{CH}}}-CH_3 \xrightarrow{H_2SO_4,\ \Delta}$$

$$CH_3-\underset{(B)}{CH=CH_2} \xrightarrow[oxidation]{Hydroboration} \underset{(C)}{CH_3CH_2CH_2OH}$$

(*A*), (*B*) and (*C*) compounds are positional isomers.

29 ZnO is commonly known as Philosopher's wool.

$$ZnO + BaO \xrightarrow[1100°C]{Heat} \underset{\text{Barium zincate}}{BaZnO_2}$$

30 $\frac{pV}{nRT} > 1$, the gas is less compressible than expected from ideal behaviour and shows positive deviation.

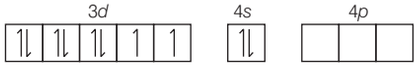
31 Proteins do not provide energy for metabolism. Fibrous protein ionisation enthalpy keratin is responsible for the formation of nail, skin and myosin for muscle formation.

32 Generally, ionisation enthalpy increases in a period form left to right but ionisation enthalpy of II group is greater than III group due to stable electronic configuration of II group.

33 **Key Concept** The complexes having sp^3-hybridisation are tetrahedral while having dsp^2-hybridisation are square planar. The magnetic behaviour of complexes can be paramagnetic and diamagnetic based on the presence and absence of unpaired electrons, respectively.

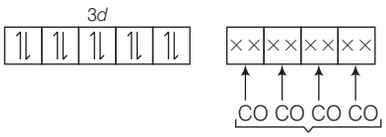
Electronic configuration of Ni($Z = 28$) is $[Ar]_{18}\ 3d^8 4s^2$. Due to presence of CO (neutral ligand), oxidation state of Ni in $[Ni(CO)_4]$ is 0.

Ni-atom



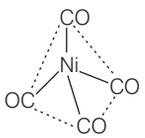
Since, CO is a strong field ligand, it pair up the unpaired electrons of Ni.

$Ni(CO)_4$



sp^3-hybridised
(Tetrahedral geometry)

There is no unpaired electron, hence, $Ni(CO)_4$ is diamagnetic with tetrahedral geometry.



34 K_a and K_b are the ionisation constant of a weak acid and its conjugate base, then

$$K_a \cdot K_b = K_w = 1 \times 10^{-14}$$

$$K_b = \frac{1.0 \times 10^{-14}}{1.0 \times 10^{-6}} = 1.0 \times 10^{-8}$$

$$pK_b = -\log 1.0 \times 10^{-8} = 8$$

35 $pOH = pK_b = -\log(2 \times 10^{-5})$

$$\left[\because \log\frac{[salt]}{[base]} = 1\right]$$

$$= 5 - 0.30 = 4.70$$

$$pH = 14 - 4.70 = 9.30$$

36 $t_{90\%} = \frac{2.303}{k}\log\frac{a}{a - 0.9a}$

$$= \frac{2.303}{k}\log 10$$

Again, $= \frac{2.303}{k}$

$$t_{1/2} = \frac{2.303}{k}\log\frac{a}{a - 0.5a}$$

$$= \frac{2.303}{k}\log 2$$

$$= \frac{2.303}{k} \times 0.3010$$

$$\frac{t_{90\%}}{t_{1/2}} = \frac{1}{0.3010} = 3.3$$

or, $t_{90\%} = 3.3$ times of $t_{1/2}$

37 Nylon 6, 6 is prepared by the condensation polymerisation of hexamethylene diamine with adipic acid under high pressure and at high temperature. Nylon 6,6 have high molecular weight and size, which is obtained by conducting the final stages of melt polymerisation. It is a strong fibre used is making sheets, bristles for brushes and in textile industry.

38 The reaction, $2SO_2 + O_2 \longrightarrow 2SO_3$ has high energy of activation and requires a catalyst (either Pt or Mo) for lowering it down.

39 $H = E + pV$, since p is not constant.

$$\Delta H = (E_2 - E_1) + (p_2V_2 - p_1V_1)$$

$$= (30) + [(4 \times 5) - (2 \times 3)]$$

$$= 30 + [20 - 6] = 44\ L\ atm$$

40 $\Delta G = \Delta H - T\Delta S$

For a reaction to be spontaneous ΔG must be negative. If ΔG and ΔH are negative, then reaction will be spontaneous at all temperature.

41 Cell constant remains constant for a cell. Cell constant is defined as the ratio of length of object and area of cross-section. $a = \frac{l}{A}$, since l and A remain constant.

42

S.N.	Column I		Column II
A.	Ionic solid	1.	NaCl
B.	Metallic solid	2.	Fe
C.	Covalent solid	3.	C (graphite)
D.	Molecular solid	4.	Dry ice

43 For zero order reaction,

$$t_{1/2} = \frac{[R]_0}{2k}$$

where, $[R]_0$ = Initial concentration of the reactant.

k = Rate constant.

Thus, $t_{1/2}$ for zero order reaction is directly proportional to the initial concentration of the reactant.

$$t_{1/2} \propto [R]_0$$

$\therefore$ For zero order reaction, when the concentration of reactant is doubled, the half-life ($t_{1/2}$) will also get doubled.

44 $\lambda_{eq} = \frac{1000k}{\text{normality}} = \frac{1000k}{0.1}$

$$\left(\kappa = \frac{\text{cell constant}}{R} = \frac{1.15}{250}\right)$$

So, $\lambda_{eq} = \frac{1000 \times 1.15}{250 \times 0.1} = 46$

45 (a) $CH_3-\underset{|}{\overset{OH}{CH}}-CH_2CH_3 \xrightarrow[\Delta]{H_2SO_4}$

$$\underset{(C_4H_8)}{CH_3-CH=CH-CH_3}$$

$$\xrightarrow[Zn/H_2O]{O_3} 2CH_3CHO \text{ or } (C_2H_4O)$$

(b) $CH_3CH_2—CH_2—CH_2—OH$

$\xrightarrow{H_2SO_4} \underset{(C_4H_8)}{CH_3CH_2CH=CH_2} \xrightarrow[Zn/H_2O]{O_3}$

$CH_3CH_2CHO + HCHO$

(c) $CH_3\underset{OH}{\underset{|}{C}}H—CH_2CH_2CH_3 \xrightarrow[\Delta]{H_2SO_4}$

$CH_3—CH=\underset{C_5H_{10}}{CHCH_2CH_3}$

$\xrightarrow[Zn/H_2O]{O_3} CH_3CHO + CH_3CH_2CHO$

(d) $H_3C—\underset{CH_3}{\overset{CH_3}{\overset{|}{\underset{|}{C}}}}—OH \xrightarrow[\Delta]{H_2SO_4}$

$CH_2=\underset{CH_3}{\overset{CH_3}{\overset{|}{\underset{|}{C}}}} \xrightarrow[Zn/H_2O]{O_3}$

$\underset{(C_4H_8)}{}$

$HCHO + CH_3COCH_3$

Secondary alcohol gives Lucas test in 5 min. Reaction sequence shows it is secondary alcohol.

46 Pure water (vapour pressure = 23.8 torr at 25°C)

47 The atomic number of Zn = 30

Electrons contributed by Zn^{2+} = 28

Electrons contributed by

$4OH^- = 2 \times 4 = 8$

Thus, this complex follows Sidgwick's EAN rule. So, EAN = 28 + 8 = 36.

48 (a) Increase in nuclear charge and (c) increase in screening effect, are responsible for slightly higher I.E.

$\therefore$ (d) is the correct option.

49 Let $MCl = x$ g, NaCl = $(11.2 - x)$ g

$MCl + AgNO_3 \longrightarrow MNO_3 + \underset{\text{White ppt}}{AgCl\downarrow}$

$(M + 35.5)$ g MCl gives = 143.5 g AgCl

x g MCl gives $= \frac{143.5\,x}{M + 35.5}$ g AgCl …(i)

$\underset{(58.5\text{ g})}{NaCl} + AgNO_3 \rightarrow NaNO_3 + \underset{(143.5\text{ g})}{AgCl\downarrow}$

$(11.2 - x)$ g NaCl gives

$= \frac{143.5\,(11.2 - x)}{58.5}$ g AgCl …(ii)

$\frac{143.5\,x}{M + 35.5} + \frac{143.5\,(11.2 - x)}{58.5} = 28.7$

(given) …(iii)

On heating MCl vaporises

(being volatile)

Thus, AgCl is formed due to MCl only

Thus, $\frac{143.5\,x}{M + 35.5} = 14.35$ …(iv)

Thus, so (iii), $\frac{143.5\,(11.2 - x)}{58.5} = 14.35$

Thus, gives $X = 5.35$

From (IV), $M = 18$

MCl in mixture = 5.35 g

NaCl in mixture = 5.85 g

Thus, ionic mass of M^+ is 18.

Thus, 1 is correct.

Also, molar mass of $MCl = 53.5$ g mol^{-1}

moles of $MCl = \frac{5.35}{53.5} = 0.1$

moles of NaCl $= \frac{5.85}{58.5} = 0.1$

Mole fraction of $MCl = 0.5$

Mole fraction of NaCl = 0.5

Thus, 3 is also correct.

50 In both Friedel-Crafts reaction and Reimer-Tiemann reaction, new carbon-carbon bond is formed.