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KCET

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10 Practice Tests

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CHEMISTRY

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Practice Test 01

1. **Which of the following is the correct definition for crystal lattice?**
   (a) An arrangement of atoms in space.
   (b) Three dimensional arrangement of points in space.
   (c) A regular arrangement of the points in space.
   (d) None of the above

2. **The number of octahedral voids per atom present in a cubic close-packed structure is:**
   (a) 1 (b) 3
   (c) 2 (d) 4

3. **Solids can be classified as _____ on the basis of the nature of order present in the arrangement of their constituent particles.**
   (a) Crystalline or amorphous
   (b) Metallic or non-metallic
   (c) Magnetic or non-magnetic
   (d) Conductor or non-conductor

4. **Graphite and diamonds are _____.**
   (a) Isotopes (b) Isomers
   (c) Isotones (d) Allotropes

5. **Which of the following compounds is formed on the electrolytic reduction of nitrobenzene in presence of strong acid?**
   (a) Azoxybenzene
   (b) Aniline
   (c) Azobenzene
   (d) p-aminophenol

6. **Which of the following is formed in the reaction of an aldehyde and primary amine?**
   (a) Ketone
   (b) Aromatic acid
   (c) Schiff's base
   (d) Carboxylic acid

7. **A hydrocarbon has molecular formula C_2H_6. Which of the class of hydrocarbons cannot have this formula?**
   (a) Cycloalkene
   (b) Bicycloalkane
   (c) A diene
   (d) A bicycloalkene

8. **Which of the following is not a saturated hydrocarbon?**
   (a) Cyclohexane (b) Benzene
   (c) Butane (d) Pentane

9. **How many electrons are involved in the following redox reaction?**
   $Cr_2O_7^{2-} + Fe^{2+} + C_2O_4^{2-} \rightarrow Cr^{3+} + Fe^{3+} + CO_2$
   (Unbalanced)
   (a) 3 (b) 4
   (c) 6 (d) 5

10. **Minerals associated with redox reactions are:**
    (a) Na, Cu (b) N, Cu
    (c) Fe, Cu (d) Ca, Fe

11. **The rate for the reaction between ionic compounds cannot be determined because they are generally:**
    (a) Immeasurably slow reactions
    (b) Moderately slow reactions
    (c) Instantaneous reactions
    (d) Not precipitation reaction

12. **A reaction has both ΔH and ΔS negative. The rate of reaction:**
    (a) Increases with increase of temperature
    (b) Increases with decrease of temperature
    (c) Remains unaffected by change of temperature
    (d) Cannot be predicted for change in temperature

13. **Which of the following transition metal ions has highest magnetic moment?**
    (a) Cu^{2+} (b) Ni^{2+}
    (c) Co^{2+} (d) Fe^{2+}

14. **Which of the following is not an actinoid?**
    (a) Curium (Z = 96)
    (b) Californium (Z = 98)
    (c) Uranium (Z = 92)
    (d) Terbium (Z = 65)

15. **A solution of acetone in ethanol:**
    (a) Shows a negative deviation from Raoult's law
    (b) Shows a positive deviation from Raoult's law
    (c) Behave like a near ideal solution
    (d) Obeys Raoult's law

16. **A solution is obtained by mixing 300 g of 25% solution and 400 g of 40% solution by mass. Calculate the mass percentage of the solvent in resulting solution.**
    (a) 68.40% (b) 65.53%
    (c) 66.43% (d) 67.42%

17. **If Cl_2 gas is passed in to aqueous solution of Kl containing some CCl_4 and the mixture is shaken then:**
    (a) Upper layer becomes violet
    (b) Lower layer becomes violet
    (c) Homogenous violet layer is formed
    (d) None of these

18. **Inert gases such as helium behave like ideal gases over a wide range of temperature .However; they condense into the solid state at very low temperatures. It indicates that at very low temperature there is a:**
    (a) Weak attractive force between the atoms
    (b) Weak repulsive force between the atoms
    (c) Strong attractive force between the atoms
    (d) Strong repulsive attractive between the atoms

19. **Ag can be obtained from purified Zn-Ag alloy by:**
    (a) Distillation (b) Poling
    (c) Liquation (d) Reduction

20. **Which of the following is used in making planes?**
    (a) Copper (b) Tungsten
    (c) Aluminium (d) Steel

21. **Two bodies at different temperatures are mixed in a calorimeter. Which of the following quantities remains conserved?**
    (a) sum of the temperatures of the two bodies
    (b) total heat of the two bodies
    (c) total internal energy of the two bodies
    (d) internal energy of each body

22. **Thermodynamics is not concerned about:**
    (a) the rate at which a reaction proceeds
    (b) the feasibility of a chemical reaction
    (c) the extent to which a chemical reaction proceeds
    (d) energy changes involved in a chemical reaction

23. **What happens to the number of valence electrons in atoms of elements as we go down a group in the periodic table?**
    (a) Increases
    (b) Decreases
    (c) Same
    (d) None of these

24. Which group elements are called transition metals?
(a) Group number 1 to 2
(b) Group number 13 to 18
(c) Group number 3 to 12
(d) Group number 1 to 8

25. The compound which has one isopropyl group is:
(a) 2 -Methylpentane
(b) 2, 2, 3 -Trimethylpentane
(c) 2, 2 -Dimethylpentane
(d) 2, 2, 3, 3 -Tetramethylpentane

26. The acylation of benzene is called ____ reaction.
(a) Friedel and craft reaction
(b) Wurtz reaction
(c) Debey Huckel reaction
(d) None of the above

27. The metallic character of _____ is less than that of alkaline earth metals.
(a) boron family (b) alkali metals
(c) magnesium (d) hydrogen

28. The band spectrum is caused by:
(a) Molecules
(b) Atoms
(c) Any substance in solid state
(d) Any substance in liquid state

29. In the lowest energy level of hydrogen atom, electron has an angular momentum equal to:
(a) $\frac{\pi}{h}$ (b) $\frac{h}{\pi}$
(c) $\frac{h}{2\pi}$ (d) $\frac{2\pi}{h}$

30. A mixture having 2 g of hydrogen and 32 g of oxygen occupies how much volume at NTP?
(a) 44.8 L (b) 22.4 L
(c) 11.2 L (d) 67.2 L

31. The amount of water produced by the combustion of 16 g of methane is:
(a) 16 g (b) 36 g
(c) 18 g (d) 32 g

32. Find the incorrect match.
(a) Fine duct of aluminium - Paints and Lacquers
(b) Reducing agent in the manufacture of dye-stuffs, paints, etc. - copper dust
(c) For cutting tools and crushing machines - Chrome steel
(d) For making cables, automobiles and aeroplane parts - Nickel steel

33. Which one of the following compounds is stable?
(a) $CH_3CH(OH)_2$
(b) $(CH_3)_2C(OH)_2$
(c) $CCl_3CH(OH)_2$
(d) None of these

34. The reaction of benzene with chlorine in the presence of iron gives:
(a) Benzene hexachloride
(b) Chlorobenzene
(c) Benzyl chloride
(d) Benzoyl chloride

35. Among the following, the one has the highest mass is:
(a) 40 g of Fe
(b) 6 moles of N_2 at NTP
(c) 0.2 g of silver
(d) 10^{23} atoms of carbon

36. Oxygen molecule exhibits:
(a) Diamagnetism
(b) Paramagnetism
(c) Ferromagnetism
(d) Antiferromagnetism

37. Match various processes in surface chemistry from List 1 with their definition from:

List 1	List 2
A. Dissipation	1. Weak Vanderwalls forces exist between adsorbent and adsorbate
B. Absorption	2. if the adsorbed gas or liquid leaves the surface
C. Sorption	3. If gas or liquid molecules are uniformly distributed through out the interior
D. Physisorption	4. If both absorption and adsorption will occur

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

38. Catalytic poisoners act by:
(a) Coagulating the catalyst
(b) Getting adsorbed on the active centres on the surface of catalyst
(c) Chemical combination with any one of the reactants
(d) None of the above

39. During the electrolysis of molten sodium chloride, the time required to produce 0.10 mol of chlorine gas using a current of 3 amperes is:
(a) 55 minutes (b) 110 minutes
(c) 220 minutes (d) 330 minutes

40. In electrolytic conductors, the conductance is due to:
(a) Flow of free mobile electrons
(b) Movement of ions
(c) Either movement of electrons or ions
(d) Cannot be said

41. Which of the following is not a neutral ligand?
(a) H_2O (b) NH_3
(c) ONO (d) CO

42. The correct name of $[Pt(NH_3)_4Cl_2][PtCl_4]$ is:
(a) tetraamminedichloroplatinum(IV) tetrachloroplatinate(II)
(b) dichlorotetraammineplatinium(IV) tetrachloroplatinate(II)
(c) tetrachloroplatinum(II) tetraammineplatinate(IV)
(d) tetrachloroplatinum(II) dichlorotetraammineplatinate(IV)

43. Which of the following names is correct for $CH_2(CHO)-CH(CHO)-CH_2(CHO)$?
(a) 3- Formaldehyde-1,3-dial
(b) 2, 3, 4- Triformylpropane
(c) 2-Formylmethylbutane-1, 4-dial
(d) Propane-1, 2, 3-tricarbaldehyde

44. Which of the following compounds will undergo Cannizzaro reaction?
(a) CH_3CHO
(b) CH_3COCH_3
(c) C_6H_5CHO
(d) $C_6H_5CH_2CHO$

45. Which of the following is a functional isomer of Dimethyl ether?
(a) Ethanol
(b) Mthanol
(c) 2 - methlyl propanol
(d) None of these

46. Soaps are sodium or potassium salts of long chain _____.
(a) Carboxylic acid
(b) Alcohols
(c) Aldehydes
(d) Esters

47. Direction: The following questions consist of two statements, one labelled as Assertion and the other Reason. Examine both the statements carefully and mark the correct choice according to the instructions given below.
Assertion (A) : The temperature in the stratosphere increases with altitude.
Reason (R) : Ozone present absorbs ultraviolet radiation which is converted into heat.
(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
(b) Both Assertion and Reason are true but Reason is not correct explanation of Assertion
(c) Assertion is true and Reason is false
(d) Assertion is false and Reason is true

48. Direction: The following questions consist of two statements, one labelled as Assertion and the other Reason. Examine both the statements carefully and mark the correct choice according to the instructions given below.
Assertion : Photochemical smog is mainly composed of nitrogen oxides, volatile organic compounds, ozone and peroxyacetyl nitrates.
Reason : Photochemical smog develops in cold weather conditions by the interaction of secondary pollutants.
(a) Both Assertion and Reason are correct and Reason is the correct explanation for Assertion
(b) Both Assertion and Reason are correct but Reason is not the correct explanation for Assertion
(c) Assertion is correct but Reason is incorrect
(d) Both Assertion and Reason are incorrect

49. Which of the following is known as invert soap?
(a) Pentaerythritol monostearate
(b) Trimethyl stearyl ammonium bromide
(c) Ethoxylated nonphenol
(d) Sodium stearyl sulphate

50. Antidepresent drug among the following is:
(a) Phenelzine
(b) Promethazine
(c) Naproxen
(d) Cimetidine

51. Sucrose is composed of_____.
(a) Glucose and fructose
(b) Glucose and glycogen
(c) Two molecules of glucose
(d) Glycogen and fructose

52. Enzymes having slightly different molecular structure but performing identical activity are _____.
(a) Homoenzymes
(b) Isoenzymes
(c) Apoenzymes
(d) Coenzymes

53. In the following reaction:
$HCO_3^- + H_2O \rightleftharpoons CO_3^{2-} + H_3O^+$
Which two substances are Bronsted base?
(a) CO_3^{2-} and H_3O^+
(b) HCO_3^- and H_3O^+
(c) HCO_3^- and CO_3^{2-}
(d) CO_3^{2-} and H_2O

54. For a chemical reaction,
$m_1\ A + m_2\ B \rightarrow n_1C + n_2D$
The ratio of rate of disappearance of A to that of appearance of C is:
(a) $\frac{m_1}{m_2}$ (b) $\frac{m_2}{n_1}$
(c) $\frac{n_1}{m_1}$ (d) $\frac{m_1}{n_1}$

55. Calcium carbonate can crystallize as calcite or as aragonite, having different crystal systems. These are called:
(a) Polymorphs
(b) Polymers
(c) Isomers
(d) Mirror images

56. Be exhibits the diagonal relationship with:
(a) Mg (b) Li
(c) Si (d) Al

57. A deuterium nucleus consists of which of the following combination of particles?
(a) One proton and two neutron
(b) One proton and one neutron
(c) Two proton and one neutron
(d) One proton and three neutron

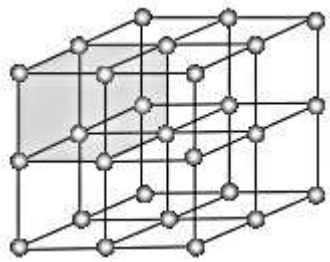
58. Tritium _____ radioactive isotope.
(a) Beta-Emitting
(b) Alpha - Emitting
(c) Gamma-Emitting
(d) None of the Above

59. The monomer caprolactam is polymerised to obtain which polymer?
(a) Teflon (b) Nylon 6
(c) Bakelite (d) Kevlar

60. Cellulose is a linear polymer of:
(a) α-glucose
(b) β-D glucose
(c) α-fructose
(d) None of these

// Hints and Solutions //

1(C).



The three dimensional arrangement of constituent particles in a crystal is represented in such a way each particle is taken as a point, the arrangement is called as crystal lattice.
Thus, a regular arrangement of the points in space is the correct definition of crystal lattice.

2(A). The total number of octahedral voids per atom present in a cubic close packed structure is 4. Besides the body centre, there is one octahedral void at the centre of each of the 12 edges.
It is surrounded by six atoms, four belonging to the same unit cell (2 on the corners and 2 on face centres) and two belonging to two adjacent unit cells. Since each edge of the cube is shared between four adjacent unit cells, so is the octahedral void located on it.
Only $\frac{1}{4}$ th of each void belongs to a particular unit cell. Thus, in cubic close packed structure, octahedral void at the body-centre of the cube is 1.
12 octahedral voids located at each edge and shared between four unit cells
$= 12 \times \frac{1}{4} = 3$
Total number of octahedral voids = 4
We know that in ccp structure, each unit cell has 4 atoms. Thus, the number of octahedral voids $= \frac{4}{4} = 1$.

3(A). Solids can be classified as crystalline or amorphous based on the nature of order present in the arrangement of their constituent particles.
A crystalline solid usually consists of a large number of small crystals, each of them having a definite characteristic geometrical shape.
- In a crystal, the arrangement of constituent particles (atoms, molecules, or ions) is ordered.

- It has long-range order which means that there is a regular pattern of arrangement of particles that repeats itself periodically over the entire crystal.
- Sodium chloride and quartz are typical examples of crystalline solids.

An amorphous solid consists of particles of irregular shape.

- The arrangement of constituent particles (atoms, molecules, or ions) in such a solid has only short-range order.
- Such portions are scattered and in between the arrangement is disordered.
- Quartz is a form of SiO_2 (silica). It has tetrahedral SiO_4 (silicate) units which are orderly arranged in crystalline quartz. When SiO_2 is melted and the melt is cooled, it forms amorphous quartz glass.

4(D). Graphite and diamonds are allotropes.

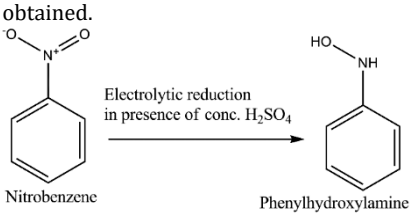
About Allotropes:

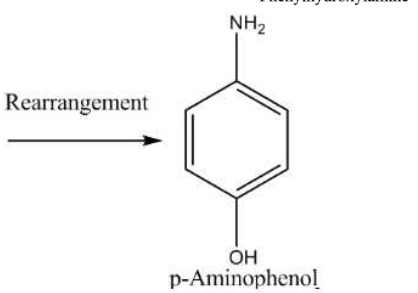
- Allotropes are the different structural forms of the Same Element and can exhibit quite different Chemical Behaviours and Physical Properties.
- The change between Allotropic Forms is triggered by the Same Forces that affect other structures, such as temperature, light, and pressure.

5(D). p-aminophenol is formed on the electrolytic reduction of nitrobenzene in presence of strong acid.

The electrolytic reduction of nitrobenzene in strongly acidic medium produces phenylhydroxylamine which rearranges to p-Aminophenol.

In weakly acidic medium, aniline is obtained whereas in alkaline medium, various mono and di-nuclear reduction products (such as nitrosobenzene, phenylhydroxylamine, azoxybenzene, azobenzene and hydrazobenzene) are obtained.





6(C). The product formed by the reaction of an aldehyde with a primary amine is Schiff base. It is a substituted imine.

$$CH_3 - C(O) - CH_3 + H_2N - R \xrightarrow{H^+} CH_3 - C(CH_3) = N - R + H_2O$$

Schiff's base

7(D). A bicycloalkene cannot have the formula of C_2H_6.

C_2H_6 has two degree of unsaturation (two H_2 less than saturated hydrocarbons), therefore it can be a diene, a cycloalkene or a bicycloalkane but it cannot be a bicycloalkene because it has three degrees of unsaturation.

8(B). Benzene is not a saturated hydrocarbon.

Always suffix -ene contains double bond between carbon atoms and in case of -yne, it contains triple bond between carbon atoms, where as in case of -ane it contains single bond between carbon atoms. Saturated hydrocarons contain single bond between carbon atoms. Here benzene is not a saturated hydrocarbon.

9(C). Given reaction is:

$Cr_2O_7^{2-} + Fe^{2+} + C_2O_4^{2-} \rightarrow Cr^3 + Fe^{3+} + CO_2$

The reaction in balanced form will be as follows:

$Cr_2O_7^{2-} + 2Fe^{2+} + 2C_2O_4^{2-} \rightarrow 2Cr^{3+} + 2Fe^{3+} + 4CO_2$

The oxidation number of chromium in $Cr_2O_7^{2-}$ is $+6$ and it reduces to $+3$ in Cr^{3+}. On balancing the equation, we will see 2 moles of chromium ion goes from $+6$ to $+3$.

Therefore, there are 6 electrons involved in the above redox reaction.

10(C). Minerals associated with redox reactions are Fe, Cu.

- Fe is an important constituent of proteins like ferredoxin and cytochromes which are involved in the transfer of electrons. It is reversibly oxidized from Fe^{2+} to Fe^{3+} during electron transfer. It activates the catalyze enzyme and is essential for the formation of chlorophyll.
- Copper helps in the formation of starch. It is required for the overall metabolism in plants. It is associated with certain enzymes involved in redox reactions and is reversibly oxidized from Cu^+ to Cu^{2+}.

11(C). The rate for the reaction between ionic compounds cannot be determined because they are generally instantaneous reactions.

Ionic compounds readily dissociate into ions, which react with each other instantaneously to form products. Therefore the rate of these reactions cannot be determined.

12(B). $\because \Delta G = \Delta H - T\Delta S = -ve$

Given: $\Delta S = -ve$

$\Delta H = -ve$

$\therefore$ To get $\Delta G = -ve$

ΔS must be less then ΔH i.e. $\Delta H > T\Delta S$

Thus, the reaction is exotherms and favours and increases with the decrease in temperature.

13(D). More the number of upaired d -electrons, more is the magnetic moment.

Therefore, we have:

(A) $Cu^{2+} : 3d^9$

No. of unpaired electrons $= 1$

(B) $Ni^{2+} : 3d^8$

No. of unpaired electrons $= 2$

(C) $Co^{2+} : 3d^7$

No. of unpaired electrons $= 3$

(D) $Fe^{2+} : 3d^6$

No. of unpaired electrons $= 4$

Therefore, Fe^{2+} has highest magnetic moment.

14(D). Terbium ($Z = 65$) is a lanthanide and all others are actinoids.

- Lanthanides have atomic numbers from 58 to 71.
- Actinides have atomic numbers from 90 to 103.
- The lanthanides and actinides form a group that appears almost disconnected from the rest of the periodic table.
- This is the f- block of elements, known as the inner transition series. This is due to the proper numerical position between Groups 2 and 3 of the transition metals.

15(B). A solution of acetone in ethanol shows a positive deviation from Raoult's law.

- It is due to miscibility of these two liquids with a difference of polarity and length of the hydrocarbon chain.
- Positive derivation occurs when vapour pressure of the component is greater than expected value.
- Acetone and ethanol both the components escape easily showing higher vapour pressure than the expected value.

16(C). Given that:

The solution is obtained by mixing 300 g of 25% solution and 400 g of 40% solution by mass.

Therefore,

Total amount of solute present in the mixture will be given by,

$300 \times \frac{25}{100} + 400 \times \frac{40}{100}$

$= 75 + 160$

$= 235$ g

Total amount of solution $= 300 + 400 = 700$ g

Therefore,

Mass percentage of the solute in the resulting solution

$= \frac{\text{Total amount of solute}}{\text{Total amount of solution}} \times 100$

$= \frac{235}{700} \times 100$

$= 33.57\%$

Then, mass percentage of the solvent in the resulting solution will be:

$= (100 - 33.57)\%$
$= 66.43\%$

17(A). $2KI + Cl_2 \rightarrow 2KCl\ l_2$
$I_2\ CCl_4 \rightarrow$ Violet Colour
But the excess of Cl_2 should be avoided.
The layer may become colourless due to conversion of I_2 to HIO_3
$I_2 + 5Cl_2 + 6H_2O \rightarrow 2HIO_3 + 10HCl$
In case of Br_2
$Br_2 + 2H_2O + Cl_2 \rightarrow 2HBrO + HCl$

18(C). Inert gases condense into the solid state at very low temperature as there is strong attractive force between the atoms.
In solid state, Van der Waals attractive forces are predominant between the atoms. The attractive force increases with the size of the atom as a result of the increase in polarizability and the decrease in ionization potential.

19(A). Ag can be obtained from purified Zn-Ag alloy by distillation.
Lead contains impurities such as Cu, Ag, Bi , sb and sn . Silver is removed by parke's process where motten zinc is added to motten impure lead, The former is immiscible with the latter. Silver is more soluble in motten zinc than in molten lead. Zinc-Silver alloy solidifies earlier then molten lead and thus can be separated.
Ag can be thus obtained from Zn-Ag alloy by distillation process.

20(C). "Aluminium" is used in making planes.
Aluminium is a strong and lightweight metal. This weight of aluminium is almost $\frac{1}{3}$ rd the weight of steel. This allows the aircraft to carry more weight. The metal aluminium is corrosion resistant and this ensures the safety of passengers.

21(C). Two bodies at different temperatures are mixed in a calorimeter. The total internal energy of the two bodies remains conserved.
There is no heat lost since the calorimeter is insulated. If we consider both the liquids together as one system, then the work done by the system is zero.
From first law of thermodynamics,
$\Delta U = Q - W$
$\Delta U = 0$
Since there is no change in internal energy, the internal energy of the system remains constant.

22(A). Thermodynamics is not concerned about the rate at which a reaction proceeds. Thermodynamics tells us about the feasibility, energy changes, and extent of a chemical reaction. It does not tell us about the rate of the reaction. The kinetics of the reaction are concerned about the rate at which the reaction proceeds.

23(C). As we move from top to bottom in a group, the number of valence electrons remains same because a group is defined such that their valence shell configuration is same. So, valence electrons remain same but valence shell changes.

24(C). Group number 3 to 12 are called transition metal.
The elements occurring in the group 3 to 12 are named as transition metals because they are metallic elements that form a transition between the main group elements, which occur in groups 1 and 2 on the left side, and groups 13–18 on the right side of the periodic table.

25(A). Isopropyl group is nothing but propane with a hydrogen from middle C-atom removed. i.e., $-CH(CH_3)_2$. 2 -methylpentane has one isopropyl group.
$2,2,3,3$ -tetramethylpentane, $2,2$ -dimethylpentane and $2,2,3$ -trimethylpentane do not contain an isopropyl group.

26(A). The acylation of benzene is called Friedel and craft reaction.
Acylation is the substitution of an acyl group into an organic compound. In case of benzene, the acyl group is substituted into the benzene ring. This reaction is also known as Friedel-Crafts acylation of Benzene.
$C_6H_6 + CH_3COCl \rightarrow C_6H_5COCH_3 + HCl$

27(A). The metallic character of boron family is less than that of alkaline earth metals.
The elements of the Boron family are less electropositive than the alkaline earth metals due to their smaller size and higher ionization enthalpies. On moving down the group, the electropositive character first increases from Boron to aluminium and then decreases from gallium so thallium due to the presence of d and f orbitals which causes poor shielding.

28(A). The band spectrum is caused by molecules. The energy levels of molecules are so close to each other that they combine to form a band. The valence band and conduction band are two types of bands. Electron transition between these two bands forms band spectrum.

29(C). As we know,
The angular momentum is given as,
$L = mvr$
The angular momentum is on integer multiple of $\frac{h}{2\pi}$.
Then we can write,
$mvr = \frac{nh}{2\pi}$
For, $n = 1$
$mvr = \frac{h}{2\pi}$

30(A). We know that:
Hydrogen exist as H_2 and oxygen as O_2 .
1 mole of all gases occupy 22.4 L volume at NTP.
Moles in 2 g hydrogen $= \frac{\text{mass}}{\text{molar mass}}$
$= \frac{2}{2}$
$= 1$ mol
$= 22.4$ L
Moles in 32 g oxygen $= \frac{\text{mass}}{\text{molar mass}}$
$= \frac{32}{32}$
$= 1$ mol
$= 22.4$ L
Then, total volume occupied $= 22.4 + 22.4$
$= 44.8$ L

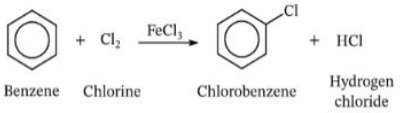
31(B). The reaction of combustion of methane takes place as follows:
$\underset{1\text{ mole}}{CH_4} + \underset{2\text{ mole}}{2O_2} \longrightarrow \underset{1\text{ mole}}{CO_2} + \underset{2\text{ mole}}{2H_2O}$
Here, we know that:
Mass of 1 mole methane is $16\,g$ i.e., $(12 + 4 \times 1)$.
Since 1 mole of methane on combustion produces 2 moles of H_2O .
Therefore, $16g$ of methane on combustion, produces 36 g of H_2O .

32(B). C opper dust is not used as a reducing agent in the manufacture of dyestuffs and paints.
Copper powders are used in very many applications, markets and technologies by virtue of the diverse range of physico-chemical properties.

33(C). Compound $CCl_3CH(OH)_2$ is stable.
Here, we noticed that two OH group attached with one carbon atom at all three compounds which is called the geminal diol compound.
(C) $CCl_3CH(OH)_2$
(A) $CH_3 - CH(OH)_2$
(B) $(CH_3)_2C(OH)_2$
Dehydration reaction:
(C)
$CCL_3CH(OH)_2 \xrightarrow[H^+]{C} Cl_3CH\,(OH_2) - O - H \xrightarrow[-H_2O]{H^+} CH_3 - C - CHO$
(A)
$CH_3 - CH(OH)_2 \xrightarrow{H^+} CH_3CH\left(OH_2^+\right) - O - H \xrightarrow[-H_2O]{H^+} CH_3 - CHO$
(B)
$(CH_3)_2C(OH)_2 \xrightarrow{H^+} (CH_3)2C\,(OH_2) - O - H \xrightarrow[-H_2O]{H^+} CH_3 - CH_2CHO$
$\because +$ I group (Alkyl group) : geminal diol compound stability decreases.
$\because -$ I group (Halogen group) : geminal diol compound stability increases.
Hence the correct option is (C).

34(B). The reaction of benzene with chlorine in the presence of iron gives chlorobenzene.
When benzene reacts with chlorine gas in the presence of iron catalyst such as iron (III) chloride , it displaces one hydrogen from the ring to chlorine atom and leads to

the formation of chlorobenzene.
The reaction takes place as follows:



35(B). We shall convert all values into grams
40 g of Fe = 40 g
6 moles of N_2 at NTP
We know that,

$$\text{Moles} = \frac{\text{weight in grams}}{\text{molecular Weight}}$$

Weight of $N_2 = 6\times$ Molecular mass of N_2
Weight of $N_2 = 6 \times 28 = 168$ g
0.2 g of silver = 0.2 g
10^{23} atoms of carbon
1 mole of carbon $= 6.022 \times 10^{23}$ atoms $= 12$ g

$$10^{23} \text{ atoms} = \frac{10^{23}}{6.023\times10^{23}} \times 12 = 1.992 \text{ g}$$

Thus, the highest mass is of 6 moles of N_2 at NTP.

36(B). According to molecular orbital theory O_2 molecule is more paramagnetic because it has two unpaired electrons in the antibonding molecular orbital.

Ions	Bond Order	Valence electron	Magnetic Properties
O_2^+	2.5	1	Paramagnetic (1)
O_2	2	2	Paramagnetic (2)
O_2^-	1.5	1	Paramagnetic (3)
O_2^{2-}	1	0	Diamagnetic

The neutral oxygen is paramagnetic according to MO theory because it ends up with two unpaired electrons in two degenerate pi antibonding molecular orbitals.
The other two are paramagnetic because they have an odd number of electrons so it doesn't matter what kind of bonding they are involved in, the electrons cannot be all paired up.
O_2^{2-} and O_2^{2+} these would also be diamagnetic as the double negative would have filled up the pi* orbitals and the double-positive version would have left both of them empty.

37(C). In surface chemistry,
1. Dissipation/ Desorption is the process of removing an adsorbed substance from a surface on which it is absorbed.
2. Absorption is a process in which the substance (adsorbate) is uniformly distributed throughout the bulk.
3. Sorption is a process where both the phenomenon of adsorption and absorption take place simultaneously.
4. Physisorption is a type of adsorption where weak Van der Waals forces act between the adsorbate and adsorbent.

Thus, the correct combination of an answer will be A-2, B-3, C-4, D-1

38(B). Catalytic poisoners act by getting adsorbed on the active centres on the surface of catalyst.
Catalyst poisoning refers to the effect that a catalyst can be 'poisoned' if it reacts with another compound that bonds chemically to its active surface sites.
This has two effects. The total number of catalytic sites or the fraction of the total surface area that has the capability of promoting reaction always decreases and the average distance that a reactant molecule must diffuse through the pore structure before undergoing reaction may increase.
Poisoned sites can no longer accelerate the reaction with which the catalyst was supposed to catalyze. Therefore, catalytic poisons act by getting adsorbed on the active centres on the surface of the catalyst.

39(B). $2Cl^- \rightarrow Cl_{2(g)} + 2e^-$

$$W = \frac{E}{96500} \times it$$

$$0.1 \times 71 = \frac{35.5}{96500} \times 3 \times t$$

$$\therefore t = 6433.33s$$

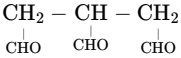
or $t = 107.22 \text{ min} \approx 110 \text{ min}$

40(B). In metallic conductors, the conductance is due to the flow of free mobile electrons and in electrolytic conductors, the conductance is due to the movement of ions in a solution of fused electrolyte.

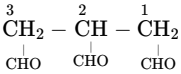
41(C). Neutral ligand means ligand with no charge on it.
Example: H_2O, NH_3, CO, C_2H_4...
ONO^- has a charge on it, therefore it is not a neutral ligand.

42(A). The name of the complex cation is written first followed by the name of the complex anion. The names of the ligands are written in alphabetical order. The roman numerals IV and II are written in parenthesis to indicate the oxidation state of platinum in complex cation and complex anion. The prefix tetra is used to indicate the number of amine and chloro ligands. So, the name of the complex $[Pt(NH_3)_4Cl_2]\,[PtCl_4]$ is tetraamminedichloroplatinum(IV) tetrachloroplatinate(II).

43(D). Given compound:



Numbering the carbon atoms, we get:



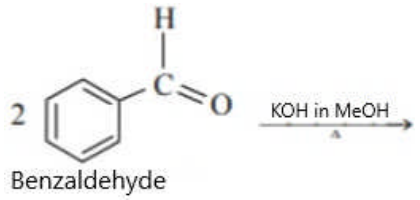
- Since there are three carbon atoms in long chain and it contains 3 -CHO groups (one on each carbon atom).
- IUPAC suffix "aldehyde" will added due to presence of functional group -CHO.

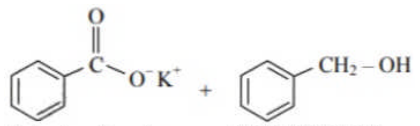
Therefore, the correct IUPAC name will be propane-1, 2, 3-tricarbaldehyde.

44(C). Aldehydes with no α -H atom undergo Cannizzaro reaction on heating with conc. alkali solution.

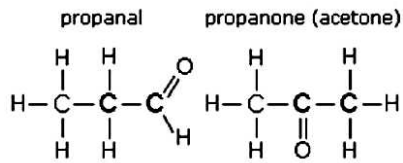
- Aldehydes undergo self -oxidation and reduction reaction on heating with concentrated alkali.
- In Cannizzaro reaction, one molecule of an aldehyde is reduced to alcohol and at the same time the second molecule is oxidized to carboxylic acid salt.
- Thus, the reaction is an example of disproportionation reaction.

Therefore, only C_6H_5CHO will undergo the reaction. The reaction is as follows:





45(A). A functional isomer of Dimethyl ether is Ethanol.
It has the same chemical formula but different functional groups attached to them. e.g C_3H_6O
It has two functional isomers i.e.,



46(A). Soaps are sodium or potassium salts of long-chain of carboxylic acids.
Sodium salts of fatty acids are called hard soaps and potassium salts of fatty acids are called soft soaps.
Soaps are sodium or potassium salts of long-chain fatty acids.
Alcohol carries one hydroxyl functional group (at least) which is bound to a saturated carbon atom. The molecular formula is $C_nH_{2n+1}OH$.
Aldehydes carry a functional group with the structure – CHO. In this, a carbon atom shares a double bond with an oxygen atom, a single bond with a hydrogen atom, and a single bond with another atom.
Esters are derived from carboxylic acids (-COOH group). The hydrogen is replaced by a hydrocarbon group in esters.

47(A). Within the Stratosphere layer, temperature increases as altitude increases, the top of the stratosphere have a temperature of about 270 K, just slightly

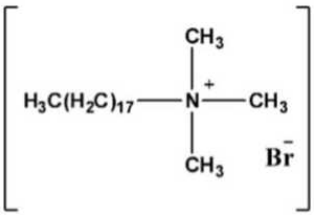
below the freezing point of water. The stratosphere is layered in temperature because ozone here absorbs high-energy UVB and UVC energy waves from the sun and is broken down into atomic oxygen (O) and diatomic oxygen. Atomic oxygen is found prevalent in the upper stratosphere due to the bombardment of UV light and the destruction of both ozone and diatomic oxygen. It is when these two forms of oxygen recombine to form ozone that they release the heat found in the stratosphere.
So, both Assertion and Reason are true and Reason is the correct explanation of Assertion.

48(C). Photochemical smog is a condition that develops when primary pollutants (such as oxides of nitrogen and volatile organic compounds) interact under the influence of sunlight to produce a mixture of secondary pollutants. Thus photochemical smog is mainly composed of oxides of nitrogen volatile organic compounds (primary pollutants), ozone and peroxyacetyl nitrate, PAN (secondary pollutants), It was first reported over Los Angeles in the 1940s. Photochemical smog is formed at high temperatures over cities and towns due to still air, emission of nitrogen oxides and hydrocarbons from automobile exhausts and solar energy. Nitrogen dioxide splits into nitric oxide and nascent oxygen. Nascent oxygen combines with molecular oxygen to form ozone. Ozone reacts with carbohydrates to form aldehydes and ketones.
Reaction inside engine:
$N_2 + O_2 \longrightarrow 2NO$
Reaction in atmosphere:
$2NO + O_2 \longrightarrow 2NO_2$
Photochemical reactions:
$NO_2 \longrightarrow NO + [O]$
$O_2 + [O] \longrightarrow O_3$
$NO + HC + O_2 \longrightarrow NO_2 + PAN$
So, Assertion is correct but Reason is incorrect.

49(B). Trimethyl stearyl ammonium bromide is known as invert soap.

- Invert soap is a class of synthetic detergents in which the surface active part of the molecule is the cation.
- It is a cationic detergent.
- Trimethyl stearyl ammonium bromide contains quaternary ammonium salt with an active cation part on the surface of the molecule. So, Trimethyl stearyl ammonium bromide is an invert soap.

The structure of Trimethyl stearyl ammonium bromide is as follows:



50(A). Phenelzine is an antidepressant (monoamine oxidase inhibitor).

- Phenelzine is a monoamine oxidase inhibitor (MAO inhibitor) used in therapy of moderate-to-severe depression.
- This medication treats depression by restoring the balance of certain natural substance (neurotransmitters) in the brain.
- Phenelzine can improve your mood and feelings of well-being.

51(A). Sucrose is a molecule composed of two monosaccharides, namely glucose and fructose. This non-reducing disaccharide has a chemical formula of $C_{12}H_{22}O_{11}$.
In a $C_{12}H_{22}O_{11}$ molecule, the fructose and glucose molecules are connected via a glycosidic bond. This type of linking of two monosaccharides called glycosidic linkage. Sucrose has a monoclinic crystal structure and is quite soluble in water. It is characterized by its sweet taste.

52(B). Enzymes having slightly different molecular structure but performing identical activity are isoenzymes. Isoenzymes refer to those enzymes from different genes that process or catalyse the same reaction. Isoenzyme of an enzyme differ from each another in their amino acid sequence, molecular weight, immunological and electrophoretic behaviours. The presence of isozymes helps in the process of metabolism which is required for the purpose of meeting the particular needs of a biological function.

53(D). Here CO_3^{2-} and H_2O are Bronsted bases as water accept H^+ and CO_3^{2-} is the conjugate base of HCO_3^- and as the reaction is reversible so CO_3^{2-} is accepting H^+.

$HCO_3^- + H_2O \rightleftharpoons CO_3^{2-} + H_3O^+$

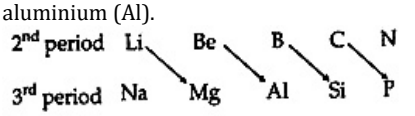
54(D). For the reaction,
$m_1\ A + m_2\ B \rightarrow n_1C + n_2D$
At equilibrium,

$$-\frac{1}{m_1}\frac{d[A]}{dt} = +\frac{1}{n_1}\frac{d[C]}{dt}$$

$$\Rightarrow -\frac{\frac{d[A]}{dt}}{\frac{d[C]}{dt}} = \frac{m_1}{n_1}$$

55(A). Calcium carbonate can crystallize as calcite or as aragonite having different crystal systems. These are called polymorphs. Polymorphism is crystallography in which solids have different crystal forms.

56(D). Be exhibits the diagonal relationship with Al.
The elements of the 2nd period, show resemblance in properties with elements of the 3rd period, placed diagonally. This is called the diagonal relationship. Beryllium (Be) shows a diagonal relationship with aluminium (Al).



57(B). A deuterium nucleus consists of one proton and one neutron.

58(A). Tritium is a beta-emitting radioactive isotope of hydrogen. Its nucleus consists of one proton and two neutrons, making it three times as heavy as a hydrogen nucleus (with its one proton) and one-and-a-half times as heavy as deuterium (which contains one proton and only one neutron).

59(B). Monomer caprolactam is polymerized to obtain Nylon 6.

60(B). Cellulose is a linear polymer of β-D-glucose units, which in contrast to starch, is oriented with $-CH_2OH$ groups alternating above and below the plane of the cellulose molecule thus producing long, unbranched chains. The absence of side chains allows cellulose molecules to lie close together and form rigid structures. Cellulose is the major structural material of plants. Wood is largely cellulose, and cotton is almost pure cellulose.