1. A certain reaction occurs in two steps as
(i) $2SO_{2(g)} + 2NO_{2(g)} \rightarrow 2SO_{3(g)} + 2NO_{(g)}$
(ii) $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$
In the reaction,

Sol. $NO_{(g)}$ is intermediate

Factual

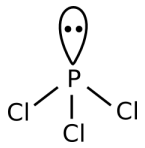
2. Which among the following equations represents the first law of thermodynamics under isobaric conditions?

Sol. $\Delta U = q + W$
$= q + (-P_{ex} \cdot \Delta V) \quad (\because W = -P_{ex} \cdot \Delta V)$
$\Delta U = q_q - P_{ex} \cdot \Delta V$

3. Formation of PCl_3 is explained on the basic of what hybridisation of phosphorus atom?

Sol. PCl_3 - has 3 sigma bond and 1 lone pair

$3 + 1 = 4$



Hence hybridization $= sp^3$

4. Identify the element that forms amphoteric oxide.

Sol. $ZnO + 2HCl \longrightarrow 2nCl_2 + H_2O$
$ZnO + 2NaOH \longrightarrow Na_2ZnO_2 + H_2O$

5. Identify the functional group that has electron donating inductive effect.

Sol. $-CH_3$ is electron donating group which shows $+I$ effect.

6. What is the oxidation number of gold in the complex $[AuCl_4]^{1-}$?

Sol. $Au = x$
$x + 4(-1) = -1$
$x - 4 = -1$
$x = -1 + 4$
$x = +3$

7. Which symbol replaces the unit of atomic mass, amu?

Sol. $'u'$

8. Which of the following compounds reacts immediately with Lucas reagent?

Sol.

$$CH_3-\underset{\displaystyle OH}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_3$$

3^o alcohol reacts with lucas reagent $(HCl + \text{anhydrous } ZnCl_2)$ immediately & gives two separate layers.

9. What is the catalyst used for oxidation of SO_2 to SO_3 in lead chamber process for manufacture of sulphuric acid?

Sol. Nitric oxide

10. The molarity of urea (molar mass $60\ g\ mol^{-1}$) solution by dissolving $15\ g$ of urea in $500\ cm^3$ of water is

Sol. Urea molar mass $= 60\ g/mol$

$$\text{molarity} = \frac{15 \times 1000}{60 \times 500} = \frac{15}{6 \times 5} = \frac{1}{2}$$

$$= 0.5\ mol\ dm^{-3}$$

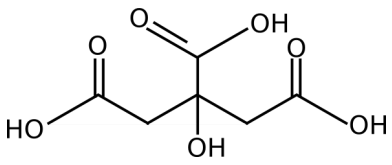
11. Molarity is

Sol. $$\text{molarity} : (M) = \frac{\text{no. of moles of solute}}{\text{vol. of solution of } dm^3}$$

12. Which of the followings is a tricarboxylic acid?

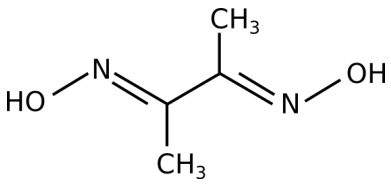
Sol. Citric Acid

Structure : -



13. What is the number of donor atoms in dimethylglyoximato ligand?

Sol.



14. In which substance does nitrogen exhibit the lowest oxidation state?

Sol. Nitrous oxide (N_2O)

15. Which of the followings is most reactive towards addition reaction of hydrogen cynide to form corresponding cynohydrin?

Sol. Formaldehyde (electrophilicity of carbocation, decreases reactivity decreases)

16. The most basic hydroxide from following is

Sol. $La(OH)_3(Z = 57)$

Due to lanthanide contration.

17. What is the SI unit of density?

Sol. $kg\ m^{-3}$

18. Which of the following compounds does NOT undergo haloform reaction?

Sol. Haloform is given by compound containing $CH_3 - \overset{\overset{O}{||}}{C} - \text{group}$ or $R - \underset{\underset{OH}{|}}{CH} - CH_3$

19. Two moles of an ideal gas are allowed to expand from a volume of 10 dm^3 to 2 dm^3 at 300 K against a pressure of 101.325 KPa. Calculate the work done

Sol. $v_1 = 10\ dm^3 = 10^{-2}m^3$

$v_2 = 2m^3$

$p = 101.325 \times 10^3 pa$

$W = -101.325 \times 10^3(1.99)$

$= -201.6\ kJ$

20. In which among the following solids, Schottky defect is NOT observed ?

Sol. ZNS - Shows Frenkel defects

21. What are the products of auto-photolysis of water ?

Sol. $H_2O \rightleftharpoons H^+ + OH^-$

$H_2O + H^+ \rightarrow H_3O^{\oplus}$

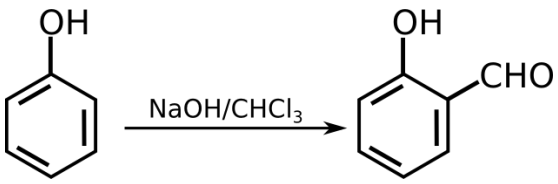
$\overline{2H_2O \rightarrow H_3O^{\oplus} + OH^-}$

22. Bauxite, the ore of aluminium, is purified by which process ?

Sol. Hall's process

23. Phenol in presence of sodium hydroxide reacts with chloroform to form salicyladehyde. The reaction is known as

Sol.



Reimer-Tiermann

24. Which among the following elements of group-2 exhibits anomalous properties ?

Sol. Be - belongs to second period

25. Excess of ammonia with sodium hypochloride solution in the prescence of glue or gelatine gives

Sol. $NH_3 + NaOCl \longrightarrow NH_2 - NH_2 + NaCl + H_2O$

26. What is the density of solution of sulphuric acid used as an electrolyte in lead accumulator ?

Sol. $1.2\, gmL^{-1}$

27. Which of the following polymers is used to manufacture clothes for firefighters ?

Sol. Nomex

28. Which element is obtained in the pure form by van Arkel method ?

Sol. Titanium - Van Arkel method

29. Which of the following is NOT a tranquilizer ?

Sol. Bromopheniiramine - Antihistamine

30. Conservation of hexane into benzene involves the reaction of

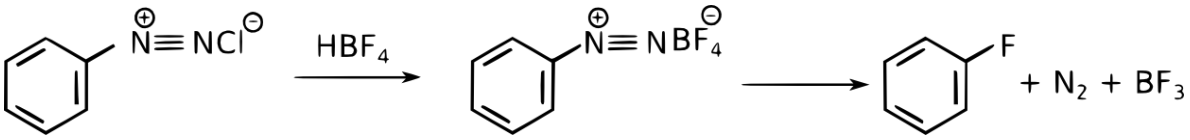
Sol. $CH_3-CH_2-CH_2-CH_2-CH_2-CH_3 \xrightarrow{\text{Dehydrogenation}}$ 

31. The element that does NOT exhibit allotropy is

Sol. Bismuth

32. Which of the following reactions is used to prepare aryl fluorides from diazonium salts and fluoroboric acid ?

Sol. Balz-Schiemann reaction



33. The correct relation between elevation of boiling point and molar mass of solute is

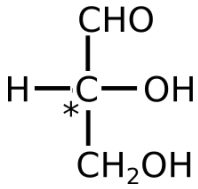
Sol. $$\Delta T_b = \frac{K_b \times W_2 \times 1000}{W_1 \times M_2}$$

$$M_2 = \frac{K_b \times W_2}{\Delta T_b \times W_1}$$

34. Which among the group - 15 elements does NOT exists as tetra atomic molecule ?

Sol. Nitrogen exists as N_2

35. Identify the monosaccharide containing only one asymmetric carbon atom in its molecule.

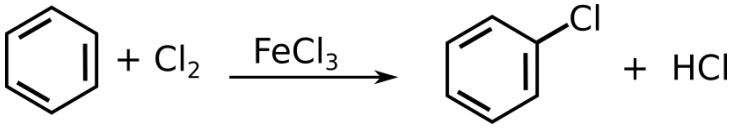
Sol.  glyceraldehyde

36. Identify the oxidation states of titanium (Z = 22) and copper (Z = 29) in their colourless compounds.

Sol. $Ti : [Ar]4s^2\,3d^2 \qquad Cu : [Ar]4s^1\,3d^{10}$

$Ti^{+4} : [Ar]4s^0\,3d^0 \qquad Cu^{+1} : [Ar]4s^0\,3d^{10}$

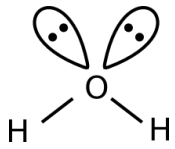
37. Arenes on treatment with chlorine in presence of ferric chloride as a catalyst undergo what type of reaction ?

Sol. 

38. In case of R, S configuration the group having highest priority is

Sol. Atomic mass of oxygen is more than that of C & N

39. What is the geometry of water molecule ?

Sol. 

40. Calculate the work done during combustion of $0.138\,kg$ of ethanol, $C_2H_5OH_{(I)}$ at at $300\,K$. Given : $R = 8.314\,Jk^{-1}\,mol^{-1}$, molar mass of ethanol $= 46\,g\,mol^{-1}$

Sol. $C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$

$1 \quad 3 \quad 2 \quad 3$

$0.138\,kg = 138/46 = 3\,mole$

$138\,gm$

$u3C_2H_5OH + 9O_{2(g)} \longrightarrow 6CO_{2(g)}9H_2O_{(u)}$

$\Delta H = 6 - 9 = -3$

Work $= -\Delta nRT$

$= -(-3) \times 8.314 \times 300$

$= 7482\,J$

41. Slope of the straight line obtained by plotting $\log_{10} k$ against $\frac{1}{T}$ represents what term ?

Sol. $K = Ae^{-Ea/RT}$

$= lnk = lnA - \dfrac{E_a}{RT}$

$\log k = \log A - \dfrac{E_a}{2.303R} \times \dfrac{1}{1T}$

$y = mx + C$

$y = \log k \quad x = \dfrac{1}{T} \quad \text{Slope} = \dfrac{-E_a}{2.303R}$

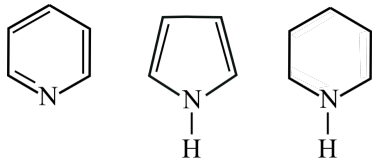
$m = \dfrac{-E_a}{2.303R}$

42. Aluminium is usually found in +3 oxidation state. In contrast, thallium exists in +1 and +3 oxidation states. This is due to :

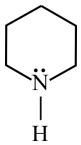
Sol. Inert pair effect

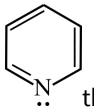
$\longrightarrow$ for heavier elements, stabilities of lower oxidation state increases due to inert behavior of ns^2 electrons.

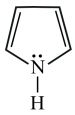
43. Arrange the following amines in the decreasing order of basicity :



I II III

Sol. The lone pair is localised in sp^3 hybrid orbital in 

In  the lone pair is localised in sp^2 hybrid orbital (not involved in resonance)



In Pyrrole the lone pair is involved in delocalisation in aromaticity.

44. A solution of sodium sulfate contains $92g$ of Na^+ ions per kilogram of water. The molality of Na^+ ions in that solution in $mol\ kg^{-1}$ is :

Sol. $$m = \frac{n_{Na^+}}{W(kg)}$$
$$= \frac{92}{23} \times \frac{1}{1}$$
$$\Rightarrow 4.$$

45. In general, the properties that decrease and increase down a group in the periodic table, respectively, are :

Sol. Down the group

electronegativity $\longrightarrow$ decreases (due to increase in atomic radius)

Atomic radius $\longrightarrow$ Increases (due to addition of extra shell)

46. In the cell represented by $Pb_{(s)}\left| Pb^{2+}{}_{(1M)} \right|\left| Ag^{+}{}_{(1M)} \right| Ag_{(s)}$, the reducing agent is

Sol. Pb (s) | Pb^{2+} (1M) || Ag^{+} (1M) | Ag

Left	Right
Anodeoxidation	Cathode Reduction

47. Which of the following proteins is globular ?

Sol. Albumin

48. The reagent used in Wolff - Kishner reduction is

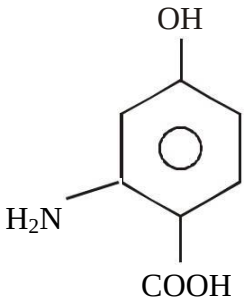
Sol. $NH_2 - NH_2$ and KOH in ethylene glycol.

$$>C=O \xrightarrow[-H_2O]{NH_2 \cdot NH_2} >C=N.NH_2 \xrightarrow[\Delta]{KOH/CH_2(OH)-CH_2(OH)} >CH_2 + N_2$$

49. Correct statement for thermoplastic polymer is

Sol. It is either linear or branched chain polymer.

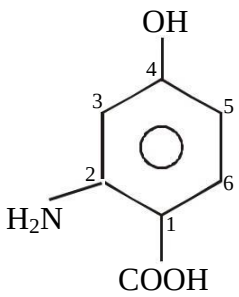
50. Write IUPAC name of following compound



Sol. Priority order of functional groups is

$-COOH > -OH > -NH_2$

Therefore, IUPAC name of the compound is as follows



2-amino-4-hydroxybenzoic acid