1. An ideal gas undergoes isothermal compression from 5 m³ against a constant external pressure of 4 Nm⁻². Heat released in this process is used to increase the temperature of 1 mole of Al. If molar heat capacity of Al is 24 J mol⁻¹ K⁻¹, the temperature of Al increases by:

(1) $\frac{3}{2}$ K  
(2) $\frac{2}{3}$ K  
(3) 1 K  
(4) 2 K

Ans. (2)

2. The 71st electron of an element X with an atomic number of 71 enters into the orbital:

(1) 4f  
(2) 6p  
(3) 6s  
(4) 5d

Ans. (1)

3. The number of 2-centre-2-electron and 3-centre-2-electron bonds in B₂H₆, respectively, are:

(1) 2 and 4  
(2) 2 and 1  
(3) 2 and 2  
(4) 4 and 2

Ans. (4)

4. The amount of sugar (C₁₂H₂₂O₁₁) required to prepare 2 L of its 0.1 M aqueous solution is:

(1) 68.4 g  
(2) 17.1 g  
(3) 34.2 g  
(4) 136.8 g

Ans. (1)

5. Among the following reactions of hydrogen with halogens, the one that requires a catalyst is:

(1) H₂ + I₂ → 2HI  
(2) H₂ + F₂ → 2HF  
(3) H₂ + Cl₂ → 2HCl  
(4) H₂ + Br₂ → 2HBr

Ans. (1)

6. Sodium metal on dissolution in liquid ammonia gives a deep blue solution due to the formation of:

(1) sodium ion-ammonia complex  
(2) sodamide  
(3) sodium-ammonia complex  
(4) ammoniated electrons

Ans. (4)

7. What will be the major product in the following mononitration reaction?

\[
\text{NO}_2^+ \text{H}_2\text{SO}_4 \rightarrow \text{ONHNO}_2^+ \text{H}_2\text{SO}_4^-
\]

Ans. (3)

8. In the cell Pt(s)|H₂(g, 1bar)|HCl(aq)|Ag(s)|Pt(s) the cell potential is 0.92 when a 10⁻⁶ molal HCl solution is used. The standard electrode potential of (AgCl/Ag, Cl⁻) electrode is:

\[
\text{given, } \frac{2.303RT}{F} = 0.06 \text{Vat298K}
\]

(1) 0.20 V  
(2) 0.76 V  
(3) 0.40 V  
(4) 0.94 V

Ans. (1)
9. The major product of the following reaction is:

\[ \text{CH}_3\text{N} \equiv \text{CHN} \rightarrow \text{NaBH}_4 \]

(1) \( \text{CH}_3\text{N} \equiv \text{CHN} \text{OH} \)
(2) \( \text{CH}_3\text{N} \equiv \text{CHN} \text{OH} \)
(3) \( \text{CH}_3\text{N} \equiv \text{CHN} \text{OH} \)
(4) \( \text{CH}_3\text{N} \equiv \text{CHN} \text{OH} \)

Ans. (3)

10. The pair that contains two P–H bonds in each of the oxoacids is:

(1) \( \text{H}_3\text{PO}_2 \) and \( \text{H}_4\text{P}_2\text{O}_5 \)
(2) \( \text{H}_4\text{P}_2\text{O}_4 \) and \( \text{H}_2\text{P}_2\text{O}_6 \)
(3) \( \text{H}_3\text{PO}_3 \) and \( \text{H}_3\text{PO}_2 \)
(4) \( \text{H}_4\text{P}_2\text{O}_5 \) and \( \text{H}_3\text{PO}_3 \)

Ans. (1)

11. The major product of the following reaction is:

\[ \text{CH}_3\text{OH} \rightarrow \text{aq. NaOH} \rightarrow \text{CH}_3\text{I} \]

(1) \( \text{CH}_3\text{OH} \text{CH}_3 \)
(2) \( \text{CH}_3\text{OH} \text{CH}_3 \)
(3) \( \text{CH}_3\text{OH} \text{CH}_3 \)
(4) \( \text{CH}_3\text{OH} \text{CH}_3 \)

Ans. (4)

12. The difference in the number of unpaired electrons of a metal ion in its high-spin and low-spin octahedral complexes is two. The metal ion is:

(1) \( \text{Fe}^{2+} \)
(2) \( \text{Co}^{2+} \)
(3) \( \text{Mn}^{2+} \)
(4) \( \text{Ni}^{2+} \)

Ans. (2)

13. A compound of formula \( \text{A}_2\text{B}_3 \) has the hcp lattice. Which atom forms the hcp lattice and what fraction of tetrahedral voids is occupied by the other atoms:

(1) hcp lattice-A, \( \frac{2}{3} \) Tetrachedral voids-B
(2) hcp lattice-B, \( \frac{1}{3} \) Tetrachedral voids-A
(3) hcp lattice-B, \( \frac{2}{3} \) Tetrachedral voids-A
(4) hcp lattice-A \( \frac{1}{3} \) Tetrachedral voids-B

Ans. (2)

14. The reaction that is NOT involved in the ozone layer depletion mechanism is the stratosphere is:

(1) \( \text{HOCl}(g) \xrightarrow{\text{hv}} \text{OH}(g) + \text{Cl}(g) \)
(2) \( \text{CF}_2\text{Cl}_2(g) \xrightarrow{\text{uv}} \text{Cl}(g) + \text{CF}_2\text{Cl}(g) \)
(3) \( \text{CH}_4 + 2\text{O}_3 \rightarrow 3\text{CH}_2 = \text{O} + 3\text{H}_2\text{OP} \)
(4) \( \text{ClO}(g) + \text{O}(g) \rightarrow \text{Cl}(g) + \text{O}_2(g) \)

Ans. (3)

15. The process with negative entropy change is:

(1) Dissolution of iodine in water
(2) Synthesis of ammonia from \( \text{N}_2 \) and \( \text{H}_2 \)
(3) Dissolution of \( \text{CaSO}_4(s) \) to \( \text{CaO}(s) \) and \( \text{SO}_3(g) \)
(4) Subimation of dry ice

Ans. (2)
16. The major product of the following reaction is:

\[
\text{CH}_3\text{OH} \xrightarrow{\text{i} \text{ dil. HCl/}\Delta} \text{CH}_3\text{O}\text{COCH}_3 \xrightarrow{\text{ii} (\text{COOH})_2/ \text{Polymerisation}} \]

Anss. (3)

17. A reaction of cobalt(III) chloride and ethylenediamine in a 1 : 2 mole ratio generates two isomeric products A (violet coloured) B (green coloured). A can show optical activity, B is optically inactive. What type of isomers does A and B represent?

(1) Geometrical isomers
(2) Ionisation isomers
(3) Coordination isomers
(4) Linkage isomers

Anss. (1)

18. The major product obtained in the following reaction is:

\[
\text{NaOEt/}\Delta \xrightarrow{\text{C}_2\text{H}_5\text{CO}_2\text{Et}} \]

Anss. (4)

19. Which of the following tests cannot be used for identifying amino acids?

(1) Biuret test
(2) Xanthoproteic test
(3) Barfoed test
(4) Ninhydrin test

Anss. (3)

20. What is the IUPAC name of the following compound?

\[
\text{CH}_3\text{CH}_3\text{H} \xrightarrow{\text{CH}_3\text{Br}} \]

(1) 3-Bromo-1, 2-dimethylbut-1-ene
(2) 4-Bromo-3-methylpent-2-ene
(3) 2-Bromo-3-methylpent-3-ene
(4) 3-Bromo-3-methyl-1, 2-dimethylprop-1-ene

Anss. (2)
21. Which is the most suitable reagent for the following transformation?

\[
\begin{align*}
\text{OH} & \\
\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_3 & \xrightarrow{\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_2\text{CO}_2\text{H}}
\end{align*}
\]

(1) alkaline KMnO\(_4\)  
(2) I\(_2\)/NaOH  
(3) Tollen's reagent  
(4) CrO\(_2/\text{CS}_2\)

Ans. (2)

22. The correct match between item 'I' and item 'II' is:

<table>
<thead>
<tr>
<th>Item 'I' (compound)</th>
<th>Item 'II' (reagent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Lysine</td>
<td>(P) 1-naphthol</td>
</tr>
<tr>
<td>(B) Furfural</td>
<td>(Q) ninhydrin</td>
</tr>
<tr>
<td>(C) Benzyl alcohol</td>
<td>(R) KMnO(_4)</td>
</tr>
<tr>
<td>(D) Styrene</td>
<td>(S) Ceric ammonium nitrate</td>
</tr>
</tbody>
</table>

(1) (A)→(Q), (B)→(P), (C)→(S), (D)→(R)  
(2) (A)→(Q), (B)→(R), (C)→(S), (D)→(P)  
(3) (A)→(Q), (B)→(P), (C)→(R), (D)→(S)  
(4) (A)→(R), (B)→(P), (C)→(Q), (D)→(S)

Ans. (1)

23. In the reaction of oxalate with permanganate in acidic medium, the number of electrons involved in producing one molecule of CO\(_2\) is:

(1) 10  
(2) 2  
(3) 1  
(4) 5

Ans. (3)

24. 5.1 g NH\(_4\)SH is introduced in 3.0 L evacuated flask at 327°C. 30% of the solid NH\(_4\)SH decomposed to NH\(_3\) and H\(_2\)S as gases. The K\(_p\) of the reaction at 327°C is (R = 0.082 L atm mol\(^{-1}\)K\(^{-1}\), Molar mass of S = 32 g mol\(^{-1}\), molar mass of N = 14 g mol\(^{-1}\)).

(1) 1 \times 10\(^{-4}\) atm\(^2\)  
(2) 4.9 \times 10\(^{-3}\) atm\(^2\)  
(3) 0.242 atm\(^2\)  
(4) 0.242 \times 10\(^{-2}\) atm\(^2\)

Ans. (3)

25. The electrolytes usually used in the electroplating of gold and silver, respectively, are:

(1) [Au(OH)\(_3\)]\(^-\) and [Ag(OH)\(_2\)]\(^-\)  
(2) [Au(CN)\(_2\)]\(^-\) and [Ag Cl\(_2\)]\(^-\)  
(3) [Au(NH\(_3\))\(_2\)]\(^+\) and [Ag(CN)\(_2\)]\(^-\)  
(4) [Au(CN)\(_2\)]\(^-\) and [Ag(CN)\(_2\)]\(^-\)  

Ans. (4)

26. Elevation in the boiling point for 1 molal solution of glucose is 2 K. The depression in the freezing point of 2 molal solutions of glucose in the same solvent is 2 K. The relation between K\(_b\) and K\(_f\) is:

(1) K\(_b\) = 0.5 K\(_f\)  
(2) K\(_b\) = 2 K\(_f\)  
(3) K\(_b\) = 1.5 K\(_f\)  
(4) K\(_b\) = K\(_f\)

Ans. (2)

27. An aromatic compound 'A' having molecular formula C\(_7\)H\(_6\)O\(_2\) on treating with aqueous ammonia and heating forms compound 'B'. The compound 'B' on reaction with molecular bromine and potassium hydroxide provides compound 'C' having molecular formula C\(_6\)H\(_7\)N. The structure of 'A' is:

(1)  
(2)  
(3)  
(4)  

Ans. (3)

28. The ground state energy of hydrogen atom is −13.6 eV. The energy of second excited state He\(^+\) ion in eV is:

(1) −6.04  
(2) −27.2  
(3) −54.4  
(4) −3.4

Ans. (1)

29. For an elementary chemical reaction, A\(_2\) \xrightarrow{k_{-1}} 2A, the expression for \(\frac{d[A]}{dt}\) is:

(1) 2k\(_1\)[A\(_2\)]−k\(_{-1}\)[A]\(^2\)  
(2) k\(_1\)[A\(_2\)]−k\(_{-1}\)[A]\(^2\)  
(3) 2k\(_1\)[A\(_2\)]−2k\(_{-1}\)[A]\(^2\)  
(4) k\(_1\)[A\(_2\)]+k\(_{-1}\)[A]\(^2\)

Ans. (3)

30. Haemoglobin and gold sol are examples of:

(1) negatively charged sols  
(2) positively charged sols  
(3) negatively and positively charged sols, respectively  
(4) positively and negatively charged sols, respectively

Ans. (4)