<table>
<thead>
<tr>
<th>Q No</th>
<th>SECTION A</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>On heating ZnO, it loses oxygen and there is excess of Zn(^{2+}) ions in the crystal.</td>
<td>1</td>
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<tr>
<td></td>
<td>OR</td>
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<td></td>
<td>When silicon is doped with phosphorous (group 15 element), the increase in conductivity is due to the delocalised negatively charged electrons.</td>
<td>1</td>
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<td>2.</td>
<td>Associated colloids</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>(t^3_{2g}) (e^3_g)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>OR</td>
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<td></td>
<td>The orbital splitting energies, (\Delta_t) are not sufficiently large for forcing pairing of electrons in the tetrahedral coordination entity formation.</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>B</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Poly (\beta) – hydroxybutyrate – co – (\beta) – hydroxy valerate</td>
<td>1</td>
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<tr>
<td>6.</td>
<td>HBr (\rightarrow) H(^+) + Br(^-)</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td>(i=1-\alpha+n\alpha)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(n=2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i=1+\alpha)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(\Delta T_f = iK_f m)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(\Delta T_f = (1+\alpha) 1.86 \times \frac{8.1}{81} \times \frac{1000}{100} = 3.53)</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td>(T_f^0 = 0^\circ C)</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td>(\Delta T_f = T_f^0 - T_f')</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td>(T_f' = -3.534^\circ C)</td>
<td>1/2</td>
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</table>

**SECTION B**

**OR**

\[ \text{Mole fraction of water, } \chi_{H_2O} = 0.88 \]
\[ \text{Mole fraction of ethanol, } \chi_{C_2H_5OH} = 1 - 0.88 = 0.12 \]

\[ \chi_{C_2H_5OH} = \frac{n_2}{n_1 + n_2} \]

\[ \text{...............(1)} \]

---

Class: XII
Chemistry
Marking Scheme 2018-19

Time allowed: 3 Hours

Maximum Marks: 70
\( n_2 = \text{number of moles of ethanol.} \)
\[ n_1 = \frac{1000}{18} = 55.5 \text{ moles} \]

Substituting the value of \( n_1 \) in equation (1)
\[ \frac{n_2}{55.5 + n_2} = 0.12 \]

\[ n_2 = 7.57 \text{ moles} \]
Molality of ethanol \( (\text{C}_2\text{H}_5\text{OH}) = 7.57 \text{ m} \)

Alternatively,
Mole fraction of water = 0.88
Mole fraction of ethanol = 1-0.88 = 0.12
Therefore 0.12 moles of ethanol are present in 0.88 moles of water.
Mass of water = 0.88 x 18 =15.84 g of water.
Molality = number of moles of solute (ethanol) present in 1000 g of solvent (water)
\[ = 12 \times 1000 / 15.84 \]
\[ = 7.57 \text{ m} \]
Molality of ethanol \( (\text{C}_2\text{H}_5\text{OH}) = 7.57 \text{ m} \)

7.(a) Reaction: Hell-Volhard-Zelinsky reaction.
IUPAC: 2-Bromopropanoic acid.
(b) Reaction: Rosenmund reduction reaction.
IUPAC: Benzaldehyde.

OR
i) 2-Methylbut-2-enal
\[
\begin{array}{c}
\text{CH}_3 \\
\text{CH}_3-\text{CH}=\text{CH}-\text{CHO}
\end{array}
\]
ii) Pent-2-enal
\[
\text{CH}_3-\text{CH}_2-\text{CH}=\text{CH}-\text{CHO}
\]

8.(a) Tert-butyl peroxide acts as a free radical generating initiator(catalyst)
(b) \( \text{CH}_2 = \text{CH}-\text{CH} = \text{CH}_2 \)
\( \text{C}_6\text{H}_5 – \text{CH} = \text{CH}_2 \)
9. **Step 1: Formation of protonated alcohol.**

![Protonated ethanol diagram]

Ethanol → Protonated ethanol (Ethyl oxonium ion)

**Step 2: Formation of carbocation.**

![Carbocation diagram]

**Step 3: Formation of ethane by elimination of a proton.**

![Ethane formation diagram]

10. (i) Zero order reaction
(ii) Slope represents \( -k \); Intercept represents \([R]_0\)
(iii) \( mol \ L^{-1} \ s^{-1} \)

11. (a) ![XeO3](image)

(b) ![PO3](image)

12. (i) Since Ti\(^{4+}/Ti^{3+}\) has lower reduction potential than Fe\(^{3+}/Fe^{2+}\), it cannot be reduced in comparison with Fe\(^{3+}/Fe^{2+}\) ions. Hence Ti\(^{4+}\) cannot oxidise Fe\(^{2+}\) to Fe\(^{3+}\).

(ii) As the value of reduction potential increases the stability of +2 oxidation increases. Therefore correct order of stability is
\[
Cr^{3+}/Cr^{2+} < Fe^{3+}/Fe^{2+} < Mn^{3+}/Mn^{2+}
\]
### SECTION C

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
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</table>
| 13.      | \( r = \frac{\sqrt{3}}{4} a \)  
          | \( 143.1 = \frac{\sqrt{3}}{4} a \)  
          | \( a = 330.4 \text{ pm} \)  
          | \( \rho = \frac{zM}{a^3 N_A} \)  
          | \( \rho = \frac{2 \times 93}{(330.4 \times 10^{-10})^3 \times 6.023 \times 10^{23}} \)  
          | \( \rho = 8.58 \text{ g/cm}^3 \)  
          | ½        |
| 14.(a)   | Molecules of benzoic acid dimerise in benzene, the number of particles are reduced. |
| 14.(b)   | The intermolecular interactions between ethanol and acetone are weaker / the escaping tendency of ethanol and acetone molecules increases on mixing / the vapour pressure increases. |
| 14.(c)   | Due to osmosis, a bacterium on fruit loses water, shrivels and dies. |
| 15.      |  
          | A : \( \text{CH}_3-\text{CH}-\text{CH}_2-\text{OH} \)  
          | B : \( \text{CH}_3-\text{CH}-\text{COOH} \)  
          | C : \( \text{CH}_3-\text{CH} = \text{CH}_2 \)  
          | D : \( \text{CH}_3-\text{CH}-\text{CH}_3-\text{OH} \)  
          | A and D are position isomers. |
16. C₆H₅CH₂Cl will undergo S₉₁ reaction faster. The carbocation formed by C₆H₅CH₂Cl gets stabilized through resonance. Greater the stability of carbocation, greater will be its ease of formation from the respective halide.

\[
\begin{align*}
(i) & \quad \begin{array}{c}
\text{CH}_2
\end{array} \\
(ii) & \quad \begin{array}{c}
\text{CH}_2
\end{array} \\
(iii) & \quad \begin{array}{c}
\text{CH}_2
\end{array} \\
(iv) & \quad \begin{array}{c}
\text{CH}_2
\end{array} \\
(v) & \quad \begin{array}{c}
\text{CH}_2
\end{array} \\
(vi) & \quad \begin{array}{c}
\text{CH}_2
\end{array}
\end{align*}
\]

OR

\[
\begin{align*}
\text{Cl} & \quad \begin{array}{c}
\text{CH}_3
\end{array} - \text{CH} - \text{CH}_2 \text{Cl} \\
\text{CH}_2 \text{Cl} - \text{CH}_2 - \text{CH}_2 \text{Cl} & \\
\text{CH}_3 - \text{CH}_2 - \text{CHCl}_2 & \\
\text{Cl} & \quad \begin{array}{c}
\text{CH}_3 \cdot \text{C} - \text{CH}_3
\end{array} \\
\text{Cl} & \quad \begin{array}{c}
\text{CH}_3 - \text{CH} - \text{CH}_2 \text{Cl}
\end{array}
\end{align*}
\]

The following isomer will exhibit enantiomerism:

\[
\begin{align*}
\text{Cl} & \quad \begin{array}{c}
\text{CH}_3 \cdot \text{CH} - \text{CH}_2 \text{Cl}
\end{array}
\end{align*}
\]

IUPAC name: 1,2-Dichloropropane.

17. (a) \[
\begin{align*}
\text{N-OH}
\end{align*}
\]

(b) HOOC - CH₂ - CH₂ - CH₂ - CH₂ – COOH
18. (i) It is unstable at cooking temperature.
(ii) Excessive hydrogen carbonate can make the stomach alkaline and trigger the production of even more acid. Metal hydroxides being insoluble do not increase the pH above neutrality.
(iii) Aspirin has anti blood clotting action.

19. (a) Amylopectin.
(b) C-2
(c) Two peptide linkages.

OR

(1) Glucose does not give 2,4-DNP test.
(2) Glucose does not give Schiff’s test.
(3) The pentaacetate of glucose does not react with hydroxylamine.
(4) Glucose does not form the hydrogen sulphite addition product with NaHSO$_3$.
(Any three points)

20. $2N_2O_5(g) \rightarrow 2N_2O_4(g) + O_2(g)$
At $t = 0$ 0.5 atm 0 atm 0 atm
At time $t$ 0.5 - $2x$ atm $2x$ atm $x$ atm
$p_t = p_{N_2O_5} + p_{N_2O_4} + p_{O_2}$
$= (0.5 - 2x) + 2x + x = 0.5 + x$
$x = p_t - 0.5$
$p_{N_2O_5} = 0.5 - 2x$
$= 0.5 - 2(p_t - 0.5)$
$= 1.5 - 2p_t$
At $t = 100$ s; $p_t = 0.512$ atm
$p_{N_2O_5} = 1.5 - 2 \times 0.512 = 0.476$ atm
$k = \frac{2.303}{t} \log \frac{p_t}{p_A}$
$k = \frac{2.303}{100s} \log \frac{0.5 \text{ atm}}{0.476 \text{ atm}}$
$k = \frac{2.303}{100s} \times 0.0216 = 4.98 \times 10^{-4} \text{ s}^{-1}$

OR

The Arrhenius equation: $k = Ae^{-\frac{E_a}{RT}}$
Taking log on both sides: $\log k = \log A - \frac{E_a}{2.303RT}$
For reaction (i)  \[ \log k_1 = \log A - \frac{E_a(1)}{2.303RT} \]
For reaction (ii)  \[ \log k_2 = \log A - \frac{E_a(2)}{2.303RT} \]
Subtracting (i) from (ii)
\[ \log \frac{k_1}{k_2} = \frac{E_a(1) - E_a(2)}{2.303RT} \]
\[ = \log \frac{k_1}{k_2} = \frac{24.9 \times 1000}{2.303 \times 8.3 \times 300} = 4.342 \]
\[ \frac{k_1}{k_2} = \text{anti} \log(4.342) = 2.198 \times 10^4 \]

| 21. | (a) | Negative charge is developed on the sol. | ½ |
|     | (b) | Adsorption of reactants on the solid surface of the catalysts increases the rate of reaction. | 1 |
|     | (c) | Na$_3$PO$_4$ Hardy-Schulze rule | ½ |

| 22. | (a) | Leached gold complex is treated with Zinc and gold is recovered by displacement method | ½ |
|     |    | \[ 2\text{Au}[(\text{CN})_2]^- \text{(aq)} + \text{Zn(s)} \rightarrow 2\text{Au(s)} + [\text{Zn(CN)}_4]^{2-}\text{(aq)} \] | ½ |
|     | (b) | Zirconium iodide is decomposed on a tungsten filament; electrically heated to 1800 K. Pure Zr metal is deposited on the filament. | ½ |
|     |    | \[ \text{ZrI}_4 \rightarrow \text{Zr} + \text{I}_2 \] | ½ |
|     | (c) | Silica is added to the ore and heated. It helps to slag off iron oxide as iron silicate | ½ |
|     |    | \[ \text{FeO} + \text{SiO}_2 \rightarrow \text{FeSiO}_3\text{(slag)} \] | ½ |

**OR**

| (a) | NaCN is used as depressants to separate two sulphide ores (ZnS and PbS) in Froth Floatation Method. | 1 |
| (b) | Carbon monoxide forms a volatile complex of nickel, nickel tetracarbonyl. | 1 |
| (c) | Coke is used as a reducing agent to reduce zinc oxide to zinc. | 1 |

| 23. | (a) | Co$^{2+}$: [Ar]$3d^7$  Sc$^{3+}$: [Ar]$3d^7$  Cr$^{3+}$: [Ar]$3d^3$  Co$^{2+}$ and Cr$^{3+}$ have unpaired electrons. Thus, they are coloured in aqueous solution. Sc$^{3+}$ has no unpaired electron. Thus it is colourless. | 1 |
|     | (b) | Metal copper has high enthalpy of atomisation and enthalpy of ionisation. Therefore the high energy required to convert Cu(s) to Cu$^{2+}$ (aq) is not balanced by its hydration enthalpy. | 1 |
Due to lanthanoid contraction the size of lanthanoid ion decreases regularly with increase in atomic size. Thus covalent character between lanthanoid ion and OH
increases from La3+ to Lu3+. Thus the basic character of hydroxides decreases from La(OH)3 to Lu(OH)3

24. (a) Isomer A: [Cr(NH3)4 BrCl ]Cl
Isomer B: [Cr (NH3)4 Cl2]Br
(b) Hybridisation of Cr in isomer A and B is d2sp3.
(c) Number of unpaired electrons in Cr3+(3d3) is 3
Magnetic moment = $\sqrt{n(n+2)}$
= $\sqrt{3(3+2)} = 3.87$ BM
(deduct half mark for wrong unit/unit not written)

25.(a) A = AgNO2
B =
C =
D = CHCl3 + KOH , Heat.

(b) Experiment | Aniline | Benzyalmine
--- | --- | ---
(i) Azo dye test: Dissolve the amine in HCl, cool it and then add cold aqueous solution of NaNO2 and then solution of β - naphthol | A brilliant orange red dye is observed. | No dye is formed.
(ii) Carbylamine test: To the organic compound add chloroform and ethanolic potassium hydroxide and heat (or any other suitable test) | A foul smelling substance (isocyanide) | No reaction.
<table>
<thead>
<tr>
<th>(c)</th>
<th>A = ( \text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2 )</th>
<th>( 1/2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B = ( \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} )</td>
<td>( 1/2 )</td>
</tr>
</tbody>
</table>

| **OR** |
|-----------------|-------------------------------------------------|---------|
| **(a)(i)**      | In strongly acidic medium, aniline is protonated to form the anilium ion which is meta directing. | 1       |
| **(ii)**        | Aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide. | 1       |
|                 | \[
\begin{align*}
\text{CH}_3\cdot\text{COOH} & \xrightarrow{\text{NH}_3, \Delta} \text{CH}_3\cdot\text{CO-NH}_2
\end{align*}
\] | 1       |
| **(b)(i)**      | \[
\begin{align*}
\text{NH}_2 & \xrightarrow{(\text{CH}_3\text{CO})_2\text{O}, \text{pyridine}} \text{NHCOCOC}_3
\end{align*}
\] | 1       |
| **(ii)**        | \[
\begin{align*}
\text{NH}_2 & \xrightarrow{\text{Br}_2, \text{CH}_3\text{COOH}} \text{NHCOCH}_3
\end{align*}
\] | 1       |

| **(c)** | p- Nitroaniline < Aniline < p- Toluidine. | 1       |

| **26.(a)** | \( E_{cell} \) decreases. | 1       |
| **(b)**    | Anode: \( \text{Cl}_2 \)↑ | 1/2     |
| **(c)**    | Cathode : \( \text{H}_2 \)↑ | 1/2     |

\[
\begin{align*}
\text{Cu}^{2+}(\text{aq.}) + \text{Ni}(s) & \rightarrow \text{Ni}^{2+}(\text{aq.}) + \text{Cu}(s) \\
E_{cell}^0 &= E_{\text{cathode}}^0 - E_{\text{anode}}^0 \\
E_{cell}^0 &= 0.34 - (-0.25) \\
E_{cell}^0 &= 0.59 \text{V} \\
E_{cell} &= E_{cell}^0 - \frac{2.303RT}{nF} \log \frac{[\text{Ni}^{2+}]}{[\text{Cu}^{2+}]} \\
E_{cell} &= 0.59 - \frac{0.059}{2} \log \frac{[0.01]}{[0.1]} \\
E_{cell} &= 0.6195 \text{V} \\
\end{align*}
\] | 1/2     |

| **OR** |
|-----------------|-------------------------------------------------|---------|
| **(a)**         | \( \lambda_{m(\text{CaCl}_2)} = \lambda_{\text{Ca}^{2+}}^0 + 2\lambda_{\text{Cl}^{-}}^0 \) | 1       |
| **(b)**         | Conductivity of \( \text{NaCl} \) decreases on dilution as the number of ions per unit volume decreases. | 1       |
Whereas molar conductivity of NaCl increases on dilution as on dilution the interionic interactions are overcome and ions are free to move.

\[ G^* = \kappa R \]
\[ \kappa = \frac{1.29}{100} = 0.0129 \text{ S cm}^{-1} \]
\[ \Lambda_m = \frac{1000 \kappa}{C} \]
\[ \Lambda_m = \frac{1000 \times 0.0129}{0.1} \]
\[ \Lambda_m = 129 \text{ S cm}^2 \text{ mol}^{-1} \]

27. (a) (i) S atom in SF₄ is not sterically protected as it is surrounded by only four F atoms, so attack of water molecules can take place easily. In contrast, S atom in SF₆ is protected by six F atoms. Thus attack by water molecules cannot take place easily.

(ii) Chlorine water produces nascent oxygen (causes oxidation) which is responsible for bleaching action.

\[ \text{Cl}_2 + H_2O \rightarrow 2\text{HCl} + [O] \]

(iii) Due to inert pair effect Bi(V) can accept a pair of electrons to form more stable Bi (III). (+3 oxidation state of Bi is more stable than its +5 oxidation state).

(b) (i) Phosphorus undergoes disproportionation reaction to form phosphine gas.

\[ P_4 + 3\text{NaOH} + 3H_2O \rightarrow \text{PH}_3 + 3\text{NaH}_2\text{PO}_2 \]

(ii) On partial hydrolysis, XeF₆ gives oxyfluoride XeOF₄ and HF.

\[ \text{XeF}_6 + H_2O \rightarrow \text{XeOF}_4 + 2\text{HF} \]

OR

(a) N.Bartlett first prepared a red compound O₂⁻PtF₆⁻. He then realised that the first ionisation enthalpy of molecular oxygen was almost identical with Xenon. So he carried out reaction between Xe and PtF₆.

(b) (i) I₂ < F₂ < Br₂ < Cl₂
(ii) NH₃ > PH₃ > AsH₃ > SbH₃ > BiH₃

(c) (i) \[ 2\text{NaOH} + \text{Cl}_2 \rightarrow \text{NaCl} + \text{NaOCl} + H_2O \]
(ii) \[ 2\text{Fe}^{3+} + \text{SO}_2 + 2H_2O \rightarrow 2\text{Fe}^{2+} + \text{SO}_4^{2-} + 4\text{H}^+ \]