

# Sample Question Paper (TERM - I)

## Solutions

### Section - A

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| <b>Ans. 1</b> | (c) Dipole - dipole interaction<br><b>Explanation:</b> Polar molecule will act as a dipole.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Ans. 2</b> | (c) Increase in temperature<br><b>Explanation:</b> Because of increase in kinetic energy of gas molecules with temperature their tendency to escape from the liquid will increase.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Ans. 3</b> | (b) Ammonia<br><b>Explanation:</b> Urea on reaction with NaOH liberates ammonia.<br>$\text{NH}_2\text{CONH}_2 + 2\text{NaOH} \rightarrow \text{Na}_2\text{CO}_3 + 2\text{NH}_3 \uparrow$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Ans. 4</b> | (a) (c) < (a) < (b)<br><b>Explanation:</b> The boiling points of isomeric haloalkanes decrease with an increase in branching as with an increase in branching surface area decreases which leads to a decrease in intermolecular forces. Hence, the increasing order of their boiling points is c < a < b.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Ans. 5</b> | (a) All of these<br><b>Explanation:</b> Oxidation of alcohols to aldehydes is partial oxidation; aldehydes are further oxidized to carboxylic acids. Conditions required for making aldehydes are heat and distillation.<br>In aldehyde formation, the temperature of the reaction should be kept above the boiling point of the aldehyde and below the boiling point of the alcohol.<br>Reagents useful for the transformation of primary alcohols to aldehydes are normally also suitable for the oxidation of secondary alcohols to ketones.<br>These include: <ul style="list-style-type: none"><li>• Chromium based reagents, such as Collins reagent (<math>\text{CrO}_3 \cdot \text{Py}_2</math>)</li><li>• Another useful reagent is PCC (pyridinium chlorochromate) oxidises primary alcohol to aldehyde</li><li>• Heat in the presence of Cu at 573K.</li></ul> |

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| <p><b>Ans. 6</b></p>  | <p>(d) Salts</p> <p><b>Explanation:</b> Amino acids are water-soluble, high melting solids and behave like salts rather than simple amines or carboxylic acids. This behaviour is due to the presence of both acidic (carboxyl group) and basic (amino group) groups in the same molecule. In aqueous solution, the carboxyl group can lose a proton and amino group can accept a proton, giving rise to a dipolar ion known as zwitter ion. This is neutral but contains both positive and negative charges.</p> |
| <p><b>Ans. 7</b></p>  | <p>(b) <math>2.786 \times 10^{-23} \text{ cm}^3</math></p> <p>Explanation: <math>a^3 = \frac{M \times Z}{N_A \times d}</math></p> $= \frac{50 \times 2}{6.02 \times 10^{23} \times 5.96}$ $= 2.787 \times 10^{-23} \text{ cm}^3$                                                                                                                                                                                                                                                                                  |
| <p><b>Ans. 8</b></p>  | <p>(a) A hypertonic solution</p> <p><b>Explanation:</b> Hypertonic solutions are more concentrated than the plant cell. The water from inside the cytoplasm of the cell diffuses out and the plant cell is said to have become flaccid. The cytoplasm has also shrunk and pulled away from the cell wall. This phenomenon is called plasmolysis.</p>                                                                                                                                                              |
| <p><b>Ans. 9</b></p>  | <p>(c) Oxidation of <math>\text{NH}_3</math> to <math>\text{NO}_2</math></p> <p><b>Explanation:</b> All the steps including oxidation of <math>\text{NH}_3</math> to <math>\text{NO}</math>, oxidation of <math>\text{NO}</math> to <math>\text{NO}_2</math> and absorption of <math>\text{NO}_2</math> in water are the fundamental steps for the production of nitric acid.</p>                                                                                                                                 |
| <p><b>Ans. 10</b></p> | <p>(a) Secondary butyl chloride</p> <p><b>Explanation:</b> Secondary butyl chloride is optically active because it has chiral carbon atom marked*</p> $\text{CH}_3 - \overset{*}{\underset{\text{Cl}}{\text{C}}}\text{H} - \text{CH}_2 - \text{CH}_3$                                                                                                                                                                                                                                                             |
| <p><b>Ans. 11</b></p> | <p>(a) Methanamine (<math>\text{CH}_3\text{NH}_2</math>)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

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|                | <p><b>Explanation:</b> <math>\text{CH}_3\text{Cl} + \text{NH}_3 \rightarrow \text{CH}_3\text{NH}_2 + \text{HCl}</math></p> <p>Ammonia molecule is a nucleophile in nature as it has unpaired electrons. This nucleophile attacks the chloromethane <math>\text{CH}_3\text{Cl}</math> molecule and forms methylamine or methenamine by a nucleophilic substitution reaction mechanism. The carbon atom is partially positive in the molecule, due to the electronegativity of the halide attached which is partially negative. The electron-rich nucleophile attacks the positive ion, causing the halide ion to be separated from the molecule.</p> |
| <b>Ans. 12</b> | <p>(d) primary structure</p> <p><b>Explanation:</b> Proteins may have one or more polypeptide chains. Each polypeptide in a protein has amino acids linked with each other in a specific sequence and it is this sequence of amino acids that is said to be the primary structure of that protein. Thus the most appropriate structure for knowing about the sequence of nucleotides in the DNA chain is its primary structure.</p>                                                                                                                                                                                                                 |
| <b>Ans. 13</b> | <p>(d) Quartz</p> <p><b>Explanation:</b> Quartz is not amorphous solids. It is crystalline.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Ans. 14</b> | <p>(c) <math>\Delta H_{\text{mix}} = 0</math></p> <p><b>Explanation:</b> For ideal solution there is no evolution or absorption of heat on mixing.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Ans. 15</b> | <p>(c) Ozone</p> <p><b>Explanation:</b> Sorret established the formula of ozone and pointed out that ozone is an allotrope of oxygen.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Ans. 16</b> | <p>(a) 1,2-dichloroethane</p> <p><b>Explanation:</b> Dihaloalkanes having the same halogen are classified as geminal halides or gem-dihalides and vicinal halides or vic-dihalides. Gem-dihalides are molecules where halogen atoms are present on the same carbon atom where Vic-dihalides are those dihaloalkanes where the halogen atoms are present on two adjacent carbon atoms. In common naming system, the gem-dihalides are named as alkylidene halides, vic-dihalides are named as alkylene dihalides. Dichloromethane contains only one carbon, so adjacent</p>                                                                          |

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|         | <p>halogen atoms cannot occur in the molecule. 1,2-dichloroethane contains two carbon atoms with adjacent halogen atoms. Ethylidene chloride, as its common name states, is a gem-dihalide. Allyl chloride contains only one chlorine atom.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Ans. 17 | <p>(b) Phenol</p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Catechol is o- hydroxyl phenol or Catechol also known as pyrocatechol or 1,2 dihydroxybenzene,</li> <li>• Resorcinol is m - hydroxyphenol</li> <li>• Quinol is p - hydroxyphenol or benzene- 1,4 - diol is an aromatic organic compound that is a type of phenol, a derivative of benzene.</li> </ul> <div style="text-align: center;"> <p>The image shows three chemical structures of dihydroxybenzene isomers. From left to right: 1,2-Dihydroxybenzene (Catechol) with two hydroxyl groups at adjacent positions; 1,3-Dihydroxybenzene (Resorcinol) with two hydroxyl groups at meta positions; and 1,4-dihydroxybenzene (Quinol) with two hydroxyl groups at para positions. Each structure consists of a benzene ring with a circle inside, and two 'OH' groups attached to the ring at the specified positions.</p> </div> |
| Ans. 18 | <p>(a) Glycogen</p> <p><b>Explanation:</b> Glycogen is stored in the liver of animals.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Ans. 19 | <p>(c) 14</p> <p><b>Explanation:</b> According to Bravais, there are only 14 possible ways of arranging points in space lattice from the 7 crystal systems such that, all the lattice points have exactly the same surrounding.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Ans. 20 | <p>(b) positive deviation from Raoult's Law.</p> <p><b>Explanation:</b> Positive deviations from Raoult's law are noticed when</p> <ol style="list-style-type: none"> <li>Exp. value of vapor pressure of mixture is more than calculated value.</li> <li>Exp. value of boiling point of mixture is less than calculated value.</li> <li><math>\Delta H_{\text{mixing}} = +ve</math></li> <li><math>\Delta V_{\text{mixing}} = +ve</math></li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

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| <b>Ans. 21</b> | <p>(a) SF<sub>6</sub> and HF</p> <p><b>Explanation:</b> <math>4 F_2 + H_2 S \rightarrow SF_6 + 2HF</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Ans. 22</b> | <p>(b) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>Cl</p> <p><b>Explanation:</b> The forces of attraction between the molecules of a compound get stronger as they get bigger in size and have more electrons. Also, for a straight-chain compound, the points of interaction between the molecules are more than for a branched compound having the same molecular formula. Thus CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>Cl has the highest melting point since it is the longest chain compound among the given options.</p>                                                                                                               |
| <b>Ans. 23</b> | <p>(a) tertiary alcohols</p> <p><b>Explanation:</b> The Grignard Reaction is the addition of an organomagnesium halide (Grignard reagent) to a ketone or aldehyde, to form tertiary or secondary alcohol, respectively. The reaction with formaldehyde leads to primary alcohol.</p> <p>Grignard Reagents are also used in the following important reactions: The addition of an excess of a Grignard reagent to an ester or lactone gives tertiary alcohol in which two alkyl groups are the same, and the addition of a Grignard reagent to a nitrile produces an unsymmetrical ketone via a metalloimine intermediate.</p> $RCOR_1 + R_2MgX \rightarrow RC(OH)R_1R_2$ |
| <b>Ans. 24</b> | <p>(d) carbohydrate</p> <p><b>Explanation:</b> Honey is a high carbohydrate substance. It also contains proteins.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Ans. 25</b> | <p>(a) sp<sup>3</sup>d<sup>2</sup></p> <p><b>Explanation:</b> The structure of all interhalogen compounds of the type XX'<sub>5</sub> involves sp<sup>3</sup>d<sup>2</sup> hybridization of the central halogen atom X and hence have octahedral (also called square pyramidal) geometry and with one position occupied by a lone pair.</p>                                                                                                                                                                                                                                                                                                                              |

**Section – B**

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| <b>Ans. 26</b> | <p>(a) 4</p> <p><b>Explanation:</b> Two-dimension close-packed structures, where rows of identical spherical molecules are stacked on top of each other, can be done in two ways, square and hexagonal. In a square close-packed structure, the second row is stacked just above the first row, and the spheres are aligned horizontally and vertically as the way mentioned above. If we observe a sphere in this arrangement, it is surrounded by four spheres that are in direct contact with it. Joining the centers of the four spheres also forms a square, thus giving the term square close-packed structure in two- dimension. Thus by definition of coordination number, a sphere in close-packed structure is 4.</p> |
| <b>Ans. 27</b> | <p>(c) Molality</p> <p><b>Explanation:</b> Volume is dependent on temperature. Molality, mole fraction and weight percentage does not depend on temperature because they involve masses of solute and solvent.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Ans. 28</b> | <p>(a) carbohydrate</p> <p><b>Explanation:</b> It is aldohexose. An aldohexose is a hexose with an aldehyde group on one end. it is naturally occurring in nature and is found in fruits.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Ans. 29</b> | <p>(b) Fluorine</p> <p><b>Explanation:</b> Of all the halogens, fluorine is the most reactive and hence is also called super halogen. Fluorine is also the most electronegative (EN = 4.0) element in the periodic table. This indicates that fluorine has a high tendency to gain electrons from other elements with lower electronegativities.</p>                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Ans. 30</b> | <p>(a) Na</p> <p><b>Explanation:</b> <math>2\text{CH}_3\text{Br} + 2\text{Na} \rightarrow \text{CH}_3\text{CH}_3 + 2\text{NaBr}</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Ans. 31</b> | <p>(d) Helium</p> <p><b>Explanation:</b> Noble gases can form compounds in which the gases are</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

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|                | <p>entrapped in the cavities of crystal lattices. Such compounds are called clathrates. Only Argon, Krypton, Xenon and Radon are known to form clathrates among the noble gases.</p>                                                                                                                                                                                                     |
| <b>Ans. 32</b> | <p>(d) glucose<br/> <b>Explanation:</b> Glucose is the monomer of many of the larger carbohydrates, namely starch, cellulose. Hydrolysis of starch gives glucose.</p>                                                                                                                                                                                                                    |
| <b>Ans. 33</b> | <p>(d) Methane<br/> <b>Explanation:</b> <math>\text{CH}_3\text{MgBr}</math> reacts with <math>\text{CH}_3\text{OH}</math> and form <math>\text{CH}_4</math>.<br/> Grignard Reagent act as both base as well as a nucleophile. In the presence of alcohol, <math>\text{H}_2\text{O}</math> or other groups having acidic hydrogen Grignard reagent act as base and abstract acidic H.</p> |
| <b>Ans. 34</b> | <p>(a) High pressure<br/> <b>Explanation:</b> High pressure increases the boiling point of water so it reduces the cooking time.</p>                                                                                                                                                                                                                                                     |
| <b>Ans. 35</b> | <p>(d) <math>\text{NI}_3</math><br/> <b>Explanation:</b> The strongest lewis base is <math>\text{NI}_3</math> due to lower electronegativity of I. So the tendency of trihalides of N decreases from <math>\text{NI}_3 &gt; \text{NBr}_3 &gt; \text{NCl}_3 &gt; \text{NF}_3</math> due to increase in electronegativity from I to F.</p>                                                 |
| <b>Ans. 36</b> | <p>(a) 2, 2-Dimethylpropane<br/> <b>Explanation:</b> All the hydrogen atoms in 2, 2-dimethyl - propane are equivalent, hence it can form only one monochlorinated product.</p>                                                                                                                                                                                                           |
| <b>Ans. 37</b> | <p>(b) 4<br/> <b>Explanation:</b> <math>d = \frac{zM}{a^3 \cdot N_A}</math></p>                                                                                                                                                                                                                                                                                                          |

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|                | $z = \frac{d \cdot a^3 N_A}{M}$ $= \frac{2.7 \times 10^3 \text{ kg m}^{-3} \times (4.05 \times 10^{-10} \text{ m})^3 \times 6.022 \times 10^{23} \text{ mol}^{-1}}{2.7 \times 10^{-2} \text{ kg mol}^{-1}}$ $= 4.004$ $= 4$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Ans. 38</b> | (d) Salicylaldehyde<br><b>Explanation:</b> Salicylaldehyde                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Ans. 39</b> | (a) $9.033 \times 10^{23}$<br>Explanation: Number of atoms in 1 mole of compound = $6.022 \times 10^{23}$<br>Number of atoms in 0.5 mole of compound = $0.5 \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$<br>For a hexagonal close-packed structure,<br>Number of octahedral voids = number of atoms in close packaging<br>Therefore, the Number of octahedral voids = $3.011 \times 10^{23}$<br>and Number of tetrahedral voids = $2 \times$ number of atoms in close packaging<br>so, Number of tetrahedral voids = $2 \times 3.011 \times 10^{23} = 6.022 \times 10^{23}$<br>Total number of voids = Tetrahedral void + octahedral void<br>= $(6.022 + 3.011) \times 10^{23}$<br>= $9.033 \times 10^{23}$ |
| <b>Ans. 40</b> | (a) The number of moles of solute dissolved per litre of the solution<br><b>Explanation:</b> Molarity $\frac{\text{Moles of solute}}{\text{Volume of solution (L)}}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Ans. 41</b> | (d) Phosphorus<br><b>Explanation:</b> Phosphorus can be involved in p - d bonding $\pi$ due to the presence of vacant d orbitals Carbon, Nitrogen, and Boron does not have d orbitals.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Ans. 42</b> | (c) (iv) > (iii) > (i) > (ii)<br><b>Explanation:</b> (iv) > (iii) > (i) > (ii)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Ans. 43</b> | (d) Oxygen                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |



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|                | <p><b>Explanation:</b> Oxygen exists as a diatomic gas at room temperature while other elements (S, Se and Te) exist as octatomic solids. Due to small size and high electronegativity, oxygen atom forms <math>p\pi - p\pi</math> double bond with other oxygen atom to form <math>O = O</math> molecule. The intermolecular forces of attraction between oxygen molecules are weak van der Waals forces and hence oxygen exists as a diatomic gas at room temperature.</p> |
| <b>Ans. 44</b> | <p>(c) All of these</p> <p><b>Explanation:</b> Complete hydrolysis of RNA yields a pentose sugar, phosphoric acid and nitrogen containing heterocyclic compounds (called bases). In RNA molecule, the sugar moiety is <math>\beta</math>-D-ribose.</p>                                                                                                                                                                                                                       |
| <b>Ans. 45</b> | <p>(c) A is true but R is false.</p> <p><b>Explanation:</b> A is true but R is false.</p>                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Ans. 46</b> | <p>(d) A is false but R is true.</p> <p><b>Explanation:</b> Haloalkanes react with AgCN to form alkyl isocyanides as the main product while KCN forms alkyl cyanides as the chief product.</p>                                                                                                                                                                                                                                                                               |
| <b>Ans. 47</b> | <p>(b) Both assertion and reason are wrong statements.</p> <p><b>Explanation:</b> Glycine can be synthesized by the body and is a non-essential amino acid.</p>                                                                                                                                                                                                                                                                                                              |
| <b>Ans. 48</b> | <p>(a) Both A and R are true and R is the correct explanation of A.</p> <p><b>Explanation:</b> Both A and R are true and R is the correct explanation of A.</p>                                                                                                                                                                                                                                                                                                              |
| <b>Ans. 49</b> | <p>(b) Both A and R are true but R is not the correct explanation of A.</p> <p><b>Explanation:</b> The FCC has maximum packing efficiency of 74% which in the case of BCC is 68% and Simple cubic has 52.4%. FCC has coordination number 12.</p>                                                                                                                                                                                                                             |

**Section – C**

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| <p><b>Ans. 50</b></p> | <p>(d) Molarity changes with temperature<br/> <b>Explanation:</b> Molarity depends upon Volume of solution which changes with Temperature.</p>                                                                                                                                                                                                                                                                                             |
| <p><b>Ans. 51</b></p> | <p>(c) Thymine<br/> <b>Explanation:</b> RNA does not have the pyrimidine Thymine and has Uracil instead while DNA has Thymine. In RNA, Adenine binds to Uracil with two hydrogen bonds while in DNA, Adenine binds to Thymine by two hydrogen bonds.</p>                                                                                                                                                                                   |
| <p><b>Ans. 52</b></p> | <p>(b) ethers<br/> <b>Explanation:</b> The Williamson ether synthesis is an organic reaction, forming an ether from an organohalide and deprotonated alcohol (alkoxide). This reaction was developed by Alexander Williamson in 1850. Typically it involves the reaction of an</p> <div style="text-align: center;"> <p style="text-align: center;">alkoxide ion with a primary alkyl halide via an <math>S_N2</math> reaction.</p> </div> |
| <p><b>Ans. 53</b></p> | <p>(b) <math>F &gt; Cl &gt; Br &gt; I</math><br/> <b>Explanation:</b> <math>F &gt; Cl &gt; Br &gt; I</math></p>                                                                                                                                                                                                                                                                                                                            |
| <p><b>Ans. 54</b></p> | <p>(b) F<br/> <b>Explanation:</b> F</p>                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p><b>Ans. 55</b></p> | <p>(c)<br/> <b>Explanation:</b> (c)</p>                                                                                                                                                                                                                                                                                                                                                                                                    |