SRMJEEE Chemistry Sample Paper – 1

Duration: 41 Minutes **Maximum Marks: 35**

Instructions

- This paper contains **35** Multiple Choice Questions (Single Correct Answer), modelled on the Chemistry section of **SRMJEEE** (SRM Joint Engineering Entrance Examination).
- Each correct answer carries **+1 mark**. There is **no negative marking**; an unattempted or wrong answer scores 0.
- Only **one** option is correct. Choose carefully.
- The actual SRMJEEE is a **computer-based test** conducted in remote-proctored online mode, with all sections sharing a common time window and no per-section limit.
- Personal calculators, mobile phones, log tables and other electronic gadgets are strictly prohibited.

Q1. 18 g of glucose (molar mass $= 180$ g mol^{-1}) is dissolved in 250 g of water. The molality of the solution is:

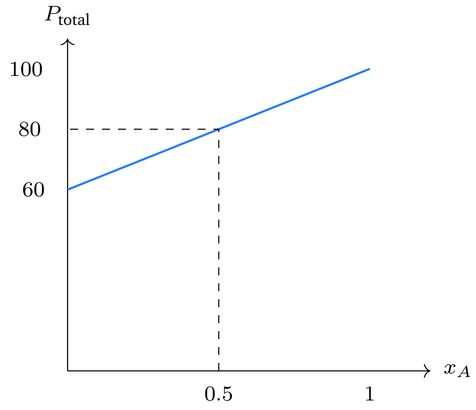
(A) 0.4 m

(B) 0.1 m

(C) 0.2 m

(D) 0.8 m

Q2. For an ideal binary solution of liquids A and B, the total vapour pressure varies linearly with mole fraction, as shown. If the vapour pressures of pure A and pure B are 100 mmHg and 60 mmHg respectively, the total vapour pressure of a solution with $x_A = 0.5$ is:



(A) 100 mmHg

(B) 80 mmHg

(C) 70 mmHg

(D) 60 mmHg

Q3. Which of the following 0.1 molal aqueous solutions will have the *highest* boiling point?

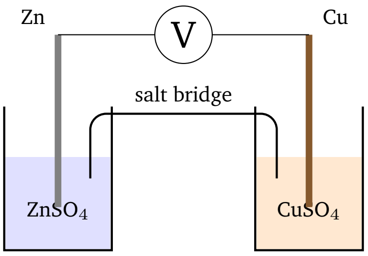
(A) 0.1 m glucose

(B) 0.1 m NaCl

(C) 0.1 m $CaCl_2$

(D) 0.1 m urea

Q4. For the Daniell cell shown, the standard electrode potentials are $E^\circ_{\text{Cu}^{2+}/\text{Cu}} = +0.34$ V and $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76$ V. The standard EMF of the cell is:



(A) 0.42 V

(B) 0.76 V

(C) -1.10 V

(D) 1.10 V

Q5. On dilution, the molar conductivity of a *strong* electrolyte:

(A) increases slightly and approaches a limiting value

(B) decreases sharply

(C) remains exactly constant

(D) falls to zero

Q6. The quantity of electric charge required to deposit one mole of aluminium from molten Al^{3+} is $(1\ F = 96500$ C$)$:

(A) 96500 C

(B) 193000 C

(C) 289500 C

(D) 48250 C

Q7. For a reaction A $\rightarrow$ products, the rate doubles when the concentration of A is doubled. The order of the reaction with respect to A is:

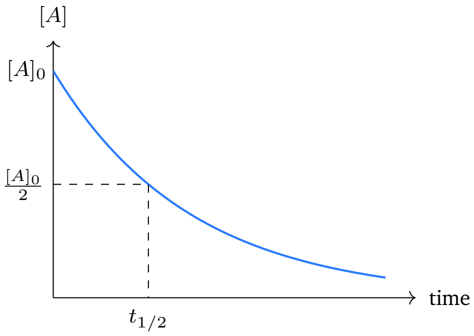
(A) 0

(B) 1

(C) 2

(D) 3

Q8. A first-order reaction has a rate constant $k = 0.0693$ min^{-1}. The concentration of the reactant falls with time as shown. The half-life of the reaction is:



(A) 10 min

(B) 1 min

(C) 100 min

(D) 5 min

Q9. According to the Arrhenius equation, as the temperature of a reaction is increased, the rate constant k:

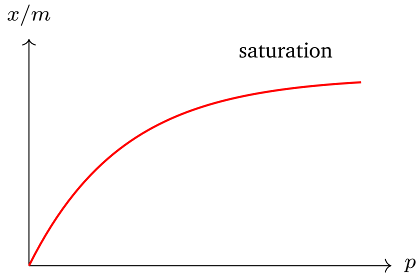
(A) decreases exponentially

(B) remains unchanged

(C) becomes zero

(D) increases exponentially

Q10. The Freundlich adsorption isotherm is written as $\frac{x}{m} = k\,p^{1/n}$. Its graph (adsorption vs pressure) is shown. For physical adsorption, the value of $1/n$ generally lies:



(A) between 0 and 1

(B) between 1 and 2

(C) greater than 2

(D) exactly equal to 1

Q11. The scattering of a beam of light by the particles of a colloidal sol, making the path of the beam visible, is known as:

(A) Brownian motion

(B) the Tyndall effect

(C) electrophoresis

(D) coagulation

Q12. Milk is a familiar colloidal system. It is best described as:

(A) a gel

(B) a solid sol

(C) an oil-in-water emulsion

(D) a foam

Q13. Among the dihalogen molecules, the one with the *highest* bond dissociation enthalpy is:

(A) F_2

(B) Cl_2

(C) Br_2

(D) I_2

Q14. The oxidation state of sulphur in sulphuric acid, H_2SO_4, is:

(A) $+2$

(B) $+4$

(C) $+6$

(D) $+7$

Q15. The correct order of basic strength of the group-15 hydrides is:

(A) $NH_3 > PH_3 > AsH_3$

(B) $PH_3 > NH_3 > AsH_3$

(C) $AsH_3 > PH_3 > NH_3$

(D) $NH_3 > AsH_3 > PH_3$

Q16. Which of the following hydrated ions is *colourless* in aqueous solution?

(A) Cu^{2+}

(B) Fe^{2+}

(C) Ni^{2+}

(D) Zn^{2+}

Q17. In potassium permanganate, $KMnO_4$, the oxidation state of manganese is:

(A) $+2$

(B) $+4$

(C) $+7$

(D) $+6$

Q18. The steady decrease in the atomic and ionic radii of the lanthanides with increasing atomic number (the lanthanide contraction) is mainly due to:

(A) poor shielding by the $3d$ electrons

(B) poor shielding of one $4f$ electron by another

(C) an increase in atomic radius down the group

(D) strong shielding by the f electrons

Q19. The IUPAC name of the complex $[Ni(CO)_4]$ is:

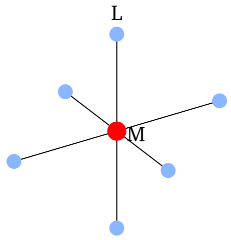
(A) nickel tetracarbonyl

(B) tetracarbonylnickel(II)

(C) tetracarbonylnickelate(0)

(D) tetracarbonylnickel(0)

Q20. In the complex ion $[Co(NH_3)_6]^{3+}$, the coordination number and the geometry around the cobalt centre are, respectively:



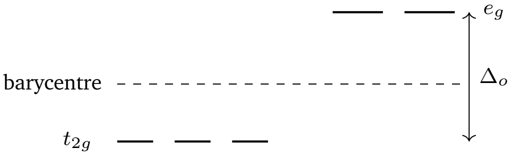
(A) 6, octahedral

(B) 4, tetrahedral

(C) 4, square planar

(D) 2, linear

Q21. In an octahedral crystal field, the five degenerate d-orbitals of the metal split into two sets, as shown. The higher-energy, doubly degenerate set is labelled:



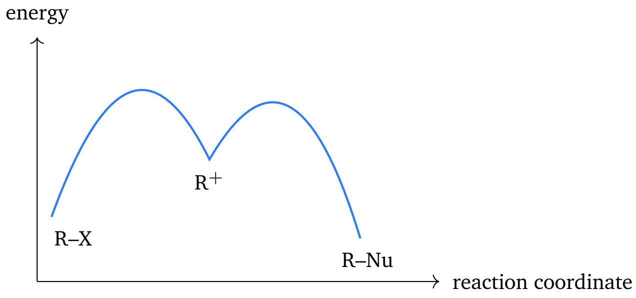
(A) t_{2g}

(B) a_{1g}

(C) e_g

(D) t_{1u}

Q22. A tertiary alkyl halide reacts with a nucleophile through the two-step energy profile shown, passing through a carbocation intermediate (R^+). This mechanism is:



(A) S_N2 (single step)

(B) E2 elimination

(C) free-radical substitution

(D) S_N1 (via a carbocation)

Q23. When an alkyl halide is heated with *alcoholic* KOH, the major product is:

(A) an alcohol

(B) an alkene

(C) an ether

(D) an amine

Q24. Chlorobenzene is far less reactive than an alkyl chloride towards nucleophilic substitution. The main reason is that:

(A) resonance gives the C–Cl bond partial double-bond character

(B) chlorine is more electronegative in chlorobenzene

(C) the benzene ring is saturated

(D) of intramolecular hydrogen bonding

Q25. The reagent used to distinguish between primary, secondary and tertiary alcohols by the rate at which turbidity appears is:

(A) Fehling's solution

(B) Tollens' reagent

(C) Baeyer's reagent

(D) Lucas reagent (anhydrous $ZnCl_2$ + conc. HCl)

Q26. Phenol is more acidic than ethanol. This is because the phenoxide ion formed on losing a proton is:

(A) less stable than the ethoxide ion

(B) stabilised by resonance (delocalisation of the negative charge)

(C) a much stronger base

(D) non-aromatic

Q27. Williamson's synthesis of an ether involves the reaction of a sodium alkoxide with:

(A) an alcohol

(B) an alkene

(C) an alkyl halide

(D) a carboxylic acid

Q28. Aldehydes are generally more reactive than ketones towards nucleophilic addition. This is mainly because, in aldehydes:

(A) there is less steric hindrance and a smaller $+I$ effect at the carbonyl carbon

(B) there is greater steric crowding at the carbonyl carbon

(C) the carbonyl group is aromatically stabilised

(D) strong intramolecular hydrogen bonding occurs

Q29. Which of the following carbonyl compounds undergoes the Cannizzaro reaction (because it has no α-hydrogen)?

(A) acetaldehyde

(B) propanal

(C) acetone

(D) benzaldehyde

Q30. Which of the following is the *strongest* carboxylic acid?

(A) CH_3COOH

(B) $Cl_3C–COOH$

(C) $ClCH_2COOH$

(D) HCOOH

Q31. In aqueous solution, which of the following is the *strongest* base?

(A) NH_3

(B) $(CH_3)_3N$

(C) $(CH_3)_2NH$

(D) CH_3NH_2

Q32. Benzene diazonium chloride reacts with phenol in mildly alkaline medium to give:

(A) an azo dye (p-hydroxyazobenzene)

(B) chlorobenzene

(C) only phenol

(D) nitrobenzene

Q33. The carbylamine reaction (formation of a foul-smelling isocyanide on heating with $CHCl_3$ and alcoholic KOH) is a test for:

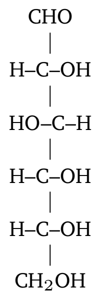
(A) tertiary amines

(B) secondary amines

(C) amides

(D) primary amines

Q34. The open-chain Fischer projection of glucose is shown. On the basis of the functional group at the top of the chain, glucose is classified as:



$$\begin{array}{c} CHO \\ | \\ H-C-OH \\ | \\ HO-C-H \\ | \\ H-C-OH \\ | \\ H-C-OH \\ | \\ CH_2OH \end{array}$$

(A) a ketohexose

(B) an aldohexose

(C) an aldopentose

(D) a ketopentose

Q35. In a protein molecule, two adjacent amino-acid units are joined together by a:

(A) glycosidic bond

(B) hydrogen bond

(C) peptide bond

(D) ester bond

Detailed Solutions

Q1.

Solution

Concept — Molality: Molality $m = \dfrac{\text{moles of solute}}{\text{mass of solvent in kg}}$. It depends only on the masses, not on temperature.

Step 1 — Moles of glucose: $n = \dfrac{18}{180} = 0.1$ mol.

Step 2 — Mass of solvent: 250 g $= 0.25$ kg, so $m = \dfrac{0.1}{0.25} = 0.4$ m.

Why other options are wrong:

- (B) 0.1 is the number of moles, not the molality.
- (C),(D) use 0.5 kg or 0.125 kg of solvent incorrectly.

Final Answer: $m = 0.4$ m $\Rightarrow \boxed{\text{A}}$

Answer: (A) **Go Back to Q1**

Q2.

Solution

Concept — Raoult's law for ideal solutions: $P_{\text{total}} = x_A P_A^\circ + x_B P_B^\circ$, a straight line between P_B° (at $x_A = 0$) and P_A° (at $x_A = 1$).

Step 1 — Substitute $x_A = x_B = 0.5$:

$$P_{\text{total}} = 0.5(100) + 0.5(60) = 50 + 30 = 80 \text{ mmHg}.$$

Step 2 — Read the graph: the dashed construction at $x_A = 0.5$ meets the line at 80 mmHg, confirming the value.

Why other options are wrong:

- (A),(D) are the pure-component pressures.
- (C) 70 is the simple average of 60 and 80, not of the two pure pressures.

Final Answer: $P_{\text{total}} = 80$ mmHg $\Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q2**

Q3.

Solution

Concept — Elevation of boiling point: $\Delta T_b = i\,K_b\,m$, where i is the van't Hoff factor (number of particles per formula unit). For the same m, the highest i gives the highest boiling point.

Step 1 — van't Hoff factors: glucose and urea ($i = 1$, non-electrolytes), NaCl ($i = 2$), $CaCl_2$ ($i = 3$: one Ca^{2+} + two Cl^-).

Step 2 — Pick the largest i: $CaCl_2$ has $i = 3$, the maximum, hence the highest boiling point.

Why other options are wrong:

- (A),(D) are non-electrolytes ($i = 1$), the smallest elevation.
- (B) NaCl gives only $i = 2$.

Final Answer: 0.1 m $CaCl_2 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q3

Q4.

Solution

Concept — Standard cell EMF: $E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$. In the Daniell cell, Cu is the cathode (reduction) and Zn the anode (oxidation).

Step 1 — Substitute:

$$E^\circ_{\text{cell}} = E^\circ_{\text{Cu}^{2+}/\text{Cu}} - E^\circ_{\text{Zn}^{2+}/\text{Zn}} = 0.34 - (-0.76) = 1.10 \text{ V}.$$

Step 2 — Sign check: a positive EMF ($+1.10$ V) confirms the cell reaction is spontaneous as drawn.

Why other options are wrong:

- (A) 0.42 adds the magnitudes wrongly; (B) 0.76 ignores the Cu potential.
- (C) -1.10 reverses cathode and anode.

Final Answer: $E^\circ_{\text{cell}} = 1.10 \text{ V} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Molar conductivity vs dilution: Λ_m increases on dilution for both strong and weak electrolytes, but the *reason* differs.

Step 1 — Strong electrolyte: it is fully ionised at all concentrations; on dilution the ions move more freely (less inter-ionic attraction), so Λ_m rises *slightly* and approaches the limiting value Λ_m° at infinite dilution.

Why other options are wrong:

- (B),(D) Λ_m never decreases or vanishes on dilution.
- (C) it is not exactly constant — it increases gradually toward Λ_m°.

Final Answer: increases slightly to a limiting value $\Rightarrow \boxed{\text{A}}$

Answer: (A)

Go Back to Q5

Q6.

Solution

Concept — Faraday's law of electrolysis: depositing one mole of a metal of charge $+n$ requires n faradays of charge.

Step 1 — Charge on the ion: Al^{3+} needs 3 electrons, so $n = 3$.

Step 2 — Total charge: $Q = nF = 3 \times 96500 = 289500$ C.

Why other options are wrong:

- (A) 96500 is for a $+1$ ion; (B) 193000 is for a $+2$ ion.
- (D) 48250 corresponds to only half a faraday.

Final Answer: $Q = 289500$ C $\Rightarrow \boxed{\text{C}}$

Answer: (C)

Go Back to Q6

Q7.

Solution

Concept — Order from the rate law: if rate $\propto [A]^x$, then doubling $[A]$ multiplies the rate by 2^x.

Step 1 — Match the data: the rate *doubles*, i.e. $2^x = 2$, so $x = 1$.

Why other options are wrong:

- (A) order 0 would leave the rate unchanged.
- (C) order 2 would quadruple the rate; (D) order 3 would multiply it by 8.

Final Answer: order $= 1 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q7

Q8.

Solution

Concept — Half-life of a first-order reaction: $t_{1/2} = \dfrac{0.693}{k}$, independent of the initial concentration.

Step 1 — Substitute:

$$t_{1/2} = \frac{0.693}{0.0693} = 10 \text{ min}.$$

Step 2 — Graph check: the curve falls to half its initial value $[A]_0/2$ exactly at $t = t_{1/2} = 10$ min, then halves again every further 10 min.

Why other options are wrong:

- (B) 1 min uses $k = 0.693$; (C) 100 min misplaces a decimal.
- (D) 5 min has no basis in $0.693/k$.

Final Answer: $t_{1/2} = 10 \text{ min} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q8

Q9.

Solution

Concept — Arrhenius equation: $k = A\,e^{-E_a/RT}$. As T rises, the exponent $-E_a/RT$ becomes less negative, so the exponential factor grows.

Step 1 — Effect of temperature: a larger T means more molecules have energy $\geq E_a$, so k *increases exponentially*. A common rule of thumb: k roughly doubles for every $10\ ^\circ\text{C}$ rise.

Why other options are wrong:

- (A),(C) k rises with T; it neither falls nor stays fixed.
- (B) k is never zero for $T > 0$.

Final Answer: k increases exponentially with $T \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q9

Q10.

Solution

Concept — Freundlich isotherm: $\dfrac{x}{m} = k\,p^{1/n}$, with $1/n$ a positive fraction between 0 and 1.

Step 1 — Interpret the exponent: since $0 < \frac{1}{n} < 1$, the adsorption rises with pressure but with a steadily decreasing slope, levelling off at high p (as the graph shows).

Step 2 — Limiting cases: $1/n = 0$ means adsorption independent of pressure; $1/n = 1$ means a linear relation. Real systems lie between these.

Why other options are wrong:

- (B),(C) values > 1 are not observed for the Freundlich exponent.
- (D) $1/n = 1$ is only a special limiting case, not the general value.

Final Answer: $1/n$ lies between 0 and $1 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q10

Q11.

Solution

Concept — Optical property of colloids: colloidal particles (1–1000 nm) are large enough to scatter visible light, making the beam path visible.

Step 1 — Name the phenomenon: this scattering is the *Tyndall effect*; the bright illuminated path is the Tyndall cone.

Why other options are wrong:

- (A) Brownian motion is the random zig-zag movement of the particles.
- (C) electrophoresis is migration of charged sol particles in a field; (D) coagulation is their aggregation.

Final Answer: Tyndall effect $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q11

Q12.

Solution

Concept — Emulsions: an emulsion is a colloid of one liquid dispersed in another. Milk is liquid fat (oil) droplets dispersed in water, i.e. an oil-in-water (o/w) emulsion (stabilised by casein).

Step 1 — Identify dispersed phase and medium: dispersed phase = liquid fat; dispersion medium = water ⇒ o/w emulsion.

Why other options are wrong:

- (A) a gel is a liquid dispersed in a solid (e.g. jelly).
- (B) a solid sol is a solid in a solid; (D) a foam is a gas in a liquid.

Final Answer: oil-in-water emulsion $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q12

Q13.

Solution

Concept — Bond enthalpy of halogens: the trend is $Cl_2 > Br_2 > F_2 > I_2$. F_2 is anomalously low because the small fluorine atoms bring their non-bonding lone pairs close together, causing strong inter-electronic repulsion.

Step 1 — Pick the maximum: Cl_2 has the highest bond dissociation enthalpy (≈ 242 kJ mol^{-1}).

Why other options are wrong:

- (A) F_2 is low due to lone-pair repulsion despite the short bond.
- (C),(D) Br_2 and I_2 have weaker bonds due to larger atomic size and poorer orbital overlap.

Final Answer: $Cl_2 \Rightarrow \boxed{\text{B}}$

$\boxed{\textbf{Answer: (B)}}$ **Go Back to Q13**

Q14.

Solution

Concept — Oxidation-state balance: the algebraic sum of oxidation states equals the overall charge (zero for a neutral molecule). Take $H = +1$, $O = -2$.

Step 1 — Set up for H_2SO_4: $2(+1) + x + 4(-2) = 0 \Rightarrow 2 + x - 8 = 0$.

Step 2 — Solve: $x = +6$.

Why other options are wrong:

- (A),(B) $+2/+4$ are the states of S in H_2S/SO_2.
- (D) $+7$ exceeds sulphur's group oxidation state of $+6$.

Final Answer: oxidation state of S $= +6 \Rightarrow \boxed{\text{C}}$

$\boxed{\textbf{Answer: (C)}}$ **Go Back to Q14**

Q15.

Solution

Concept — Basicity of group-15 hydrides: basic strength depends on the availability (electron density) of the lone pair on the central atom, which decreases down the group as the atom gets larger and the lone pair more diffuse.

Step 1 — Order: $NH_3 > PH_3 > AsH_3 > SbH_3$. Nitrogen, being smallest, has the most concentrated, most available lone pair.

Why other options are wrong:

- (B),(C) reverse part of the correct trend.
- (D) wrongly places AsH_3 above PH_3.

Final Answer: $NH_3 > PH_3 > AsH_3 \Rightarrow \boxed{\text{A}}$

Answer: (A) **Go Back to Q15**

Q16.

Solution

Concept — Colour in transition-metal ions: colour arises from d–d electronic transitions, which require *partially filled* d-orbitals. Ions with d^0 or d^{10} configurations are colourless.

Step 1 — Configurations: Cu^{2+} (d^9), Fe^{2+} (d^6), Ni^{2+} (d^8) are all partially filled (coloured); Zn^{2+} is d^{10} (completely filled).

Step 2 — Conclusion: Zn^{2+} has no possible d–d transition, so it is colourless.

Why other options are wrong:

- (A),(B),(C) all have partly filled d-orbitals and are coloured (blue, pale green, green).

Final Answer: Zn^{2+} (d^{10}) $\Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q16**

Q17.

Solution

Concept — Oxidation state in an oxoanion salt: for $\mathrm{KMnO_4}$, $\mathrm{K} = +1$, $\mathrm{O} = -2$, and the sum is zero.

Step 1 — Set up: $(+1) + x + 4(-2) = 0 \Rightarrow 1 + x - 8 = 0.$

Step 2 — Solve: $x = +7$, the highest oxidation state of manganese.

Why other options are wrong:

- (A),(B) $+2/+4$ occur in $\mathrm{MnSO_4/MnO_2}$.
- (D) $+6$ is the state in manganate, $\mathrm{MnO_4^{2-}}$, not permanganate.

Final Answer: oxidation state of Mn $= +7 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q17

Q18.

Solution

Concept — Lanthanide contraction: across the $4f$ series each added electron enters an inner $4f$ orbital, which shields the increasing nuclear charge very poorly.

Step 1 — Effect: the poorly-shielded nuclear charge pulls the outer electrons inward, so atomic and ionic radii decrease steadily from La to Lu.

Why other options are wrong:

- (A) the contraction is due to $4f$ (not $3d$) shielding.
- (C) radii decrease, not increase; (D) f electrons shield *poorly*, the opposite of “strong”.

Final Answer: poor shielding by $4f$ electrons $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q18

Q19.

Solution

Concept — Naming neutral carbonyl complexes: ligands are named first (CO = carbonyl), then the metal, with the oxidation state of the metal in Roman numerals in brackets. A neutral complex takes no "-ate".

Step 1 — Oxidation state of Ni: CO is neutral and the complex is neutral, so Ni is in the 0 oxidation state.

Step 2 — Assemble the name: four CO → "tetracarbonyl"; metal "nickel(0)" ⇒ tetracarbonylnickel(0).

Why other options are wrong:

- (A) ligand must precede the metal as one word.
- (B) the oxidation state is 0, not II; (C) "-ate" is only for anionic complexes.

Final Answer: tetracarbonylnickel(0) ⇒ $\boxed{\text{D}}$

Answer: (D) **Go Back to Q19**

Q20.

Solution

Concept — Coordination number and geometry: the coordination number is the number of donor atoms bonded to the metal; six monodentate ligands almost always give an octahedral arrangement (as the figure shows).

Step 1 — Count the ligands: $[Co(NH_3)_6]^{3+}$ has six NH_3 ligands ⇒ coordination number 6.

Step 2 — Geometry: six ligands at the vertices of an octahedron ⇒ octahedral (Co^{3+} is d^6, sp^3d^2/inner-orbital).

Why other options are wrong:

- (B),(C) tetrahedral/square planar correspond to coordination number 4.
- (D) linear is coordination number 2.

Final Answer: 6, octahedral ⇒ $\boxed{\text{A}}$

Answer: (A) **Go Back to Q20**

Q21.

Solution

Concept — Crystal-field splitting (octahedral): the six ligands approach along the axes, raising the energy of the two axial-pointing orbitals (d_{z^2}, $d_{x^2-y^2}$) and lowering the three in-between orbitals (d_{xy}, d_{yz}, d_{zx}).

Step 1 — Label the sets: the lower triply-degenerate set is t_{2g}; the upper doubly-degenerate set is e_g, separated by the crystal-field splitting energy Δ_o.

Step 2 — Read the figure: the two higher levels marked at the top are the e_g set.

Why other options are wrong:

- (A) t_{2g} is the lower set of three orbitals.
- (B),(D) a_{1g}/t_{1u} are not the d-orbital labels in this splitting.

Final Answer: higher set $= e_g \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q21

Q22.

Solution

Concept — S$_N$1 mechanism: a unimolecular nucleophilic substitution proceeds in two steps — slow ionisation to a carbocation, then fast attack by the nucleophile. The energy profile therefore shows two maxima with a carbocation minimum between them.

Step 1 — Why tertiary: a 3° carbocation is strongly stabilised (hyperconjugation + inductive effect), so tertiary halides favour S$_N$1.

Step 2 — Match the profile: two transition states bracketing the R$^+$ intermediate $\Rightarrow$ S$_N$1 (not the single-step S$_N$2).

Why other options are wrong:

- (A) S$_N$2 is a one-step concerted process (a single energy hump), favoured by 1° halides.
- (B),(C) E2 and free-radical paths give different products and profiles.

Final Answer: S$_N$1 (via a carbocation) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q22

Q23.

Solution

Concept — Aqueous vs alcoholic KOH: aqueous KOH (OH^- as nucleophile) gives substitution (alcohol), whereas *alcoholic* KOH (OR^-/OH^- acting as a base) favours β-elimination (dehydrohalogenation).

Step 1 — Reaction: alcoholic KOH removes a β-hydrogen and the halide leaves, forming a C=C double bond (alkene).

Why other options are wrong:

- (A) an alcohol forms with *aqueous* KOH (substitution).
- (C),(D) ethers/amines need different reagents (alkoxide/ammonia).

Final Answer: an alkene (elimination) $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q23

Q24.

Solution

Concept — Low reactivity of haloarenes: in chlorobenzene the lone pairs on Cl conjugate with the ring, so the C–Cl bond acquires partial double-bond character and becomes shorter and stronger.

Step 1 — Consequence: the strengthened C–Cl bond is hard to break, and the electron-rich ring repels incoming nucleophiles, so nucleophilic substitution is very difficult.

Why other options are wrong:

- (B) the electronegativity of Cl is essentially the same as in alkyl chlorides.
- (C) "saturated" is incorrect for benzene; (D) no relevant H-bonding exists here.

Final Answer: resonance gives partial double-bond character $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q24

Q25.

Solution

Concept — Lucas test: Lucas reagent (anhydrous $ZnCl_2$ in conc. HCl) converts alcohols to alkyl chlorides; the resulting turbidity appears at a rate that depends on carbocation stability.

Step 1 — Distinguishing rates: tertiary alcohols react immediately (turbidity at once), secondary in about 5 min, and primary only on heating $\Rightarrow$ the three classes are distinguished.

Why other options are wrong:

- (A),(B) Fehling's/Tollens' test for aldehydes, not alcohols.
- (C) Baeyer's reagent tests for unsaturation.

Final Answer: Lucas reagent $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q25

Q26.

Solution

Concept — Acidity and conjugate-base stability: the more stable the conjugate base, the stronger the acid.

Step 1 — Phenoxide vs ethoxide: in the phenoxide ion the negative charge is delocalised over the ring (resonance), strongly stabilising it; the ethoxide charge stays localised on oxygen.

Step 2 — Conclusion: the resonance-stabilised phenoxide makes phenol a much stronger acid than ethanol.

Why other options are wrong:

- (A) the phenoxide is *more* stable, not less.
- (C),(D) phenoxide is a weaker base, and it remains aromatic.

Final Answer: stabilised by resonance $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q26

Q27.

Solution

Concept — Williamson ether synthesis: an S_N2 reaction between a sodium alkoxide (RO^-Na^+) and an alkyl halide gives an ether, R–O–R′.

Step 1 — Reaction: RO^- attacks the carbon bearing the halogen, displacing X^- and forming the C–O–C linkage.

Step 2 — Best choice of halide: primary alkyl halides work best (least elimination).

Why other options are wrong:

- (A),(B),(D) alcohols/alkenes/acids do not undergo this alkoxide → ether substitution.

Final Answer: an alkyl halide $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q27

Q28.

Solution

Concept — Reactivity towards nucleophilic addition: a more electrophilic and less crowded carbonyl carbon reacts faster.

Step 1 — Compare aldehydes and ketones: aldehydes have only one alkyl group (one $+I$/electron-donating group) and one H, so the carbonyl carbon is more positive and less hindered than in ketones (two alkyl groups).

Step 2 — Conclusion: less steric hindrance + smaller $+I$ effect ⇒ aldehydes add nucleophiles faster.

Why other options are wrong:

- (B) aldehydes are *less* crowded, not more.
- (C),(D) carbonyls are not aromatically stabilised, and H-bonding is not the cause.

Final Answer: less steric hindrance and smaller $+I$ effect $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q28

Q29.

Solution

Concept — Cannizzaro reaction: carbonyl compounds that have *no* α-hydrogen undergo self oxidation-reduction (disproportionation) with concentrated alkali, giving an alcohol and a carboxylate.

Step 1 — Check for α-H: acetaldehyde, propanal and acetone all have α-hydrogens (they instead undergo aldol reactions); benzaldehyde (C_6H_5CHO) has none.

Step 2 — Conclusion: only benzaldehyde gives the Cannizzaro reaction $\rightarrow$ benzyl alcohol + benzoate.

Why other options are wrong:

- (A),(B),(C) possess α-hydrogens, so they undergo aldol condensation, not Cannizzaro.

Final Answer: benzaldehyde $\Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q29**

Q30.

Solution

Concept — Inductive effect on acid strength: electron-withdrawing groups stabilise the carboxylate anion, increasing acidity. More (and more electronegative) halogens near the COOH group $\Rightarrow$ stronger acid.

Step 1 — Compare: $Cl_3C\text{–}COOH$ has three Cl atoms withdrawing electron density, far more than one Cl ($ClCH_2COOH$) or none (CH_3COOH, HCOOH).

Step 2 — Order: $Cl_3CCOOH > ClCH_2COOH > HCOOH > CH_3COOH$.

Why other options are wrong:

- (A) CH_3COOH is the weakest (electron-donating CH_3).
- (C),(D) have fewer or no electron-withdrawing chlorines.

Final Answer: trichloroacetic acid, $Cl_3C\text{–}COOH \Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q30**

Q31.

Solution

Concept — Basicity of amines in water: the observed order results from the balance of the inductive $(+I)$ effect, steric hindrance and solvation (H-bonding stabilisation of the cation). In water the order is $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$.

Step 1 — Pick the strongest: dimethylamine, $(CH_3)_2NH$, best combines electron donation with adequate solvation, so it is the strongest base in aqueous solution.

Why other options are wrong:

- (B) $(CH_3)_3N$ is weakened by steric hindrance and poor cation solvation.
- (A),(D) NH_3 and CH_3NH_2 are less basic than $(CH_3)_2NH$ in water.

Final Answer: $(CH_3)_2NH \Rightarrow \boxed{C}$

Answer: (C) **Go Back to Q31**

Q32.

Solution

Concept — Diazo coupling: a benzene diazonium salt acts as an electrophile and couples at the *para* position of an activated aromatic ring (phenol, aniline) to give a brightly coloured azo compound.

Step 1 — Product: with phenol it gives p-hydroxyazobenzene, an orange azo dye containing the –N=N– chromophore.

Why other options are wrong:

- (B) chlorobenzene forms via the Sandmeyer reaction with CuCl, not with phenol.
- (C),(D) no simple regeneration of phenol or formation of nitrobenzene occurs.

Final Answer: an azo dye (p-hydroxyazobenzene) $\Rightarrow \boxed{A}$

Answer: (A) **Go Back to Q32**

Q33.

Solution

Concept — Carbylamine (isocyanide) test: only primary amines, when warmed with chloroform and alcoholic KOH, give carbylamines (isocyanides) with a characteristic offensive smell.

Step 1 — Reaction: $R\text{–}NH_2 + CHCl_3 + 3KOH \rightarrow R\text{–}NC + 3KCl + 3H_2O$.

Step 2 — Conclusion: the foul odour confirms a primary amine; secondary and tertiary amines do not respond.

Why other options are wrong:

- (A),(B) secondary and tertiary amines give no carbylamine.
- (C) amides do not undergo this test.

Final Answer: primary amines $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q33

Q34.

Solution

Concept — Classifying monosaccharides: a monosaccharide is named by its carbonyl group (aldo-/keto-) and the number of carbon atoms (triose, tetrose, pentose, hexose).

Step 1 — Read the structure: glucose has six carbons and a –CHO (aldehyde) group at C-1, as shown at the top of the Fischer projection.

Step 2 — Classify: six carbons + aldehyde group ⇒ an aldohexose.

Why other options are wrong:

- (A),(D) “keto” is wrong — glucose has an aldehyde, not a ketone (that is fructose).
- (C) glucose has six carbons, not five.

Final Answer: an aldohexose $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q34

Q35.

Solution

Concept — Protein primary structure: proteins are polymers of α-amino acids joined by amide linkages formed between the –COOH of one acid and the $-NH_2$ of the next, with loss of water.

Step 1 — Name the linkage: this –CO–NH– amide bond between amino-acid residues is called a peptide bond.

Why other options are wrong:

- (A) glycosidic bonds join monosaccharides in carbohydrates.
- (B) hydrogen bonds stabilise secondary/tertiary structure but do not link the residues covalently; (D) ester bonds occur in fats, not proteins.

Final Answer: a peptide bond $\Rightarrow \boxed{\text{C}}$

Answer: (C) **Go Back to Q35**

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	C	4	D	5	A
6	C	7	B	8	A	9	D	10	A
11	B	12	C	13	B	14	C	15	A
16	D	17	C	18	B	19	D	20	A
21	C	22	D	23	B	24	A	25	D
26	B	27	C	28	A	29	D	30	B
31	C	32	A	33	D	34	B	35	C