NEST Chemistry Sample Paper – 2

Duration: 45 Minutes **Maximum Marks: 60**

Instructions

- This paper contains **20 Multiple Choice Questions (single correct answer)**, modelled on the Chemistry section of **NEST 2026**.
- Each correct answer carries **+3 marks**. There is a deduction of -1 **mark** for each incorrect answer; **no marks** are deducted for an unattempted question.
- Every question has exactly **four options**, of which only **one** is correct. Choose carefully.
- Personal calculators, log tables, mobile phones, and other electronic gadgets are strictly prohibited in the examination hall.
- A simple on-screen (virtual) calculator is provided in the computer-based test interface and may be used; blank sheets for rough work are supplied at the exam centre.

Q1. The number of oxygen atoms present in 4.4 g of carbon dioxide (CO_2, molar mass 44 g mol^{-1}) is (take $N_A = 6.0 \times 10^{23}$ mol^{-1})

(A) 6.0×10^{22}

(B) 1.2×10^{23}

(C) 6.0×10^{23}

(D) 3.0×10^{22}

Q2. For the principal quantum number $n = 3$, the maximum number of electrons that can have the azimuthal quantum number $l = 2$ is

(A) 2

(B) 6

(C) 10

(D) 14

Q3. Which of the following arrangements correctly lists the elements in order of *increasing* electronegativity (Pauling scale)?

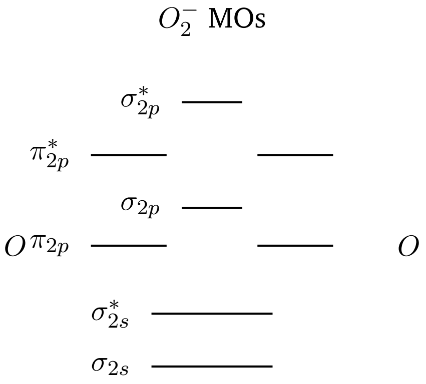
(A) $B < C < N < F$

(B) $F < N < C < B$

(C) $C < B < N < F$

(D) $N < C < B < F$

Q4. The molecular orbital energy-level scheme for a homonuclear diatomic species is shown below. Using molecular orbital theory, the bond order and magnetic nature of the superoxide ion O_2^- are



(A) bond order 2.5, diamagnetic

(B) bond order 2.0, paramagnetic

(C) bond order 1.5, paramagnetic

(D) bond order 1.0, diamagnetic

Q5. For a certain reaction $\Delta H = +30\ \text{kJ mol}^{-1}$ and $\Delta S = +100\ \text{J K}^{-1}\,\text{mol}^{-1}$, both assumed temperature independent. The temperature above which the reaction becomes spontaneous (i.e. the equilibrium temperature) is

(A) 200 K

(B) 300 K

(C) 30 K

(D) 3000 K

Q6. The pH of a 0.001 M aqueous solution of $NaOH$ (a strong base, fully dissociated) at $25°$C is

(A) 3

(B) 10

(C) 14

(D) 11

Q7. In acidic medium, the permanganate ion is reduced according to $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$. The equivalent weight of $KMnO_4$ (molar mass 158 g mol^{-1}) acting as an oxidant in this medium is

(A) 158 g eq^{-1}

(B) 79 g eq^{-1}

(C) 31.6 g eq^{-1}

(D) 52.7 g eq^{-1}

Q8. Under identical conditions of temperature and pressure, the ratio of the rate of effusion of helium (He, molar mass 4 g mol^{-1}) to that of methane (CH_4, molar mass 16 g mol^{-1}) is

(A) $2 : 1$

(B) $1 : 2$

(C) $4 : 1$

(D) $1 : 4$

Q9. When 18 g of glucose ($C_6H_{12}O_6$, molar mass 180 g mol^{-1}, a non-volatile non-electrolyte) is dissolved in 500 g of water, the elevation in boiling point is (K_b for water $= 0.52$ K kg mol^{-1})

(A) 0.052 K

(B) 0.104 K

(C) 0.26 K

(D) 0.52 K

Q10. For the half-cell $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ with standard electrode potential $E^\circ = +0.34$ V, the electrode potential at 25°C when $[Cu^{2+}] = 10^{-2}$ M is (take $\frac{0.059}{n}\log$ form, $n = 2$)

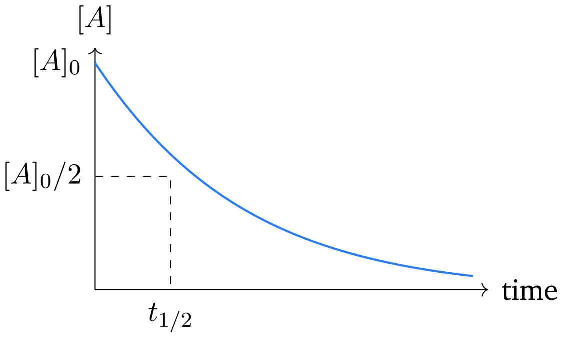
(A) $+0.399$ V

(B) $+0.34$ V

(C) $+0.281$ V

(D) $+0.222$ V

Q11. The concentration of a reactant in a first-order reaction decays with time as shown. If the rate constant is $k = 0.0693$ min^{-1}, the half-life of the reaction is



(A) 6.93 min

(B) 100 min

(C) 0.693 min

(D) 10 min

Q12. Which of the following statements about transition-metal ions is *correct*?

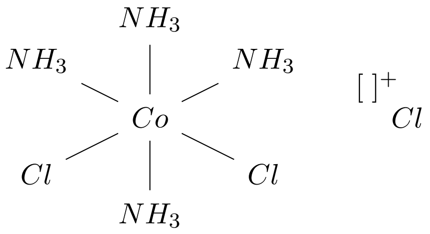
(A) Cu^{2+} ($3d^9$) is coloured because it can undergo d–d electronic transitions.

(B) Zn^{2+} ($3d^{10}$) is coloured because its d-subshell is completely filled.

(C) Sc^{3+} ($3d^{0}$) is coloured owing to d–d transitions.

(D) Colour in transition-metal ions arises from s–s transitions only.

Q13. The IUPAC name of the coordination compound whose structure is shown below is



The complex is $[Co(NH_3)_4Cl_2]Cl$.

(A) tetraamminedichlorocobalt(III) chloride

(B) tetraamminedichloridocobalt(III) chloride

(C) dichloridotetraamminecobalt(II) chloride

(D) tetraamminedichloridocobaltate(III) chloride

Q14. The total number of structural (constitutional) isomers possible for the molecular formula $C_4H_{10}O$ that are *alcohols* only (i.e. containing an $-OH$ group) is

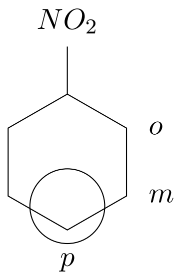
(A) 2

(B) 3

(C) 4

(D) 7

Q15. When nitrobenzene undergoes electrophilic aromatic substitution (e.g. further nitration), the incoming electrophile is directed mainly to the position shown. The $-NO_2$ group is



(A) an ortho/para-directing, activating group.

(B) an ortho/para-directing, deactivating group.

(C) a meta-directing, activating group.

(D) a meta-directing, deactivating group.

Q16. When 2-bromo-2-methylpropane (*tert*-butyl bromide) is heated with concentrated alcoholic KOH, the major organic product is

(A) 2-methylprop-1-ene (isobutylene)

(B) 2-methylpropan-2-ol

(C) 2-methylpropan-1-ol

(D) butan-2-ol

Q17. Three alcohols are shown below. On treatment with acidified $K_2Cr_2O_7$ (a strong oxidising agent), which one is *resistant* to oxidation under normal conditions?

(I)	(II)	(III)
$CH_3CH_2{-}OH$	$(CH_3)_2CH{-}OH$	$(CH_3)_3C{-}OH$

(A) (I), the primary alcohol

(B) (III), the tertiary alcohol

(C) (II), the secondary alcohol

(D) all three are oxidised equally easily

Q18. Which of the following aldehydes undergoes the Cannizzaro reaction (disproportionation in concentrated alkali)?

(A) ethanal (CH_3CHO)

(B) propanal (CH_3CH_2CHO)

(C) methanal ($HCHO$)

(D) phenylacetaldehyde ($C_6H_5CH_2CHO$)

Q19. In the Hinsberg test, a tertiary amine (R_3N) behaves as follows when treated with benzenesulphonyl chloride ($C_6H_5SO_2Cl$):

(A) gives a product soluble in aqueous KOH.

(B) gives a product insoluble in aqueous KOH.

(C) forms a sulphonamide that dissolves on adding acid then base.

(D) does not react, since it has no replaceable hydrogen on nitrogen.

Q20. An α-amino acid exists predominantly as a dipolar zwitterion at a particular pH. The pH at which the amino acid carries *no net charge* and does not migrate in an electric field is called its

(A) neutralisation point

(B) isoelectric point

(C) equivalence point

(D) end point

Detailed Solutions

Q1.

Solution

Concept — Mole concept and Avogadro's number: The number of molecules equals moles $\times N_A$; each CO_2 molecule contains 2 oxygen atoms.

Step 1 — Moles of CO_2: $n = \frac{4.4}{44} = 0.1$ mol.

Step 2 — Oxygen atoms: Each molecule has 2 O atoms, so

$$N_O = 0.1 \times N_A \times 2 = 0.1 \times (6.0 \times 10^{23}) \times 2 = 1.2 \times 10^{23}.$$

Why other options are wrong:

- (A) 6.0×10^{22} counts molecules ($0.1\,N_A$), not oxygen atoms.
- (C) 6.0×10^{23} is one full mole of atoms (assumes 1 mol CO_2).
- (D) 3.0×10^{22} halves the molecule count instead of doubling.

Final Answer: 1.2×10^{23} oxygen atoms $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — Quantum numbers and subshell capacity: For a given l, there are $(2l + 1)$ orbitals, each holding 2 electrons, so a subshell holds $2(2l + 1)$ electrons.

Step 1 — Identify the subshell: For $n = 3$, $l = 2$ is the $3d$ subshell ($l = 2 \Rightarrow d$).

Step 2 — Count electrons: Number of orbitals $= 2l + 1 = 2(2) + 1 = 5$. Maximum electrons $= 2 \times 5 = 10$.

Why other options are wrong:

- (A) 2 is the capacity of one orbital, not the whole subshell.
- (B) 6 is the capacity of a p subshell ($l = 1$).
- (D) 14 is the capacity of an f subshell ($l = 3$).

Final Answer: 10 electrons $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q2

Q3.

Solution

Concept — Periodic trend in electronegativity: Across a period (left to right) electronegativity increases as nuclear charge rises and atomic radius shrinks. For period 2: B $(2.0) <$ C $(2.5) <$ N $(3.0) <$ F (4.0).

Step 1 — Order them: Increasing electronegativity is $B < C < N < F$.

Why other options are wrong:

- (B) $F < N < C < B$ is the reverse (decreasing) order.
- (C) $C < B < N < F$ wrongly puts B above C.
- (D) $N < C < B < F$ scrambles the period-2 trend.

Final Answer: $B < C < N < F \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q3

Q4.

Solution

Concept — Molecular orbital theory: Bond order $= \frac{1}{2}(N_b - N_a)$, where N_b and N_a are electrons in bonding and antibonding MOs. Unpaired electrons make a species paramagnetic.

Step 1 — Electron count: Neutral O_2 has 16 electrons; O_2^- has 17. The extra electron enters the antibonding π^*_{2p} set.

Step 2 — Bonding/antibonding tally: For O_2^-, $N_b = 10$ and $N_a = 7$ (the π^*_{2p} now holds 3 electrons).

$$\text{Bond order} = \tfrac{1}{2}(10 - 7) = \tfrac{3}{2} = 1.5.$$

Step 3 — Magnetism: The three electrons in the two π^*_{2p} orbitals leave one unpaired electron, so O_2^- is paramagnetic.

Why other options are wrong:

- (A) bond order 2.5 diamagnetic describes no O_2 species correctly.
- (B) bond order 2.0 is neutral O_2 (which is paramagnetic, not the superoxide).
- (D) bond order 1.0 diamagnetic corresponds to peroxide O_2^{2-} (which is diamagnetic with BO 1); the count here is wrong for O_2^-.

Final Answer: bond order 1.5, paramagnetic $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q4

Q5.

Solution

Concept — Gibbs free energy and spontaneity: A reaction is spontaneous when $\Delta G = \Delta H - T\Delta S < 0$. For endothermic, entropy-increasing reactions, spontaneity sets in above the equilibrium temperature $T = \Delta H/\Delta S$.

Step 1 — Equate $\Delta G = 0$: At equilibrium $\Delta H = T\Delta S$, so $T = \dfrac{\Delta H}{\Delta S}$.

Step 2 — Substitute (consistent units): Convert $\Delta H = 30{,}000\ \mathrm{J\,mol^{-1}}$, $\Delta S = 100\ \mathrm{J\,K^{-1}\,mol^{-1}}$:

$$T = \frac{30{,}000}{100} = 300\ \mathrm{K}.$$

Above 300 K, $T\Delta S > \Delta H$ so $\Delta G < 0$ and the reaction is spontaneous.

Why other options are wrong:

- (A) 200 K uses a wrong ratio of the numbers.
- (C) 30 K forgets to convert kJ to J (off by 1000).
- (D) 3000 K converts in the wrong direction.

Final Answer: $T = 300\ \mathrm{K} \Rightarrow \boxed{\mathrm{B}}$

Answer: (B) Go Back to Q5

Q6.

Solution

Concept — pH of a strong base: A strong base is fully dissociated, so $[OH^-]$ equals the concentration. Use $pOH = -\log[OH^-]$ and $pH + pOH = 14$ at 25°C.

Step 1 — Hydroxide concentration: $[OH^-] = 0.001\ \mathrm{M} = 10^{-3}\ \mathrm{M}$, so $pOH = 3$.

Step 2 — Convert to pH: $pH = 14 - pOH = 14 - 3 = 11$.

Why other options are wrong:

- (A) 3 is the pOH, not the pH.
- (B) 10 comes from a subtraction slip.
- (C) 14 would require $[OH^-] = 1\ \mathrm{M}$.

Final Answer: $pH = 11 \Rightarrow \boxed{\mathrm{D}}$

Answer: (D) Go Back to Q6

Q7.

Solution

Concept — Equivalent weight of an oxidant: Equivalent weight $= \dfrac{\text{molar mass}}{n\text{-factor}}$, where the n-factor is the number of electrons gained per formula unit.

Step 1 — n-factor: From $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$, Mn goes from $+7$ to $+2$, gaining 5 electrons, so $n = 5$.

Step 2 — Equivalent weight: $E = \dfrac{158}{5} = 31.6\ \text{g eq}^{-1}$.

Why other options are wrong:

- (A) 158 uses $n = 1$.
- (B) 79 uses $n = 2$.
- (D) 52.7 uses $n = 3$ (the neutral/faintly alkaline medium value), not the acidic-medium $n = 5$.

Final Answer: $E = 31.6\ \text{g eq}^{-1} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — Graham's law of effusion: The rate of effusion is inversely proportional to the square root of molar mass: $\dfrac{r_1}{r_2} = \sqrt{\dfrac{M_2}{M_1}}$.

Step 1 — Substitute:

$$\frac{r_{He}}{r_{CH_4}} = \sqrt{\frac{M_{CH_4}}{M_{He}}} = \sqrt{\frac{16}{4}} = \sqrt{4} = 2.$$

Step 2 — State ratio: The ratio is $2 : 1$ (helium effuses twice as fast).

Why other options are wrong:

- (B) $1 : 2$ inverts the ratio.
- (C) $4 : 1$ forgets the square root (uses the mass ratio directly).
- (D) $1 : 4$ inverts and omits the square root.

Final Answer: $r_{He} : r_{CH_4} = 2 : 1 \Rightarrow \boxed{\text{A}}$

$\boxed{\textbf{Answer: (A)}}$ Go Back to Q8

Q9.

Solution

Concept — Elevation in boiling point: $\Delta T_b = K_b\, m$, where m is molality (mol of solute per kg of solvent); glucose is a non-electrolyte ($i = 1$).

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

Step 2 — Molality: solvent $= 500$ g $= 0.5$ kg, so $m = \dfrac{0.1}{0.5} = 0.2\ \text{mol}\,\text{kg}^{-1}$.

Step 3 — Elevation: $\Delta T_b = K_b\, m = 0.52 \times 0.2 = 0.104$ K.

Why other options are wrong:

- (A) 0.052 K uses molality 0.1 (forgets the 0.5 kg conversion).
- (C) 0.26 K uses $m = 0.5$.
- (D) 0.52 K uses $m = 1$.

Final Answer: $\Delta T_b = 0.104\ \text{K} \Rightarrow \boxed{\text{B}}$

$\boxed{\textbf{Answer: (B)}}$ Go Back to Q9

Q10.

Solution

Concept — Nernst equation: For the reduction $Cu^{2+} + 2e^- \rightarrow Cu$, $E = E^\circ - \dfrac{0.059}{n} \log \dfrac{1}{[Cu^{2+}]}$ at $25°$C (pure solid Cu has unit activity).

Step 1 — Set up: $n = 2$, $[Cu^{2+}] = 10^{-2}$ M, so $\log \dfrac{1}{[Cu^{2+}]} = \log 10^2 = 2$.

Step 2 — Substitute:

$$E = 0.34 - \frac{0.059}{2}(2) = 0.34 - 0.059 = 0.281\ \text{V}.$$

Why other options are wrong:

- (A) $+0.399$ V adds instead of subtracting the correction.
- (B) $+0.34$ V ignores the non-standard concentration entirely.
- (D) $+0.222$ V uses $n = 1$ (doubles the correction term).

Final Answer: $E = +0.281\ \text{V} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q10

Q11.

Solution

Concept — First-order half-life: For a first-order reaction the half-life is independent of initial concentration: $t_{1/2} = \frac{0.693}{k}$.

Step 1 — Substitute:

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

Step 2 — Interpret the curve: The concentration falls from $[A]_0$ to $[A]_0/2$ over each interval of 10 min, matching the exponential decay shown.

Why other options are wrong:

- (A) 6.93 min comes from dividing 0.693 by k wrongly (a power-of-ten slip).
- (B) 100 min misplaces the decimal in k.
- (C) 0.693 min uses $k = 1$ min^{-1}.

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

Answer: (D) Go Back to Q11

Q12.

Solution

Concept — Colour in transition-metal ions: Colour arises from d–d electronic transitions, which require a partially filled d-subshell. Ions with empty (d^0) or completely filled (d^{10}) d-subshells are colourless.

Step 1 — Examine Cu^{2+}: Cu^{2+} is $3d^9$, a partially filled subshell, so d–d transitions are possible and the ion is coloured (blue). Statement (A) is correct.

Why other options are wrong:

- (B) Zn^{2+} ($3d^{10}$) is colourless precisely because the d-subshell is full (no d–d transition).
- (C) Sc^{3+} ($3d^0$) is colourless; with no d-electrons there are no d–d transitions.
- (D) Colour is due to d–d transitions, not s–s transitions.

Final Answer: Cu^{2+} is coloured via d–d transitions $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q12

Q13.

Solution

Concept — IUPAC nomenclature of coordination compounds: Name ligands alphabetically, using current (2005) anionic-ligand names (chlorido, not chloro). The cation is named first, then the anion; the metal oxidation state is given in roman numerals.

Step 1 — Oxidation state of Co: In $[Co(NH_3)_4Cl_2]^+$, ammine is neutral and each chlorido is -1, so $x + 2(-1) = +1 \Rightarrow x = +3$, i.e. cobalt(III).

Step 2 — Order the ligands alphabetically: "ammine" (a) before "chlorido" (c): *tetraamminedichlorido*.

Step 3 — Assemble: cation $[Co(NH_3)_4Cl_2]^+$ + anion Cl^- gives *tetraamminedichloridocobalt(III) chloride*.

Why other options are wrong:

- (A) uses the older "chloro" instead of "chlorido".
- (C) lists chlorido before ammine (wrong alphabetical order) and the wrong oxidation state (II).
- (D) uses "cobaltate" (the -*ate* suffix is only for anionic complexes; this complex is a cation).

Final Answer: tetraamminedichloridocobalt(III) chloride $\Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q13**

Q14.

Solution

Concept — Structural isomerism: For $C_4H_{10}O$ the alcohols are those isomers carrying an $-OH$ group on a saturated C_4 skeleton.

Step 1 — List the carbon skeletons: The C_4 chain is either straight (n-butane skeleton) or branched (isobutane skeleton).

Step 2 — Place the $-OH$:

- Butan-1-ol: $CH_3CH_2CH_2CH_2OH$
- Butan-2-ol: $CH_3CH_2CH(OH)CH_3$
- 2-methylpropan-1-ol: $(CH_3)_2CHCH_2OH$
- 2-methylpropan-2-ol: $(CH_3)_3COH$

That gives 4 alcohols. (The remaining $C_4H_{10}O$ isomers are ethers, which are excluded.)

Why other options are wrong:

- (A) 2 misses the branched-chain alcohols.
- (B) 3 misses one positional/branched isomer.
- (D) 7 is the total of all $C_4H_{10}O$ isomers (alcohols + ethers).

Final Answer: 4 alcohols $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q14

Q15.

Solution

Concept — Directing and activating effects: A substituent that withdraws electrons deactivates the ring toward electrophilic substitution. The $-NO_2$ group is strongly electron-withdrawing (by both $-I$ and $-M$) and directs incoming electrophiles to the meta position.

Step 1 — Electronic effect: $-NO_2$ pulls electron density out of the ring, so the ring is deactivated (substitution is slower than for benzene).

Step 2 — Directing effect: Resonance places positive charge at the ortho and para positions, so the electrophile attacks the less destabilised meta position.

Why other options are wrong:

- (A) ortho/para activating describes groups like $-OH$, $-NH_2$, not $-NO_2$.
- (B) $-NO_2$ is deactivating but meta-directing, not ortho/para.
- (C) meta-directing groups are deactivating, never activating.

Final Answer: $-NO_2$ is meta-directing and deactivating $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q15

Q16.

Solution

Concept — Elimination vs substitution: Tertiary haloalkanes with a strong, bulky base in an alcoholic medium favour β-elimination ($E1/E2$), giving an alkene (dehydrohalogenation), rather than substitution.

Step 1 — Reagent and substrate: *tert*-butyl bromide $(CH_3)_3CBr$ is a 3° halide; concentrated *alcoholic* KOH is the classic dehydrohalogenating reagent.

Step 2 — Product: Loss of HBr gives the alkene 2-methylprop-1-ene, $(CH_3)_2C{=}CH_2$ (isobutylene).

Why other options are wrong:

- (B) 2-methylpropan-2-ol is the substitution product, favoured by *aqueous* (not alcoholic) KOH.
- (C) 2-methylpropan-1-ol would need an impossible rearrangement.
- (D) butan-2-ol has the wrong carbon skeleton.

Final Answer: 2-methylprop-1-ene (isobutylene) $\Rightarrow \boxed{\text{A}}$

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

Q17.

Solution

Concept — Oxidation of alcohols: Primary and secondary alcohols have an α-C–H bond that can be removed during oxidation (to aldehyde/acid and ketone respectively). A tertiary alcohol has *no* α-hydrogen on the carbinol carbon, so it resists oxidation under mild conditions.

Step 1 — Examine each: (I) ethanol (1°) $\rightarrow$ acetaldehyde/acetic acid; (II) propan-2-ol (2°) $\rightarrow$ acetone; (III) *tert*-butanol (3°) has no α-H.

Step 2 — Identify the resistant one: $(CH_3)_3C{-}OH$ cannot lose an α-H, so acidified $K_2Cr_2O_7$ does not oxidise it (only drastic conditions cleave C–C bonds).

Why other options are wrong:

- (A) the primary alcohol is readily oxidised.
- (C) the secondary alcohol is readily oxidised to a ketone.
- (D) the three alcohols differ greatly in ease of oxidation.

Final Answer: the tertiary alcohol (III) is resistant $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q17

Q18.

Solution

Concept — Cannizzaro reaction: Aldehydes that lack an α-hydrogen undergo self disproportionation in concentrated alkali, giving an alcohol and a carboxylate salt.

Step 1 — Check for α-H: Methanal $HCHO$ has *no* α-carbon (no α-H), so it qualifies.

$$2\,HCHO + NaOH \to CH_3OH + HCOONa.$$

Step 2 — Reject the others: Ethanal, propanal and phenylacetaldehyde all possess α-hydrogens, so they undergo the aldol reaction instead.

Why other options are wrong:

- (A) ethanal has three α-H (aldol, not Cannizzaro).
- (B) propanal has α-H.
- (D) phenylacetaldehyde has a CH_2 α to the CHO, so it has α-H.

Final Answer: methanal ($HCHO$) undergoes Cannizzaro $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q18

Q19.

Solution

Concept — Hinsberg test: Benzenesulphonyl chloride reacts with amines that have N–H bonds. Primary and secondary amines form sulphonamides (different solubilities), but a tertiary amine has no N–H and does not react.

Step 1 — Tertiary amine structure: R_3N has all three nitrogen valencies bonded to carbon, leaving no replaceable hydrogen on nitrogen.

Step 2 — Consequence: With no N–H, no sulphonamide forms; the tertiary amine remains unreacted (it may dissolve in acid as the salt, but does not give a Hinsberg product).

Why other options are wrong:

- (A) the KOH-soluble sulphonamide is the response of a *primary* amine.
- (B) the KOH-insoluble sulphonamide is the response of a *secondary* amine.

- (C) describes sulphonamide chemistry, which a tertiary amine cannot undergo.

Final Answer: no reaction (no replaceable N–H) ⇒ $\boxed{\text{D}}$

Answer: (D) Go Back to Q19

Q20.

Solution

Concept — Zwitterion and isoelectric point: An amino acid exists as a zwitterion ($^{+}H_3N–CHR–COO^{-}$) over a range of pH. At one specific pH the positive and negative charges balance exactly and the net charge is zero.

Step 1 — Define the pH: At this pH the molecule does not migrate toward either electrode in an electric field. This pH is the *isoelectric point* (pI).

Step 2 — Note: For a simple amino acid $pI = \frac{1}{2}(pK_{a1} + pK_{a2})$, and the amino acid has minimum solubility there.

Why other options are wrong:

- (A) "neutralisation point" is not the defined term for zero net charge.
- (C) the equivalence point refers to titration stoichiometry, not zero net charge.
- (D) the end point is a titration indicator term, not a charge condition.

Final Answer: the isoelectric point ⇒ $\boxed{\text{B}}$

Answer: (B) Go Back to Q20

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	A	4	C	5	B
6	D	7	C	8	A	9	B	10	C
11	D	12	A	13	B	14	C	15	D
16	A	17	B	18	C	19	D	20	B