NEST Chemistry Sample Paper – 5

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. Urea, $(\mathrm{NH_2})_2\mathrm{CO}$, is a widely used nitrogenous fertiliser. Using atomic masses $\mathrm{H} = 1$, $\mathrm{C} = 12$, $\mathrm{N} = 14$, $\mathrm{O} = 16$, the percentage by mass of nitrogen in urea is closest to

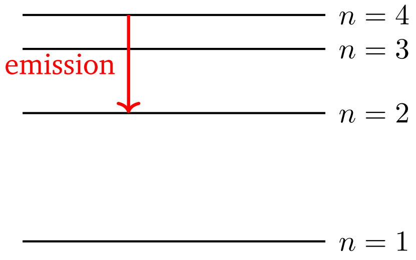
(A) 23.3%

(B) 46.7%

(C) 28.0%

(D) 60.0%

Q2. An electron in a hydrogen atom de-excites from the level $n = 4$ to $n = 2$, as indicated by the arrow in the diagram. Using the Rydberg constant $R_H = 1.097 \times 10^7\ \mathrm{m^{-1}}$, the wavelength of the emitted spectral line is closest to



(A) 656 nm

(B) 410 nm

(C) 486 nm

(D) 434 nm

Q3. For the second-period elements, which one of the following correctly explains why the first ionization enthalpy of nitrogen is *greater* than that of oxygen?

(A) Nitrogen has a stable half-filled $2p^3$ configuration, while removing an electron from O $(2p^4)$ relieves inter-electronic repulsion in a paired orbital.

(B) Nitrogen has a higher effective nuclear charge than oxygen.

(C) Oxygen has a larger atomic radius than nitrogen.

(D) Nitrogen has a completely filled $2p$ subshell.

Q4. Consider the carbon dioxide molecule, $\mathrm{O{=}C{=}O}$, shown below. The hybridization of the central carbon atom and the total number of σ and π bonds in the molecule are, respectively,

$$\mathrm{O=C=O}$$

(A) sp^3; two σ and two π

(B) sp; four σ and zero π

(C) sp^2; two σ and one π

(D) sp; two σ and two π

Q5. A gas absorbs 200 J of heat and, in the same process, does 80 J of work on its surroundings. The change in internal energy (ΔU) of the gas is

(A) -120 J

(B) $+120$ J

(C) $+280$ J

(D) -280 J

Q6. The solubility product of silver chloride, AgCl, is $K_{sp} = 1.8 \times 10^{-10}$ at 298 K. Its molar solubility in $0.10\ \mathrm{mol\,L^{-1}}$ NaCl solution is

(A) $1.34 \times 10^{-5}\ \mathrm{mol\,L^{-1}}$

(B) $1.8 \times 10^{-9}\ \mathrm{mol\,L^{-1}}$

(C) $1.8 \times 10^{-11}\ \mathrm{mol\,L^{-1}}$

(D) $9.0 \times 10^{-10}\ \mathrm{mol\,L^{-1}}$

Q7. In which of the following reactions does chlorine undergo *disproportionation*?

(A) $\mathrm{H_2 + Cl_2 \rightarrow 2\,HCl}$

(B) $\mathrm{2\,Na + Cl_2 \rightarrow 2\,NaCl}$

(C) $\mathrm{MnO_2 + 4\,HCl \rightarrow MnCl_2 + Cl_2 + 2\,H_2O}$

(D) $\mathrm{Cl_2 + 2\,NaOH \rightarrow NaCl + NaOCl + H_2O}$

Q8. A 0.82 g sample of a gaseous oxide occupies 0.50 L at 300 K and 1.0 atm. Using $R = 0.0821\ \mathrm{L\,atm\,K^{-1}mol^{-1}}$, the molar mass of the gas is closest to

(A) $40\ \mathrm{g\,mol^{-1}}$

(B) $20\ \mathrm{g\,mol^{-1}}$

(C) $44\ \mathrm{g\,mol^{-1}}$

(D) $80\ \mathrm{g\,mol^{-1}}$

Q9. An electrolyte $\mathrm{AB_2}$ dissociates completely in water as $\mathrm{AB_2 \rightarrow A^{2+} + 2\,B^-}$. For a dilute solution showing 100% dissociation, the van't Hoff factor i

and the relation of the observed depression in freezing point (ΔT_f^{obs}) to the value calculated assuming no dissociation (ΔT_f^{calc}) are

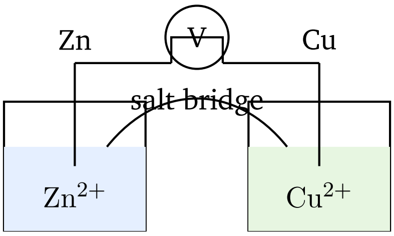
(A) $i = 2;\ \Delta T_f^{obs} = 2\,\Delta T_f^{calc}$

(B) $i = 3;\ \Delta T_f^{obs} = 3\,\Delta T_f^{calc}$

(C) $i = 3;\ \Delta T_f^{obs} = \frac{1}{3}\Delta T_f^{calc}$

(D) $i = \frac{1}{3};\ \Delta T_f^{obs} = \frac{1}{3}\Delta T_f^{calc}$

Q10. For the Daniell cell shown, the standard cell potential is $E^\circ_{cell} = 1.10$ V and $n = 2$. Taking $F = 96500\ \mathrm{C\,mol^{-1}}$, the standard Gibbs energy change ΔG° for the cell reaction is



(A) $-1.06 \times 10^5\ \mathrm{J\,mol^{-1}}$

(B) $+2.12 \times 10^5\ \mathrm{J\,mol^{-1}}$

(C) $-2.12 \times 10^5\ \mathrm{J\,mol^{-1}}$

(D) $-1.10\ \mathrm{J\,mol^{-1}}$

Q11. A first-order reaction has a rate constant $k = 2.0 \times 10^{-3}\ \mathrm{s^{-1}}$. The time required for the reactant concentration to fall to one-fourth of its initial value is (take $\ln 2 = 0.693$)

(A) 693 s

(B) 347 s

(C) 1386 s

(D) 2000 s

Q12. In which of the following compounds does the transition-metal atom exhibit its *highest* (group) oxidation state?

(A) MnO_2 (Mn in $+4$)

(B) Cr_2O_3 (Cr in $+3$)

(C) $FeCl_3$ (Fe in $+3$)

(D) $KMnO_4$ (Mn in $+7$)

Q13. For an octahedral complex of the type $[MA_2B_2C_2]$ (where A, B, C are three different monodentate ligands), ignoring optical isomerism, the number of distinct *geometrical* isomers is

(A) 4

(B) 3

(C) 6

(D) 2

Q14. Consider the three carboxylic acids shown below. Arrange them in *decreasing* order of acid strength (K_a).

CH_3COOH	$ClCH_2COOH$	$Cl_2CHCOOH$
(I)	(II)	(III)

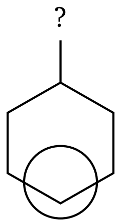
(A) I $>$ II $>$ III

(B) III $>$ II $>$ I

(C) II $>$ III $>$ I

(D) III $>$ I $>$ II

Q15. Benzene reacts with chloromethane, CH_3Cl, in the presence of anhydrous $AlCl_3$. The major organic product of this Friedel–Crafts alkylation is



(A) Chlorobenzene

(B) Benzaldehyde

(C) Toluene (methylbenzene)

(D) Benzoic acid

Q16. When chloroethane, CH_3CH_2Cl, is treated with sodium metal in dry ether (Wurtz reaction), the major hydrocarbon product is

(A) n-butane, $CH_3CH_2CH_2CH_3$

(B) ethene, $CH_2{=}CH_2$

(C) ethane, CH_3CH_3

(D) propane, $CH_3CH_2CH_3$

Q17. Phenol is treated with chloroform and aqueous sodium hydroxide, and the mixture is then acidified (Reimer–Tiemann reaction). The major organic product is

(A) benzoic acid

(B) picric acid

(C) anisole

(D) salicylaldehyde (2-hydroxybenzaldehyde)

Q18. Which one of the following compounds gives a *positive* iodoform test (yellow precipitate of CHI_3) on treatment with I_2 and $NaOH$?

(A) Benzaldehyde, C_6H_5CHO

(B) Acetone (propan-2-one), CH_3COCH_3

(C) Diethyl ketone (pentan-3-one), $CH_3CH_2COCH_2CH_3$

(D) Methanol, CH_3OH

Q19. Acetamide, CH_3CONH_2, is treated with bromine and aqueous potassium hydroxide (Hofmann bromamide degradation). The amine produced is

(A) ethylamine, $CH_3CH_2NH_2$

(B) acetonitrile, CH_3CN

(C) methylamine, CH_3NH_2

(D) dimethylamine, $(CH_3)_2NH$

Q20. Which one of the following statements about the polysaccharide *starch* is correct?

(A) It is a polymer of β-D-glucose joined by $\beta(1 \rightarrow 4)$ glycosidic linkages.

(B) It is a monosaccharide that cannot be hydrolysed further.

(C) Its straight-chain component, amylopectin, is unbranched.

(D) It is a polymer of α-D-glucose; amylose has $\alpha(1 \rightarrow 4)$ linkages while amylopectin also has $\alpha(1 \rightarrow 6)$ branch linkages.

Detailed Solutions

Q1.

Solution

Concept — Percentage by mass: The mass percentage of an element equals (total mass of that element in one formula unit) divided by (molar mass of the compound), times 100.

Step 1 — Molar mass of urea: $(NH_2)_2CO$ has $2\,N + 4\,H + 1\,C + 1\,O = 2(14) + 4(1) + 12 + 16 = 28 + 4 + 12 + 16 = 60\ \text{g mol}^{-1}$.

Step 2 — Nitrogen contribution: Mass of N $= 2 \times 14 = 28$ g.

$$\%\,N = \frac{28}{60} \times 100 = 46.7\%.$$

Why other options are wrong:

- (A) 23.3% counts only one N atom $(14/60)$.
- (C) 28.0% reports the N mass, not the percentage.
- (D) 60.0% is the molar mass, not the N percentage.

Final Answer: $\%\,N = 46.7\% \Rightarrow \boxed{B}$

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — Rydberg formula: For a hydrogen emission line, $\dfrac{1}{\lambda} = R_H\left(\dfrac{1}{n_1^2} - \dfrac{1}{n_2^2}\right)$ with $n_1 < n_2$. The $n = 4 \to n = 2$ transition is a Balmer line (visible region).

Step 1 — Substitute: $n_1 = 2$, $n_2 = 4$:

$$\frac{1}{\lambda} = R_H\left(\frac{1}{4} - \frac{1}{16}\right) = R_H\left(\frac{4-1}{16}\right) = \frac{3R_H}{16}.$$

Step 2 — Compute: $\dfrac{1}{\lambda} = \dfrac{3(1.097 \times 10^7)}{16} = 2.057 \times 10^6\ \text{m}^{-1}$, so $\lambda = 4.86 \times 10^{-7}$ m $= 486$ nm.

Why other options are wrong:

- (A) 656 nm is the $3 \to 2$ line (H_α).

- (B) 410 nm is the $6 \to 2$ line.
- (D) 434 nm is the $5 \to 2$ line.

Final Answer: $\lambda \approx 486$ nm $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q2

Q3.

Solution

Concept — Half-filled stability anomaly: Ionization enthalpy generally rises across a period, but exactly half-filled subshells have extra exchange-energy stability, making them harder to ionize.

Step 1 — Configurations: N is $1s^2 2s^2 2p^3$ (half-filled $2p$); O is $1s^2 2s^2 2p^4$.

Step 2 — Reasoning: Removing an electron from N breaks a stable half-filled set, so it needs more energy. In O, the fourth $2p$ electron is paired in one orbital; the inter-electronic repulsion makes it easier to remove. Hence $\text{IE}_1(\text{N}) > \text{IE}_1(\text{O})$.

Why other options are wrong:

- (B) Effective nuclear charge actually increases from N to O, which alone would predict the opposite trend.
- (C) Oxygen is smaller than nitrogen, not larger.
- (D) Nitrogen's $2p$ is half-filled, not completely filled.

Final Answer: Half-filled $2p^3$ stability of N $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q3

Q4.

Solution

Concept — Hybridization and bond counting: The hybridization of a central atom follows from its steric number (number of σ bonds + lone pairs). Each double bond is one σ and one π.

Step 1 — Geometry of CO_2: Carbon is bonded to two oxygens with no lone pairs on C, giving two electron domains $\Rightarrow$ linear $\Rightarrow$ sp hybridization.

Step 2 — Count bonds: Each C=O is a double bond $= 1\,\sigma + 1\,\pi$. Two such bonds give $2\,\sigma$ and $2\,\pi$ in total.

Why other options are wrong:

- (A) sp^3 would mean four electron domains (it is only two).
- (B) sp is right, but CO_2 has π bonds, not four σ.
- (C) sp^2 corresponds to three electron domains, not two.

Final Answer: sp carbon; two σ and two π bonds $\Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q4**

Q5.

Solution

Concept — First law of thermodynamics: $\Delta U = q + w$, where (using the chemistry convention) w is the work done *on* the system. When the gas does work on the surroundings, w is negative.

Step 1 — Assign signs: Heat absorbed $q = +200$ J. Gas does 80 J of work on surroundings, so $w = -80$ J.

Step 2 — Apply first law:

$$\Delta U = q + w = 200 + (-80) = +120 \text{ J}.$$

Why other options are wrong:

- (A) -120 J reverses the sign of ΔU.
- (C) $+280$ J adds the work instead of subtracting (w sign error).
- (D) -280 J both reverses heat and adds work.

Final Answer: $\Delta U = +120 \text{ J} \Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q5**

Q6.

Solution

Concept — Common-ion effect: In a solution already containing a common ion, the solubility of a sparingly soluble salt is suppressed. For AgCl, $K_{sp} = [\text{Ag}^+][\text{Cl}^-]$.

Step 1 — Set up: Let solubility in 0.10 M NaCl be s. Then $[\text{Ag}^+] = s$ and $[\text{Cl}^-] \approx 0.10$ (the added chloride dominates).

$$K_{sp} = s\,(0.10) = 1.8 \times 10^{-10}.$$

Step 2 — Solve: $s = \dfrac{1.8 \times 10^{-10}}{0.10} = 1.8 \times 10^{-9}\ \mathrm{mol\,L^{-1}}$.

Why other options are wrong:

- (A) 1.34×10^{-5} is the solubility in *pure* water ($\sqrt{K_{sp}}$), ignoring the common ion.
- (C) 1.8×10^{-11} wrongly multiplies (instead of divides) by 0.10.
- (D) 9.0×10^{-10} divides by the wrong concentration.

Final Answer: $s = 1.8 \times 10^{-9}\ \mathrm{mol\,L^{-1}} \Rightarrow \boxed{\mathrm{B}}$

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — Disproportionation: A single element in one oxidation state is simultaneously oxidised and reduced, ending up in both a higher and a lower oxidation state.

Step 1 — Examine option (D): $Cl_2 + 2\,NaOH \rightarrow NaCl + NaOCl + H_2O$. Chlorine starts at 0 in Cl_2. In $NaCl$ it is -1 (reduced); in $NaOCl$ it is $+1$ (oxidised). The same element splits into two states ⇒ disproportionation.

Step 2 — Why the others are simple redox: In (A) and (B), Cl_2 (0) is only reduced to Cl^-. In (C), Cl in HCl (-1) is oxidised to Cl_2 (0) while Mn is reduced; one element changes one way only.

Why other options are wrong:

- (A), (B) Chlorine is only reduced (no simultaneous oxidation of the same element).
- (C) Chloride is only oxidised; manganese is the reduced species, so it is comproportionation/ordinary redox, not disproportionation.

Final Answer: Chlorine disproportionates in $Cl_2 + NaOH \Rightarrow \boxed{\mathrm{D}}$

Answer: (D) Go Back to Q7

Q8.

Solution

Concept — Ideal-gas molar mass: From $PV = nRT$ with $n = \frac{m}{M}$, the molar mass is $M = \frac{mRT}{PV}$.

Step 1 — Substitute: $m = 0.82$ g, $R = 0.0821$, $T = 300$ K, $P = 1.0$ atm, $V = 0.50$ L.

$$M = \frac{(0.82)(0.0821)(300)}{(1.0)(0.50)} = \frac{20.20}{0.50}.$$

Step 2 — Compute: $M = 40.4 \approx 40\ \mathrm{g\,mol^{-1}}$.

Why other options are wrong:

- (B) $20\ \mathrm{g\,mol^{-1}}$ uses $V = 1.0$ L (doubles the volume).
- (C) $44\ \mathrm{g\,mol^{-1}}$ guesses CO_2 without using the data.
- (D) $80\ \mathrm{g\,mol^{-1}}$ halves the volume instead.

Final Answer: $M \approx 40\ \mathrm{g\,mol^{-1}} \Rightarrow \boxed{\mathrm{A}}$

Answer: (A) Go Back to Q8

Q9.

Solution

Concept — van't Hoff factor: i is the ratio of the actual number of particles in solution to the number of formula units dissolved. Colligative properties scale directly with i: $\Delta T_f^{obs} = i\,\Delta T_f^{calc}$.

Step 1 — Particles from one formula unit: $AB_2 \to A^{2+} + 2\,B^-$ gives $1 + 2 = 3$ ions. With complete dissociation, $i = 3$.

Step 2 — Effect on ΔT_f: Since depression in freezing point is colligative, $\Delta T_f^{obs} = i\,\Delta T_f^{calc} = 3\,\Delta T_f^{calc}$.

Why other options are wrong:

- (A) $i = 2$ counts only two ions (forgets the second B^-).
- (C) The factor multiplies, it does not divide, so $\frac{1}{3}$ is wrong.
- (D) $i < 1$ would indicate *association*, the opposite of dissociation.

Final Answer: $i = 3$ and $\Delta T_f^{obs} = 3\,\Delta T_f^{calc} \Rightarrow \boxed{\mathrm{B}}$

Answer: (B) Go Back to Q9

Q10.

Solution

Concept — Gibbs energy from cell potential: For a galvanic cell, $\Delta G^\circ = -nFE^\circ_{cell}$. A positive E° gives a negative ΔG° (spontaneous).

Step 1 — Substitute: $n = 2$, $F = 96500\ \mathrm{C\,mol^{-1}}$, $E^\circ = 1.10$ V.

$$\Delta G^\circ = -(2)(96500)(1.10).$$

Step 2 — Compute: $2 \times 96500 = 193000$; $193000 \times 1.10 = 212300 \approx 2.12 \times 10^5$. With the negative sign, $\Delta G^\circ = -2.12 \times 10^5\ \mathrm{J\,mol^{-1}}$.

Why other options are wrong:

- (A) -1.06×10^5 uses $n = 1$.
- (B) $+2.12 \times 10^5$ has the wrong sign (would mean non-spontaneous).
- (D) -1.10 forgets the nF factor entirely.

Final Answer: $\Delta G^\circ = -2.12 \times 10^5\ \mathrm{J\,mol^{-1}} \Rightarrow \boxed{\mathrm{C}}$

Answer: (C) Go Back to Q10

Q11.

Solution

Concept — First-order integrated rate law: $t = \dfrac{1}{k} \ln \dfrac{[A]_0}{[A]}$. Falling to one-fourth means two successive halvings.

Step 1 — Ratio: $\dfrac{[A]_0}{[A]} = 4$, so $\ln 4 = 2 \ln 2 = 2(0.693) = 1.386$.

Step 2 — Time:

$$t = \frac{1.386}{2.0 \times 10^{-3}} = 693\ \mathrm{s}.$$

(Equivalently, $t = 2\,t_{1/2}$ with $t_{1/2} = \ln 2/k = 346.5$ s.)

Why other options are wrong:

- (B) 347 s is one half-life (reaching one-half, not one-fourth).
- (C) 1386 s uses $\ln 4 = 1.386$ but with k ten times too small.
- (D) 2000 s drops the logarithm ($1/k$ alone).

Final Answer: $t = 693$ s $\Rightarrow \boxed{\mathrm{A}}$

Answer: (A) Go Back to Q11

Q12.

Solution

Concept — Highest oxidation state: The maximum (group) oxidation state available to a transition metal is shown when it is bonded to the most electronegative atoms (O, F). For Mn (group 7) the maximum is $+7$.

Step 1 — Oxidation states given: MnO_2: $+4$; Cr_2O_3: $+3$; $FeCl_3$: $+3$; $KMnO_4$: $+7$.

Step 2 — Identify the maximum: Among these, $+7$ in $KMnO_4$ is the highest, and it equals Mn's group oxidation state.

Why other options are wrong:

- (A) MnO_2 has Mn only in $+4$, below its maximum of $+7$.
- (B) Cr in Cr_2O_3 is $+3$ (its group maximum is $+6$, as in $K_2Cr_2O_7$).
- (C) Fe in $FeCl_3$ is $+3$, not a group-maximum example here.

Final Answer: Mn shows $+7$ in $KMnO_4 \Rightarrow \boxed{D}$

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Geometrical isomerism in $[MA_2B_2C_2]$: In an octahedral complex with three pairs of different ligands, each pair can be *cis* or *trans*, but the geometry constrains the combinations.

Step 1 — Enumerate: The distinct geometrical isomers of $[MA_2B_2C_2]$ are: all-cis; and three isomers in which exactly one of the three pairs (A, B, or C) is trans while the other two are cis. The "all-trans" arrangement of all three pairs is also possible. Counting carefully, the standard result is **six** geometrical isomers (five are achiral; one all-cis form is also optically active).

Step 2 — Conclusion: Ignoring optical isomerism, $[MA_2B_2C_2]$ has **six** geometrical isomers.

Why other options are wrong:

- (A) 4 undercounts the trans/cis combinations.

- (B) 3 is the count for $[MA_2B_2]$-type square or simpler systems, not this one.
- (D) 2 (just cis/trans) applies to $[MA_4B_2]$, not three different pairs.

Final Answer: 6 geometrical isomers $\Rightarrow \boxed{C}$

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

Q14.

Solution

Concept — Inductive effect on acidity: Electron-withdrawing groups (like Cl) stabilise the carboxylate anion by dispersing its negative charge, increasing acid strength. More electron-withdrawing groups $\Rightarrow$ stronger acid.

Step 1 — Compare: CH_3COOH (I) has an electron-*donating* methyl, the weakest acid. $ClCH_2COOH$ (II) has one Cl ($-I$ effect). $Cl_2CHCOOH$ (III) has two Cl atoms, the strongest $-I$ pull.

Step 2 — Order: Acid strength III $>$ II $>$ I (and pK_a falls: $\approx 1.3, 2.9, 4.76$).

Why other options are wrong:

- (A) Reverses the order (donating methyl cannot be most acidic).
- (C) Places one Cl above two Cl; more Cl means stronger, not weaker.
- (D) Wrongly puts CH_3COOH above the chloro acids.

Final Answer: III $>$ II $>$ I $\Rightarrow \boxed{B}$

Answer: (B) **Go Back to Q14**

Q15.

Solution

Concept — Friedel–Crafts alkylation: An alkyl halide with anhydrous $AlCl_3$ generates an electrophilic carbocation that substitutes a ring hydrogen of benzene, attaching an alkyl group.

Step 1 — Electrophile: $CH_3Cl + AlCl_3 \rightarrow CH_3^+ + AlCl_4^-$ (a methyl cation equivalent).

Step 2 — Product: The CH_3 group attaches to the ring, giving methylbenzene (toluene), $C_6H_5CH_3$, with loss of HCl.

Why other options are wrong:

- (A) Chlorobenzene needs $Cl_2/FeCl_3$ (halogenation), not an alkyl halide.
- (B) Benzaldehyde comes from formylation (Gattermann–Koch), not this reaction.
- (D) Benzoic acid requires oxidation of the side chain, a later step.

Final Answer: Toluene (methylbenzene) $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Wurtz reaction: Two molecules of an alkyl halide couple with sodium in dry ether, joining the two alkyl groups to form a symmetrical alkane with twice the carbon count.

Step 1 — Couple two ethyl groups: $2\,CH_3CH_2Cl + 2\,Na \rightarrow CH_3CH_2{-}CH_2CH_3 + 2\,NaCl$.

Step 2 — Product: Two C_2 units give a C_4 alkane, n-butane.

Why other options are wrong:

- (B) Ethene would come from elimination (dehydrohalogenation), not Wurtz coupling.
- (C) Ethane has the same carbon count as the halide; Wurtz *doubles* it.
- (D) Propane (C_3) cannot form from coupling two C_2 fragments.

Final Answer: n-butane, $CH_3CH_2CH_2CH_3 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q16

Q17.

Solution

Concept — Reimer–Tiemann reaction: Phenol with $CHCl_3$ and aqueous $NaOH$ generates dichlorocarbene, which attacks the ortho position; after hydrolysis and acidification a $-CHO$ group is introduced ortho to the $-OH$.

Step 1 — Intermediate: $CHCl_3 + OH^- \rightarrow {:}CCl_2$ (dichlorocarbene), the electrophile.

Step 2 — Product: Ortho-formylation gives 2-hydroxybenzaldehyde (salicylaldehyde) as the major product after acidification.

Why other options are wrong:

- (A) Benzoic acid is not formed; the carbene gives an aldehyde, not a ring acid.
- (B) Picric acid arises from nitration, not the Reimer–Tiemann reaction.
- (C) Anisole ($C_6H_5OCH_3$) is an ether from Williamson synthesis.

Final Answer: Salicylaldehyde (2-hydroxybenzaldehyde) $\Rightarrow \boxed{D}$

Answer: (D) **Go Back to Q17**

Q18.

Solution

Concept — Iodoform test: A positive test requires a methyl ketone (CH_3CO-) or a group oxidisable to it (such as $CH_3CH(OH)-$ or ethanol/acetaldehyde). These give the yellow CHI_3 precipitate with $I_2/NaOH$.

Step 1 — Check acetone: CH_3COCH_3 has a CH_3CO- unit (a methyl ketone), so it gives a positive iodoform test.

Step 2 — Reaction: The three α-hydrogens of the methyl group are replaced by iodine, and cleavage releases CHI_3.

Why other options are wrong:

- (A) Benzaldehyde has no CH_3CO- group; it gives a negative test.
- (C) Pentan-3-one ($CH_3CH_2COCH_2CH_3$) lacks a methyl directly on the carbonyl.
- (D) Methanol has only one carbon and no methyl-carbonyl pattern.

Final Answer: Acetone gives a positive iodoform test $\Rightarrow \boxed{B}$

Answer: (B) **Go Back to Q18**

Q19.

Solution

Concept — Hofmann bromamide degradation: A primary amide treated with Br_2 and aqueous KOH loses the carbonyl carbon as carbonate and gives a primary amine with *one fewer* carbon than the amide.

Step 1 — Count carbons: Acetamide CH_3CONH_2 has two carbons. Losing the carbonyl carbon leaves a one-carbon amine.

Step 2 — Product: $CH_3CONH_2 \xrightarrow{Br_2,\,KOH} CH_3NH_2$ (methylamine).

Why other options are wrong:

- (A) Ethylamine has the same carbon count as the amide; Hofmann *removes* a carbon.
- (B) Acetonitrile is a dehydration product of the amide, not a Hofmann product.
- (D) Dimethylamine is a secondary amine; Hofmann gives a primary amine.

Final Answer: Methylamine, $CH_3NH_2 \Rightarrow \boxed{C}$

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

Q20.

Solution

Concept — Starch structure: Starch is a polysaccharide of α-D-glucose. It has two components: amylose (linear, $\alpha(1 \to 4)$ linkages) and amylopectin (branched, with additional $\alpha(1 \to 6)$ linkages at the branch points).

Step 1 — Linkage type: The glycosidic bonds are α, distinguishing starch from cellulose (which is β-linked β-D-glucose).

Step 2 — Components: Amylose is the straight-chain portion; amylopectin is the branched portion. So statement (D) is the correct description.

Why other options are wrong:

- (A) $\beta(1 \to 4)$ linkages of β-D-glucose describe cellulose, not starch.
- (B) Starch is a polysaccharide, not a non-hydrolysable monosaccharide.
- (C) The branched component is amylopectin, and it *is* branched; the unbranched component is amylose.

Final Answer: Starch is α-D-glucose with $\alpha(1 \to 4)$ and $\alpha(1 \to 6)$ linkages $\Rightarrow \boxed{D}$

$\boxed{\text{Answer: (D)}}$ Go Back to Q20

Answer Key

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