NEET 2023 — Chemistry Question Paper with Solutions

42 Chemistry questions as set in the paper · answers checked by RankUp

NEET 2023

1. The conductivity of centimolar solution of KCl at 25°C is 0.0210 ohm^{-1} cm^{-1} and the resistance of the cell containing the solution at 25°C is 60 ohm. The value of cell constant is -

(A) 3.28 cm^{-1}
(B) 1.26 cm^{-1}
(C) 3.34 cm^{-1}
(D) 1.34 cm^{-1}

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2. For a certain reaction, the rate = k[A]^2[B], when the initial concentration of A is tripled keeping concentration of B constant, the initial rate would

(A) increase by a factor of six
(B) increase by a factor of nine
(C) increase by a factor of three
(D) decrease by a factor of nine

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3. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A : Helium is used to dilute oxygen in diving apparatus.
Reason R : Helium has high solubility in O_2.
In the light of the above statements, choose the correct answer from the options given below:

(A) Both A and R are true but R is NOT the correct explanation of A.
(B) A is true but R is false.
(C) A is false but R is true.
(D) Both A and R are true and R is the correct explanation of A.

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4. Amongst the following, the total number of species NOT having eight electrons around central atom in its outer most shell, is
NH_3, $AlCl_3$, $BeCl_2$, CCl_4, PCl_5 :

(A) 2
(B) 4
(C) 1
(D) 3

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5. The correct order of energies of molecular orbitals of N_2 molecule, is

(A) σ1s < σ*1s < σ2s < σ*2s < σ2pz < (π2px = π2py) < (π*2px = π*2py) < σ*2pz
(B) σ1s < σ*1s < σ2s < σ*2s < σ2pz < σ*2pz < (π2px = π2py) < (π*2px = π*2py)
(C) σ1s < σ*1s < σ2s < σ*2s < (π2px = π2py) < (π*2px = π*2py) < σ2pz < σ*2pz
(D) σ1s < σ*1s < σ2s < σ*2s < (π2px = π2py) < σ2pz < (π*2px = π*2py) < σ*2pz

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6. Match List I with List II:

List I: (A) Coke (B) Diamond (C) Fullerene (D) Graphite

List II: (I) Carbon atoms are sp^3 hybridised (II) Used as a dry lubricant (III) Used as a reducing agent (IV) Cage like molecules

Choose the correct answer from the options given below:

(A) A-IV, B-I, C-II, D-III
(B) A-III, B-I, C-IV, D-II
(C) A-III, B-IV, C-I, D-II
(D) A-II, B-IV, C-I, D-III

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7. The number of σ bonds, π bonds and lone pair of electrons in pyridine, respectively are:

(A) 12, 3, 0
(B) 11, 3, 1
(C) 12, 2, 1
(D) 11, 2, 0

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8. The element expected to form largest ion to achieve the nearest noble gas configuration is

(A) F
(B) N
(C) Na
(D) O

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9. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : A reaction can have zero activation energy.

Reason R : The minimum extra amount of energy absorbed by reactant molecules so that their energy becomes equal to threshold value, is called activation energy.

In the light of the above statements, choose the correct answer from the options given below:

(A) Both A and R are true but R is NOT the correct explanation of A.
(B) A is true but R is false.
(C) A is false but R is true.
(D) Both A and R are true and R is the correct explanation of A.

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10. Consider the following reaction and identify the product (P).

CH_3–CH(CH_3)–CH(OH)–CH_3 (3-Methylbutan-2-ol) —HBr→ Product (P)

(A) $CH_3CH = CH - CH_3$
(B) CH_3–CH(CH_3)–CH(Br)–CH_3
(C) $(CH_3)_3C–CH_2Br$
(D) CH_3–C(Br)(CH_3)–CH_2–CH_3

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11. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A : In equation $\Delta_rG = -nFE_{cell}$, value of Δ_rG depends on n.

Reason R : E_{cell} is an intensive property and Δ_rG is an extensive property.

In the light of the above statements, choose the correct answer from the options given below:

(A) Both A and R are true but R is NOT the correct explanation of A.
(B) A is true but R is false.
(C) A is false but R is true.
(D) Both A and R are true and R is the correct explanation of A.

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12. In Lassaigne's extract of an organic compound, both nitrogen and sulphur are present, which gives blood red colour with Fe^{3+} due to the formation of-

(A) NaSCN
(B) $[Fe(CN)_5NOS]^{4-}$
(C) $[Fe(SCN)]^{2+}$
(D) $Fe_4[Fe(CN)_6]_3 \cdot xH_2O$

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13. Identify the product in the following reaction:

$C_6H_5N_2^+Cl^- \xrightarrow{\text{(i) } Cu_2Br_2/HBr;\ \text{(ii) Mg/dry ether;}\ \text{(iii) } H_2O} \text{Product}$

(A) C_6H_6 (benzene)
(B) C_6H_5MgBr
(C) p-BrC_6H_4OH (4-bromophenol)
(D) C_6H_5OH (phenol)

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14. Select the correct Statements from the following :

A. Atoms of all elements are composed of two fundamental particles.

B. The mass of the electron is 9.10939×10^{-31} kg.

C. All the isotopes of a given elements show same chemical properties.

D. Protons and electrons are collectively known as nucleons.

E. Dalton's atomic theory, regarded the atom as an ultimate particle of matter.

Choose the correct answer from the options given below.

(A) C, D and E only
(B) A and E only
(C) B, C and E only
(D) A, B and C only

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15. Given below are two statements:

Statement I : A unit formed by the attachment of a base to 1' position of sugar is known as nucleoside

Statement II : When nucleoside is linked to phosphorous acid at 5' position of sugar moiety, we get nucleotide.

In the light of the above statements, choose the correct answer from the options given below:

(A) Both Statement I and Statement II are false
(B) Statement I is true but Statement II is false
(C) Statement I is false but Statement II is true
(D) Both Statement I and Statement II are true

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16. Taking stability as the factor, which one of the following represents correct relationship?

(A) $InI_3 > InI$
(B) $AlCl > AlCl_3$
(C) $TlI > TlI_3$
(D) $TlCl_3 > TlCl$

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17. Intermolecular forces are forces of attraction and repulsion between interacting particles that will include:
A. dipole - dipole forces.
B. dipole - induced dipole forces
C. hydrogen bonding
D. covalent bonding
E. dispersion forces
Choose the most appropriate answer from the options given below :

(A) A, B, C, D are correct
(B) A, B, C, E are correct
(C) A, C, D, E are correct
(D) B, C, D, E are correct

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18. Amongst the given options which of the following molecules/ion acts as a Lewis acid?

(A) H_2O
(B) BF_3
(C) OH^-
(D) NH_3

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19. The right option for the mass of CO_2 produced by heating 20 g of 20% pure limestone is
(Atomic mass of Ca = 40)
[$CaCO_3$ —1200 K→ $CaO + CO_2$]

(A) 1.76 g
(B) 2.64 g
(C) 1.32 g
(D) 1.12 g

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20. The relation between n_m, (n_m = the number of permissible values of magnetic quantum number (m)) for a given value of azimuthal quantum number (l), is

(A) $l = 2n_m + 1$
(B) $n_m = 2l^2 + 1$
(C) $n_m = l + 2$
(D) $l = (n_m - 1)/2$

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21. The stability of Cu^{2+} is more than Cu^+ salts in aqueous solution due to -

(A) enthalpy of atomization.
(B) hydration energy.
(C) second ionisation enthalpy.
(D) first ionisation enthalpy.

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22. Which of the following reactions will NOT give primary amine as the product?

(A) CH_3CN —(i) $LiAlH_4$, (ii) H_3O^+→ Product

(B) CH_3NC —(i) $LiAlH_4$, (ii) H_3O^+→ Product

(C) CH_3CONH_2 —(i) $LiAlH_4$, (ii) H_3O^+→ Product

(D) CH_3CONH_2 —Br_2/KOH→ Product

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23. The given compound C_6H_5–CH=CH–CH(X)–CH_2CH_3 is an example of _____.

(A) aryl halide

(B) allylic halide

(C) vinylic halide

(D) benzylic halide

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24. Homoleptic complex from the following complexes is :

(A) Diamminechloridonitrito-N-platinum (II)

(B) Pentaamminecarbonatocobalt (III) chloride

(C) Triamminetriaquachromium (III) chloride

(D) Potassium trioxalatoaluminate (III)

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25. Consider the following reaction

C_6H_5–CH_2–O–C_6H_5 —HI, Δ→ A + B

Identify products A and B :-

(A) A = $C_6H_5CH_2OH$ and B = C_6H_5I

(B) A = $C_6H_5CH_2I$ and B = C_6H_5OH

(C) A = $C_6H_5CH_3$ and B = C_6H_5I

(D) A = $C_6H_5CH_3$ and B = C_6H_5OH

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26. The equilibrium concentrations of the species in the reaction A + B ⇌ C + D are 2, 3, 10 and 6 mol L^{-1}, respectively at 300 K. ΔG^0 for the reaction is (R = 2 cal/mol K)

(A) −137.26 cal

(B) −1381.80 cal

(C) −13.73 cal

(D) 1372.60 cal

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27. Which amongst the following options is the correct relation between change in enthalpy and change in internal energy?

(A) $\Delta H = \Delta U + \Delta n_gRT$

(B) $\Delta H - \Delta U = -\Delta nRT$

(C) $\Delta H + \Delta U = \Delta nR$

(D) $\Delta H = \Delta U - \Delta n_gRT$

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28. Match List I with List II:

List I (Oxoacids of Sulphur): (A) Peroxodisulphuric acid (B) Sulphuric acid (C) Pyrosulphuric acid (D) Sulphurous acid

List II (Bonds): (I) Two S-OH, Four S=O, One S-O-S (II) Two S-OH, One S=O (III) Two S-OH, Four S=O, One S-O-O-S (IV) Two S-OH, Two S=O

Choose the correct answer from the options given below:

(A) A-III, B-IV, C-I, D-II

(B) A-I, B-III, C-IV, D-II

(C) A-III, B-IV, C-II, D-I

(D) A-I, B-III, C-II, D-IV

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29. Which of the following statements are INCORRECT?

A. All the transition metals except scandium form MO oxides which are ionic.

B. The highest oxidation number corresponding to the group number in transition metal oxides is attained in Sc_2O_3 to Mn_2O_7.

C. Basic character increases from V_2O_3 to V_2O_4 to V_2O_5.

D. V_2O_4 dissolves in acids to give VO_4^{3-} salts.

E. CrO is basic but Cr_2O_3 is amphoteric.

Choose the correct answer from the options given below:

(A) B and D only
(B) C and D only
(C) B and C only
(D) A and E only

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30. Which complex compound is most stable?

(A) $[Co(NH_3)_3(NO_3)_3]$
(B) $[CoCl_2(en)_2]NO_3$
(C) $[Co(NH_3)_6]_2(SO_4)_3$
(D) $[Co(NH_3)_4(H_2O)Br](NO_3)_2$

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31. On balancing the given redox reaction,

$aCr_2O_7^{2-} + bSO_3^{2-}(aq) + cH^+(aq) \rightarrow 2aCr^{3+}(aq) + bSO_4^{2-}(aq) + (c/2)H_2O(l)$

the coefficients a, b and c are found to be, respectively -

(A) 3, 8, 1
(B) 1, 8, 3
(C) 8, 1, 3
(D) 1, 3, 8

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32. Identify the final product [D] obtained in the following sequence of reactions.

$CH_3CHO \xrightarrow{i)\ LiAlH_4,\ ii)\ H_3O^+} [A] \xrightarrow{H_2SO_4,\ \Delta} [B] \xrightarrow{HBr} [C] \xrightarrow{C_6H_5Br,\ Na/dry\ ether} [D]$

(A) $C_6H_5–C_6H_5$ (biphenyl)
(B) C_4H_{10}
(C) $HC \equiv C^-Na^+$
(D) $C_6H_5–CH_2CH_3$ (ethylbenzene)

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33. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R :

Assertion A : Metallic sodium dissolves in liquid ammonia giving a deep blue solution, which is paramagnetic.

Reason R : The deep blue solution is due to the formation of amide.

In the light of the above statements, choose the correct answer from the options given below:

(A) Both A and R are true but R is NOT the correct explanation of A.
(B) A is true but R is false.
(C) A is false but R is true.
(D) Both A and R are true and R is the correct explanation of A.

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34. Which one is an example of heterogenous catalysis?

(A) Hydrolysis of sugar catalysed by H^+ ions.
(B) Decomposition of ozone is presence of nitrogen monoxide.
(C) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron.
(D) Oxidation of sulphur dioxide into sulphur trioxide in the presence of oxides of nitrogen.

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35. A compound is formed by two elements A and B. The elements B forms cubic close packed structure and atoms of A occupy 1/3 of tetrahedral voids. If the formula of the compound is A_xB_y, then the value of x + y is in option

(A) 4
(B) 3
(C) 2
(D) 5

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36. Which amongst the following molecules on polymerization produces neoprene?

(A) $H_2C = C(Cl) – CH = CH_2$
(B) $H_2C = CH – C \equiv CH$
(C) $H_2C = C(CH_3) – CH = CH_2$
(D) $H_2C = CH – CH = CH_2$

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37. Some tranquilizers are listed below. Which one from the following belongs to barbiturates?

(A) Meprobamate
(B) Valium
(C) Veronal
(D) Chlordiazepoxide

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38. Which of the following statements are NOT correct?

A. Hydrogen is used to reduce heavy metal oxides to metals.
B. Heavy water is used to study reaction mechanism.
C. Hydrogen is used to make saturated fats from oils
D. The H – H bond dissociation enthalpy is lowest as compared to a single bond between two atoms of any element.
E. Hydrogen reduces oxides of metals that are more active than iron.
Choose the most appropriate answer from the options given below:

(A) B, D only
(B) D, E only
(C) A, B, C only
(D) B, C, D, E only

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39. Weight (g) of two moles of the organic compound, which is obtained by heating sodium ethanoate with sodium hydroxide in presence of calcium oxide is :

(A) 32
(B) 30
(C) 18
(D) 16

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40. Given below are two statements:
Statement I : The nutrient deficient water bodies lead to eutrophication.
Statement II : Eutrophication leads to decrease in the level of oxygen in the water bodies.
In the light of the above statements, choose the correct answer from the options given below:

(A) Both Statement I and Statement II are false
(B) Statement I is correct but Statement II is false.
(C) Statement I is incorrect but Statement II is true.
(D) Both Statement I and Statement II are true.

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41. The reaction that does NOT take place in blast furnace between 900 K to 1500 K temperature range during extraction of iron is :

(A) $FeO + CO \rightarrow Fe + CO_2$
(B) $C + CO_2 \rightarrow 2CO$
(C) $CaO + SiO_2 \rightarrow CaSiO_3$
(D) $Fe_2O_3 + CO \rightarrow 2FeO + CO_2$

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42. What fraction of one edge centred octahedral void lies in one unit cell of fcc?

(A) 1/3
(B) 1/4
(C) 1/12
(D) 1/2

Answer key and explanations

1. Answer: (B) 1.26 cm^{-1}

Cell constant $G^* = \kappa \times R = 0.0210\ ohm^{-1}\ cm^{-1} \times 60\ ohm = 1.26\ cm^{-1}$. Dividing instead of multiplying (or using 1/R) gives none of the other values sensibly; conductivity times resistance is the defining relation.

2. Answer: (B) increase by a factor of nine

The rate is second order in A, so tripling [A] multiplies the rate by $3^2 = 9$. A factor of three would apply only if the reaction were first order in A.

3. Answer: (B) A is true but R is false.

Helium is mixed with oxygen in diving cylinders because it is only sparingly soluble in blood, avoiding the bends caused by dissolved nitrogen, so the assertion is true. The reason is false: the relevant property is helium's low solubility (in blood), not a high solubility in O_2.

4. Answer: (D) 3

NH_3 and CCl_4 have an octet. $AlCl_3$ has 6 and $BeCl_2$ has 4 electrons around the central atom (incomplete octets), while PCl_5 has 10 (expanded octet). So three species do not have eight electrons.

5. Answer: (D) σ1s < σ*1s < σ2s < σ*2s < (π2px = π2py) < σ2pz < (π*2px = π*2py) < σ*2pz

For N_2 and lighter diatomics, s–p mixing raises σ2pz above the degenerate π2p pair, so the order is … σ*2s < (π2px = π2py) < σ2pz < (π*2px = π*2py) < σ*2pz. Placing σ2pz below the π2p orbitals is the order for O_2 and F_2.

6. Answer: (B) A-III, B-I, C-IV, D-II

Coke is used as a reducing agent in metallurgy, every carbon in diamond is sp^3 hybridised, fullerenes are cage-like molecules such as C_{60}, and layered graphite is a dry lubricant. That gives A-III, B-I, C-IV, D-II.

7. Answer: (B) 11, 3, 1

Pyridine C_5H_5N has 6 ring σ bonds plus 5 C–H σ bonds = 11 σ bonds, three π bonds in the aromatic ring, and one lone pair on nitrogen. Counting 12 σ bonds wrongly adds an N–H bond that pyridine does not have.

8. Answer: (B) N

N^{3-}, O^{2-}, F^- and Na^+ are isoelectronic (10 electrons); the ion with the fewest protons, N^{3-} (7 protons), holds the electrons least tightly and is largest. Na^+ is the smallest of the set.

9. Answer: (C) A is false but R is true.

The reason is the textbook definition of activation energy: the extra energy needed to reach the threshold energy. Within the collision/Arrhenius model every reaction needs some threshold to be crossed, so the assertion that activation energy can be zero is taken as false.

10. Answer: (D) $CH_3–C(Br)(CH_3)–CH_2–CH_3$

Protonation and loss of water give a secondary carbocation at C-2, which undergoes a 1,2-hydride shift to the more stable tertiary carbocation at C-3; Br^- then attacks it, giving 2-bromo-2-methylbutane. The unrearranged 2-bromo-3-methylbutane ignores this rearrangement.

11. Answer: (D) Both A and R are true and R is the correct explanation of A.

E_cell is intensive (independent of how much reaction is written), whereas Δ_rG is extensive and scales with the amount, which enters through n, the number of electrons transferred. So Δ_rG depends on n precisely because it is extensive while E_cell is not; both are true and the reason explains the assertion.

12. Answer: (C) $[Fe(SCN)]^{2+}$

When both N and S are present, fusion with sodium gives NaSCN, and the thiocyanate ion reacts with Fe^{3+} to give the blood-red complex $[Fe(SCN)]^{2+}$. NaSCN itself is colourless, and Prussian blue indicates nitrogen alone.

13. Answer: (A) C_6H_6 (benzene)

Sandmeyer reaction converts benzenediazonium chloride to bromobenzene; Mg in dry ether gives phenylmagnesium bromide, which is protonated by water to benzene. Phenylmagnesium bromide is only the intermediate, and phenol would need warm water on the diazonium salt.

14. Answer: (C) B, C and E only

The electron mass is 9.10939×10^{-31} kg, isotopes have the same electron configuration and hence the same chemistry, and Dalton treated the atom as indivisible, so B, C and E are correct. Atoms contain three fundamental particles, and nucleons are protons and neutrons, not protons and electrons.

15. Answer: (B) Statement I is true but Statement II is false

A base attached at C-1′ of the pentose is a nucleoside, so Statement I is true. A nucleotide is formed when the nucleoside is esterified with phosphoric acid (H_3PO_4) at C-5′, not phosphorous acid, so Statement II is false.

16. Answer: (C) $TlI > TlI_3$

Down group 13 the inert pair effect makes the +1 state more stable than +3 for thallium, so TlI is more stable than TlI_3. For aluminium the +3 state is the stable one, and for Tl the chloride $TlCl_3$ is less stable than TlCl.

17. Answer: (B) A, B, C, E are correct

Dipole–dipole, dipole–induced dipole, hydrogen bonding and London dispersion forces all act between molecules. Covalent bonding holds atoms together within a molecule, so it is an intramolecular force and must be excluded.

18. Answer: (B) BF_3

BF_3 has an incomplete octet on boron and accepts an electron pair, so it is a Lewis acid. H_2O, OH^- and NH_3 all carry lone pairs that they donate, making them Lewis bases.

19. Answer: (A) 1.76 g

Pure $CaCO_3$ = 20 % of 20 g = 4 g = 4/100 = 0.04 mol, which gives 0.04 mol CO_2 = 0.04 × 44 = 1.76 g. The trap is ignoring the 20 % purity: the full 20 g would give 8.8 g of CO_2, and 1.12 g would correspond to only 2.55 g of $CaCO_3$.

20. Answer: (D) $l = (n_m - 1)/2$

For a given l, m runs from −l to +l, so $n_m = 2l + 1$, which rearranges to $l = (n_m - 1)/2$. The relation $l = 2n_m + 1$ has the roles of l and n_m swapped.

21. Answer: (B) hydration energy.

The much more negative hydration enthalpy of the small, doubly charged Cu^{2+} ion more than compensates for the second ionisation enthalpy of copper, so Cu^{2+} is more stable in water and Cu^+ disproportionates. The second ionisation enthalpy works against Cu^{2+}, so it cannot be the reason.

22. Answer: (B) CH_3NC —(i) $LiAlH_4$, (ii) H_3O^+→ Product

Reduction of methyl isocyanide gives N-methylmethanamine, CH_3NHCH_3, a secondary amine. Reduction of the nitrile or the amide gives ethanamine, and the Hofmann bromamide reaction gives methanamine, both primary amines.

23. Answer: (B) allylic halide

The halogen is on an sp^3 carbon directly attached to a C=C double bond, which makes it an allylic halide. It is not benzylic because the carbon bearing X is not bonded to the ring, and not vinylic because X is not on a doubly bonded carbon.

24. Answer: (D) Potassium trioxalatoaluminate (III)

A homoleptic complex has only one kind of ligand; $K_3[Al(C_2O_4)_3]$ contains only oxalate ligands. Each of the others has two or more different ligands (ammine with chlorido/nitrito, carbonato or aqua).

25. Answer: (B) A = $C_6H_5CH_2I$ and B = C_6H_5OH

HI protonates the ether and iodide attacks the benzylic carbon (the aryl–O bond has partial double-bond character and is not cleaved), giving benzyl iodide and phenol. Iodobenzene cannot form because nucleophilic substitution at the aromatic carbon does not occur.

26. Answer: (B) −1381.80 cal

$K = (10 \times 6)/(2 \times 3) = 10$. $\Delta G° = -2.303RT \log K = -2.303 \times 2 \times 300 \times 1 = -1381.8$ cal. A positive value would mean $K < 1$, which contradicts the data.

27. Answer: (A) $\Delta H = \Delta U + \Delta n_g RT$

From $H = U + PV$ and $PV = nRT$ for gases, $\Delta H = \Delta U + \Delta n_g\, RT$, where Δn_g is moles of gaseous products minus gaseous reactants. The minus-sign versions reverse the sign of the $P\Delta V$ work term.

28. Answer: (A) A-III, B-IV, C-I, D-II

$H_2S_2O_8$ has a peroxo S–O–O–S bridge with four S=O and two S–OH; H_2SO_4 has two S=O and two S–OH; $H_2S_2O_7$ has an S–O–S bridge with four S=O and two S–OH; H_2SO_3 has one S=O and two S–OH. This gives A-III, B-IV, C-I, D-II; swapping the peroxo and oxo bridges is the trap.

29. Answer: (B) C and D only

As the oxidation state of vanadium rises from +3 to +5, its oxides become less basic and more acidic, so C is wrong; V_2O_4 dissolves in acids to give oxovanadium(IV) VO^{2+} salts, not VO_4^{3-}, so D is wrong. A, B and E are correct textbook statements.

30. Answer: (B) $[CoCl_2(en)_2]NO_3$

Ethylenediamine is a bidentate chelating ligand, and the chelate effect makes $[CoCl_2(en)_2]^+$ much more stable than the complexes with only monodentate ligands. The hexaammine complex has strong ligands but no chelate rings.

31. Answer: (D) 1, 3, 8

Each $Cr_2O_7^{2-}$ gains 6 electrons (2 Cr from +6 to +3) and each SO_3^{2-} loses 2 (S from +4 to +6), so 1 $Cr_2O_7^{2-}$ reacts with 3 SO_3^{2-}. Balancing O and H gives $Cr_2O_7^{2-} + 3SO_3^{2-} + 8H^+ \rightarrow 2Cr^{3+} + 3SO_4^{2-} + 4H_2O$, i.e. a = 1, b = 3, c = 8.

32. Answer: (D) C_6H_5–CH_2CH_3 (ethylbenzene)

Ethanal is reduced to ethanol, dehydrated to ethene, which adds HBr to give bromoethane; Wurtz–Fittig coupling with bromobenzene and sodium gives ethylbenzene. Butane and biphenyl are only the side products of like-with-like coupling.

33. Answer: (B) A is true but R is false.

Sodium in liquid ammonia gives ammoniated electrons, which cause both the deep blue colour and the paramagnetism, so the assertion is true. Amide ($NaNH_2$) forms only slowly and makes the solution less blue, so the reason is false.

34. Answer: (C) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron.

In the Haber process the gaseous reactants react on solid iron, so the catalyst is in a different phase: heterogeneous catalysis. Acid-catalysed sugar hydrolysis and the gas-phase NO-catalysed reactions have catalyst and reactants in the same phase.

35. Answer: (D) 5

A ccp unit cell has 4 B atoms and 8 tetrahedral voids; A fills 1/3 of them = 8/3. A : B = 8/3 : 4 = 2 : 3, so the formula is A_2B_3 and x + y = 5.

36. Answer: (A) $H_2C = C(Cl) – CH = CH_2$

Neoprene is polychloroprene, made by polymerising chloroprene, 2-chlorobuta-1,3-diene. Isoprene (the methyl analogue) gives natural-rubber type polymer, and buta-1,3-diene is used for Buna rubbers.

37. Answer: (C) Veronal

Veronal (barbital) is a derivative of barbituric acid. Meprobamate is a carbamate, and Valium and chlordiazepoxide are benzodiazepines.

38. Answer: (B) D, E only

The H–H bond dissociation enthalpy (435.9 kJ/mol) is the highest for a single bond between two atoms of any element, so D is wrong; hydrogen reduces oxides of metals less active than iron, not more active ones, so E is wrong. A, B and C are correct uses of hydrogen and heavy water.

39. Answer: (A) 32

Soda-lime decarboxylation: $CH_3COONa + NaOH \rightarrow CH_4 + Na_2CO_3$ (CaO). Methane has M = 16 g/mol, so two moles weigh 32 g. Giving 16 g is the mass of one mole; 30 g would be ethane, which is not formed.

40. Answer: (C) Statement I is incorrect but Statement II is true.

Eutrophication is caused by nutrient enrichment (e.g. phosphates, nitrates), not nutrient deficiency, so Statement I is wrong. The resulting algal bloom and its decay use up dissolved oxygen, so Statement II is true.

41. Answer: (D) $Fe_2O_3 + CO \rightarrow 2FeO + CO_2$

Reduction of Fe_2O_3 by CO to FeO occurs in the cooler upper zone (about 500–800 K). In the 900–1500 K zone, CO_2 is reduced by coke to CO, FeO is reduced to iron, and lime combines with silica to form slag.

42. Answer: (B) 1/4

An edge centre is shared by four unit cells, so only 1/4 of an edge-centred octahedral void belongs to one cell. 1/2 would be the share of a face-centred site.

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