

NEET 2017 — Chemistry Question Paper with Solutions

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

NEET 2017 · Q1

1. HgCl_2 and I_2 both when dissolved in water containing I^- ions the pair of species formed is:

- (A) HgI_2 , I_3^-
- (B) HgI_2 , I^-
- (C) HgI_4^{2-} , I_3^-
- (D) Hg_2I_2 , I^-

NEET 2017 · Q2

2. Predict the correct intermediate and product in the following reaction: $\text{H}_3\text{C}-\text{C}\equiv\text{CH} \xrightarrow{(\text{H}_2\text{O}, \text{H}_2\text{SO}_4, \text{HgSO}_4)} \text{intermediate (A)} \rightarrow \text{product (B)}$

- (A) A: $\text{H}_3\text{C}-\text{C}(\text{SO}_4)=\text{CH}_2$, B: $\text{H}_3\text{C}-\text{CO}-\text{CH}_3$
- (B) A: $\text{H}_3\text{C}-\text{C}(\text{OH})=\text{CH}_2$, B: $\text{H}_3\text{C}-\text{C}(\text{SO}_4)=\text{CH}_2$
- (C) A: $\text{H}_3\text{C}-\text{CO}-\text{CH}_3$, B: $\text{H}_3\text{C}-\text{C}\equiv\text{CH}$
- (D) A: $\text{H}_3\text{C}-\text{C}(\text{OH})=\text{CH}_2$, B: $\text{H}_3\text{C}-\text{CO}-\text{CH}_3$

NEET 2017 · Q3

3. The correct statement regarding electrophile is:

- (A) Electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from a nucleophile
- (B) Electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from another electrophile
- (C) Electrophiles are generally neutral species and can form a bond by accepting a pair of electrons from a nucleophile
- (D) Electrophile can be either neutral or positively charged species and can form a bond by accepting a pair of electrons from a nucleophile

NEET 2017 · Q4

4. Which of the following pairs of compounds is isoelectronic and isostructural?

- (A) BeCl_2 , XeF_2
- (B) TeI_2 , XeF_2
- (C) IBr_2^- , XeF_2
- (D) IF_3 , XeF_2

NEET 2017 · Q5

5. The species, having bond angles of 120° is:

- (A) PH_3
- (B) ClF_3
- (C) NCl_3
- (D) BCl_3

NEET 2017 · Q6

6. Which of the following is a sink for CO?

- (A) Haemoglobin
- (B) Micro organisms present in the soil
- (C) Oceans
- (D) Plants

NEET 2017 · Q7

7. Which one of the following pairs of species have the same bond order?

- (A) CO , NO
- (B) O_2 , NO^+
- (C) CN^- , CO
- (D) N_2 , O_2^-

NEET 2017 · Q9

8. Name the gas that can readily decolourise acidified KMnO_4 solution:

- (A) CO_2
- (B) SO_2
- (C) NO_2
- (D) P_2O_5

NEET 2017 · Q10

9. Which one is the wrong statement?

- (A) de-Broglie's wavelength is given by $\lambda = h/mv$, where m = mass of the particle, v = group velocity of the particle.
- (B) The uncertainty principle is $\Delta E \times \Delta t \geq h/4\pi$
- (C) Half filled and fully filled orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement.
- (D) The energy of 2s orbital is less than the energy of 2p orbital in case of Hydrogen like atoms.

NEET 2017 · Q11

10. Correct increasing order for the wavelengths of absorption in the visible region for the complexes of Co^{3+} is:

- (A) $[\text{Co}(\text{en})_3]^{3+}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
- (B) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$, $[\text{Co}(\text{en})_3]^{3+}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$
- (C) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Co}(\text{en})_3]^{3+}$
- (D) $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Co}(\text{en})_3]^{3+}$, $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$

NEET 2017 · Q12

11. The correct order of the stoichiometries of AgCl formed when AgNO_3 in excess is treated with the complexes: $\text{CoCl}_3 \cdot 6\text{NH}_3$, $\text{CoCl}_3 \cdot 5\text{NH}_3$, $\text{CoCl}_3 \cdot 4\text{NH}_3$ respectively is:

- (A) 1 AgCl , 3 AgCl , 2 AgCl
- (B) 3 AgCl , 1 AgCl , 2 AgCl
- (C) 3 AgCl , 2 AgCl , 1 AgCl
- (D) 2 AgCl , 3 AgCl , 1 AgCl

NEET 2017 · Q13

12. Which one is the most acidic compound?

- (A) p-Cresol (4-methylphenol)
- (B) Phenol
- (C) p-Nitrophenol (4-nitrophenol)
- (D) Picric acid (2,4,6-trinitrophenol)

NEET 2017 · Q14

13. The correct increasing order of basic strength for the following compounds is: (I) aniline, $\text{C}_6\text{H}_5\text{NH}_2$ (II) p-nitroaniline, $\text{p-O}_2\text{N-C}_6\text{H}_4\text{-NH}_2$ (III) p-toluidine, $\text{p-CH}_3\text{-C}_6\text{H}_4\text{-NH}_2$

- (A) $\text{II} < \text{III} < \text{I}$
- (B) $\text{III} < \text{I} < \text{II}$
- (C) $\text{III} < \text{II} < \text{I}$
- (D) $\text{II} < \text{I} < \text{III}$

NEET 2017 · Q15

14. In which pair of ions both the species contain S-S bond?

- (A) $\text{S}_2\text{O}_7^{2-}$, $\text{S}_2\text{O}_3^{2-}$
- (B) $\text{S}_4\text{O}_6^{2-}$, $\text{S}_2\text{O}_3^{2-}$
- (C) $\text{S}_2\text{O}_7^{2-}$, $\text{S}_2\text{O}_8^{2-}$
- (D) $\text{S}_4\text{O}_6^{2-}$, $\text{S}_2\text{O}_7^{2-}$

NEET 2017 · Q16

15. Mixture of chloroxylenol and terpineol acts as:

- (A) analgesic
- (B) antiseptic
- (C) antipyretic
- (D) antibiotic

NEET 2017 · Q17

16. Which one is the correct order of acidity?

- (A) $\text{CH}_2=\text{CH}_2 > \text{CH}_3-\text{CH}=\text{CH}_2 > \text{CH}_3-\text{C}\equiv\text{CH} > \text{CH}\equiv\text{CH}$
- (B) $\text{CH}\equiv\text{CH} > \text{CH}_3-\text{C}\equiv\text{CH} > \text{CH}_2=\text{CH}_2 > \text{CH}_3-\text{CH}_3$
- (C) $\text{CH}\equiv\text{CH} > \text{CH}_2=\text{CH}_2 > \text{CH}_3-\text{C}\equiv\text{CH} > \text{CH}_3-\text{CH}_3$
- (D) $\text{CH}_3-\text{CH}_3 > \text{CH}_2=\text{CH}_2 > \text{CH}_3-\text{C}\equiv\text{CH} > \text{CH}\equiv\text{CH}$

NEET 2017 · Q18

17. The heating of phenyl-methyl ethers with HI produces.

- (A) ethyl chlorides
- (B) iodobenzene
- (C) phenol
- (D) benzene

NEET 2017 · Q24

18. For a given reaction, $\Delta H = 35.5 \text{ kJ mol}^{-1}$ and $\Delta S = 83.6 \text{ J K}^{-1} \text{ mol}^{-1}$. The reaction is spontaneous at: (Assume that ΔH and ΔS do not vary with temperature)

- (A) $T < 425 \text{ K}$
- (B) $T > 425 \text{ K}$
- (C) all temperatures
- (D) $T > 298 \text{ K}$

NEET 2017 · Q25

19. In the electrochemical cell: $\text{Zn}|\text{ZnSO}_4 (0.01 \text{ M})||\text{CuSO}_4 (1.0 \text{ M})|\text{Cu}$, the emf of this Daniel cell is E_1 . When the concentration of ZnSO_4 is changed to 1.0 M and that of CuSO_4 changed to 0.01 M , the emf changes to E_2 . From the followings, which one is the relationship between E_1 and E_2 ? (Given, $RT/F = 0.059$)

- (A) $E_1 = E_2$
- (B) $E_1 < E_2$
- (C) $E_1 > E_2$
- (D) $E_2 = 0 \neq E_1$

NEET 2017 · Q26

20. An example of a sigma bonded organometallic compound is:

- (A) Ruthenocene
- (B) Grignard's reagent
- (C) Ferrocene
- (D) Cobaltocene

NEET 2017 · Q27

21. The equilibrium constants of the following are: $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ K_1 ; $\text{N}_2 + \text{O}_2 \rightleftharpoons 2\text{NO}$ K_2 ; $\text{H}_2 + \frac{1}{2}\text{O}_2 \rightarrow \text{H}_2\text{O}$ K_3 . The equilibrium constant (K) of the reaction: $2\text{NH}_3 + \frac{5}{2}\text{O}_2 \rightleftharpoons 2\text{NO} + 3\text{H}_2\text{O}$, will be:

- (A) $K_1 K_3^3 / K_2$
- (B) $K_2 K_3^3 / K_1$
- (C) $K_2 K_3 / K_1$
- (D) $K_2^3 K_3 / K_1$

NEET 2017 · Q28

22. The element $Z = 114$ has been discovered recently. It will belong to which of the following family/group and electronic configuration?

- (A) Halogen family, $[\text{Rn}] 5f^{14} 6d^{10} 7s^2 7p^5$
- (B) Carbon family, $[\text{Rn}] 5f^{14} 6d^{10} 7s^2 7p^2$
- (C) Oxygen family, $[\text{Rn}] 5f^{14} 6d^{10} 7s^2 7p^4$
- (D) Nitrogen family, $[\text{Rn}] 5f^{14} 6d^{10} 7s^2 7p^6$

NEET 2017 · Q29

23. Pick out the correct statement with respect to $[\text{Mn}(\text{CN})_6]^{3-}$:

- (A) It is sp^3d^2 hybridised and octahedral
- (B) It is sp^3d^2 hybridised and tetrahedral
- (C) It is d^2sp^3 hybridised and octahedral
- (D) It is dsp^2 hybridised and square planar

NEET 2017 · Q31

24. It is because of inability of ns^2 electrons of the valence shell to participate in bonding that:

- (A) Sn^{2+} is reducing while Pb^{4+} is oxidising
- (B) Sn^{2+} is oxidising while Pb^{4+} is reducing
- (C) Sn^{2+} and Pb^{2+} are both oxidising and reducing
- (D) Sn^{4+} is reducing while Pb^{4+} is oxidising

NEET 2017 · Q32

25. Which of the following statements is not correct?

- (A) Insulin maintains sugar level in the blood of a human body.
- (B) Ovalbumin is a simple food reserve in egg - white.
- (C) Blood proteins thrombin and fibrinogen are involved in blood clotting.
- (D) Denaturation makes the proteins more active.

NEET 2017 · Q33

26. Which is the incorrect statement?

- (A) $\text{FeO}_{0.98}$ has non stoichiometric metal deficiency defect.
- (B) Density decreases in case of crystals with Schottky's defect.
- (C) $\text{NaCl}(\text{s})$ is insulator, silicon is semiconductor, silver is conductor, quartz is piezo electric crystal.
- (D) Frenkel defect is favoured in those ionic compounds in which sizes of cation and anions are almost equal.

NEET 2017 · Q35

27. The reason for greater range of oxidation states in actinoids is attributed to:

- (A) the radioactive nature of actinoids
- (B) actinoid contraction
- (C) 5f, 6d and 7s levels having comparable energies
- (D) 4f and 5d levels being close in energies

NEET 2017 · Q36

28. Extraction of gold and silver involves leaching with CN^- ion. Silver is later recovered by:

- (A) liquation
- (B) distillation
- (C) zone refining
- (D) displacement with Zn

NEET 2017 · Q37

29. Ionic mobility of which of the following alkali metal ions is lowest when aqueous solution of their salts are put under an electric field?

- (A) Na
- (B) K
- (C) Rb
- (D) Li

NEET 2017 · Q38

30. Which of the following is dependent on temperature?

- (A) Molality
- (B) Molarity
- (C) Mole fraction
- (D) Weight percentage

NEET 2017 · Q39

31. If molality of the dilute solution is doubled, the value of molal depression constant (K_f) will be:

- (A) doubled
- (B) halved
- (C) tripled
- (D) unchanged

NEET 2017 · Q40

32. Mechanism of a hypothetical reaction $X_2 + Y_2 \rightarrow 2XY$ is given below: (i) $X_2 \rightarrow X + X$ (fast) (ii) $X + Y_2 \rightleftharpoons XY + Y$ (slow) (iii) $X + Y \rightarrow XY$ (fast). The overall order of the reaction will be:

- (A) 1
- (B) 2
- (C) 0
- (D) 1.5

NEET 2017 · Q41

33. Concentration of the Ag^+ ions in a saturated solution of $Ag_2C_2O_4$ is $2.2 \times 10^{-4} \text{ mol L}^{-1}$. Solubility product of $Ag_2C_2O_4$ is:

- (A) 2.42×10^{-8}
- (B) 2.66×10^{-12}
- (C) 4.5×10^{-11}
- (D) 5.3×10^{-12}

NEET 2017 · Q42

34. Match the interhalogen compounds of column I with the geometry in column II and assign the correct code. Column I: (a) XX' (b) XX'_3 (c) XX'_5 (d) XX'_7 . Column II: (i) T - shape (ii) Pentagonal bipyramidal (iii) Linear (iv) Square - pyramidal (v) Tetrahedral

- (A) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)
- (B) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)
- (C) (a)-(v), (b)-(iv), (c)-(iii), (d)-(ii)
- (D) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

NEET 2017 · Q43

35. Which one of the following statements is not correct?

- (A) Catalyst does not initiate any reaction.
- (B) The value of equilibrium constant is changed in the presence of a catalyst in the reaction at equilibrium.
- (C) Enzymes catalyse mainly bio-chemical reactions.
- (D) Coenzymes increase the catalytic activity of enzyme.

NEET 2017 · Q44

36. Consider the reactions: $X (C_2H_6O) \xrightarrow{(Cu/573 K)} A$; $A \xrightarrow{([Ag(NH_3)_2]^+, ^-OH, \Delta)} \text{Silver mirror observed}$; $A \xrightarrow{(^-OH, \Delta)} Y$; $A \xrightarrow{(NH_2-NH-CO-NH_2)} Z$. Identify A, X, Y and Z

- (A) A-Methoxymethane, X-Ethanoic acid, Y-Acetate ion, Z-hydrazine.
- (B) A-Methoxymethane, X-Ethanol, Y-Ethanoic acid, Z-Semicarbazide.
- (C) A-Ethanal, X-Ethanol, Y-But-2-enal, Z-Semicarbazone.
- (D) A-Ethanol, X-Acetaldehyde, Y-Butanone, Z-Hydrazone.

NEET 2017 · Q45

37. Which of the following reactions is appropriate for converting acetamide to methanamine?

- (A) Carbylamine reaction
- (B) Hoffmann hypobromamide reaction
- (C) Stephens reaction
- (D) Gabriels phthalimide synthesis

Answer key and explanations

1. Answer: (C) HgI_4^{2-} , I_3^-

In excess iodide, HgCl_2 first gives HgI_2 , which dissolves in more I^- as the complex HgI_4^{2-} (as in Nessler's reagent), while I_2 combines with I^- to form the triiodide ion I_3^- . HgI_2 cannot remain as such because excess I^- is present.

2. Answer: (D) A: $\text{H}_3\text{C}-\text{C}(\text{OH})=\text{CH}_2$, B: $\text{H}_3\text{C}-\text{CO}-\text{CH}_3$

Mercuric-ion catalysed hydration of propyne adds water by Markovnikov's rule, giving the enol $\text{CH}_3-\text{C}(\text{OH})=\text{CH}_2$. The enol is unstable and tautomerises to the ketone, acetone (CH_3COCH_3). No sulphate-containing product is formed.

3. Answer: (D) Electrophile can be either neutral or positively charged species and can form a bond by accepting a pair of electrons from a nucleophile

An electrophile is an electron-deficient species: it may be positively charged (H^+ , NO_2^+) or neutral (BF_3 , AlCl_3 , carbonyl carbon), and it bonds by accepting an electron pair from a nucleophile. Saying electrophiles are 'generally neutral' ignores the many cationic electrophiles, and negatively charged species are nucleophiles.

4. Answer: (C) IBr_2^- , XeF_2

XeF_2 and IBr_2^- both have 22 valence electrons ($8 + 14$ and $7 + 14 + 1$) and both have three lone pairs on the central atom with two bonds, giving a linear shape. BeCl_2 is linear but has only 16 valence electrons, and TeI_2 is bent.

5. Answer: (D) BCl_3

BCl_3 has sp^2 boron with no lone pair, so it is trigonal planar with 120° angles. PH_3 and NCl_3 are pyramidal (angles below 109.5°) and ClF_3 is T-shaped (angles near 90°).

6. Answer: (B) Micro organisms present in the soil

Soil microorganisms remove carbon monoxide from the atmosphere by oxidising it, so the soil acts as the natural sink for CO. Haemoglobin binds CO in the body but is not an environmental sink, and oceans are a major sink for CO_2 , not CO.

7. Answer: (C) CN^- , CO

CN^- and CO are both 14-electron species, isoelectronic with N_2 , so each has bond order 3. NO has 2.5 against 3 for CO, O_2 has 2 against 3 for NO^+ , and O_2^- has 1.5 against 3 for N_2 .

8. Answer: (B) SO_2

SO_2 is a strong reducing agent: it reduces purple MnO_4^- to nearly colourless Mn^{2+} while being oxidised to sulphate, and NCERT gives this decolourisation as a test for SO_2 . CO_2 and P_2O_5 are not reducing, and NO_2 is itself an oxidising agent rather than the gas known for this test.

9. Answer: (D) The energy of 2s orbital is less than the energy of 2p orbital in case of Hydrogen like atoms.

In hydrogen-like (one-electron) species the energy depends only on n , so 2s and 2p are degenerate; the 2s-below-2p order holds only for multi-electron atoms. The other statements are correct: $\lambda = h/mv$, $\Delta E \cdot \Delta t \geq h/4\pi$, and half/fully filled subshells are extra stable.

10. Answer: (A) $[\text{Co}(\text{en})_3]^{3+}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$

Field strength follows the spectrochemical series $\text{en} > \text{NH}_3 > \text{H}_2\text{O}$, so Δ_o is largest for the en complex. Absorbed wavelength is inversely related to Δ_o ($\lambda = hc/\Delta_o$), so the order of increasing wavelength is $[\text{Co}(\text{en})_3]^{3+} < [\text{Co}(\text{NH}_3)_6]^{3+} < [\text{Co}(\text{H}_2\text{O})_6]^{3+}$. Writing the reverse order confuses increasing Δ_o with increasing wavelength.

11. Answer: (C) 3 AgCl, 2 AgCl, 1 AgCl

The complexes are $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$, $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ and $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$. Only chloride outside the coordination sphere is precipitated by Ag^+ , giving 3, 2 and 1 mol AgCl respectively.

12. Answer: (D) Picric acid (2,4,6-trinitrophenol)

Electron-withdrawing $-\text{NO}_2$ groups at ortho and para positions stabilise the phenoxide ion by resonance, so acidity rises with the number of nitro groups; 2,4,6-trinitrophenol (pK_a about 0.4) is the strongest acid. The methyl group of p-cresol is electron-donating and makes it weaker than phenol.

13. Answer: (D) II < I < III

The electron-donating $-\text{CH}_3$ at the para position increases electron density on nitrogen, so p-toluidine is more basic than aniline, while the $-\text{NO}_2$ group withdraws the lone pair by resonance and makes p-nitroaniline the weakest base. Hence II < I < III.

14. Answer: (B) $\text{S}_4\text{O}_6^{2-}$, $\text{S}_2\text{O}_3^{2-}$

Thiosulphate $\text{S}_2\text{O}_3^{2-}$ has one sulphur bonded directly to the central S, and tetrathionate $\text{S}_4\text{O}_6^{2-}$ has an -S-S- chain between two SO_3 groups. Disulphate $\text{S}_2\text{O}_7^{2-}$ has an S-O-S bridge and peroxodisulphate $\text{S}_2\text{O}_8^{2-}$ an S-O-O-S bridge, with no S-S bond.

15. Answer: (B) antiseptic

A mixture of chloroxylenol and terpineol is the antiseptic Dettol, applied to living tissue to stop microbial growth. It does not relieve pain or fever and is not a microbially derived antibiotic.

16. Answer: (B) $\text{CH}\equiv\text{CH} > \text{CH}_3\text{-C}\equiv\text{CH} > \text{CH}_2=\text{CH}_2 > \text{CH}_3\text{-CH}_3$

Acidity of C-H rises with s-character of the carbon: sp (50%) > sp^2 (33%) > sp^3 (25%), so alkynes > alkenes > alkanes. Between the alkynes, the electron-donating methyl group makes propyne less acidic than ethyne, which is why ethene cannot be placed above propyne.

17. Answer: (C) phenol

HI protonates anisole and I^- attacks the methyl carbon by $\text{S}_\text{N}2$, giving phenol and CHI_3 . Iodobenzene does not form because the aryl C-O bond has partial double-bond character and $\text{S}_\text{N}2$ attack on an sp^2 ring carbon does not occur.

18. Answer: (B) $T > 425 \text{ K}$

$\Delta G = \Delta H - T\Delta S$ is negative when $T > \Delta H/\Delta S = 35500 / 83.6 \approx 425 \text{ K}$. Both ΔH and ΔS are positive, so the reaction is non-spontaneous at low temperature and becomes spontaneous only above 425 K; it is not spontaneous at all temperatures.

19. Answer: (C) $E_1 > E_2$

$E = E^\circ - (0.059/2) \log([\text{Zn}^{2+}]/[\text{Cu}^{2+}])$. For E_1 the ratio is 0.01/1 so $E_1 = E^\circ + 0.059 \text{ V}$; for E_2 the ratio is 1/0.01 so $E_2 = E^\circ - 0.059 \text{ V}$. Hence $E_1 > E_2$; reversing the concentrations does not make the emf zero.

20. Answer: (B) Grignard's reagent

In a Grignard reagent RMgX the alkyl carbon is joined to magnesium by a single σ bond. Ferrocene, ruthenocene and cobaltocene are sandwich compounds in which the metal is π -bonded to cyclopentadienyl rings.

21. Answer: (B) $\text{K}_2\text{K}_3^3/\text{K}_1$

The required reaction = (reverse of the NH_3 formation) + (NO formation) + $3 \times (\text{H}_2\text{O formation})$: $2\text{NH}_3 \rightarrow \text{N}_2 + 3\text{H}_2$ ($1/\text{K}_1$), $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$ (K_2), $3\text{H}_2 + 3/2 \text{O}_2 \rightarrow 3\text{H}_2\text{O}$ (K_3^3). Adding reactions multiplies constants, so $\text{K} = \text{K}_2\text{K}_3^3/\text{K}_1$.

22. Answer: (B) Carbon family, $[\text{Rn}] 5\text{f}^{14} 6\text{d}^{10} 7\text{s}^2 7\text{p}^2$

After radon ($Z = 86$), 32 more electrons fill $7\text{s}^2 5\text{f}^{14} 6\text{d}^{10} 7\text{p}^2$, reaching $Z = 86 + 2 + 14 + 10 + 2 = 114$. A p^2 valence configuration places it in group 14, the carbon family (flerovium).

23. Answer: (C) It is d^2sp^3 hybridised and octahedral

Mn^{3+} is 3d^4 . CN^- is a strong-field ligand, so the four electrons pair into three 3d orbitals, leaving two inner 3d orbitals free; with 4s and 4p they give d^2sp^3 hybridisation and an octahedral (inner-orbital) complex. sp^3d^2 would apply to a weak-field outer-orbital complex.

24. Answer: (A) Sn^{2+} is reducing while Pb^{4+} is oxidising

The inert pair effect makes the +2 state more stable down group 14. For tin the +4 state is still the more stable, so Sn^{2+} tends to lose electrons and acts as a reducing agent; for lead the +2 state is more stable, so Pb^{4+} gains electrons and acts as an oxidising agent.

25. Answer: (D) Denaturation makes the proteins more active.

Denaturation destroys the secondary and tertiary structure of a protein, so it loses its biological activity rather than gaining it. The other statements are correct: insulin regulates blood glucose, ovalbumin is the storage protein of egg white, and thrombin and fibrinogen take part in clotting.

26. Answer: (D) Frenkel defect is favoured in those ionic compounds in which sizes of cation and anions are almost equal.

Frenkel defects occur when the cation is much smaller than the anion (AgCl , ZnS), so the small cation can move into an interstitial site; similar-sized ions favour Schottky defects instead. $\text{FeO}_{0.98}$ is metal deficient, and Schottky defects lower density because ions are missing.

27. Answer: (C) 5f, 6d and 7s levels having comparable energies

In actinoids the 5f, 6d and 7s orbitals are close in energy, so varying numbers of electrons from all three can be used in bonding, giving many oxidation states. 4f and 5d levels belong to the lanthanoids, and radioactivity or contraction does not create extra oxidation states.

28. Answer: (D) displacement with Zn

Leaching with cyanide forms the soluble complex $[\text{Ag}(\text{CN})_2]^-$. Zinc, being more electropositive, displaces silver: $2[\text{Ag}(\text{CN})_2]^- + \text{Zn} \rightarrow [\text{Zn}(\text{CN})_4]^{2-} + 2\text{Ag}$. Liquation, distillation and zone refining are refining methods, not recovery from the cyanide solution.

29. Answer: (D) Li

Li^+ is the smallest alkali metal ion, so it has the highest charge density and is the most heavily hydrated. Its large hydrated radius makes it move most slowly in solution, so Li^+ has the lowest ionic mobility even though the bare ion is the smallest.

30. Answer: (B) Molarity

Molarity is moles per litre of solution, and the volume of a solution changes with temperature, so molarity changes too. Molality, mole fraction and weight percentage involve only masses or mole numbers, which do not depend on temperature.

31. Answer: (D) unchanged

K_f is a property of the solvent alone ($K_f = R \cdot M \cdot T_f^2 / 1000 \Delta H_{\text{fus}}$), so it does not change with concentration. Doubling the molality doubles the depression $\Delta T_f = K_f \cdot m$, not K_f itself.

32. Answer: (D) 1.5

The slow step gives rate $= k[X][Y_2]$. X comes from the fast pre-equilibrium $X_2 \rightleftharpoons 2X$, so $[X] = \sqrt{K[X_2]}$ and rate $= k'[X_2]^{1/2}[Y_2]$. The overall order is $1/2 + 1 = 1.5$; taking the slow step's molecularity of 2 as the order ignores that X is an intermediate.

33. Answer: (D) 5.3×10^{-12}

$\text{Ag}_2\text{C}_2\text{O}_4 \rightleftharpoons 2\text{Ag}^+ + \text{C}_2\text{O}_4^{2-}$, so $[\text{C}_2\text{O}_4^{2-}] = \frac{1}{2} \times 2.2 \times 10^{-4} = 1.1 \times 10^{-4} \text{ M}$. $K_{\text{sp}} = [\text{Ag}^+]^2[\text{C}_2\text{O}_4^{2-}] = (2.2 \times 10^{-4})^2 \times 1.1 \times 10^{-4} = 4.84 \times 10^{-8} \times 1.1 \times 10^{-4} \approx 5.3 \times 10^{-12}$. Forgetting to square $[\text{Ag}^+]$ gives a wrong value.

34. Answer: (B) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

XX' is diatomic and linear. XX'_3 has 3 bond pairs and 2 lone pairs (sp^3d), giving a T shape; XX'_5 has 5 bond pairs and 1 lone pair (sp^3d^2), giving a square pyramid; XX'_7 has 7 bond pairs (sp^3d^3), giving a pentagonal bipyramid.

35. Answer: (B) The value of equilibrium constant is changed in the presence of a catalyst in the reaction at equilibrium.

A catalyst speeds up the forward and backward reactions equally, so equilibrium is reached sooner but the equilibrium constant stays the same. The other statements are correct: a catalyst cannot start a reaction that is not feasible, enzymes are biological catalysts, and coenzymes enhance enzyme activity.

36. Answer: (C) A-Ethanal, X-Ethanol, Y-But-2-enal, Z-Semicarbazone.

$\text{C}_2\text{H}_6\text{O}$ that is dehydrogenated by Cu at 573 K must be ethanol, giving ethanal as A, which gives the silver mirror with Tollens' reagent. With dilute alkali and heat ethanal undergoes aldol condensation to but-2-enal as Y, and with semicarbazide it forms the semicarbazone Z. Methoxymethane is also $\text{C}_2\text{H}_6\text{O}$ but cannot be dehydrogenated to an aldehyde.

37. Answer: (B) Hoffmann hypobromamide reaction

$\text{CH}_3\text{CONH}_2 + \text{Br}_2 + 4\text{NaOH} \rightarrow \text{CH}_3\text{NH}_2 + \text{Na}_2\text{CO}_3 + 2\text{NaBr} + 2\text{H}_2\text{O}$: the Hoffmann bromamide (hypobromite) degradation gives an amine with one carbon fewer, exactly acetamide to methanamine. Gabriel synthesis starts from an alkyl halide, Stephens reduction gives aldehydes from nitriles, and the carbylamine reaction is a test for primary amines.

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