NEET Chemistry Sample Paper 02

A) Subject: Chemistry
B) Total Questions: 45 Questions (All Compulsory)
C) Marking Scheme & Rules:

- Correct Answer: +4 marks
- Incorrect Answer: -1 mark (Negative marking)
- Unattempted Question: 0 marks
- Multiple Answers: Treated as incorrect, attracting -1 mark

Q1. A gas expands by 0.5 L against a constant external pressure of 1 atm. The work done is used to heat 10 moles of water at 290 K. Given 1 L-atm = 101.3 J, the final temperature of water will be (C_p for water = 75 J mol^{-1} K^{-1}):

A. 290.14 K
B. 290.067 K
C. 291 K
D. 290.5 K

Q2. The decomposition of N_2O_5 in CCl_4 at 318 K has a rate constant of 6.2×10^{-4} s^{-1}. What is the half-life of this reaction?

A. 1117 s
B. 100 s
C. 500 s
D. 2234 s

Q3. Resistance of 0.1 M KCl is 100 Ω. If resistance of 0.02 M KCl in the same cell is 520 Ω, calculate molar conductivity of 0.02 M KCl (Conductivity of 0.1 M KCl is 1.29 S/m):

A. 124×10^{-4} S m^2 mol^{-1}
B. 12.4×10^{-4} S m^2 mol^{-1}
C. 1.24 S m^2 mol^{-1}
D. 124 S m^2 mol^{-1}

Q4. Which of the following aqueous solutions will exhibit the highest boiling point elevation?

A. 0.1 M Urea
B. 0.1 M NaCl
C. 0.1 M $MgCl_2$
D. 0.1 M $AlCl_3$

Q5. For a reaction to be spontaneous at all temperatures, the conditions must be:

A. $\Delta H = +\text{ve}, \Delta S = +\text{ve}$
B. $\Delta H = -\text{ve}, \Delta S = -\text{ve}$
C. $\Delta H = -\text{ve}, \Delta S = +\text{ve}$
D. $\Delta H = +\text{ve}, \Delta S = -\text{ve}$

Q6. The pH of a buffer solution containing 0.1 M acetic acid and 0.1 M sodium acetate (pK_a of $CH_3COOH = 4.74$) is:

A. 4.74
B. 5.74
C. 3.74
D. 7.0

Q7. The unit of the rate constant for a second-order reaction is:
A. s^{-1}
B. mol L^{-1} s^{-1}
C. L mol^{-1} s^{-1}
D. L^2 mol^{-2} s^{-1}

Q8. At 25°C, the K_{sp} of $Mg(OH)_2$ is 1.0×10^{-11}. At which pH will Mg^{2+} ions start precipitating from a solution containing 0.001 M Mg^{2+} ions?
A. 9
B. 10
C. 11
D. 8

Q9. How many atoms are present in a unit cell of a body-centered cubic (BCC) crystal?
A. 1
B. 2
C. 3
D. 4

Q10. The work done during expansion of a gas from 4 dm^3 to 6 dm^3 against a constant external pressure of 3 atm is (1 L-atm = 101.32 J):
A. −6 J
B. −608 J
C. +304 J
D. −304 J

Q11. In the electrolytic cell, the flow of electrons is from:
A. Cathode to anode in solution
B. Cathode to anode through external supply
C. Anode to cathode through external supply
D. Anode to cathode in solution

Q12. Which of the following is not a property of hydrophilic sols?
A. High concentration of dispersed phase
B. Reversible nature
C. Coagulation by small amounts of electrolytes
D. High viscosity

Q13. The number of moles of $KMnO_4$ reduced by 1 mole of KI in alkaline medium is:
A. 1
B. 2
C. 5
D. 1/2

Q14. The wavelength of a particle with mass 1 g moving with velocity 100 m/s is

($h = 6.6 \times 10^{-34}$ J s):
A. 6.6×10^{-33} m
B. 6.6×10^{-35} m
C. 6.6×10^{-30} m
D. 6.6×10^{-25} m

Q15. The osmotic pressure of a solution can be increased by:
A. Increasing volume
B. Increasing temperature
C. Decreasing solute concentration
D. Removing semi-permeable membrane

Q16. Which of the following pairs of ions are isoelectronic and isostructural?
A. CO_3^{2-}, NO_3^-
B. ClO_3^-, CO_3^{2-}
C. SO_3^{2-}, NO_3^-
D. ClO_3^-, SO_3^{2-}

Q17. The correct order of atomic radii for the following elements is:
A. Li ¿ Be ¿ B ¿ C
B. Li ¡ Be ¡ B ¡ C
C. C ¿ B ¿ Be ¿ Li
D. B ¿ C ¿ Be ¿ Li

Q18. The maximum oxidation state shown by any transition element is:
A. +7
B. +8
C. +6
D. +5

Q19. Which of the following is the strongest oxidizing agent?
A. F_2
B. Cl_2
C. Br_2
D. I_2

Q20. The hybridization of Ni in $[Ni(CO)_4]$ is:
A. sp^3
B. dsp^2
C. sp^3d
D. sp^3d^2

Q21. Lanthanoid contraction is caused by:
A. Poor shielding of 4f electrons
B. Effective shielding of 4f electrons
C. Increase in nuclear charge
D. Both A and C

Q22. Which of the following phosphorus oxyacids is a reducing agent and also monobasic?
A. H_3PO_4

B. H_3PO_3
C. H_3PO_2
D. $H_4P_2O_7$

Q23. The shape of XeF_2 is:
A. Linear
B. Bent
C. V-shape
D. T-shape

Q24. Which of the following transition metal ions is colorless in aqueous solution?
A. Ti^{4+}
B. V^{3+}
C. Cr^{3+}
D. Fe^{3+}

Q25. The correct order of basic strength of group 15 hydrides is:
A. $NH_3 > PH_3 > AsH_3 > SbH_3$
B. $NH_3 < PH_3 < AsH_3 < SbH_3$
C. $PH_3 > NH_3 > AsH_3 > SbH_3$
D. $AsH_3 > SbH_3 > NH_3 > PH_3$

Q26. $KMnO_4$ acts as oxidizing agent in acidic medium. Moles of $KMnO_4$ needed to react with one mole of S^{2-} ions in acidic solution:
A. 2/5
B. 3/5
C. 4/5
D. 1/5

Q27. Which of the following ligands forms a chelate?
A. Acetate
B. Oxalate
C. Cyanide
D. Ammonia

Q28. The bond order in O_2^+ is:
A. 2
B. 2.5
C. 1.5
D. 3

Q29. Which of the following is a "p-block" element?
A. Al
B. Mg
C. Sc
D. Zn

Q30. The geometry of SF_6 is:
A. Octahedral
B. Tetrahedral

C. Trigonal bipyramidal
D. Square planar

Q31. The IUPAC name of the compound $CH_3 - CH(OH) - CH_2 - CHO$ is:
A. 3-hydroxybutanal
B. 2-hydroxybutanal
C. 3-hydroxybutanol
D. 3-oxobutanol

Q32. Which of the following carbocations is the most stable?
A. $(CH_3)_3C^+$
B. $(CH_3)_2CH^+$
C. $CH_3CH_2^+$
D. CH_3^+

Q33. Propene reacts with HBr in the presence of peroxide to give:
A. 1-bromopropane
B. 2-bromopropane
C. 1,2-dibromopropane
D. 2,2-dibromopropane

Q34. Which of the following will undergo Cannizzaro reaction?
A. CH_3CHO
B. HCHO
C. CH_3CH_2CHO
D. CH_3COCH_3

Q35. The reaction of CH_3MgBr with formaldehyde followed by hydrolysis gives:
A. Ethanol
B. Methanol
C. Propanol
D. 2-propanol

Q36. Phenol is more acidic than ethanol because:
A. Phenoxide ion is resonance stabilized
B. Ethoxide ion is resonance stabilized
C. Phenol has more carbon atoms
D. Phenol is aromatic

Q37. The monomer of Teflon is:
A. Vinyl chloride
B. Tetrafluoroethene
C. Isoprene
D. Styrene

Q38. Which of the following is a primary amine?
A. $(CH_3)_2NH$
B. CH_3NH_2
C. $(CH_3)_3N$
D. $C_6H_5NHCH_3$

Q39. Glucose reacts with NH_2OH to give an oxime. This indicates the presence of:
A. Carbonyl group
B. Hydroxyl group
C. Carboxyl group
D. Five carbon atoms

Q40. Which of the following is used as an antiseptic?
A. Iodoform
B. Chloroform
C. Carbon tetrachloride
D. DDT

Q41. Heating an alcohol with concentrated H_2SO_4 at 443 K yields:
A. Alkene
B. Ether
C. Alkane
D. Ester

Q42. Which of the following tests is used to distinguish between aldehydes and ketones?
A. Tollen's test
B. Iodoform test
C. Lucas test
D. Ninhydrin test

Q43. The linkage present in DNA is:
A. Peptide linkage
B. Glycosidic linkage
C. Phosphodiester linkage
D. Hydrogen linkage

Q44. The reaction of CH_3COCl with H_2 in the presence of $Pd/BaSO_4$ gives:
A. CH_3CHO
B. CH_3CH_2OH
C. CH_3COOH
D. CH_4

Q45. Which of the following is a non-reducing sugar?
A. Maltose
B. Lactose
C. Sucrose
D. Cellobiose

Answer& Explanations

1. **(B)** $W = -P\Delta V = -1$ atm $\times$ 0.5 L $= -0.5$ L-atm $= -50.65$ J. Magnitude of energy is $Q = nC_p\Delta T \implies 50.65 = 10 \times 75 \times \Delta T \implies \Delta T = 0.0675$. $T_f = 290 + 0.067 = 290.067$ K.

2. **(A)** For 1st order: $t_{1/2} = 0.693/k = 0.693/(6.2 \times 10^{-4}) \approx 1117$ s.

3. **(B)** Cell constant $G^* = \kappa \cdot R = 1.29 \times 100 = 129$ m^{-1}. For 0.02 M: $\kappa = G^*/R = 129/520 = 0.248$ S/m. $\Lambda_m = \kappa/C = 0.248/20 = 0.0124 = 12.4 \times 10^{-4}$ S m^2 mol^{-1}.

4. **(D)** Boiling point elevation $\Delta T_b \propto i$. $AlCl_3$ dissociates into 4 ions ($i = 4$), which is the highest.

5. **(C)** $\Delta G = \Delta H - T\Delta S$. For ΔG to be negative at all T, ΔH must be negative and ΔS must be positive.

6. **(A)** $pH = pK_a + \log([\text{Salt}]/[\text{Acid}])$. Since [Salt] = [Acid], $pH = pK_a = 4.74$.

7. **(C)** Rate $= k[A]^2 \implies$ mol L^{-1} s^{-1} $= k$(mol L^{-1})^2. Rearranging: $k =$ L mol^{-1} s^{-1}.

8. **(B)** $K_{sp} = [Mg^{2+}][OH^-]^2 \implies 10^{-11} = (10^{-3})[OH^-]^2 \implies [OH^-] = 10^{-4}$. $pOH = 4$, so $pH = 10$.

9. **(B)** BCC has 8 corner atoms ($8 \times 1/8 = 1$) and 1 center atom (1). Total = 2 atoms.

10. **(B)** $W = -P\Delta V = -3$ atm $\times$ 2 L $= -6$ L-atm $= -6 \times 101.32 = -607.9$ J.

11. **(C)** Electrons flow from anode (oxidation) to cathode (reduction) through external circuit.

12. **(C)** Hydrophilic (lyophilic) sols are stable and not easily coagulated by electrolytes.

13. **(B)** In alkaline medium: $2MnO_4^- + I^- + H_2O \rightarrow 2MnO_2 + IO_3^- + 2OH^-$. (Ratio is 2:1).

14. **(A)** $\lambda = h/mv = (6.6 \times 10^{-34})/(10^{-3} \cdot 100) = 6.6 \times 10^{-33}$ m.

15. **(B)** $\Pi = CRT$. Osmotic pressure is proportional to absolute temperature.

16. **(A)** Both have 32 valence electrons and are trigonal planar.

17. **(A)** Radius decreases across a period due to increased nuclear charge.

18. **(B)** Os and Ru can show +8 oxidation states.

19. **(A)** F_2 has the highest SRP (Standard Reduction Potential).

20. **(A)** Ni(0) is $3d^8 4s^2$. Strong field CO causes pairing to $3d^{10}$, leaving $4s$ and $4p$ for sp^3.

21. **(D)** Poor shielding of 4f and increasing nuclear charge pull electrons in.

22. **(C)** H_3PO_2 has two P-H bonds (reducing) and one P-OH bond (monobasic).

23. **(A)** 2 BPs and 3 LPs (equatorial) result in a linear molecular shape.

24. **(A)** Ti^{4+} is $3d^0$. No d-d transitions are possible, hence it is colorless.
25. **(A)** Basic strength decreases down the group due to decrease in lone pair density.
26. **(A)** Equivalents: $n_1M_1 = n_2M_2 \implies 5 \cdot \text{moles} = 2 \cdot 1 \implies \text{moles} = 2/5$.
27. **(B)** Oxalate is bidentate and forms a stable ring (chelate).
28. **(B)** O_2 (2.0) $\rightarrow O_2^+$ (2.5) because electron is removed from antibonding orbital.
29. **(A)** Last electron of Al enters 3p subshell.
30. **(A)** sp^3d^2 hybridization with zero lone pairs gives octahedral geometry.
31. **(A)** Aldehyde group (-CHO) has priority; it is a 4-carbon chain.
32. **(A)** Tertiary carbocations are stabilized by +I and 9 hyperconjugative H-atoms.
33. **(A)** Peroxide effect (Kharasch) results in Anti-Markovnikov addition of HBr.
34. **(B)** HCHO lacks α-hydrogen and undergoes disproportionation.
35. **(A)** $HCHO + CH_3MgBr \xrightarrow{H_2O} CH_3CH_2OH$ (Ethanol).
36. **(A)** Phenoxide ion is stabilized by delocalization over the benzene ring.
37. **(B)** Teflon is poly(tetrafluoroethene).
38. **(B)** Methylamine (CH_3NH_2) has one N-C bond.
39. **(A)** Reaction with NH_2OH is characteristic of the carbonyl group.
40. **(B)** Intermolecular dehydration at lower temperature (413 K) forms ethers.
41. **(A)** High temperature (443 K) causes intramolecular dehydration to alkenes.
42. **(A)** Tollen's reagent is reduced by aldehydes (silver mirror) but not by simple ketones.
43. **(C)** Nucleotides in DNA/RNA are joined by 3'-5' phosphodiester bonds.
44. **(A)** Rosenmund reduction converts acid chlorides to aldehydes.
45. **(C)** In sucrose, reducing groups of glucose and fructose are locked in the glycosidic bond.