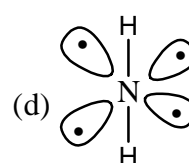
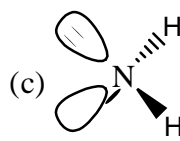
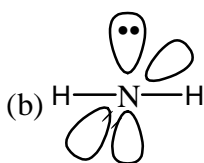
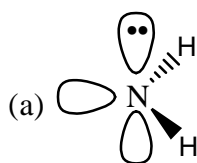




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SECTION-A

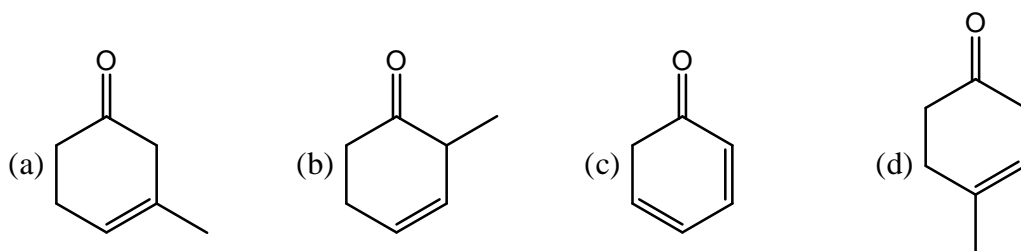
- The ground state term symbol for Eu^{3+} is
 (a) 7F_0 (b) 7F_6 (c) 3F_0 (d) 3F_6
- Which of the following compound would be drawn most strongly into a magnetic field?
 (a) TiCl_4 (b) VCl_3 (c) FeCl_2 (d) CuCl_2
- Which of the following correctly represents the balanced chemical reaction between aluminum and sulfur?
 (a) $16\text{Al} + 3\text{S}_8 \longrightarrow 8\text{Al}_2\text{S}_3$ (b) $12\text{Al} + \text{S}_8 \longrightarrow 4\text{Al}_3\text{S}_2$
 (c) $8\text{Al} + \text{S}_8 \longrightarrow 8\text{AlS}$ (d) $4\text{Al} + \text{S}_8 \longrightarrow 8\text{AlS}_2$
- When two ionic compounds are dissolved in water, a double replacement reaction can
 (a) Never occur since all ions in water are "spectator ions"
 (b) Occur if two of the ions form an insoluble ionic compound, which precipitates out of solution
 (c) Occur if the ions react to form a gas, which bubbles out of the solution
 (d) Occur only if the ions form covalent bonds with each other.
- Which Bronsted acid (H_2O or $\text{H}_2\text{S}_{(\text{aq})}$) is the stronger acid and why is it the stronger acid?
 (a) H_2O is the stronger acid because oxygen has a greater electronegativity than sulfur, which gives the attached hydrogen atom more proton character
 (b) H_2O is the stronger acid because H_2S is a gas and gases are not acids.
 (c) H_2S is the stronger acid because the hydrogen-sulfur bond is much weaker than the hydrogen-oxygen bond due to a greater difference in atomic orbital energy levels.
 (d) H_2S is the stronger acid because it is a heavier molecule and therefore has more energetic collisions.
- The common features among the species CN , CO , and NO are
 (a) Bond order three and iso-electronic
 (b) Bond order three and weak-field ligands
 (c) Bond order two and stronger-field ligands
 (d) Iso-electronic and weak-field ligands
- The central atom in BrF_5 has ? bonding pairs of electrons and ? non-bonding pairs of electrons
 (a) 1 and 5 (b) 0 and 5 (c) 5 and 1 (d) 5 and 0
- Which of the following best represents the three-dimensional view of H_2N^+ ion?



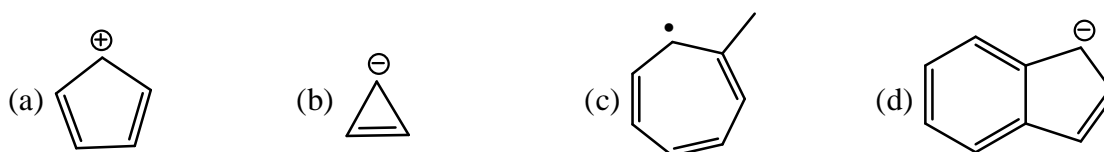
9. What you call an element if it has 18 electrons in penultimate shell and 3 electrons in outer most shell?
 (a) s block element (b) p block element (c) d block element (d) f block element
10. What is the geometry of $[\text{AuCl}_4]^-$ complex ion?
 (a) Square-planar (b) Tetrahedral
 (c) Trigonal monopyramidal (d) See-saw
11. The complex ions $[\text{Cr}(\text{en})_2\text{ClBr}]\text{Br}$ and $[\text{Cr}(\text{en})_2\text{Br}_2]\text{Cl}$ are called (where “en” stands for ethylene diamine):
 (a) Optical isomers (b) Linkage isomers (c) Geometrical isomers (d) Ionisation isomers
12. The correct formula of the compound whose name is hexaamminechromium (III) nitrate is
 (a) $[\text{Cr}(\text{NH}_2)_6](\text{NO}_3)_3$ (b) $[\text{Cr}(\text{NH}_3)_6](\text{NO}_2)_3$
 (c) $[\text{Cr}(\text{NH}_3)_6](\text{NO}_3)_3$ (d) $[\text{Cr}(\text{NO}_3)_3](\text{NH}_3)_6$
13. The expected spin-only magnetic moments for $[\text{Fe}(\text{CN})_6]^{4-}$ and $[\text{FeF}_6]^{3-}$ are
 (a) 1.73 and 1.73 B.M. (b) 1.73 and 5.92 B.M.
 (c) 0.0 and 1.73 B.M. (d) 0.0 and 5.92 B.M.
14. The molecule $[\text{Pt}(\text{NH}_3)(\text{OH}_2)\text{BrCl}]$ is square planar. How many geometrical isomers of this molecule can exist?
 (a) 2 (b) 3 (c) 4 (d) 6
15. Which statement about octahedral complex ions is correct?
 (a) A C_3 axis makes the d_{xy} , d_{xz} and d_{yz} orbitals indistinguishable, or degenerate
 (b) A C_3 axis destabilizes the d_{xy} , d_{xz} and d_{yz} orbitals relative to the $d_{x^2-y^2}$ and d_x^2 orbitals
 (c) The donor atoms of the ligands point directly toward the d_{xy} , d_{xz} and d_{yz} orbitals.
 (d) The t_{2g} orbitals are destabilized by $+3/5\Delta_0$
16. Which equation best represents the first ionization energy of magnesium?
 (a) $\text{Mg}(s) \rightarrow \text{Mg}^+(s) + e^-$ (b) $\text{Mg}(g) \rightarrow \text{Mg}^{3+}(g) + 2e^-$
 (c) $\text{Mg}(s) \rightarrow \text{Mg}^+(g) + e^-$ (d) $\text{Mg}(s) \rightarrow \text{Mg}^+(g) + e^-$
17. Which pair of species describes the correct increasing order of the property given?
 (a) Covalent character : HI, HBr (b) Ionic radius : Mg, Mg^{2+}
 (c) Melting point : I_2 , Br_2 (d) First ionization potential : O, S
18. Consider the following nuclear reaction
 ${}^{60}\text{Ni}_{28} + \alpha \rightarrow X \rightarrow {}^{63}\text{Zn}_{30} + Y$
 The X and Y are
 (a) ${}^{63}\text{Zn}_{30}$ and neutron (b) ${}^{63}\text{Zn}_{30}$ and β particle
 (c) ${}^{64}\text{Zn}_{31}$ and proton (d) ${}^{64}\text{Zn}_{32}$ and neutron
19. The reaction between hexacyanoferrate (III) and iodide ion in strongly acidic solution produces:
 (a) $[\text{Fe}(\text{CN})_6]^{3-}$ and iodine (b) $[\text{Fe}(\text{CN})_6]^{2-}$ and iodide ion
 (c) $[\text{Fe}(\text{CN})_6]^{4-}$ and iodine (d) $[\text{Fe}(\text{CN})_6]^{3-}$ and iodide ion



20. The perchloric acid molecule contains
 (a) 13 lone pairs, 1 π bond, and 4 σ bonds
 (b) 9 lone pairs, no π bond, and 6 σ bonds
 (c) 8 lone pairs, 2 π bonds, and 7 σ bonds
 (d) 11 lone pairs, no π bonds, and 5 σ bonds
21. Toluene on oxidation with alkaline KMnO_4 forms benzoic acid. What is the product formed when n-propyl benzene is oxidized with KMnO_4 ?
 (a) $\text{C}_6\text{H}_5\text{CH}_2\text{COOH}$ (b) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{COOH}$
 (c) $\text{C}_6\text{H}_5\text{COOH}$ (d) $\text{C}_6\text{H}_5\text{CHO}$
22. What is the relative area of each peak in a quartet spin-spin splitting pattern?
 (a) 1 : 4 : 4 : 1 (b) 1 : 2 : 2 : 1 (c) 1 : 2 : 1 (d) 1 : 3 : 3 : 1
23. Which of the following reacts with fastest with NaOH , H_2O ?
 (a) ethylene oxide (oxirane) (b) cis-2, 3-dimethyloxirane
 (c) trans-2, 3-dimethyloxirane (d) 2, 2, 3, 3-tetramethyloxirane
24. What is the relationship between keto and enol tautomers?
 (a) Resonance forms (b) Stereoisomers
 (c) Constitutional isomers (d) Different conformations of the same compound
25. Lucas reagent is
 (a) Anhydrous CuCl_2/HCl (b) Anhydrous $\text{CuCl}_2/\text{H}_2\text{SO}_4$
 (c) Anhydrous ZnCl_2/HCl (d) Anhydrous $\text{ZnCl}_2/\text{H}_2\text{SO}_4$
26. Correct order of basicity of the following anion is
 (a) $\text{CH}_3\text{COO}^- < \text{OH}^- < \text{CH}_3\text{O}^-$ (b) $\text{CH}_3\text{COO}^- > \text{OH}^- > \text{CH}_3\text{O}^-$
 (c) $\text{CH}_3\text{COO}^- < \text{CH}_3\text{O}^- < \text{OH}^-$ (d) $\text{CH}_3\text{COO}^- > \text{CH}_3\text{O}^- > \text{OH}^-$
27. Which of the following compounds will have largest λ_{max} ?



28. The correct order of reactivity towards electrophilic aromatic substitution is:
 (a) Furan > Thiophene > Pyrrole > Benzene
 (b) Thiophene > Furan > Pyrrole > Benzene
 (c) Benzene > Thiophene > Furan > Pyrrole
 (d) Pyrrole > Furan > Thiophene > Benzene
29. Which of the following compound is aromatic?



30. Ethylene molecules may be joined together in large numbers to form polymer which of the following best describes this process?
 (a) Electrophilic addition catalyzed by an acid
 (b) Nucleophilic addition catalyzed by an acid
 (c) Addition reaction involves free radicals
 (d) Substitution reaction catalyzed by oxygen
31. IUPAC name of the following compound is
-
- (a) 2-Methyl-5-isobutylheptane
 (b) 2, 7-Dimethyl-4-ethyloctane
 (c) 2, 7-Dimethyl-5-ethyloctane
 (d) 2, 7, 7-trimethyl-4-ethylheptane
32. Amino acids with OH group are
 (a) Serine and alanine
 (b) Alanine and valine
 (c) Serine and threonine
 (d) Valine and isoleucine
33. In accordance with the sequence rule, correct order of priority of the following group is
 (a) $\text{COOH} > \text{CH} = \text{CH}_2 > \text{CH}_2\text{CH} = \text{CH}_2 > \text{CH}_2\text{CH}_2\text{CH}_3$
 (b) $\text{COOH} < \text{CH} = \text{CH}_2 < \text{CH}_2\text{CH} = \text{CH}_2 < \text{CH}_2\text{CH}_2\text{CH}_3$
 (c) $\text{COOH} < \text{CH}_2\text{CH}_2\text{CH}_3 > \text{CH} = \text{CH}_2 > \text{CH}_2\text{CH} = \text{CH}_2$
 (d) $\text{COOH} > \text{CH}_2\text{CH} = \text{CH}_2 > \text{CH} = \text{CH}_2 > \text{CH}_2\text{CH}_2\text{CH}_3$
34. The fingerprint region of the infrared spectrum, which is characteristic for each individual compound, is between
 (a) $400\text{--}1400\text{ cm}^{-1}$
 (b) $1400\text{--}900\text{ cm}^{-1}$
 (c) $900\text{--}600\text{ cm}^{-1}$
 (d) $600\text{--}250\text{ cm}^{-1}$
35. Which of the following techniques would be most useful to identify and quantify the presence of a known impurity in a drug substance?
 (a) HPLC
 (b) NMR
 (c) IR
 (d) UV
36. Which of the following compounds does not absorb light in the UV/visible spectrum?
 (a) Aspirin
 (b) Paracetamol
 (c) Chloral hydrate
 (d) Phenobarbitone
37. Victor Meyer test is used for the confirmation of
 (a) $1^\circ, 2^\circ, 3^\circ$ Amines
 (b) $1^\circ, 2^\circ, 3^\circ$ Alcohols
 (c) Carbonyl group
 (d) Nitro group
38. Correct statement about carbonyl stretching frequency in the IR of cyclopentanone and cyclohexanone is?
 (a) Both have same frequency stretching
 (b) Cyclopentanone : 1745 cm^{-1} ; Cyclohexanone : 1715 cm^{-1}
 (c) Cyclopentanone : 1715 cm^{-1} ; Cyclohexanone : 1745 cm^{-1}
 (d) Cyclopentanone : 1690 cm^{-1} ; Cyclohexanone : 1675 cm^{-1}
39. An acid (HA) has $K_a = 10^{-7}$, what will be its $\text{p}K_a$?
 (a) 7
 (b) -7
 (c) -0.7
 (d) 1/7
40. Major product that would be formed when 2-bromo-hexane undergoes 1 : 1 elimination reaction
 (a) Z-2-Hexene
 (b) 1-Hexene
 (c) E-2-Hexene
 (d) Mixture of E/Z-2-hexene



41. Vander Waal's equation for n moles of a gas is
 (a) $(P + a/V^2)(V - b) = RT$ (b) $(P + na/V^2)(V - nb) = nRT$
 (c) $(P + na/V^2)(V - b) = nRT$ (d) $(P + n^2a/V^2)(V - nb) = nRT$
42. With increase in temperature, the viscosities of gases and liquids respectively :
 (a) Increase, decrease (b) Decrease, increase
 (c) Increase, increase (d) Decrease, decrease
43. The fraction of molecules of a gas possessing velocities in a given range depends on
 (a) Total number of molecules (b) Temperature
 (c) Volume of the gas (d) Pressure of the gas
44. The triple point of water is 273.16K; what will be the temperature in degree Celsius:
 (a) 0 (b) 0.01 (c) -0.01 (d) 100
45. System A is 1 mole of ice at -10°C and system B is 1 mole of super-cooled water at -10°C . Choose the correct statement
 (a) A has greater vapour pressure than B
 (b) A has greater free energy than B
 (c) A has lower free energy than B
 (d) Both A and B have the same free energy
46. Reverse osmosis is an example of
 (a) Reversible process (b) Irreversible process
 (c) Equilibrium process (d) Non-spontaneous process
47. A gas (system) at 0.1 atm, pressure is enclosed in a cylinder fitted with a weightless, frictionless piston and the cylinder is placed in the surroundings, where the pressure is 1 atm. In the spontaneous process that occur isothermally.
 (a) Entropy of the system increases, that of surroundings decreases
 (b) Entropy of the system decreases, that of surroundings increase
 (c) Entropy of the system and the surroundings increase
 (d) Entropy of the system and the surroundings decrease
48. Mean velocity, most probable velocity and root mean square velocity are approximately in the ratio
 (a) 1.13 : 1 : 1.23 (b) 1.23 : 1 : 1.13 (c) 1.23 : 1.13 : 1 (d) 1 : 1.13 : 1.23
49. Which one of the following is not a perfect differential?
 (a) dG (b) dT (c) dQ (d) dH
50. A condition for equilibrium is
 (a) $\delta G = 0$ (b) $\delta G_{T,V} = 0$ (c) $\delta G_{T,P} = 0$ (d) $\delta G_{P,V} = 0$
51. The E_{cell}^0 of an Al-air battery is 2.73 V and it involves a 12 electron process. The ΔG^0 in kJ will be
 (a) 3161.340 kJ (b) -32.76 kJ (c) 32.76 kJ (d) -3161.340 kJ
52. For the first order reaction, if the time taken for 50% of the reaction is t secs; the time required for completion of 99.99% reaction is
 (a) 5 t (b) 10 t (c) 2 t (d) 100 t
53. If $e^{\alpha x}$ is an eigen function and d^n/dx^n is an operator then the eigen value will be
 (a) α^n (b) α (c) n (d) n^α



54. A projectile of mass 1.0 g is known to be within $1\mu\text{ms}^{-1}$. Calculate the minimum uncertainty in its position.
 (a) $5 \times 10^{26} \text{ m s}^{-1}$ (b) $5 \times 10^{26} \text{ m}$ (c) $5 \times 10^{-26} \text{ m s}^{-1}$ (d) $5 \times 10^{-26} \text{ m}$
55. In NMR spectroscopy, by what mechanism the saturation effect is removed, to maintain the population difference
 (a) spin-spin relaxation (b) spin-lattice relaxation
 (c) Magic angle spinning (d) Nuclear Overhauser effect.
56. In the hydrogen molecule, when hydrogen is replaced by deuterium. What will happen to the rotational constant B?
 (a) Increase (b) Becomes zero (c) Decreases (d) Remains same
57. Choose the correct statement
 (a) For a real gas C_p changes with temperature, but does not change with pressure
 (b) For an ideal gas C_p changes neither with temperature nor with pressure
 (c) For a real gas C_p changes with temperature, but does not with pressure
 (d) For a real gas C_p changes with both temperature and pressure
58. Bragg's law can be stated as
 (a) $n\lambda = 2d \sin \theta$ (b) $n\lambda = 2a \sin \theta$ (c) $n\lambda = \sqrt{2}d \sin \theta$ (d) $d = 2\lambda \sin \theta$
59. To be classified as "nanoscale" an object must have one dimension in the order of
 (a) 10^{-10} m (b) 10^{-15} m (c) 10^{-8} m (d) 10^{-9} m
60. How many phase are present in the equilibria, $\text{CaCO}_3(\text{s}) \leftrightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$?
 (a) 1 (b) 2 (c) 3 (d) 4

Answer Key

- | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|
| 1. (a) | 2. (c) | 3. (a) | 4. (b) | 5. (c) | 6. (a) | 7. (c) |
| 8. (c) | 9. (b) | 10. (a) | 11. (d) | 12. (c) | 13. (d) | 14. (b) |
| 15. (a) | 16. (c) | 17. (d) | 18. (a) | 19. (c) | 20. (d) | 21. (c) |
| 22. (d) | 23. (a) | 24. (c) | 25. (c) | 26. (a) | 27. (c) | 28. (d) |
| 29. (d) | 30. (c) | 31. (b) | 32. (c) | 33. (a) | 34. (b) | 35. (a) |
| 36. (c) | 37. (b) | 38. (b) | 39. (a) | 40. (c) | 41. (d) | 42. (a) |
| 43. (b) | 44. (b) | 45. (c) | 46. (d) | 47. (b) | 48. (a) | 49. (c) |
| 50. (c) | 51. (d) | 52. (b) | 53. (a) | 54. (d) | 55. (b) | 56. (c) |
| 57. (c) | 58. (a) | 59. (d) | 60. (c) | | | |

