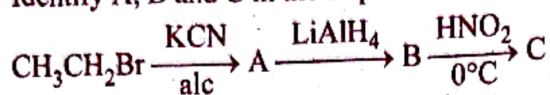


CHEMISTRY

- A pair of compounds having the same boiling points are
(A) cis but-2-ene and trans but-2-ene
(B) n-hexane and neo-hexane
(C) benzene and naphthalene
(D) (+) butan-2-ol and (-) butan-2-ol

- Identify A, B and C in the sequence :



- (A) $\text{CH}_3\text{CH}_2\text{CN}$, $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$, $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
(B) $\text{CH}_3\text{CH}_2\text{NC}$, $\text{CH}_3\text{CH}_2\text{OH}$, $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$
(C) $\text{CH}_3\text{CH}_2\text{CN}$, $\text{C}_2\text{H}_5\text{OH}$, $\text{C}_2\text{H}_5\text{N}_2\text{Cl}$
(D) $\text{CH}_3\text{CH}_2\text{CN}$, $\text{CH}_3\text{CH}_2\text{NH}_2$, $\text{C}_2\text{H}_5\text{OH}$

- $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_2\text{OH} \xrightarrow{\text{PCC}} \text{CH}_3 - \text{CH} = \text{CH} - \text{CHO}$

Hybridisation change involved at C-1 in the above reaction

- (A) sp^3 to sp (B) sp^3 to sp^2 (C) sp^2 to sp^3 (D) sp to sp^2

- If a didentate ligand ethane-1, 2-diamine is progressively added in the molar ratio en : Ni :: 1 : 1, 2 : 1, 3 : 1 to $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ aq solution, following co-ordination entities are formed.

- I. $[\text{Ni}(\text{H}_2\text{O})_4\text{en}]^{2+}_{(\text{aq})}$ - pale blue
II. $[\text{Ni}(\text{H}_2\text{O})_2(\text{en})_2]^{2+}_{(\text{aq})}$ - blue/purple
III. $[\text{Ni}(\text{en})_3]^{2+}_{(\text{aq})}$ - violet

The wavelength in nm of light absorbed in case of I and III are respectively

- (A) 475 nm and 310 nm (B) 300 nm and 475 nm
(C) 310 nm and 500 nm (D) 600 nm and 535 nm

- Which of the following is an organometallic compound ?

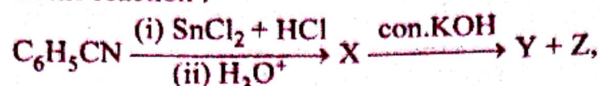
- (A) CH_3COONa (B) $\text{CH}_3\text{CH}_2\text{MgBr}$ (C) $(\text{CH}_3\text{COO})_2\text{Ca}$ (D) CH_3ONa



Space For Rough Work

6. A better reagent to oxidize primary alcohols into aldehyde is :
 (A) PCC (B) Alkaline KMnO_4
 (C) Acidified $\text{K}_2\text{Cr}_2\text{O}_7$ (D) CrO_3

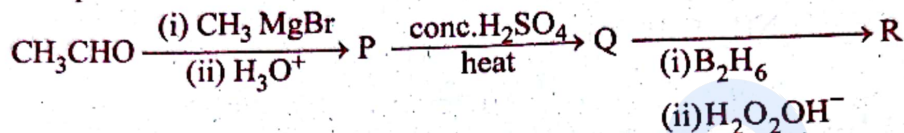
7. In the reaction :



Formation of X, formation of Y and Z are known by

- (A) Rosenmund reduction, Cannizaro reaction.
 (B) Clemmensen reduction, Sandmeyer reaction.
 (C) Wolff-Kishner reduction, Wurtz reaction.
 (D) Stephen reaction, Cannizaro reaction.

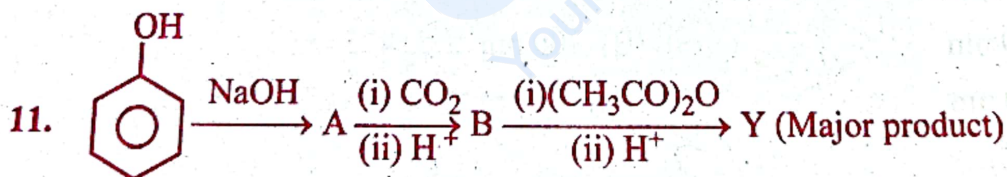
8. Compounds P and R in the following reaction are



- (A) Position isomers (B) Functional isomers
 (C) Metamers (D) Identical
9. Aniline does not undergo
 (A) Nitration (B) Sulphonation
 (C) Friedel-Craft reaction (D) Bromination

10. The heating of phenyl methyl ether with HI produces an aromatic compound A which on treatment with con. HNO_3 gives B. A and B respectively are,

- (A) Methanol, Ethanoic acid (B) Picric acid, Phenol
 (C) Iodobenzene, 1-Iodo-4-nitrobenzene (D) Phenol, Picric acid



Y in the above reaction is

- (A) Salicylaldehyde (B) Aspirin (C) Cumene (D) Picric acid

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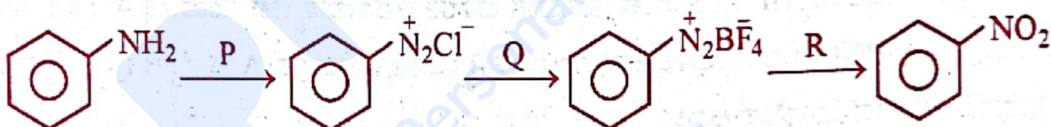
12. Sucrose is dextrorotatory but after hydrolysis the mixture show laevorotation, this is because of
- (A) Laevorotation of glucose is more than dextrorotation of fructose.
 (B) Sucrose is a non-reducing sugar.
 (C) Recemic mixture is formed.
 (D) Laevorotation of fructose is more than dextrorotation of glucose.

13. The correct order of match between column X and column Y is :

X		Y	
I.	Vitamin A	i.	Muscular weakness
II.	Vitamin D	ii.	Increased blood clotting time
III.	Vitamin E	iii.	Night-blindness
IV.	Vitamin K	iv.	Osteomalacia

- (A) I – iv, II – iii, III – ii, IV – i
 (B) I – ii, II – i, III – iii, IV – iv
 (C) I – iii, II – ii, III – iv, IV – i
 (D) I – iii, II – iv, III – i, IV – ii

14. In the reaction :



P, Q and R respectively are :

- (A) $\text{NaNO}_2 + \text{dil. HCl}$, HBF_4 , $\text{Cu} + \text{NaNO}_2$
 (B) $\text{NaNO}_2 + \text{con. HCl}$, F_2 , $\text{Cu} + \text{NaNO}_3$
 (C) $\text{NaNO}_2 + \text{dil. HCl}$, BF_3 , $\text{Cu} + \text{NaNO}_2$
 (D) $\text{NaNO}_3 + \text{dil. HCl}$, F_2 , $\text{Cu} + \text{NaNO}_3$

15. Thyroxine produced in the thyroid gland is an iodinated derivative of _____.

- (A) threonine (B) lysine (C) tyrosine (D) tryptophan



Space For Rough Work

16. Which one of the following is a non-narcotic analgesic ?
 (A) Heroin (B) Codeine (C) Aspirin (D) Morphine
17. Receptors are proteins and crucial to body communication process. These receptors are embedded in
 (A) Cell membrane (B) Protein (C) Endocrine gland (D) Chromosomes
18. Which of the following monomers form biodegradable polymers ?
 (A) Ethylene glycol and phthalic acid
 (B) Caprolactum and 1, 3 – Butadiene
 (C) Phenol and formaldehyde
 (D) 3-hydroxybutanoic acid and 3-hydroxypentanoic acid
19. Match the List-I with List-II in the following :

List-I	List-II
1. Caprolactum	(a) $\text{-(CH}_2\text{-CH)}_n\text{-}$ CH_3
2. Vinyl chloride	(b) $\text{-(CH}_2\text{-CH)}_n\text{-}$ C_6H_5
3. Styrene	(c) $\text{-(CH}_2\text{-CH)}_n\text{-}$ Cl
4. Propene	(d) $\text{-(}\overset{\text{O}}{\parallel}\text{C(CH}_2\text{)}_5\text{N)}_n\text{-}$ H

(A) 1-c, 2-d, 3-a, 4-b

(B) 1-a, 2-d, 3-c, 4-b

(C) 1-d, 2-c, 3-a, 4-b

(D) 1-d, 2-c, 3-b, 4-a



Space For Rough Work

20. The correct order of first ionisation enthalpy of given elements is
 (A) $\text{Li} < \text{B} < \text{Be} < \text{C}$ (B) $\text{Be} < \text{Li} < \text{B} < \text{C}$ (C) $\text{C} < \text{B} < \text{Be} < \text{Li}$ (D) $\text{Li} < \text{Be} < \text{B} < \text{C}$
21. Which of the following statement is INCORRECT ?
 (A) Bond length of $\text{O}_2 >$ Bond length of O_2^{2+} (B) Bond order of $\text{O}_2 <$ Bond order of O_2^{2-}
 (C) Bond length of $\text{O}_2 <$ Bond length of O_2^{2-} (D) Bond order of $\text{O}_2 >$ Bond order of O_2^{2-}
22. A gas at a pressure of 2 atm is heated from 25°C to 323°C and simultaneously compressed to $\frac{2}{3}$ of its original value. Then the final pressure is
 (A) 1.33 atm (B) 6 atm (C) 2 atm (D) 4 atm
23. Lattice enthalpy for NaCl is $+788 \text{ kJ mol}^{-1}$ and $\Delta H^\circ_{\text{Hyd}} = -784 \text{ kJ mol}^{-1}$. Enthalpy of solution of NaCl is
 (A) $+572 \text{ kJ mol}^{-1}$ (B) $+4 \text{ kJ mol}^{-1}$ (C) -572 kJ mol^{-1} (D) -4 kJ mol^{-1}
24. At 500 K, for a reversible reaction $\text{A}_{2(\text{g})} + \text{B}_{2(\text{g})} \rightleftharpoons 2\text{AB}_{(\text{g})}$ in a closed container, $K_C = 2 \times 10^{-5}$. In the presence of catalyst, the equilibrium is attaining 10 times faster. The equilibrium constant K_C in the presence of catalyst at the same temperature is
 (A) 2×10^{-4} (B) 2×10^{-6} (C) 2×10^{-10} (D) 2×10^{-5}
25. A weak acid with pK_a 5.9 and weak base with pK_b 5.8 are mixed in equal proportions. pH of the resulting solution is
 (A) 7.005 (B) 7.5 (C) 7 (D) 7.05
26. Temperature of 25°C in Fahrenheit and Kelvin scale respectively are
 (A) 77°F and 298.15 K (B) 17°F and 298.15 K
 (C) 45°F and 260.15 K (D) 47°F and 312.15 K
27. The number of protons, neutrons and electrons in the ion $^{32}_{16}\text{S}^{2-}$ respectively are
 (A) 16, 18, 16 (B) 16, 16, 18 (C) 18, 16, 16 (D) 16, 16, 16

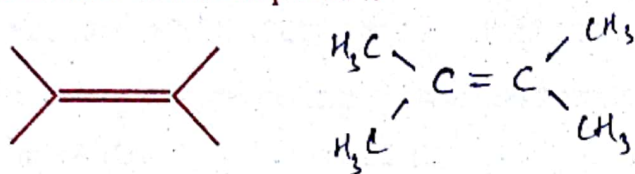
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Handwritten calculations and notes:

- $\text{N} + 2 = \text{A}$
- $\text{N} = \text{A} - 2$
- $1 = 32 - 16 = 16$
- 523.15
- $1.5 \cdot 9 + 5.8$
- 11.7
- 5.9×50
- 273.15
- 12
- $2 \times 2 = 4$
- 1.33
- 273.15
- $25^\circ + 25$
- 298.15
- $\text{PV} = \text{nRT}$
- 273.15
- 25°
- 298.15
- $(2\text{C}0521\text{K}23) \text{ C}$

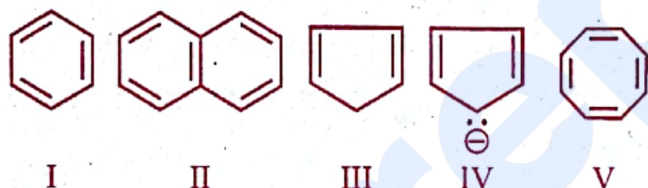
28. A pair of amphoteric oxides is
 (A) $\text{Al}_2\text{O}_3, \text{Li}_2\text{O}$ (B) BeO, BO_3 (C) BeO, MgO (D) BeO, ZnO
29. The composition of water gas is
 (A) $\text{CO}_{(g)} + \text{N}_{2(g)}$ (B) $\text{CH}_{4(g)}$ (C) $\text{CO}_{(g)} + \text{H}_2\text{O}_{(g)}$ (D) $\text{CO}_{(g)} + \text{H}_{2(g)}$

30. IUPAC name of the compound is



- (A) 2, 3 – dimethylbut-2-ene (B) 2, 3 – dimethyl butyne
 (C) 1, 1, 2, 2 – tetra methylethene (D) 2, 3 – dimethyl butene

31. Among the following :

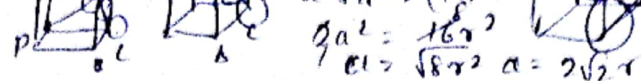


The set which represents aromatic species is

- (A) I, II and III (B) III, IV and V (C) II and III (D) I, II and IV
32. Which one of the following gases converts haemoglobin into carboxy haemoglobin ?
 (A) CO (B) O_2 (C) NO (D) CO_2
33. What is the oxidation number of S in $\text{H}_2\text{S}_2\text{O}_8$?
 (A) +5 (B) +4 (C) +7 (D) +6
 Handwritten calculation: $2x + 12 - 16 = 0$
 $2x = 4$
 $x = +2$
34. A 30% solution of hydrogen peroxide is
 (A) '30 volume' hydrogen peroxide (B) '10 volume' hydrogen peroxide
 (C) '50 volume' hydrogen peroxide (D) '100 volume' hydrogen peroxide



Space For Rough Work



35. If 'a' stands for the edge length of the cubic systems – The ratio of radii in simple cubic, body centered cubic and face centered cubic unit cells is

$$\frac{4r}{\sqrt{3}} = a$$

$$r = \frac{\sqrt{3}a}{4}$$

(A) $1a : \sqrt{3}a : \sqrt{2}a$

(B) $\frac{1}{2}a : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}a$

(C) $\frac{1}{2}a : \frac{\sqrt{3}}{2}a : \frac{\sqrt{2}}{2}a$

(D) $\frac{1}{2}a : \sqrt{3}a : \frac{1}{\sqrt{2}}a$

$$\frac{\frac{a}{2}}{\frac{a}{2\sqrt{2}}} = \frac{a}{2} \times \frac{2\sqrt{2}}{a} = \sqrt{2}$$

36. Dimerisation of solute molecules in low dielectric constant solvent is due to :

- (A) Hydrogen bond
(C) Co-ordinate bond

- (B) Covalent bond
(D) Ionic bond

37. The swelling in feet and ankles of an aged person due to sitting continuously for long hours during travel, is reduced by soaking the feet in warm salt water. This is because of :

- (A) Reverse Osmosis (B) Osmosis (C) Edema (D) Diffusion

38. A sample of water is found to contain 5.85% $\left(\frac{w}{w}\right)$ of AB (molecular mass 58.5) and 9.50% $\left(\frac{w}{w}\right)$ XY₂ (molecular mass 95). Assuming 80% ionisation of AB and 60% ionisation of XY₂, the freezing point of water sample is [Given : K_f for water 1.86 K kg mol⁻¹, Freezing point of pure water is 273 K and A, B and Y are monovalent ions]

- (A) 264.25 K (B) 265.56 K (C) 280.44 K (D) 281.75 K

39. Match the column A (type of crystalline solid) with the column B (example for each type) :

A	B
P. Molecular Solid	i. SiC
Q. Ionic Solid	ii. Mg
R. Metallic Solid	iii. H ₂ O
S. Network Solid	iv. MgO

- (A) P-iii, Q-i, R-ii, S-iv
(C) P-ii, Q-iv, R-iii, S-i

- (B) P-iv, Q-iii, R-ii, S-i
(D) P-iii, Q-iv, R-ii, S-i

40. A metal crystallises in a body centered cubic lattice with the metallic radius $\sqrt{3}$ Å. The volume of the unit cell in m³ is

- (A) 64×10^{-29} (B) 4×10^{-29} (C) 6.4×10^{-29} (D) 4×10^{-10}

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Handwritten calculations for question 40:

$$\frac{1}{4} \pi r^2 \times 2 = \frac{1}{4} \pi (3.14) (3 \times 10^{-10})^2 \times 2$$

$$= \frac{1}{4} (3.14) (9 \times 10^{-20}) \times 2$$

$$= \frac{1}{2} (3.14) (9 \times 10^{-20})$$

$$= 1.413 \times 10^{-19} \text{ m}^2$$

$$\frac{1}{4} \pi r^2 \times 2 = \frac{1}{4} \pi (3.14) (3 \times 10^{-10})^2 \times 2$$

$$= \frac{1}{4} (3.14) (9 \times 10^{-20}) \times 2$$

$$= 1.413 \times 10^{-19} \text{ m}^2$$

41. The resistance of 0.1 M weak acid HA in a conductivity cell is $2 \times 10^3 \text{ Ohm}$. The cell constant of the cell is 0.78 C m^{-1} and λ_m° of acid HA is $390 \text{ S cm}^2 \text{ mol}^{-1}$. The pH of the solution is
 (A) 3.3 (B) 4.2 (C) 5 (D) 3
42. In which one of the following reactions, rate constant has the unit $\text{mol L}^{-1} \text{ s}^{-1}$?
 (A) Acid catalysed hydrolysis of $\text{CH}_3\text{COOCH}_3$
 (B) $\text{CHCl}_3 + \text{Cl}_2 \longrightarrow \text{CCl}_4 + \text{HCl}$
 (C) $2\text{NO}_{(\text{g})} + \text{O}_{2(\text{g})} \longrightarrow 2\text{NO}_{2(\text{g})}$
 (D) Decomposition of HI on the surface of Gold
43. For a reaction, the value of rate constant at 300 K is $6.0 \times 10^5 \text{ s}^{-1}$. The value of Arrhenius factor A at infinitely high temperature is :
 (A) $6 \times 10^5 \times e^{-E_a/300R}$ (B) $e^{-E_a/300R}$
 (C) $\frac{6 \times 10^{-5}}{300}$ (D) 6×10^5
44. The rate constants k_1 and k_2 for two different reactions are $10^{16} \times e^{-2000/T}$ and $10^{15} \times e^{-1000/T}$ respectively. The temperature at which $k_1 = k_2$ is :
 (A) $\frac{2000}{2.303} \text{ K}$ (B) 2000 K (C) $\frac{1000}{2.303} \text{ K}$ (D) 1000 K
45. During the electrolysis of brine, by using inert electrodes,
 (A) O_2 liberates at anode (B) H_2 liberates at anode
 (C) Na deposits on cathode (D) Cl_2 liberates at anode
46. Consider the following 4 electrodes
 A : $\text{Ag}^+ (0.0001 \text{ M}) / \text{Ag}_{(\text{s})}$; B : $\text{Ag}^+ (0.1 \text{ M}) / \text{Ag}_{(\text{s})}$
 C : $\text{Ag}^+ (0.01 \text{ M}) / \text{Ag}_{(\text{s})}$; D : $\text{Ag}^+ (0.001 \text{ M}) / \text{Ag}_{(\text{s})}$; $E^\circ_{\text{Ag}^+/\text{Ag}} = +0.80 \text{ V}$
 Then reduction potential in volts of the electrodes in the order
 (A) $B > C > D > A$ (B) $C > D > A > B$
 (C) $A > D > C > B$ (D) $A > B > C > D$

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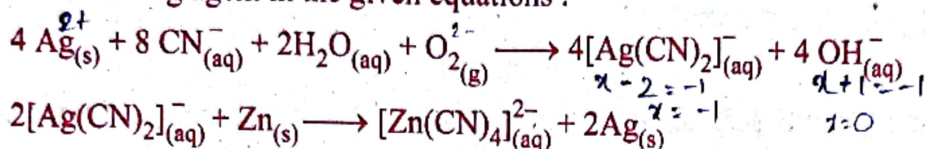


47. When FeCl_3 is added to excess of hot water gives a sol 'X'. When FeCl_3 is added to $\text{NaOH}_{(\text{aq})}$ solution, gives sol 'Y'.

X and Y formed in the above processes respectively are

- (A) $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O} / \text{OH}^-$ and $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O} / \text{Fe}^{3+}$
 (B) $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O} / \text{H}^+$ and $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O} / \text{Na}^+$
 (C) $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O} / \text{Cl}^-$ and $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O} / \text{OH}^-$
 (D) $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O} / \text{Fe}^{3+}$ and $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O} / \text{OH}^-$

48. The reducing agent in the given equations :



- (A) Zn (B) O_2 (C) H_2O (D) CN^-

49. For the formation of which compound in Ellingham diagram ΔG° becomes more and more negative with increase in temperature ?

- (A) CO (B) FeO (C) ZnO (D) Cu_2O

50. Which of the following compound does not give dinitrogen on heating ?

- (A) $\text{Ba}(\text{N}_3)_2$ (B) NH_4NO_2 (C) NH_4NO_3 (D) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$

51. Aqueous solution of raw sugar when passed over beds of animal charcoal, it becomes colourless. Pick the correct set of terminologies that can be used for the above example.

	Adsorbent	Adsorbate	Process
(A)	Solution of Sugar	Animal Charcoal	Sorption
(B)	Animal Charcoal	Solution of Sugar	Absorption
(C)	Animal Charcoal	Colouring substance	Adsorption
(D)	Colouring Substance	Animal Charcoal	Adsorption

52. For Freundlich adsorption isotherm, a graph of $\log (x/m)$ Vs. $\log (P)$ gives a straight line. The slope of line and its Y-axis intercept respectively are

- (A) $\log \left(\frac{1}{n} \right), K$ (B) $\frac{1}{n}, \log K$ (C) $\log \left(\frac{1}{n} \right), \log K$ (D) $\frac{1}{n}, K$

Space For Rough Work



53. In solid state, PCl_5 is a/an
 (A) Octahedral structure
 (B) Ionic solid with $[\text{PCl}_6]^+$ and $[\text{PCl}_4]^-$
 (C) Ionic solid with $[\text{PCl}_4]^+$ and $[\text{PCl}_6]^-$
 (D) Covalent solid present in the form of P_2Cl_{10}
54. In which one of the following pairs, both the elements does not have $(n-1)d^{10}ns^2$ configuration in its elementary state ?
 (A) Zn, Cd (B) Cd, Hg (C) Hg, Cn (D) Cu, Zn
55. Which of the following is CORRECT with respect to melting point of a transition element ?
 (A) $\text{V} > \text{Cr}$ (B) $\text{Cr} > \text{Mn}$ (C) $\text{Mn} > \text{Fe}$ (D) $\text{Ti} > \text{V}$
56. $a\text{MnO}_4^- + b\text{S}_2\text{O}_3^{2-} + \text{H}_2\text{O} \longrightarrow x\text{MnO}_2 + y\text{SO}_4^{2-} + z\text{OH}^-$
 a and y respectively are
 (A) 8; 3 (B) 8; 6 (C) 3; 6 (D) 8; 8
57. Which formula and name combination is INCORRECT ?
 (A) $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3]$ – Potassium trioxalatoaluminate (III)
 (B) $[\text{Pt}(\text{NH}_3)_2 \text{Cl}(\text{NO}_2)]$ – Diamminechloridonitrito – N – platinum (II)
 (C) $[\text{CoCl}_2(\text{en})_2]\text{Cl}$ – Dichloridodiethylenediammine cobalt (II) chloride
 (D) $[\text{Co}(\text{NH}_3)_4 (\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$ – Tetraammineaquachloridocobalt (III) chloride
58. Which of the following system in an octahedral complex has maximum unpaired electrons ?
 (A) d^9 (high spin) (B) d^6 (low spin) (C) d^4 (low spin) (D) d^7 (high spin)
59. The correct decreasing order of basicity of hydrides of Group-15 elements is
 (A) $\text{SbH}_3 > \text{AsH}_3 > \text{PH}_3 > \text{NH}_3$ (B) $\text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{NH}_3$
 (C) $\text{AsH}_3 > \text{SbH}_3 > \text{NH}_3 > \text{PH}_3$ (D) $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3$
60. Which one of the following oxoacids of phosphorus can reduce AgNO_3 to metallic silver ?
 (A) H_3PO_2 (B) $\text{H}_4\text{P}_2\text{O}_7$ (C) $\text{H}_4\text{P}_2\text{O}_6$ (D) H_3PO_4



Space For Rough Work