CHEMICAL SCIENCES

Paper – II

1. The number 111 in binary representation means the number in decimal system

(A) 4 (B) 5

(C) 6 (D) 7.

2. Which of the following is *not* an operating system ?

(A) BASIC (B) UNIX

(C) LINUX (D) MAC.

3. The acronym 'ROM' stands for

(A) Read Only Memory (B) Role Of Memory

(C) Rough Organisation Memory (D) Random Orientation Memory.

4. Which of the following is never an output device ?

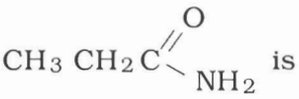
(A) USB Port (B) Printer

(C) DVD (D) Keyboard.

5. Drive *C* refers always to a

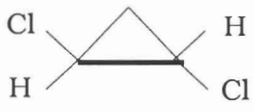
(A) hard disk drive (B) CD/DVD drive

(C) pen drive (D) floppy disk drive.

6. The product of $LiAlH_4$ reduction of  is

(A) $CH_3CH_2CH_2NH_2$ (B) $CH_3CH_2CH_2OH$

(C) $CH_3CH_2CH=O$ (D) $CH_3CH_2CH_3$.

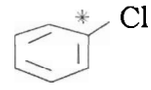
7. The name of  is

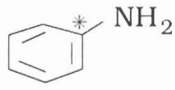
(A) (1*R* , 2*S*) – 1, 2-dichlorocyclopropane

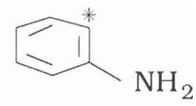
(B) (1*R* , 2*R*) – 1, 2-dichlorocyclopropane

(C) (1*S* , 2*S*) – 1, 2-dichlorocyclopropane

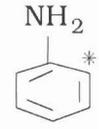
(D) (1*S* , 2*R*) – 1, 2-dichlorocyclopropane.

8. The compound which is not the product of reaction of  with $NaNH_2$ / liq. NH_3 is ($C^* \equiv C^{14}$)

(A) 

(B) 

(C) 

(D) 

9. Which is the base peak in the mass-spectrum of toluene ?

(A) m/z 92 (B) m/z 91

(C) m/z 77 (D) m/z 65.

10. The correct name of the product of reduction of $CH_3CH_2C \equiv C - CH_3$ with sodium and ethanol is

(A) (*E*) -2-pentene (B) (*Z*) - 2-pentene

(C) (*E*) - 3-pentene (D) (*Z*) - 3-pentene.

11. A reaction vessel contains N_2 , H_2 and NH_3 in equilibrium. If an inert gas is added at constant volume, then

(A) K_P will increase

(B) K_P will decrease

(C) the equilibrium yield of NH_3 will increase

(D) no change will occur.

12. The rotation constant (*B*) of a diatomic molecule is

(A) $h / 4\pi^2 I$ (B) $h^2 / 4\pi^2 I$

(C) $h^2 / 8\pi^2 I$ (D) $h / 8\pi^2 I$.

13. A singlet $\rightarrow$ triplet transition becomes allowed because of

(A) spin-orbit coupling (B) spin-spin coupling

(C) spin-lattice relaxation (D) natural broadening of spectral lines.

14. Which of the following does not have a three fold rotational symmetry axis ?

(A) BCl_3 (B) CH_4

(C) NH_3 (D) ClF_3 .

15. The structure of cesium metal at 25°C and 1 atm pressure is body centred cubic. At the same temperature but at higher pressure, cesium undergoes a phase transition to yield a structure much more dense than body centred cubic. Which of the following is the likely structure at high pressure ?

(A) Cubic close packed (B) Amorphous

(C) Primitive cubic (D) Primitive tetragonal.

16. Which of the following proteins functions as an electron carrier in biology ?

(A) Ceruloplasmin (B) Transferrin

(C) Cyt. P-450 (D) Ferredoxin.

17. Select the correct order of ion conductances in aqueous solutions.

(A) $H^+ > OH^- > F^- > Br^-$ (B) $OH^- > H^+ > Br^- > F^-$

(C) $H^+ > OH^- > Br^- > F^-$ (D) $Br^- > F^- > OH^- > H^+$.

18. Hydroboration-oxidation product of 1-methyl cyclopentene is

(A) *cis*-2-methyl cyclopentanol (B) *trans*-2-methyl cyclopentanol

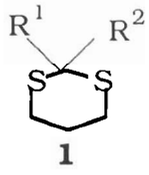
(C) 2-methyl cyclopentanone (D) 3-methyl cyclopentanone.

19. Which one is not a greener solvent ?

(A) Supercritical CO_2 (B) Superheated steam

(C) CH_2Cl_2 (D) Acetate buffer.

20. The 1 ; 3-dithiane **1** will be cleaved by



1

(A) HCl (B) aq. NaOH solution

(C) $HgCl_2$, H_2O (D) $MgCl_2$, H_2O.

21. Molar extinction coefficient of which of the following complexes is maximum for its λ_{max} ?

(A) $\left[Cu \left(NH_3 \right)_4^{2+} \right]$ (B) $\left[FeCl_4^- \right]$

(C) $\left[CoCl_4^{2-} \right]$ (D) $\left[Ti \left(H_2O \right)_6^{3+} \right]$.

22. $^{60}_{27}Co$ may be synthesized from $^{60}_{28}Ni$ by

(A) (n, γ) reaction (B) (α, p) reaction

(C) (α, n) reaction (D) (n, p) reaction.

23. Electronic absorption spectrum of $\left[Ti \left(H_2O \right)_6^{3+} \right]$ ion shows a single absorption maximum at 500 nm. The 10 Dq value of the species is

(A) $10{,}000\ cm^{-1}$ (B) $15{,}000\ cm^{-1}$

(C) $20{,}000\ cm^{-1}$ (D) $25{,}000\ cm^{-1}$.

24. The species in which of the following pairs have different geometry ?

(A) NF_3 and ClF_3 (B) NH_4^+ and SO_4^{2-}

(C) PO_4^{3-} and ClO_4^- (D) $BeCl_2$ and CO_2.

25. $Co(CO)_4$ will be isolobal with which of the following ?

(A) $Ni(CO)_3$ (B) $Mn(CO)_5$

(C) $Fe(CO)_4$ (D) $Cr(CO)_3$.

26. Oxygen-oxygen bond orders in the dioxygen species are in the following orders

(A) $O_2 < O_2^- < O_2^+ < O_2^{2-}$ (B) $O_2 < O_2^- > O_2^+ > O_2^{2-}$

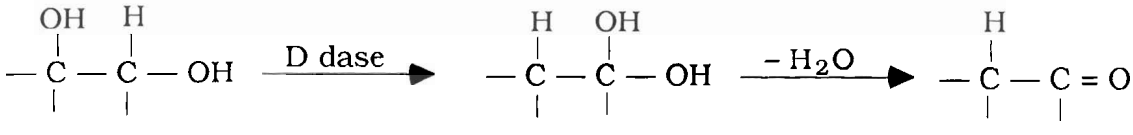
(C) $O_2 < O_2^- = O_2^+ > O_2^{2-}$ (D) $O_2 > O_2^- = O_2^+ > O_2^{2-}$.

27. Metal-metal bond order in the complex ion $\left[Mo_2 \left(SO_4 \right)_4^{3-} \right]$ is

(A) 4 (B) 3·5

(C) 3·0 (D) 2·5

28. Diol dehydrase (*D* dase) reaction :



requires the following coenzyme

(A) Vitamin B_{12} coenzyme (B) Coenzyme *Q*

(C) Vitamin B_6 coenzyme (D) Acetyl coenzyme-*A*.

29. Which statement is not correct for Reinecke's salt ?

(A) Chromium (III) (B) Red colour

(C) Inner metallic complex (D) Actinometery.

30. Identify the transition metal in the followiing :

18-electron complex : $\left(\eta^5 - C_5H_5\right) M \left(C_2H_4\right)_2$

(A) Mn (B) Fe

(C) Co (D) Mo.

31. Ground state term symbol of NO molecule is

(A) $^2\Delta$ (B) $^2\Sigma$

(C) $^2\Pi$ (D) $^1\Sigma$.

32. The energy levels of a particle in a cubic box are given by the expression

$$\Sigma_{nx,\,ny,\,nz} = \frac{h^2}{8\,ma^2}\left(n_x^2 + n_y^2 + n_z^2\right)$$

in which n_x, n_y, n_z = 1, 2, 3 ... and a is the length of the box.

The degeneracy of the $E = \frac{lnh^2}{8\,ma^2}$ level is

(A) 2 (B) 3

(C) 4 (D) 6.

33. The correct radial wave function for a hydrogenic d-orbital has the form (with β some constant)

(A) $e^{-\beta r^2}$ (B) $re^{-\beta r}$

(C) $r^2 e^{-\beta r}$ (D) $r^r e^{-\beta r^2}$.

34. A system consists of N particles and behaves according to Boltzmann statistics. At temperature T, the number of particles in a state having energy ε and a degeneracy, g, is directly proportional to

(A) $ge^{\varepsilon/kT}$ (B) ε / kT

(C) $g\,\varepsilon$ / kT (D) $ge^{-\varepsilon/kT}$.

35. When a solute distributes itself between two immiscible solvents, the equilibrium situation is given by the condition [μ : chemical potential, a : activity, c : concentration]

(A) $\mu_1^0 = \mu_2^0$ (B) $\mu_1 = \mu_2$

(C) $a_1 = a_2$ (D) $c_1 = c_2$.

36. The rate of a certain reaction is found to depend on the reactant concentration (R) as follows :

$$\text{Rate} = \frac{k_1 R}{1 + k_2 R}$$

This means, in the long-time limit, the reaction will be

(A) zero order (B) first order

(C) fractional order (D) exothermic.

37. In the Debye-Huckel limiting law, given by

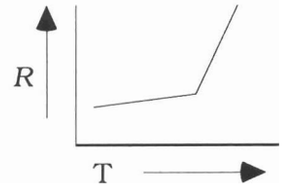
$$\log f_{\pm} = -A Z_{\pm}^2 \sqrt{\mu} ,$$

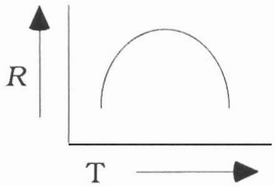
the A factor depends on temperature T and dielectric constant D according to

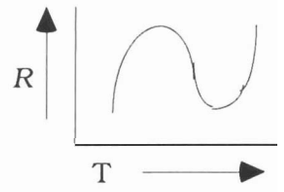
(A) $A \propto (DT)^{3/2}$ (B) $A \propto \frac{D^{3/2}}{T^{3/2}}$

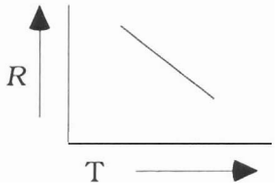
(C) $A \propto \frac{T^{3/2}}{D^{3/2}}$ (D) $A \propto \frac{1}{(DT)^{3/2}}$.

38. Which of the following curves denotes the enzyme reaction ?

(A) 

(B) 

(C) 

(D) 

39. In an FCC structure, atomic radius (r) is related to lattice spacing (a) by

(A) $r = \frac{a}{2}$ (B) $r = \frac{a}{\sqrt{2}}$

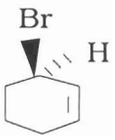
(C) $r = \frac{a}{2\sqrt{2}}$ (D) $r = \frac{a}{\sqrt{3}}$.

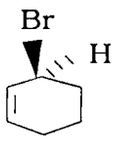
40. With increasing concentration, the surface tension of an aqueous solution is seen to show initially a steep fall-off and then attain a steady value. The solute is most probably

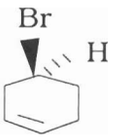
(A) sugar (B) NaCl

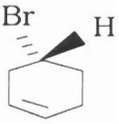
(C) $CH_3 - (CH_2)_8 COONa$ (D) $CH_3 COONa$.

41. The structure of (S)-3-bromocyclohexene is

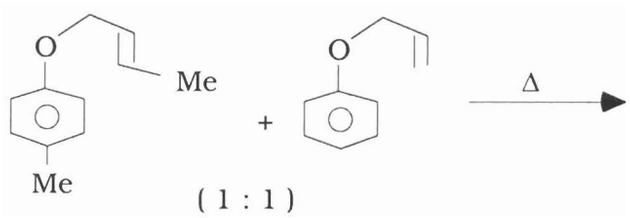
(A) 

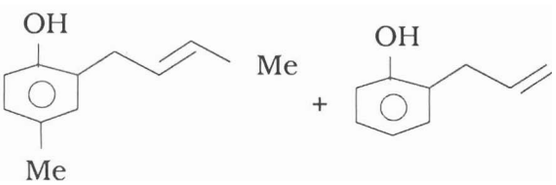
(B) 

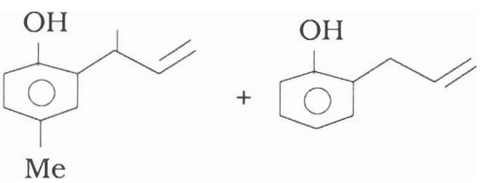
(C) 

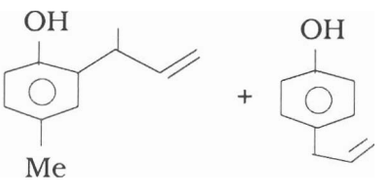
(D) 

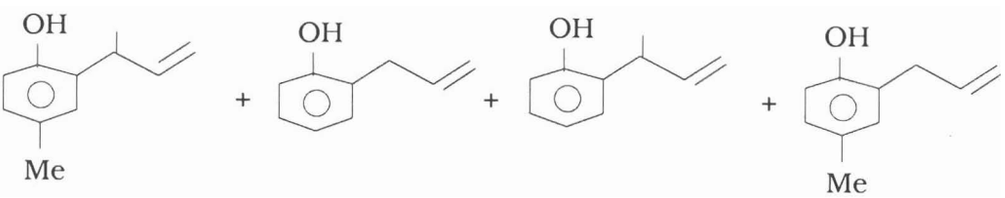
42. The products of the following reaction are



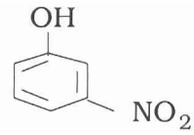
(A) 

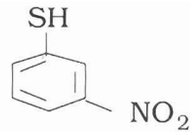
(B) 

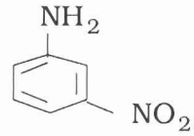
(C) 

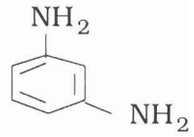
(D) 

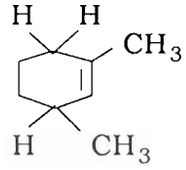
43. Product of reduction of *m*-dinitrobenzene with hot aqueous NH_4SH is

(A) 

(B) 

(C) 

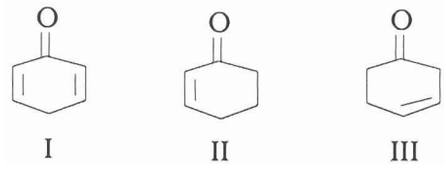
(D) 

44. Number of allylic hydrogens for  is

(A) 9 (nine) (B) 7 (seven)

(C) 6 (six) (D) 5 (five).

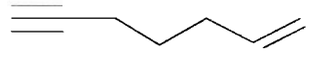
45. The λ_{max} (*U.V.*) of the following compounds are in the order :



I II III

(A) I > II > III (B) III > I > II

(C) I > III > II (D) II > I > III.

46. The IUPAC nomenclature of  is

(A) Hept-6-en-1-yne (B) Hept-1-yn-6-ene

(C) Hept-1-en-6-yne (D) Hept-6-yn-1-ene.

47. Which one is considered 'interfering' in qualitative analysis ?

(A) Arsenate (B) Silicate

(C) Chromate (D) Iodate.

48. Which of the following laboratory reagents is not toxic ?

(A) EDTA solution (B) H_2S

(C) $BaCl_2$ solution (D) $K_2Cr_2O_7$ solution.

49. The increasing order of acidity is as follows :

(A) $CH_3COOH < ClCH_2COOH < Me_3CCH_2COOH < Me_3SiCH_2COOH$

(B) $ClCH_2COOH < CH_3COOH < Me_3CCH_2COOH < Me_3SiCH_2COOH$

(C) $ClCH_2COOH < CH_3COOH < Me_3SiCH_2COOH < Me_3CCH_2COOH$

(D) $Me_3SiCH_2COOH < Me_3CCH_2COOH < CH_3COOH < ClCH_2COOH$.

50. What is the name of the element obtained from the artificial nuclear reaction

$^{240}_{94}Pu\left(^{12}_{6}C, 4n\right)$?

(A) Californium (B) Einsteinium

(C) Fermium (D) Mendelevium.