1. Which amongst the following is the most stable carbocation ?

(a) $CH_3-\overset{+}{C}H-CH_3$ (b) $CH_3-\overset{+}{C}(CH_3)-CH_3$

(c) $\overset{+}{C}H_3$ (d) $CH_3\overset{+}{C}H_2$

2. Products of the following reaction

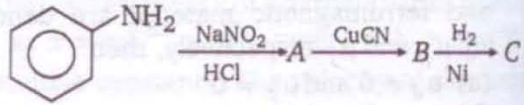
$CH_3C \equiv C \cdot CH_2CH_3 \xrightarrow[(2)\ \text{Hydrolysis}]{(1)\ O_3} \ldots$ are

(a) $CH_3CHO + CH_3CH_2CHO$
(b) $CH_3COOH + CH_3COCH_3$
(c) $CH_3COOH + HOOC \cdot CH_2CH_3$
(d) $CH_3COOH + CO_2$

3. At 25°C, the dissociation constant of a base, BOH, is 1.0×10^{-12}. The concentration of hydroxyl ions in 0.01 M aqueous solution of the base would be

(a) 2.0×10^{-6} mol L^{-1}
(b) 1.0×10^{-5} mol L^{-1}
(c) 1.0×10^{-6} mol L^{-1}
(d) 1.0×10^{-7} mol L^{-1}

4. Aniline in a set of reactions yielded a product *D*.



The structure of the product *D* would be

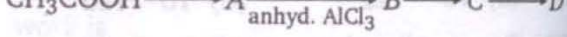
(a) $C_6H_5CH_2NH_2$ (b) $C_6H_5NHCH_2CH_3$
(c) C_6H_5NHOH (d) $C_6H_5CH_2OH$

5. The mass of carbon anode consumed (giving only carbondioxide) in the production of 270 kg of aluminium metal from bauxite by the Hall process is

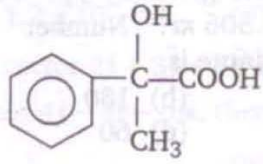
(Atomic mass Al = 27)

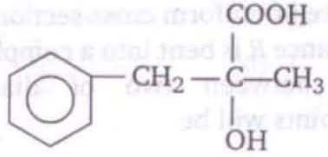
(a) 180 kg (b) 270 kg
(c) 540 kg (d) 90 kg

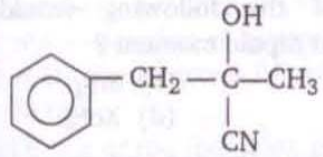
6. In a set of reactions, acetic acid yielded a product *D*.

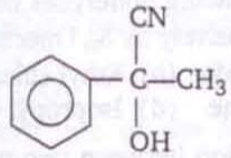


The structure of *D* would be

(a) 

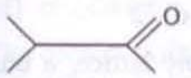
(b) 

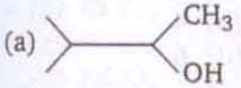
(c) 

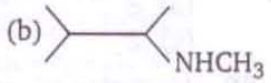
(d) 

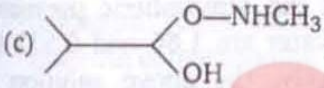
7. The major organic product formed from the following reaction

$$\xrightarrow[\text{(ii) } LiAlH_4 \text{ (iii) } H_2O]{\text{(i) } CH_3NH_2} \ldots\ldots \text{is}$$



(a) 

(b) 

(c) 

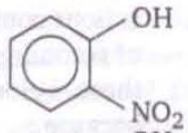
(d) 

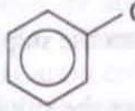
8. The number of moles of $KMnO_4$ reduced by one mole of KI in alkaline medium is
   (a) one-fifth (b) five
   (c) one (d) two

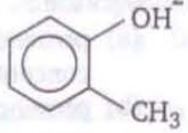
9. Which of the following molecules has trigonal planar geometry ?
   (a) IF_3 (b) PCl_3
   (c) NH_3 (d) BF_3

10. The aqueous solution containing which one of the following ions will be colourless ?
    (Atomic no. Sc = 21, Fe = 26, Ti = 22, Mn = 25)
    (a) Sc^{3+} (b) Fe^{2+}
    (c) Ti^{3+} (d) Mn^{2+}

11. Which one of the following compounds is most acidic ?

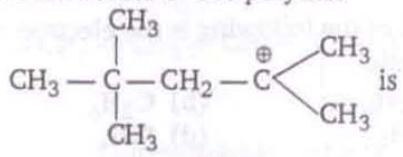
(a) $Cl—CH_2—CH_2—OH$ (b) 

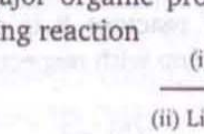
(c) 

(d) 

12. A reaction occurs spontaneously if
    (a) $T\Delta S < \Delta H$ and both ΔH and ΔS are +ve
    (b) $T\Delta S > \Delta H$ and both ΔH and ΔS are +ve
    (c) $T\Delta S = \Delta H$ and both ΔH and ΔS are +ve
    (d) $T\Delta S > \Delta H$ and ΔH is + ve and ΔS is –ve

13. The monomer of the polymer



(a) 

(b) $(CH_3)_2 C{=}C(CH_3)_2$

(c) $CH_3CH{=}CH \cdot CH_3$

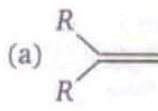
(d) $CH_3CH{=}CH_2$

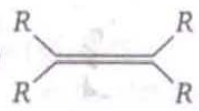
14. The correct sequence of increasing covalent character is represented by
    (a) $LiCl < NaCl < BeCl_2$
    (b) $BeCl_2 < NaCl < LiCl$
    (c) $NaCl < LiCl < BeCl_2$
    (d) $BeCl_2 < LiCl < NaCl$

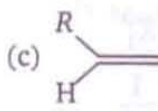
15. What is the correct relationship between the pHs of isomolar solutions of sodium oxide (pH_1), sodium sulphide (pH_2), sodium selenide (pH_3) and sodium telluride (pH_4) ?
    (a) $pH_1 > pH_2 \approx pH_3 > pH_4$
    (b) $pH_1 < pH_2 < pH_3 < pH_4$
    (c) $pH_1 < pH_2 < pH_3 \approx pH_4$
    (d) $pH_1 > pH_2 > pH_3 > pH_4$

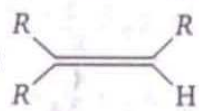
16. Which of the following pairs of a chemical reaction is certain to result in a spontaneous reaction ?
    (a) Exothermic and decreasing disorder
    (b) Endothermic and increasing disorder
    (c) Exothermic and increasing disorder
    (d) Endothermic and decreasing disorder

17. Which one of the following alkenes will react faster with H_2 under catalytic hydrogenation conditions ?
    (R = Alkyl substituent)

(a) 

(b) 

(c) 

(d) 

18. For a first order reaction $A \longrightarrow B$, the reaction rate at reactant concentration of 0.01 M is found to be 2.0×10^{-5} mol $L^{-1}s^{-1}$. The half life period of the reaction is

(a) 220 s (b) 30 s
(c) 300 s (d) 347 s

19. Which of the following is the electron deficient molecule ?

(a) B_2H_6 (b) C_2H_6
(c) PH_3 (d) SiH_4

20. A nuclide of an alkaline earth metal undergoes radioactive decay by emission of three α-particles in succession. The group of the periodic table to which the resulting daughter element would belong to

(a) Group 14 (b) Group 16
(c) Group 4 (d) Group 6

21. The absolute enthalpy of neutralisation of the reaction

$MgO(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l)$

will be

(a) less than – 57.33 kJ mol^{-1}
(b) – 57.33 kJ mol^{-1}
(c) greater than –57.33 kJ mol^{-1}
(d) 57.33 kJ mol^{-1}

22. Which one of the following forms micelles in aqueous solution above certain concentration?

(a) Urea
(b) Dodecyl trimethyl ammonium chloride
(c) Pyridinium chloride
(d) Glucose

23. Electrolytic reduction of nitrobenzene in weakly acidic medium gives

(a) aniline
(b) nitrosobenzene
(c) N-phenylhydroxylamine
(d) *p*-hydroxyaniline

24. Equilibrium constants K_1 and K_2 for the following equilibria

$$NO(g) + \frac{1}{2}O_2 \overset{K_1}{\rightleftharpoons} NO_2(g) \text{ and}$$

$$2NO_2(g) \overset{K_2}{\rightleftharpoons} 2NO(g) + O_2(g)$$

are related as

(a) $K_2 = \frac{1}{K_1}$ (b) $K_2 = K_1^2$
(c) $K_2 = \frac{K_1}{2}$ (d) $K_2 = \frac{1}{K_1^2}$

25. Which of the following would have a permanent dipole moment ?

(a) BF_3 (b) SiF_4
(c) SF_4 (d) XeF_4

26. Which of the following undergoes nucleophilic substitution exclusively by S_N1 mechanism ?

(a) Benzyl chloride (b) Ethyl chloride
(c) Chlorobenzene (d) Isopropyl chloride

27. The rate of reaction between two reactants *A* and *B* decreases by a factor of 4, if the concentration of reactant *B* is doubled. The order of this reaction with respect to reactant *B* is

(a) –1 (b) –2
(c) 1 (d) 2

28. In a face-centered cubic lattice, a unit cell is shared equally by how many unit cells ?

(a) 8 (b) 4
(c) 2 (d) 6

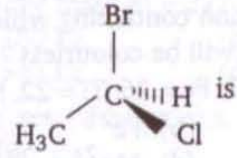
29. A solution of urea (mol. mass 56g mol^{-1}) boils at 100.18°C at the atmospheric pressure. If k_f and k_b for water are 1.86 and 0.512 K kg mol^{-1} respectively, the above solution will freeze at

(a) – 6.54° C (b) 6.54° C
(c) 0.654° C (d) – 0.654° C

30. Which functional group participates in disulphide bond formation in proteins ?

(a) Thiolactone (b) Thiol
(c) Thioether (d) Thioester

31. The chirality of the compound



is

(a) *R* (b) *S*
(c) *Z* (d) *E*

32. H_2S gas when passed through a solution of cations containing HCl precipitates the cations of second group of qualitative analysis but not those belonging to the fourth group. It is because :

(a) presence of HCl decreases the sulphide ion concentration
(b) presence of HCl increases the sulphide ion concentration

(c) solubility product of group II sulphides is more than that of group IV sulphides
(d) sulphides of group IV cations are unstable in HCl

33. Which one of the following oxides is expected to exhibit paramagnetic behaviour ?
(a) CO_2 (b) SO_2
(c) ClO_2 (d) SiO_2

34. Which one of the following is expected to exhibit optical isomerism ?
(en = ethylenediamine)
(a) *cis*-$[Pt(NH_3)_2Cl_2]$
(b) *trans*-$[Co(en)_2Cl_2]$
(c) *trans*-$[Pt(NH_3)_2Cl_2]$
(d) *cis*-$[Co(en)_2Cl_2]$

35. The correct order of acid strength is
(a) $HClO < HClO_2 < HClO_3 < HClO_4$
(b) $HClO_4 < HClO < HClO_2 < HClO_3$
(c) $HClO_2 < HClO_3 < HClO_4 < HClO$
(d) $HClO_4 < HClO_3 < HClO_2 < HClO$

36. The main reason for larger number of oxidation states exhibited by the actinides than the corresponding lanthanides, is
(a) lesser energy difference between 5*f* and 6*d* orbitals than between 4*f* and 5*d* orbitals
(b) larger atomic size of actinides than the lanthanides
(c) more energy difference between 5*f* and 6*d* orbitals than between 4*f* and 5*d* orbitals
(d) greater reactive nature of the actinides than the lanthanides

37. Names of some compounds are given. Which one is not correct in IUPAC system ?
(a) $CH_3-\underset{\underset{OH}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-CH_3$
3–methyl–2butanol

(b) $CH_3-C\equiv C-CH(CH_3)_2$
4-methyl-2-pentyne

(c) $CH_3-CH_2-\underset{\underset{CH_2}{\|}}{C}-\underset{\underset{CH_3}{|}}{CH}-CH_3$
2-ethyl-3-methyl-but-1-ene

(d) $CH_3-CH_2-CH_2-\underset{\underset{CH_2CH_3}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-CH_2CH_3$
3-methyl-4-ethyl heptane

38. A solution has a 1 : 4 mole ratio of pentane to hexane. The vapour pressure of the pure hydrocarbons at 20°C are 440 mm of Hg for pentane and 120 mm of Hg for hexane. The mole fraction of pentane in the vapour phase would be
(a) 0.549 (b) 0.200
(c) 0.786 (d) 0.478

39. 4.5 g of aluminium (Atomic mass 27 amu) is deposited at cathode from Al^{3+} solution by a certain quantity of electric charge. The volume of hydrogen produced at STP from H^+ ions in solution by the same quantity of electric charge will be
(a) 22.4 L (b) 44.8 L
(c) 5.6 L (d) 11.2 L

40. The best method for the separation of naphthalene and benzoic acid from their mixture is
(a) chromatography
(b) crystallisation
(c) distillation
(d) sublimation

Answer – Key

1. b	**2. c**	**3. d**	**4. d**	**5. d**	**6. a**	**7. b**	**8. d**	**9. d**	**10. a**
11. b	**12. b**	**13. a**	**14. c**	**15. d**	**16. c**	**17. a**	**18. d**	**19. a**	**20. a**
21. a	**22. b**	**23. c**	**24. d**	**25. c**	**26. a**	**27. b**	**28. d**	**29. d**	**30. b**
31. a	**32. a**	**33. c**	**34. b**	**35. a**	**36. a**	**37. d**	**38. d**	**39. c**	**40. d**