CHEMISTRY

1. Which one of the following statements is FALSE?

   1) During roasting, moisture is removed from the ore.
   2) The ore is freed from almost all nonmetallic impurities.
   3) Calcination of ore is carried out in the absence of any blast of air.
   4) The concentrated zinc blende is subjected to calcination during its extraction by pyrometallurgy.

2. Which one of the following sets of quantum numbers represents the highest energy level in an atom?

   1) $n = 4,\ l = 0,\ m = 0,\ s = +\frac{1}{2}$
   2) $n = 3,\ l = 1,\ m = 1,\ s = +\frac{1}{2}$
   3) $n = 3,\ l = 2,\ m = -2,\ s = +\frac{1}{2}$
   4) $n = 3,\ l = 0,\ m = 0,\ s = +\frac{1}{2}$

3. When O_2 is converted into O_2^+; .....

   1) both paramagnetic character and bond order increase
   2) bond order decreases
   3) paramagnetic character increases
   4) paramagnetic character decreases and the bond order increases

4. In chromite ore, the oxidation number of iron and chromium are respectively .....

   1) +3, +2
   2) +3, +6
   3) +2, +6
   4) +2, +3

5. The number of naturally occurring *p*-block elements that are diamagnetic is .....

   1) 18
   2) 6
   3) 5
   4) 7

(Space for Rough Work)

6. If the energies of the two photons are in the ratio of 3 : 2, their wavelengths will be in the ratio of .....

1) 9 : 4 2) 2 : 3

3) 1 : 2 4) 3 : 2

7. Which one of these is NOT TRUE for benzene?

1) There are three carbon-carbon single bonds and three carbon-carbon double bonds.
2) It forms only one type of monosubstituted product.
3) The bond angle between carbon-carbon bonds is 120°.
4) Heat of hydrogenation of benzene is less than the theoretical value.

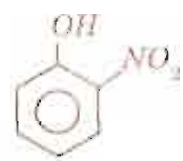
8. Generally, the first ionization energy increases along a period. But there are some exceptions. The one which is NOT an exception is .....

1) *Na* and *Mg* 2) *Be* and *B*

3) *N* and *O* 4) *Mg* and *Al*

9. Out of the given two compounds, the vapour pressure of B at a particular temperature is .....

(A)



(B)

1) lower than that of A
2) higher than that of A
3) same as that of A
4) higher or lower than A depending on the size of the vessel

10. Increasing order of carbon-carbon bond length for the following is .....

C_2H_4	C_2H_2	C_6H_6	C_2H_6
(A)	(B)	(C)	(D)

1) B < C < A < D 2) C < B < A < D

3) B < A < C < D 4) D < C < A < B

(Space for Rough Work)

11. A mixture of $CaCl_2$ and $NaCl$ weighing 4.44 g is treated with sodium carbonate solution to precipitate all the calcium ions as calcium carbonate. The calcium carbonate so obtained is heated strongly to get 0.56 g of CaO. The percentage of $NaCl$ in the mixture is ..... (Atomic mass of $Ca = 40$).

1) 31.5 2) 75

3) 25 4) 40.2

12. 50 cm^3 of 0.2 N HCl is titrated against 0.1 N $NaOH$ solution. The titration was discontinued after adding 50 cm^3 of $NaOH$. The remaining titration is completed by adding 0.5 N KOH. The volume of KOH required for completing the titration is .....

1) 10 cm^3 2) 12 cm^3

3) 16.2 cm^3 4) 21.0 cm^3

13. The rms velocity of hydrogen is $\sqrt{7}$ times the rms velocity of nitrogen. If T is the temperature of the gas, which of the following is true?

1) $T_{N_2} = T_{H_2}$ 2) $T_{H_2} = \sqrt{7}\,T_{N_2}$

3) $T_{N_2} = 2T_{H_2}$ 4) $T_{N_2} = \sqrt{7}\,T_{H_2}$

14. 25 g of each of the following gases are taken at 27°C and 600 mm pressure. Which of these will have the least volume?

1) HBr 2) HCl

3) HF 4) HI

15. The amount of heat evolved when 500 cm^3 of 0.1 M HCl is mixed with 200 cm^3 of 0.2 M $NaOH$ is .....

1) 1.292 kJ 2) 2.292 kJ

3) 0.292 kJ 4) 22.9 kJ

(Space for Rough Work)

16. The enthalpy of vaporization of benzene is +35.3 kJ/mol at its boiling point of 80°C. The entropy change in the transition of vapour to liquid at its boiling point is ..... (in J mol^{-1} K^{-1})

1) −100 2) +100

3) +342 4) −342

17. Based on the first law of thermodynamics, which one of the following is correct?

1) For an isothermal process, $q = +w$

2) For an isochoric process, $\Delta U = -q$

3) For an adiabatic process, $\Delta U = -w$

4) For a cyclic process, $q = -w$

18. Consider the following gaseous equilibria with equilibrium constants K_1 and K_2 respectively.

$$SO_{2(g)} + \frac{1}{2}O_{2(g)} \rightleftharpoons SO_{3(g)}$$

$$2SO_{3(g)} \rightleftharpoons 2SO_{2(g)} + O_{2(g)}$$

The equilibrium constants are related as .....

1) $2K_1 = K_2^2$ 2) $K_1^2 = \frac{1}{K_2}$

3) $K_2^2 = \frac{1}{K_1}$ 4) $K_2 = \frac{2}{K_1^2}$

19. During the adsorption of Krypton on activated charcoal at low temperature; .....

1) $\Delta H < 0$ and $\Delta S < 0$ 2) $\Delta H > 0$ and $\Delta S < 0$

3) $\Delta H > 0$ and $\Delta S > 0$ 4) $\Delta H < 0$ and $\Delta S > 0$

20. For the reversible reaction, $A_{(g)} + B_{(g)} \rightleftharpoons C_{(g)} + D_{(g)}$ $\Delta G^\circ = -350$ kJ, which one of the following statements is true?

1) The reaction is thermodynamically nonfeasible.

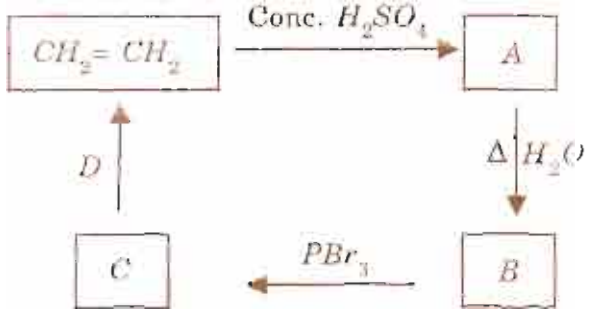
2) The entropy change is negative.

3) Equilibrium constant is greater than one.

4) The reaction should be instantaneous.

(Space for Rough Work)

21. Identify B and D in the following sequence of reactions.



1) Methanol and bromoethane
2) Ethyl hydrogen sulphate and alcoholic KOH
3) Ethyl hydrogen sulphate and aqueous KOH
4) Ethanol and alcoholic KOH

22. The compound which gives turbidity immediately with Lucas reagent at room temperature is .....

1) butan-1-ol
2) butan-2-ol
3) 2-methyl propan-2-ol
4) 2-methyl propan-1-ol

23. Ethyl benzene CANNOT be prepared by .....

1) Wurtz reaction
2) Wurtz-Fittig reaction
3) Friedel-Crafts reaction
4) Clemmensen reduction

24. 1.2 g of organic compound on Kjeldahlization liberates ammonia which consumes 30 cm^3 of 1 N HCl. The percentage of nitrogen in the organic compound is .....

1) 30
2) 35
3) 46.67
4) 20.8

25. Carbon cannot reduce Fe_2O_3 to Fe at a temperature below 983 K because .....

1) free energy change for the formation of CO is more negative than that of Fe_2O_3
2) CO is thermodynamically more stable than Fe_2O_3
3) carbon has higher affinity towards oxygen than iron
4) iron has higher affinity towards oxygen than carbon

(Space for Rough Work)

26. The yellow precipitate formed during the chromyl chloride test is chemically .....

1) chromic acid
2) lead chromate
3) lead acetate
4) sodium chromate

27. One gram of silver gets distributed between 10 cm^3 of molten zinc and 100 cm^3 of molten lead at 800°C. The percentage of silver still left in the lead layer is approximately .....

1) 3
2) 6
3) 8
4)

28. Which one of the following is true?

1) $NaOH$ is used in the concentration of bauxite ore.
2) $NaOH$ is a primary standard in volumetric analysis.
3) Manganous hydroxide is soluble in excess of $NaOH$ solution.
4) $NaOH$ solution does not react with Cl_2.

29. In Ramsay and Rayleigh's isolation of noble gases from air, the nitrogen of the air is finally converted into .....

1) $NaNO_2$ only
2) NO and NO_2
3) $NaNO_3$ only
4) $NaNO_2$ and $NaNO_3$

30. The spin only magnetic moment of Fe^{2+} ion (in BM) is approximately .....

1)
2) 7
3) 5
4) 6

(Space for Rough Work)

31. The IUPAC name of the complex $\left[Co(NH_3)_4Cl_2\right]Cl$ is .....

1) dichloro tetraammine cobalt (III) chloride
2) tetraammine dichloro cobalt (III) chloride
3) tetraammine dichloro cobalt (II) chloride
4) tetraammine dichloro cobalt (IV) chloride

32. Excess of silver nitrate solution is added to 100 ml of 0.01 M Pentaaqua chloro chromium (III) chloride solution. The mass of silver chloride obtained in grams is ..... [Atomic mass of silver is 108].

1) 287×10^{-2}
2) 143.5×10^{-3}
3) 143.5×10^{-2}
4) 287×10^{-3}

33. The following data were obtained during the first order decomposition of $2A_{(g)} \rightarrow B_{(g)} + C_{(s)}$ at a constant volume and at a particular temperature.

Sr. No.	Time	Total pressure in Pascal
1	At the end of 10 min	300
2	After completion	200

The rate constant in min^{-1} is .....

1) 0.0693
2) 69.3
3) 6.93
4) 6.93×10^{-4}

34. The time required for 100% completion of a zero order reaction is .....

1) ak
2) $\frac{a}{2k}$
3) $\frac{a}{k}$
4) $\frac{2k}{a}$

35. The activation energy of a reaction at a given temperature is found to be 2.303 RT J mol^{-1}. The ratio of rate constant to the Arrhenius factor is .....

1) 0.01
2) 0.1
3) 0.02
4) 0.001

(Space for Rough Work)

36. pH value of which one of the following is NOT equal to one?

1) 0.1 M CH_3COOH
2) 0.1 M HNO_3
3) 0.05 M H_2SO_4
4) 50 cm^3 0.4 M HCl + 50 cm^3 0.2 M $NaOH$

37. A buffer solution contains 0.1 mole of sodium acetate dissolved in 1000 cm^3 of 0.1 M acetic acid. To the above buffer solution, 0.1 mole of sodium acetate is further added and dissolved. The pH of the resulting buffer is .....

1) pK_a
2) $pK_a + 2$
3) $pK_a - Log\ 2$
4) $pK_a + Log\ 2$

38. H_2S is passed into one dm^3 of a solution containing 0.1 mole of Zn^{2+} and 0.01 mole of Cu^{2+} till the sulphide ion concentration reaches $8.1 \times 10^{-?}$ moles. Which one of the following statements is true?
[K_{sp} of ZnS and CuS are 3×10^{-22} and 8×10^{-36} respectively]

1) Only ZnS precipitates
2) Both CuS and ZnS precipitate
3) Only CuS precipitates
4) No precipitation occurs

39. E_1, E_2 and E_3 are the emfs of the following three galvanic cells respectively :

(i) $Zn(s) \mid Zn^{2+}(0.1\,M) \parallel Cu^{2+}(1\,M) \mid Cu(s)$
(ii) $Zn(s) \mid Zn^{2+}(1\,M) \parallel Cu^{2+}(1\,M) \mid Cu(s)$
(iii) $Zn(s) \mid Zn^{2+}(1\,M) \parallel Cu^{2+}(0.1\,M) \mid Cu(s)$

Which one of the following is true?

1) $E_3 > E_1 > E_2$
2) $E_1 > E_2 >$
3) $E_3 > E_2 > E_1$
4) $E_2 > E_1 >$

40. 0.023 g of sodium metal is reacted with 100 cm^3 of water. The pH of the resulting solution is .....

1) 10
2)
3) 9
4) 12

(Spare for Rough Work)

41. The standard emf of a galvanic cell involving 2 moles of electrons in its redox reaction is 0.59 V. The equilibrium constant for the redox reaction of the cell is .....

1) 10^{-2} 2) 10^{2}

3) 10 4) 10^{10}

42. 9.65 coulombs of electric current is passed through fused anhydrous $MgCl_2$. The magnesium metal thus obtained is completely converted into a Grignard reagent. The number of moles of Grignard reagent obtained is .....

1) 5×10^{-4} 2) 1×10^{-4}

3) 5×10^{-5} 4) 1×10^{-5}

43. The empirical formula of a nonelectrolyte is CH_2O. A solution containing 3 g of the compound exerts the same osmotic pressure as that of 0.05 M glucose solution. The molecular formula of the compound is .....

1) CH_2O 2) $C_2H_4O_2$

3) $C_4H_8O_4$ 4) $C_6H_6O_3$

44. Which one of the following is a covalent crystal?

1) Rock salt 2) Ice

3) Quartz 4) Dry ice

45. Which one of the following DOES NOT involve coagulation?

1) Clotting of blood by the use of ferric chloride

2) Formation of delta region

3) Treatment of drinking water by potash alum

4) Peptization

(Space for Rough Work)

46. A solution of two liquids boils at a temperature more than the boiling point of either of them. Hence, the binary solution shows .....

1) negative deviation from Raoult's law
2) positive deviation from Raoult's law
3) no deviation from Raoult's law
4) positive or negative deviation from Raoult's law depending upon the composition

47. Which one of the nitrogen atoms in $H_2\overset{I}{N}-\overset{II}{NH}-\overset{\overset{O}{\|}}{\overset{III}{C}}-NH_2$ is the most nucleophilic?

1)
2)
3)
4) All three nitrogen atoms are equally strong nucleophilic centers

48. The maximum number of possible optical isomers in 1-bromo-2-methyl cyclobutane is ...

1) 4 2) 2
3) 8 4) 16

49. Which one of the following is the most energetic conformation of cyclohexane?

1) Boat 2) Twisted boat
3) Chair 4) Half chair

50. Which one of the following is an intermediate in the reaction of benzene with CH_3Cl in the presence of anhydrous $AlCl_3$?

1) Cl^+ 2) CH_3^+
3) CH_3^- 4) 

(Space for Rough Work)

51. Which one of the following is NOT TRUE for the hydrolysis of *t*-butyl bromide with aqueous *NaOH*?

1) Reaction occurs through the S_N1 mechanism.
2) The intermediate formed is a carbocation.
3) Rate of the reaction doubles when the concentration of alkali is doubled.
4) Rate of the reaction doubles when the concentration of *t*-butyl bromide is doubled.

52. Following is the substitution reaction in which *–CN* replaces *–Cl*.

$$R\text{–}Cl + \underset{(alcoholic)}{KCN} \xrightarrow{\Delta} R\text{–}CN + KCl$$

To obtain propanenitrile, *R-Cl* should be .....

1) chloroethane
2) 1-chloropropane
3) chloromethane
4) 2-chloropropane

53. The conversion of *m*-nitrophenol to resorcinol involves respectively .....

1) hydrolysis, diazotization and reduction
2) diazotization, reduction and hydrolysis
3) hydrolysis, reduction and diazotization
4) reduction, diazotization and hydrolysis

54. Formic acid is a stronger acid than acetic acid. This can be explained using .....

1) +M effect
2) –I effect
3) +I effect
4) –M effect

55. The reagent with which both acetaldehyde and acetone react is .....

1) Fehling's solution
2) I_2 / *NaOH*
3) Tollens' reagent
4) Carbonic acid

(Space for Rough Work)

56. Which of the following gives an aldehyde on dry distillation?

1) Calcium formate + calcium acetate
2) Calcium acetate + calcium benzoate
3) Calcium acetate
4) Calcium benzoate

57. α-maltose consists of .....

1) one α-D-glucopyranose unit and one β-D-glucopyranose unit with 1-2 glycosidic linkage
2) two α-D-glucopyranose units with 1-2 glycosidic linkage
3) two β-D-glucopyranose units with 1-4 glycosidic linkage
4) two α-D-glucopyranose units with 1-4 glycosidic linkage

58. Which one of the following DOES NOT correctly match with each other?

1) Silk-polyamide
2) Lipase-enzyme
3) Butter-fat
4) Oxytocin-enzyme

59. In an alkaline medium, glycine predominantly exists as/in a/an

1) cation
2) anion
3) zwitterion
4) covalent form

60. The IUPAC name of  is ...

1) but-3-enoic acid
2) but-1-enoic acid
3) pent-4-enoic acid
4) prop-2-enoic acid

(Space for Rough Work)