Mock Test – 1 (Engineering Entrance)

The following mock test has been prepared keeping in mind the major competitive exams, that is, AIEEE, IIT-JEE and AIPMT which enable students understand the methodology used in solving various types of questions and thereby enhance their competitive skills.

1. A compound is formed by elements A and B. This crystal-lizes in the cubic structure where the A atoms are at the corners of the cube and B atoms are at the body centers. The simplest formula of the compound is
   (a) AB   (b) A_2B (c) AB_2 (d) AB_{6+}

2. An electrochemical cell stops working after some time because
   (a) one of the electrodes is eaten away.
   (b) electrode potentials of both the electrodes become equal in magnitude.
   (c) electrode potentials of both electrodes go on decreasing.
   (d) electrode potentials of both the electrodes go on increasing.

3. The major product in the reaction of α-bromocyclohexa-none with potassium ethoxide is

   (a)

   (b)

   (c)

   (d)
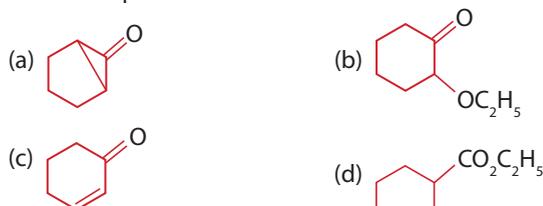
4. Which of the following is addition polymer?
   (a) PVC   (b) Nylon-6
   (c) Terylene   (d) None of these

5. For the reaction $H_2(g) + I_2(g) \rightarrow 2HI(g)$, the rate of disap-pearance of H_2 is 1.0×10^{-4} mol L^{-1} s^{-1}. The rate of appear-ance of HI will be
   (a) 1.0×10^{-4} mol L^{-1} s^{-1} (b) 0.50×10^{-4} mol L^{-1} s^{-1}
   (c) 2.0×10^{-4} mol L^{-1} s^{-1} (d) 4.0×10^{-4} mol L^{-1} s^{-1}

6. An aqueous solution of hydrochloric acid
   (a) obeys Raoult's law.
   (b) shows negative deviations from Raoult's law.
   (c) shows positive deviations from Raoult's law.
   (d) obeys Henry's law at all compositions.

7. Which of the following reagents can convert benzenedia-zonium chloride into benzene?
   (a) Water   (b) HNO_3
   (c) Hypophosphorous acid   (d) HCl

8. Which radical can bring about the highest oxidation state of transition metal?
   (a) F$^-$ (b) Cl$^-$ (c) Br$^-$ (d) I$^-$

9. A mixture of two organic chlorine compounds was treated with sodium metal in ether solution. Isobutane was obtained as one of the products. The two chlorides are:
   (a) methyl chloride and propyl chloride.
   (b) methyl chloride and ethyl chloride.
   (c) isopropyl chloride and methyl chloride.
   (d) isopropyl chloride and ethyl chloride.

10. Which of the following contains both Ca and Mg?
    (a) Limestone   (b) Dolomite
    (c) Chalk   (d) Feldspar

11. A compound X (C_5H_8) reacts with ammoniacal $AgNO_3$ to give a white precipitate, and on oxidation with hot alkaline $KMnO_4$ gives the acid, $(CH_3)_2CHCOOH$. Therefore, X is:
    (a) $CH_2 = CHCH = CHCH_3$ (b) $CH_3(CH_2)_2C \equiv CH$
    (c) $(CH_3)_2CH - C \equiv CH$ (d) $(CH_3)_2C = C = CH_2$

12. Which one of the following will most readily be dehy-drated in acidic conditions?

    (a)

    (b)

    (c)

    (d)
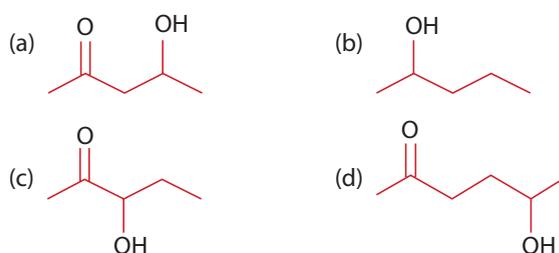
13. Which of the following statements are correct?
    (a) α- and β-D-glucopyranose are anomers.
    (b) α- and β-fructose are enantiomers.
    (c) Galactose is a C4 epimer of glucose.
    (d) Invert sugar is laevorotatory.

14. Which of the following statements are correct for a binary solution which shows negative deviation from Raoult's law?
    (a) The negative deviation from linearity diminishes and tends to zero as the concentration of the solution component approaches unity.
    (b) When solutions form, their volumes are smaller than the sum of the volumes of their components.
    (c) Heat is released during the formation of the solution.
    (d) Heat is absorbed during the formation of the solution.

15. The space in which atoms are not present in unit cell is/are
    (a) in sc 48%.   (b) in fcc 26%.
    (c) in bcc 32%.   (d) in hcp 26%.

16. In the chemical reaction $C_6H_5NH_2 \xrightarrow[\text{HCl, 5 °C}]{\text{NaNO}_2} A \xrightarrow{\text{HBF}_4} B$ the compounds A and B are

(a) nitrobenzene; fluorobenzene

(b) phenol; benzene

(c) benzenediazonium chloride; fluorobenzene

(d) nitrobenzene; chlorobenzene

17. The grouping >CO is present in

(a) ethers.   (b) alcohols.

(c) ketones.   (d) aldehydes.

18. In the reaction $RCONH_2 + X \rightarrow RNH_2$ the reagent X is

(a) PCl_5 (b) $NaOH + Br_2$

(c) soda lime.   (d) NaOBr

19. In a reaction $2X + Y \rightarrow X_2Y$, the reactant X will disappear at

(a) half the rate as that of disappearance of Y.

(b) the same rate as that of disappearance of Y.

(c) twice the rate as that of appearance of X_2Y.

(d) twice the rate as that of disappearance of Y.

20. Which one of the following conditions will increase the voltage of the cell represented by the following equation?

$$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$$

(a) Decrease in the concentration of $Zn^{2+}(aq)$ ions.

(b) Increase in the concentration of $Cu^{2+}(aq)$ ions.

(c) Decrease in the temperature.

(d) Increase in the pressure.

Assertion-Reasoning Type

NOTE: Each question contains **Statement-1** (Assertion) and **Statement-2** (Reason). Each question has four choices (a), (b), (c) and (d) out of which ONLY ONE is correct.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1,

(c) Statement-1 is True, Statement-2 is False.

(d) Statement-1 is False, Statement-2 is True.

21. **Statement-1:** In AgCl crystal, Frenkel defect can be observed.

Statement-2: Ag^+ is a small-sized atom.

22. **Statement-1:** $CuSO_4$ can be kept in a zinc vessel.
Statement-2: Cu is placed above zinc in the electrochemical series.

23. **Statement-1:** Cyclohexanone forms cyanohydrin in good yield but 2,4,6-trimethylcyclohexanone does not.
Statement-2: The formation of cyanohydrin involves the nucleophilic attack by CN^- ion on the carbonyl carbon.

24. **Statement-1:** Reverse osmosis is used to purify saline water.
Statement-2: Solvent molecules pass from concentrated to dilute solution through semipermeable membrane if high pressure is applied on the solution.

25. **Statement-1:** The dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.

Statement-2: Benzene molecule (or ring) is flat (planar) with all carbon and hydrogen atoms lying in the same plane, while in cyclohexyl chloride the ring of cyclohexane is not planar.

26. **Statement-1:** Aldehydes are more reactive than corresponding ketone for nucleophilic reactions.

Statement-2: Due to electron density at functional group carbon, which is higher in ketone than in aldehyde.

27. **Statement-1:** Hydrolysis of cane sugar is a first-order reaction.

Statement-2: Water is present in large excess during hydrolysis.

Passage I for Questions 28 to 30

Close-packing of particles result in two highly efficient lattices, hexagonal close-packed (hcp) and cubic close-packed (ccp) structures. The latter is also called face-centered cubic lattice (fcc). In both of these packing, 74% space is filled. The remaining space is present in the form of two types of voids – octahedral voids and tetrahedral voids. Other types of packing that are not close-packing have less efficient packing of particles. While in body-centered cubic lattice (bcc), 68% space is filled and in simple cubic lattice only 52.4 % space is filled.

28. In hcp structure, the packing fraction is

(a) 0.68   (b) 0.774

(c) 0.50   (d) 0.54

29. In hexagonal close-packing of sphere in three dimensions,

(a) in one unit cell there are 12 octahedral voids and all are completely inside the unit cell.

(b) in one unit cell there are 6 octahedral voids and all are completely inside the unit cell.

(c) in one unit cell there are 6 octahedral voids out of which three are completely inside the unit cell and other three are from contributions of octahedral voids which are partially inside the unit cell.

(d) in one unit cell there are 12 tetrahedral voids and all are completely inside the unit cell

30. How many six-fold axes of symmetry does a hexagonal close-packing have?

(a) 2   (b) 3

(c) 1   (d) 4

Passage II for Questions 31 to 33

All the four colligative properties of solutions depend solely on the total number of solute particles present in solution. Various electrolytes ionize and yield more than one particle per unit in solution. The properties of these electrolytes can be correlated by the use of a factor called van't Hoff factor

31. The van't Hoff factor for NaCl is 1.9. The degree of dissociation is

(a) 45%   (b) 100%   (c) 90%   (d) 60%

32. A 0.01 M solution of $K_2[Fe(CN)_6]$ is 50% dissociated at 27 °C. Then, the osmotic pressure of solution will be

(a) 0.02 atm   (b) 0.61 atm

(c) 0.78 atm   (d) 1.29 atm

33. The ratio of elevation of boiling point for NaCl solution to that for sugar of same concentration is

(a) 1   (b) 2   (c) 3   (d) 0.5

Passage III for Questions 34 to 36

An unknown compound of carbon, hydrogen and oxygen containing 69.8% carbon, 11.6% hydrogen has a molecular mass of 86 g mol^{-1}. It does not reduce Fehling's solution, but forms a bisulphite addition compound, and gives a positive iodoform test.

34. Molecular formula for the compound is

(a) $C_5H_{10}O$ (b) C_5H_9OH

(c) CH_3CHO (d) None of these.

35. Unknown compound may be

(a) aldehyde.   (b) ketone.

(c) carboxylic acid.   (d) alcohol.

36. The possible compound is

(a) pentan-2-one.

(b) pentan-1-one.

(c) 3-methylbutan-1-one.

(d) None of these.

Passage IV for Questions 37 to 39

With the exception the simplest amino acid, glycine, all amino acids contain a chiral center. Further, almost all naturally occurring amino acids have L-configuration at the α-carbon, that is, they have the same relative configuration as L-glyceraldehyde.

In the dry state, amino acids exist as dipolar ions (also known as zwitterions) or inner salts, a form in which the carboxyl group is present as a carboxylate ion –COO^-, and the amino group as an ammonium ion, –NH_3^+.

$$
\underset{H_2NCHCOOH}{\overset{R}{|}} \qquad \underset{H_3\overset{+}{N}CHCO\overset{-}{O}}{\overset{R}{|}}
$$
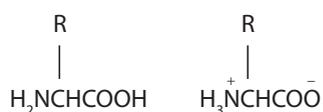
The dipolar ionic (salt-like) structure of amino acids explains all of its above properties.

37. In aqueous solution, glycine is present as

(a) $H_3N^+CH_2COO^-$ (b) $H_3N^+CH_2COOH$

(c) $H_2NCH_2COO^-$ (d) All of these.

38. Amino acids constitute one of the important class of organic compounds. These are

(a) fairly soluble in organic solvents such as ether, benzene, etc.

(b) fairly soluble in water.

(c) insoluble in both organic solvents and water.

(d) soluble in both organic solvents and water.

39. Glycine in strongly acidic medium

(a) exists as a cation.   (b) exists as an anion.

(c) exists as a dipolar ion.   (d) exists as a neutral molecule.

Passage V for Questions 40 to 42
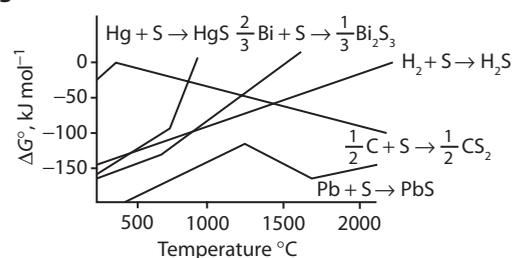
40. Formation of which of the sulphides is most spontaneous?

(a) HgS   (b) Bi_2S_3 (c) PbS   (d) CS_2

41. Which occurs to minimum extent in nature?

(a) AgS   (b) H_2S (c) Bi_2S_3 (d) CS_2
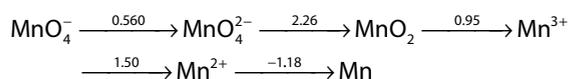
42. Which of the following sulphides can be reduced to metal by H_2 at about 1000 °C?

(a) HgS   (b) PbS

(c) CS_2 (d) All of these.

Passage VI for Questions 43 to 45

The potential of an electrode when each species involved in it exists in the standard state is called its standard potential. The standard reduction potential of a couple is the measure of its tendency to get reduced. A series obtained by arranging the various couples in order of their decreasing standard potentials is called electrochemical series. Any of the two couples of this series joined together gives an electrochemical cell in which reduction occurs at the electrode which occupies the higher position. The standard potential of hydrogen electrode is taken to be zero by convention.

Given below is the sequence of half-reactions (acidic media) with relevant $E°$ values in volts at 298K.
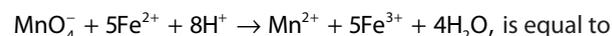
$$MnO_4^- \xrightarrow{0.560} MnO_4^{2-} \xrightarrow{2.26} MnO_2 \xrightarrow{0.95} Mn^{3+}$$
$$\xrightarrow{1.50} Mn^{2+} \xrightarrow{-1.18} Mn$$

Also given some more data are:

$$Fe^{2+} \xrightarrow{-0.44} Fe(s) \xrightarrow{+0.036} Fe^{3+}$$

43. The $E°$ for $MnO_4^- \rightarrow Mn^{2+}$ is equal to

(a) 1.054 V   (b) 1.506 V

(c) 5.27 V   (d) 7.53 V

44. The value of $E°$ for the reaction:

$MnO_4^- + 5Fe^{2+} + 8H^+ \rightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$, is equal to

(a) 0.734 V

(b) 0.282 V

(c) 4.498 V

(d) Cannot be calculated as concentrations of species are not given.

45. For the cell

Fe(s) | Fe^{2+} (0.1 M) || 100 mL 0.3 M HA (pK$_a$ = 5.2), mixed with 50 mL 0.4 M NaOH | H_2 (1 atm), Pt the E_{cell} at 298 K (2.303 $\dfrac{RT}{F}$ and $\log_{10} 20 = 1.3$) is equal to
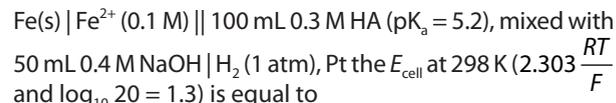
(a) –0.15 V   (b) +0.185 V

(c) –0.44 V   (d) +0.145 V
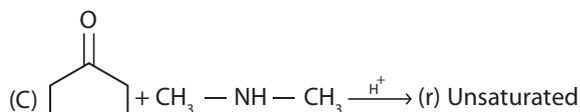
Integer Answer Type

46. Silver has a cubic unit cell with a cell edge of 480 pm. Its density is 10.6 g cm^{-3}. How many atoms of silver are there in the unit cell?

47. At equimolar concentration of Fe^{2+} and Fe^{3+} what must $[Ag^+]$ be so that the voltage of the galvanic cell made from Ag^+/Ag and Fe^{3+}/Fe^{2+} electrodes equals zero? The reaction is $Fe^{2+} + Ag^+ \rightleftharpoons Fe^{3+} + Ag$. Determine the quilibrium constant at 25 °C for the reaction. Given: $E^o_{Ag^+/Ag}$ = 7.99 V and $E^o_{Fe^+/Fe^{2+}}$ = 0.771 volt.

48. Sea Water contains 1297.3 g of Mg^{2+} per metric ton. How much of slaked lime in kg must be added to 1.0 metric ton of sea water to precipitate all of the Mg^{2+} ions.

49. The molal freezing point depression constant for benzene (C_6H_6) is 4.90 K kg mol^{-1}. Selenium exists as a polymer of the type Se_x. When 3.26 g of selenium is dissolved in 226 g of benzene, the observed freezing point is 0.112 °C lower than that of pure benzene. Deduce the value of x. (Atomic mass of Se = 78.8 u)

Matrix–Match Type

Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

50.

Column I	Column II
(A) Irregular arrangement	(p) SiO_4^{4-} of particles in a crystal
(B) Cubic	(q) Potassium chloride crystal
(C) Tetrahedral	(r) Crystal defect
(D) Glass	(s) Amorphous solid

51.

Column I	Column II
(A) $CH_2 = CH - CHO \xrightarrow{NaBH_4}$	(p) Schiffs' base
(B) $C_6H_5CHO + Ph - NH_2 \xrightarrow{H^+}$	(q) Acetal
(C) (cyclohexanone) $+ CH_3 - NH - CH_3 \xrightarrow{H^+}$	(r) Unsaturated
(D) $RCHO + 2RCH_2OH \xrightarrow{H^+}$	(s) Enamine

52.

Column I	Column II
(a) Iron and copper	(p) Poling
(b) Zirconium and titanium	(q) Bessemerization
(c) Lead and tin	(r) van Arkel
(d) Copper and tin	(s) Liquation

ANSWER KEY

1. (a)	**19.** (c, d)	**37.** (d)
2. (b)	**20.** (a, b)	**38.** (b)
3. (d)	**21.** (a)	**39.** (a)
4. (a)	**22.** (a)	**40.** (d)
5. (c)	**23.** (a)	**41.** (d)
6. (b)	**24.** (a)	**42.** (b)
7. (c)	**25.** (a)	**43.** (b)
8. (a)	**26.** (a)	**44.** (a)
9. (c)	**27.** (a)	**45.** (d)
10. (b)	**28.** (b)	**46.** (4)
11. (c)	**29.** (b)	**47.** (3)
12. (a)	**30.** (c)	**48.** (4)
13. (a, c, d)	**31.** (c)	**49.** (8)
14. (a, b, c)	**32.** (b)	**50.** A → (r); B → (q); C → (p); D → (s)
15. (a, b, c, d)	**33.** (b)	**51.** A → (r); B → (p); C → (s); D → (q)
16. (c)	**34.** (a)	**52.** A → (q); B → (r); C → (s); D → (p)
17. (c, d)	**35.** (b)	
18. (b, d)	**36.** (a)	