CHEMISTRY

SECTION-A

1. 15 mL of $\frac{N}{10}$ NaOH solution completely neutralises 12 mL of H_2SO_4 solution. The normality of H_2SO_4 solution will be;

(1) $\frac{N}{13}$ (2) $\frac{N}{8}$

(3) $\frac{N}{15}$ (4) $\frac{N}{10}$

2. Equivalent weight of crystalline oxalic acid is;

(1) 30 (2) 60

(3) 90 (4) 63

3. Volume of a gas at NTP is 1.12×10^{-7} cc. The number of molecules in it is;

(1) 3.01×10^{12} (2) 3.01×10^{18}

(3) 3.01×10^{24} (4) 3.01×10^{30}

4. What is the pH of solution made by mixing equal volumes of 0.1 N H_2SO_4, 0.1 N HNO_3, 0.1 N HCl?
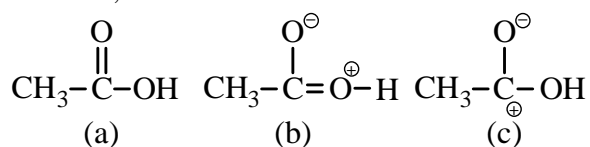
(1) 1 (2) 2

(3) 3 (4) 4

5. The configuration $1s^2 2s^2 2p^5 3s^1$ shows;

(1) excited state of O_2^{-}

(2) excited state of neon atom.

(3) excited state of fluorine atom.

(4) ground state of fluorine atom.

6. Inorganic benzene is;

(1) $B_3H_3N_3$ (2) BH_3NH_3

(3) $B_3H_6N_3$ (4) $H_3B_3N_6$

7. Compare relative stability of following resonating structure;

$$\underset{(a)}{CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-OH} \quad \underset{(b)}{CH_3-\overset{\overset{\displaystyle O^{\ominus}}{|}}{C}=\overset{\oplus}{O}-H} \quad \underset{(c)}{CH_3-\underset{\oplus}{\overset{\overset{\displaystyle O^{\ominus}}{|}}{C}}-OH}$$

(1) a > b > c (2) a > c > b

(3) b > a > c (4) c > a > b

8. The pH of a solution obtained by mixing 100 ml of 0.2M CH_3COOH with 100 mL of 0.2 M NaOH would be: (pK_a for CH_3COOH = 4.74)

(1) 4.74 (2) 8.87

(3) 9.10 (4) 8.57

9. Which one of the following is a **correct** set with respect to a molecule, hybridization and shape?

(1) $BeCl_2$: sp^2, linear

(2) $BeCl_2$: sp^2, triangular planar

(3) BCl_3 : sp^2, triangular planar

(4) BCl_3 : sp^3, tetrahedral

10. **Assertion:** The sum of protons and neutrons is always different in isobars.

Reason: Isobars are atoms of different elements having same mass number but different atomic number.

(1) Both **Assertion (A)** and **Reason (R)** are true, and **Reason (R)** is a correct explanation of **Assertion (A)**.

(2) Both **Assertion (A)** and **Reason (R)** are true, but **Reason (R)** is not a correct explanation of **Assertion (A)**.

(3) **Assertion (A)** is true, and **Reason (R)** is false.

(4) **Assertion (A)** is false, and **Reason (R)** is true.

11. Equivalent amounts (moles) of H_2 and I_2 are heated in a closed vessel till equilibrium is obtained. If 80% of the H_2 can be converted to HI, the K_C at this temperature is;

(1) 64 (2) 16

(3) 0.25 (4) 4

12. The bond length in and follows the order:

(1) $O_2^{2-} > O_2^- > O_2 > O_2^+$

(2) $O_2^+ > O_2 > O_2^- > O_2^{2-}$

(3) $O_2 > O_2^- > O_2^{2-} > O_2^+$

(4) $O_2^- > O_2^{2-} > O_2^+ > O_2$

13. Which of the following is least ionic?

(1) AgCl (2) KCl

(3) $BaCl_2$ (4) NaCl

14. Which of the following **cannot** be explained by Valence bond theory?

(1) Existence of H_2^+.

(2) Paramagnetic behaviour of B_2.

(3) Stability of O_2^+.

(4) All of these.

15. Statement-I: Spin quantum number can have two values, $+\frac{1}{2}$ and $-\frac{1}{2}$.

Statement-II: + and – signs signify the positive and negative wave functions.

(1) Statement I and Statement II both are correct.

(2) Statement I is correct, but Statement II is incorrect.

(3) Statement I is incorrect, but Statement II is correct.

(4) Statement I and Statement II both are incorrect.

16. Statement-I: All photons possess the same amount of energy.

Statement-II: Energy of photon does **not** depend upon wavelength of light used.

(1) Statement I and Statement II both are correct.

(2) Statement I is correct, but Statement II is incorrect.

(3) Statement I is incorrect, but Statement II is correct.

(4) Statement I and Statement II both are incorrect.

17. Statement-I: Absorption spectrum consists of some bright lines separated by dark spaces.

Statement-II: Emission spectrum consists of dark lines.

(1) Statement I and Statement II both are correct.

(2) Statement I is correct, but Statement II is incorrect.

(3) Statement I is incorrect, but Statement II is correct.

(4) Statement I and Statement II both are incorrect.

18. In thermodynamics, a process is called reversible when:

(1) surroundings and system change into each other.

(2) there is no boundary between system and surroundings.

(3) the surroundings are always in equilibrium with the system.

(4) the system changes into the surroundings spontaneously.

19. Assertion: For Balmer series of hydrogen spectrum, the value $n_1 = 2$ and $n_2 = 3, 4, 5$.

Reason: The value of n for a line in Balmer series of hydrogen spectrum having the highest wavelength is 4 and 6.

(1) Both **Assertion (A)** and **Reason (R)** are the true, and **Reason (R)** is a correct explanation of **Assertion (A)**.

(2) Both **Assertion (A)** and **Reason (R)** are the true, but **Reason (R)** is not a correct explanation of **Assertion (A)**.

(3) **Assertion (A)** is true, and **Reason (R)** is false.

(4) **Assertion (A)** is false, and **Reason (R)** is true.

20. Which one is a state function?

(1) heat supplied at constant pressure.

(2) heat supplied at constant volume.

(3) enthalpy.

(4) All of these.

21. $q = -w$ is true for;

(1) isothermal process.

(2) adiabatic process.

(3) cyclic process.

(4) Both (1) and (3).

22. Which of the following is most soluble in water?

(1) MnS ($K_{sp} = 8 \times 10^{-37}$)

(2) ZnS ($K_{sp} = 7 \times 10^{-16}$)

(3) Bi_2S_3 ($K_{sp} = 1 \times 10^{-70}$)

(4) Ag_2S ($K_{sp} = 6 \times 10^{-51}$)

23. The pH of 0.01M NaOH(aq) solution will be:

(1) 7.01   (2) 2

(3) 12   (4) 9

24. In which of the following equilibrium, $K_p = K_c$?

(1) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

(2) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

(3) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

(4) $H_2(g) + Cl_2(g) \rightleftharpoons 2\ HCl(g)$

25. The bond energies of C = C and C – C at 298K are 590 and 331 kJ/mol respectively. The enthalpy of polymerization per mole of ethylene is;

(1) 70   (2) 72

(3) –70   (4) –72

26. Which of the following is **not** an endothermic reaction?
(1) combustion to ethane
(2) melting of ice
(3) graphite $\rightarrow$ diamond
(4) decomposition of water

27. Carbon monoxide is;
(1) acidic   (2) neutral
(3) amphoteric   (4) basic

28. $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
In above reaction, at equilibrium condition mole fraction of PCl_5 is 0.4 and mole fraction of Cl_2 is 0.3. Then find out mole fraction of PCl_3
$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$;
(1) 0.3   (2) 0.7
(3) 0.4   (4) 0.6

29. Match **List-I** with **List-II** to find out the **correct** option.

List-I		List-II	
(A)	pH of milk	(I)	6.8
(B)	pH of black coffee	(II)	5.5
(C)	pH of tomato juice	(III)	4.2
(D)	pH of egg white	(IV)	7.8

(1) (A) – (III), (B) – (IV), (C) – (I), (D) – (II)
(2) (A) – (IV), (B) – (I), (C) – (II), (D) – (III)
(3) (A) – (II), (B) – (III), (C) – (IV), (D) – (I)
(4) (A) – (I), (B) – (II), (C) – (III), (D) – (IV)

30. Carbon forms a large number of compounds because it has:
(1) fixed valency
(2) contains non-metallic nature
(3) high ionization potential
(4) contains property of catenation

31. Match **List-I** with **List-II** to find out the **correct** option.

List-I (Molecule)		List-II (Hybridisation)	
(A)	PCl_5	(I)	sp^3d^3
(B)	ICl_5	(II)	sp^2
(C)	XeF_6	(III)	sp^3d^2
(D)	SO_3	(IV)	sp^3d

(1) (A) – (III), (B) – (I), (C) – (IV), (D) – (II)
(2) (A) – (IV), (B) – (III), (C) – (II), (D) – (I)
(3) (A) – (IV), (B) – (III), (C) – (I), (D) – (II)
(4) (A) – (II), (B) – (III), (C) – (IV), (D) – (I)

32. For the redox reaction
$MnO_4^- + C_2O_4^{2-} + H^+ \rightarrow CO_2 + H_2O$, the **correct** stoichiometric coefficients of $MnO_4^-, C_2O_4^{2-}$ and H^+ are respectively;
(1) 2, 5, 16   (2) 16, 5, 2
(3) 5, 16, 2   (4) 2, 16, 5

33. The pH value of $\dfrac{N}{10}$ NaOH is;
(1) 9   (2) 10
(3) 12   (4) 13

34. Select Polyprotic Arrhenius acids from the following;
(1) H_3PO_2 (2) H_3PO_3
(3) H_3BO_3 (4) HCOOH

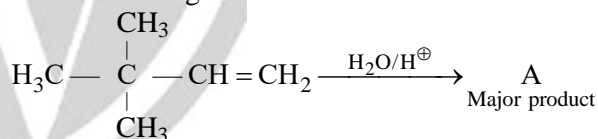**35.** The maximum number of stereoisomer's possible for 3-hydroxy-2-methylbutanoic acid is:
(1) 1   (2) 2
(3) 3   (4) 4

SECTION-B

36. One mole of an ideal gas is allowed to expand reversibly and adiabatically from a temperature of 27°C. If the work done during the process is 3 kJ, then final temperature of the gas is ($Cv = 20$ J/K);
(1) 100 K   (2) 150 K
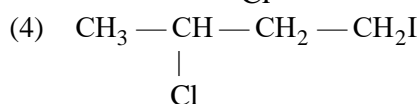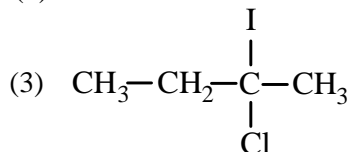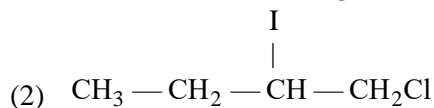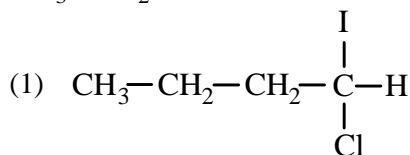(3) 195 K   (4) 255 K

37. In the following reaction:

$$H_3C - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH = CH_2 \xrightarrow{H_2O/H^{\oplus}} \underset{\text{Major product}}{A}$$

The major product is;

(1) $H_3C - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - \underset{\underset{OH}{|}}{CH} - CH_3$

(2) $H_3C - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_2 - \underset{\underset{OH}{|}}{CH_2}$

(3) $H_3C - \underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_2 - \underset{\underset{CH_3}{|}}{CH_2}$

(4) $H_2C - \underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}} - \underset{\underset{CH_3}{|}}{CH_2} - CH_3$

38. Predict the product 'C' obtained in the following reaction of 1-butyne

$$CH_3 - CH_2 - C \equiv CH \xrightarrow{HCl} B \xrightarrow{HI} C$$

(1)
$$CH_3-CH_2-CH_2-\underset{\underset{Cl}{|}}{\overset{\overset{I}{|}}{C}}-H$$

(2)
$$CH_3 - CH_2 - \underset{}{\overset{\overset{I}{|}}{CH}} - CH_2Cl$$

(3)
$$CH_3-CH_2-\underset{\underset{Cl}{|}}{\overset{\overset{I}{|}}{C}}-CH_3$$

(4)
$$CH_3 - \underset{\underset{Cl}{|}}{CH} - CH_2 - CH_2I$$

39. The **correct** statement among the following is;
(1) allyl carbocation ($CH_2 = CH -CH_2^+$) is more stable than propyl carbocation.
(2) propyl carbocation is more stable than allyl carbocation.
(3) both are equally stable.
(4) none of the above.

40. The **correct** order of acidity among the following is;
(1) $CH_3COOH > BrCH_2COOH > ClCH_2COOH > FCH_2COOH$
(2) $FCH_2COOH > CH_3COOH > BrCH_2COOH > ClCH_2COOH$
(3) $BrCH_2COOH > ClCH_2COOH > FCH_2COOH > CH_3COOH$
(4) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$

41. Enthalpy of neutralisation of CH_3COOH by NaOH is –50.6 kJ/mol and the heat of neutralisation of a strong acid with NaOH is–55.9 kJ/mol. The value of enthalpy for the ionisation of CH_3COOH is;
(1) 3.5 kJ/mol (2) 4.6 kJ/mol
(3) 5.3 kJ/mol (4) 6.4 kJ/mol

42. For the reaction, $2Cl(g) \rightarrow Cl_2(g)$, the signs of ΔH and ΔS respectively, are;
(1) +, – (2) +, +
(3) –, – (4) –, +

43. The IUPAC symbol for the element with atomic number 119 would be;
(1) Uue (2) Une
(3) Uun (4) Unn

44. The maximum number of atomic orbitals associated with a principal quantum number 4 is;
(1) 4 (2) 8
(3) 16 (4) 32

45. Which group of periodic table contains non-metal?
(1) IA (2) IIIA
(3) VIIA (4) VIII

46. Which of the following does **not** exist?
(1) PbI_4 (2) PbI_2
(3) $SnCl_4$ (4) BiF_3

47. For a spontaneous process, the **correct** statement is;
(1) Entropy of the system always increases
(2) Free energy of the system always increases
(3) Total entropy change is always negative
(4) Total entropy change is always positive

48. Ce (58) is a member of;
(1) s-block (2) p-block
(3) d-block (4) f-block

49. The linear structure is assumed by;
(A) $SnCl_2$ (B) NCO^-
(C) NO_2^+ (D) CS_2
(1) A, B and C (2) B, C and D
(3) A, C and D (4) None of these

50. The bond angles of NH_3, NH_4^+ and NH_2^- are in the order;
(1) $NH_2^- > NH_3 > NH_4^+$
(2) $NH_4^+ > NH_3 > NH_2^-$
(3) $NH_3 > NH_2^- > NH_4^+$
(4) $NH_3 > NH_4^+ > NH_2^-$