JB Academy, Ayodhya
Annual Examination 2024

Time Allowed: 3 hours **Sub: Chemistry** **M. Marks: 70**

General Instructions:

Read the following instructions carefully.

(*a*) There are **35** questions in this question paper with internal choice.
(*b*) Section A consists of 18 multiple-choice questions carrying 1 mark each.
(*c*) Section B consists of 7 very short answer questions carrying 2 marks each.
(*d*) Section C consists of 5 short answer questions carrying 3 marks each.
(*e*) Section D consists of 2 case-based questions carrying 4 marks each.
(*f*) Section E consists of 3 long answer questions carrying 5 marks each.
(*g*) **All questions are compulsory.**
(*h*) **Use of log tables and calculators is not allowed.**

Section–A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1.The solution of A and B are 0.1 and 0.2 molar in a substance. If 100 mL of 'A' are mixed with 25 mL of B and there is no change in volume, then the final molarity of solution is (1)

(a) 0.15 M (b) 0.18 M

(c) 0.12 M (d) 0.30 M

2. A hydrocarbon was found to contain 75% by mass of carbon and 25% by mass of hydrogen. What is empirical formula of the compound? (1)

(a) C_2H_4 (b) C_2H_6

(c) CH_4 (d) C_6H_6

3. The mass of one mole a chloride formed by metal 'X' is 111.0 g. Which one could be formula of chloride? (1)

(a) XCl (b) XCl_2

(c) XCl_3 (d) XCl_4

4. The azimuthal quantum number for the 17^{th} electron of Cl- atom is:

(a) 1 (b)2

(c)3 (d) 0

5.Which one of the following ions has electronic configuration $[Ar]3d^6$?

(a) Ni^{3+} (b) Mn^{3+} (c) Fe^{3+} (d) Co^{3+}

6. The Debroglie wavelength of a tennis ball of mass 60 gm moving with a velocity of 10 meter per second is approximately :

(a)10^{-31} meter (b)10^{-16} meter (c)10^{-25} meter (d)10^{-33} meter

7. Which one of the following orders represents the correct sequence of increasing order of basic nature of oxides?

(a) Al_2O_3<MgO<Na_2O<K_2O (b) MgO< K_2O Al_2O_3< Na_2O

(c) Na_2O<K_2O<MgO< Al_2O_3 (d) K_2O< Na_2O< Al2O3<MgO

8. The ionic radii (in A^0) of N^{3-},O^{2-} and F^- are respectively.

(a) 1.71, 1.40, 1.36 (b) 1.71,1.36,1.40

(c) 1.36,1.40, 1.71 (d) 1.36,1.71,1.40

9. Which of the following atoms has highest first ionization energy?

(a) Rb (b) Na (c) K (d) Sc

10. In which of the following pairs, the species are not isostructural?

(a) PCl^+_4 and $SiCl_4$ (b) PF_5 and BrF_5

(c) AlF^{3-}_6 and SF_6 (d) CO_3^{2-} and NO_3^-

11. What type of hybridisation is present on central nitrogen atom of NO_3^- ion?

(a) sp^2 (b) sp^3 (c) sp^3d (d) d sp^2

12. Maximum bond angle at nitrogen is presnet in which of the following?

(a) NO_2 (b) NO_2^- (c) NO_2^+ (d) NO_3

13. The enthalpy of neutralization of a weak acid by a strong base is:

(a) -57.32 kj (b)+57.32 kj

(c) equal to -57.32 kj + enthalpy of inoization of weak acid (d) more than -57.32 kj

14. Enthalpy of neutralization of HCl with NaOH is x. The heat evolved when 500 mL of 2N HCl are mixed with 250 mL of 4 N NaOH will be:

(a) 500x (b) 100x (c) x (d) 10x

15. An ideal gas expands in volume from $1X10^{-3}$ m^3 to $1X10^{-2}$ m^3 at 300 K against a constant pressure of $1X10^{-5}$ Nm^{-2} . The work done is

(a) -900 J (b) -900 kj (c) 270 kj (d) 900 Kj

16. Draw structure of ehtynyl.

17. Draw Tautomer of p-Benzoquinone

18. Find total no G.I. of foolwing compound

C_6H_5 - CH = CH - CH = CH - CH = CH - CH = CH - Cl

(a) 6 (b)8 (c) 10 (d)12

Section–B

This section contains 7 questions. The following questions are very short answer type and carry 2 marks each.

19. Which law explains the formation of five oxides of nitrogen?
20. Name the different spectral lines associated with the spectrum of the hydrogen atom.
21. Explain, why the second ionisation enthalpy of an element is higher than first?
22. Give lewis dot structure of the following:
    (a) SO_3^{2-} (b) PO_4^{3-}
23. Write short notes on the following?
    (a) Heat of neutralization (b) Heat of reaction.
24. Why is the enthalpy of sublimation equal to the sum of enthalpy of fusion and enthalpy of vaporization?
25. Write type of Structural Isomerism.

Section–C

This section contains 5 questions. The following questions are short answer type and carry 3 marks each.

26. (a) What is meant by the term free energy of a system. What will be the state of chemical reactions when:

(i) $\Delta G=0$ (ii) $\Delta G>0$ (iii) $\Delta G<0$

(b) How does the Gibbs Free energy change when spontaneous reaction occurs? Show with th help of diagram how Gibb's energy changes during the course of a reaction.

27. (a) Write all types of Geometrical isomerism with proper example?
    (b) How to calculate the total of GI in cases of Symmetrical and nonsymmertrical compound.

28. Given reason for the following:

    (i) PF_5 is known but NF_5 is not.

    (ii) Carbon-oxygen bond length in Na_2CO_3 are equal.

    (iii) Boiling point of hydrogen chloride is lower than that of hydrogen fluoride.

29. (a) Which groups of the periodic table is known as d-block elements? Why?

    (b) Write four main characteristics of transiton elements in the long form of periodic table.

    (c) How are elements classified on the basis of electronic configuration? State four general characteristics of s-block elements.

30. In a hydrogen atom, an electron jumps from the third orbit to the first orbit. Find out the frequency and wavelength of the spectral line. [$R_H=1.09678X\ 10^7\ m^{-1}$]

Section–D

The following questions are case-based questions. Each questions carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

31. Read the passage and answer the following question:

The existing large number of organic compounds and their ever-increasing numbers has made it necessary to classify them on the basis of their structures. Organic compounds are broadly classified as open-chain compounds which are also called aliphatic compounds. Aliphatic compounds further classified as homocyclic and heterocyclic compounds. Aromatic compounds are special types of compounds. Alicyclic compounds, aromatic compounds may also have heteroatom in the ring. Such compounds are called heterocyclic aromatic compounds. Organic compounds can also be classified on the basis of functional groups, into families or homologous series. The members of a homologous series can be represented by general molecular formula and the successive members differ from each other in molecular formula by a $–CH_2$ unit.
In these questions, a statement of assertion followed by the statement of reason is given. Choose the correct answer out of the following choices

1. Assertion and reason both are correct statements and reason is the correct explanation for assertion.
2. Assertion and reason both are correct statements and reason is not the correct explanation for assertion.
3. Assertion is the correct statement but reason is wrong statement.
4. Assertion is the wrong statement but reason is correct statement.

1. Assertion: Tetrahydrofuran is aliphatic compounds
   Reason: Sometimes atoms other than carbon are also present in the ring known as heterocyclic.
2. Assertion: Hydroxyl group (–OH) is a functional group.
   Reason: The functional group is defined as an atom or group of atoms joined in a specific manner with characteristic chemical properties of the organic compounds.
3. Assertion: Non-benzenoid compound is a classification as the alicyclic compound.
   Reason: Aniline is a benzenoid compound.
4. Assertion: $H_2C=CH_2$ is a condensed structural formula.
   Reason: Condensed structural formula is represented by omitting some or all of the dashes representing covalent bonds.

32. **Read the passage and answer the following questions:**

A large number of orbitals are possible in an atom. Qualitatively these orbitals can be distinguished by their size, shape and orientation. An orbital of smaller size means there is more chance of finding the electron near the nucleus. Similarly, shape and orientation mean that there is more probability of finding the electron along with certain directions than along others. The principal quantum number determines the size and to large extent the energy of the orbital. Azimuthal quantum number, 'l' is also known as orbital angular momentum or subsidiary quantum number. It defines the three-dimensional shape of the orbital. Each shell consists of one or more subshells or sub-levels. The number of sub-shells in a principal shell is equal to the value of n. Magnetic orbital quantum number. 'ml ' gives information about the spatial orientation of the orbital with respect to a standard set of co-ordinate axis. The fourth quantum number is known as the electron spin quantum number (m_s). An electron spins around its own axis, much in a similar way as the earth spins around its own axis while revolving around the sun.

1. Assertion and reason both are correct statements and reason is the correct explanation for assertion.
2. Assertion and reason both are correct statements and reason is not the correct explanation for assertion.
3. Assertion is the correct statement but reason is wrong statement.
4. Assertion is the wrong statement but reason is correct statement.

1. **Assertion:** Each orbital is designated by three quantum numbers labelled as n, l and m_l.
   Reason: 'n' is a positive integer with value of n = 1,2,3.
2. **Assertion:** The principal quantum number identifies the shell.
   Reason: Size of an orbital decrease with the increase of principal quantum number 'n'.

3. **Assertion:** For n = 2, the possible value of l can be 0 and 1.
   Reason: For a given value of n, l can have n values ranging from 0 to n – 1.
4. **Assertion:** Each orbital in an atom, is defined by a set of values for n, l and m_l.
   Reason: m_l designates the orientation of the orbital.

OR

5. **Assertion:** Spin quantum numbers m_s can take the values of +½ or –½.
   Reason: Two spin states of the electron and are normally represented by two arrows, ↑ (spin down) and ↓ (spin up).

Section–E

The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

33. 2.8 g of calcium oxide (CaO) prepared by heating limestone were found to be contain 0.8 g of oxygen. When one gram of oxygen treated with calcium 3.5 g of calcium oxide were obtained. Show that these results illustrate the law of definite proportion.

Or

Carbon Di oxide contains 27.27% of carbon, carbon disulphide contains 15.97% carbon and sulphur dioxide conatains 50% sulphur. Show that the results illustrate the law of reciprocal proportions.

34. A given mass of a gas at 0^0C is compressed reversibly and adiabatically to a pressure 20 times the initial value. Calculate the final temperature of the gas.

Or

Calculate q, w, ΔU and ΔH for the reversible isothermal expansion of 1 mole of ideal gas at 27^0C from a volume of 10 dm^3 to a volume of 20 dm^3 .

35. What is resonance? How is resonance energy calculated? Write resonance structure of:

(a) Ozone (b) sulphur trioxide (c) Nitrous oxide

********** ALL THE BEST **********