

BK BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS SENIOR SECONDARY CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL

MID-TERM EXAMINATION 2023-24



Class : XI Date : 16/10/23 **CHEMISTRY (43)**

Duration: 3 Hrs Max. Marks: 70

General Instructions:

Read the following instructions carefully.

- (a) There are **33** questions in this question paper with internal choice.
- (b) SECTION A consists of 16 multiple -choice questions carrying 1 mark each.
- (c) SECTION B consists of 5 short answer questions carrying 2 marks each.
- (d) SECTION C consists of 7 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.

| The number of atoms in 4.25g of NH₃ is approximately. | | | | | | | |
|---|--------------------------------------|--------------------------|--------------------------|----------------------|--|--|--|
| (a) 4 x 10 ²³ | (b) 2 x 10 ²³ | (c) 1 x 10 ²³ | (d) 6 x 10 ²³ | | | | |
| 2. The mass of an atom of carbon is ————. | | | | | | | |
| (a) 1g (l | b) 1.99 x 10 ^{-23 g} | (c) 1/12 g | (d) 1.99 | x 10 ²³ g | | | |
| 3. A pure substance which contains only one type of atom is called ————–. | | | | | | | |
| (a) An element | (b) A compound | (c) A s | olid | (d) A liquid | | | |
| 4. The maximum number of atomic orbitals associated with a principal quantum number 5 is: | | | | | | | |
| (a) 9 (b) | 12 (c) 16 | (d) 25 | | | | | |
| 5. Which type of radiation is not emitted by the electronic structure of atoms? | | | | | | | |
| (a) Ultraviolet ligh | t (b) X-rays | (c) Visible | e light | (d) y-rays | | | |
| 6. Number of unpaired electrons in 1s ² 2s ² 2p ³ is: | | | | | | | |

- (a) 2 (b) 0 (c) 3 (d) 1
- 7. The quantum numbers of four electrons are given below

| | n | I | m | S |
|------------|---|---|---|------|
| Electron 1 | 3 | 0 | 0 | -1/2 |
| Electron 2 | 4 | 0 | 0 | 1/2 |
| Electron 3 | 3 | 2 | 0 | 1/2 |
| Electron 4 | 3 | 1 | 0 | -1/2 |

The correct order of decreasing energy of these electrons is:

- (a) Electron 3 > Electron 1 > Electron 4 > Electron 2
- (b) Electron 4 > Electron 2 > Electron 3 > Electron 1

(c) Electron 3 > Electron 2 > Electron 4 > Electron 1

(d) Electron 2 > Electron 4 > Electron 3 > Electron 1

- 8. An element X occurs in short period having configuration ns²np¹. The formula and nature of its oxide are:
 (a) XO₃, basic
 (b) XO₃, acidic
 (c) X₂O₃, amphoteric
 (d) X₂O₃, basic
- 9. The maximum number of valence electrons possible for atoms in the second period of periodic table is:
 (a) 18
 (b) 10
 (c) 8
 (d) 2
- 10. The outermost electronic configuration of the most electronegative element is:
 - (a) ns²np³ (b) ns²np⁴ (c) ns²np⁵ (d) ns²np⁶

11. An atom of an element A has three electrons in its outer most orbit and that of B has six electrons in its outermost orbit. The formula of the compound between these two will be

(a) A_3B_6 (b) A_2B_3 (c) A_3B_2 (d) A_2B

12. The maximum number of hydrogen bonds that a molecule of water can have is: (a) 1 (b) 2 (c) 3 (d) 4

Directions: The questions below consists of an assertion and a reason. Use the following key to choose the appropriate answer.

- (a) If both assertion and reason are correct and reason is correct explanation of the assertion.
- (b) If both assertion and reason are correct, but the reason is not the correct explanation of the assertion.
- (c) If assertion is correct, but reason is incorrect.
- (d) If assertion is incorrect, but reason is correct.
- Assertion: 1 mole of sulphuric acid contains 32 g each of sulphur and oxygen element.
 Reason: 1 mole of sulphuric acid represents 98 g of the species.
- 14. **Assertion:** It is impossible to determine the exact position and exact momentum of an electron simultaneously.

Reason: The path of an electron in an atom is clearly defined.

15. **Assertion:** According to Mendeleev, periodic properties of elements is a function of their atomic number.

Reason: Atomic number is equal to the number of protons.

16. **Assertion:** Atoms can combine either by transfer of valence of electrons from one atom to another or by sharing of valence electrons.

Reason: Sharing and transfer of valence electrons is done by atoms to have an octet in their valence shell.

SECTION B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

- 17. A solution is prepared by adding 2g of a substance A to 18g of water. Calculate the mass percent of the solute.
- 18. Calculate the molar mass of the following:

(i) H₂O (ii) HNO₃

19. Calculate the mass of a photon with wavelength 3.6 Å.

OR

What will be the wavelength of a ball of mass 0.1 kg moving with a velocity of 10ms⁻¹?

- 20. What does atomic radius and ionic radius really mean to you?
- 21. Write Lewis symbols for the following atoms and ions:

(a) S and S²⁻ (b) AI and AI³⁺

SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. In three moles of ethane (C_2H_6), calculate the following:

- (i) Number of moles of carbon atoms.
- (ii) Number of moles of hydrogen atoms.

(iii) Number of molecules of ethane.

- 23. (a) Calculate the number of atoms in 24g of He.
 - (b) How much copper can be obtained from 100g of copper sulphate? (At.mass, Cu=63.5u, S=32u, O=16u).
- 24. Which atoms are indicated by the following configurations?

(a) [He] $2s^1$ (b) [Ne] $3s^2 3p^3$ (c) [Ar] $4s^2 3d$

25. A photon of wavelength 4 X 10⁻⁷ m strikes on metal surface, the work function of the metal being 2.13eV. Calculate:

- (i) the energy of the photon (eV),
- (ii) the kinetic energy of the emission,
- (iii) the velocity of the photoelectron. ($1eV=1.6020\times10^{-19}J$)

26. Consider the following species:

N³⁻, O²⁻, F⁻, Na⁺, Mg²⁺ and Al³⁺

- (a) What is common in them?
- (b) Arrange them in the order of increasing ionic radii.

OR

What are the major differences between metals and non-metals?

27. Distinguish between a sigma and a pi bond.

28. Write the resonance structures for SO₃ , NO₂ , NO $^{-}_{3}$

SECTION D

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

29. The principal quantum number 'n' is a positive integer with a value of n = 1, 2, 3......The principal quantum number determines the size and to a large extent the energy of the orbital. Azimuthal quantum number. 'I' is also known as orbital angular momentum or subsidiary quantum number. It defines the three-dimensional shape of the orbital. For a given value of n, I can have n values ranging from 0 to n - 1, that is, for a given value of n, the possible value of I are I = 0, 1, 2,(n-1). Magnetic orbital quantum number. 'Gives information about the spatial orientation of the orbital with respect to a standard set of coordinate axis. For any sub-shell (defined by 'I' value) 2I+1 values of mI are possible and these values are given buy: mI = -I, -(I-1), -(I-2)..., 0, 1..., (I-2), (I-1). In 1925, George Hollenbeck and Samuel Goldsmith proposed the presence of the fourth quantum number known as the electron-spin quantum number (ms). Electron has, besides charge and mass, intrinsic spin angular quantum number. The spin angular momentum of the electron — a vector quantity, can have two orientations relative to the chosen axis. These two orientations are distinguished by the spin quantum numbers which can take the values of +½ or -½. These are called the two spin states of the electron and are normally represented by two arrows, \uparrow (spin up) and \downarrow (spin down). The

four quantum numbers provide the following information:

(a) Quantum mechanics is a theoretical science that deals with the study of the motions of the ______ objects.

(b) The principal quantum number is denoted by_____

(c)______is also known as orbital angular momentum or subsidiary quantum number and also it describes the ______ of the orbitals.

OR

Using s, p, d, f notations, describe the orbital with the following quantum numbers.

- (i) n = 2, l = 1
- (ii) n = 5, l = 3

30. A modern version, the so-called "long form" of the Periodic Table of the elements, is the most convenient and widely used. The horizontal rows (which Mendeleev called series) are called periods and the vertical columns, are groups. Elements having similar outer electronic configurations in their atoms are arranged in vertical columns, referred to as groups or families. According to the recommendation of the International Union of Pure and Applied Chemistry (IUPAC), the groups are numbered from 1 to 18 replacing the older notation of groups IA ... VIIA, VIII, IB ... VIIB, and O. There are altogether seven periods. The period number corresponds to the highest principal quantum number (n) of the elements in the period. The first period contains 2 elements. The subsequent periods consist of 8, 8, 18, 18, and 32 elements, respectively. The seventh period is incomplete and like the sixth period would have a theoretical maximum (on the basis of quantum numbers) of 32 elements. In this form of the Periodic Table, 14 elements of both the sixth and seventh periods (lanthanoids and actinoids, respectively) are placed in separate panels at the bottom. the IUPAC has made a recommendation that until a new element's discovery is proved, and its name is officially recognized, a systematic nomenclature be derived directly from the atomic number of the element using the numerical roots for 0 and numbers 1-9. The roots are put together in order of digits which make up the atomic number and "mum" is added at the end.

(a) Horizontal row in periodic table called____

(b) According to Modern Periodic Law the physical and chemical properties of the elements are periodic functions of their_____.

(c) What is the IUPAC name of the elements having atomic number 107 and 112.

OR

What is the number of groups and periods in modern periodic table?

SECTION E

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

31. (a) Which out of NH3 and NF3 has higher dipole moment and why?

(b) Describe the shapes of sp , sp² , sp³ hybrid orbitals.

OR

- (a) Explain the types of H-Bonds.
- (b) Discuss the shape of the following molecules using the VSEPR model: $BeCl_2$, BCl_3 , PH_3

32. (a) What is the basic theme of organisation in the periodic table?

(b) Energy of an electron in the ground state of the hydrogen atom is -2.18×10^{-18} J. Calculate the ionization enthalpy of atomic hydrogen in terms of J mol⁻¹

OR

- (a) Use the periodic table to answer the following questions.
 - (i) Identify an element with five electrons in the outer subshell.
 - (ii) Identify an element that would tends to lose two electrons.
 - (iii) Identify an element that would tends to gain two electrons.
- (b) Assign the position of the element having outer electronic configuration:
 - (i) ns^2np^4 for n=3
 - (ii) (n-1)d²ns² for n=4
- 33. Attempt any five of the following:
 - (a) Write the electronic configuration of Calcium.
 - (b) Write the equation for the kinetic energy of the ejected electron.
 - (c) What is the number of photons of light with a wavelength of 4000 pm that provide 1 J of energy?
 - (d) Write the electronic configuration of Na+.
 - (e) How many electrons will be present in the subshells having ms value of -1/2 for n=4?
 - (f) The mass of an electron is 9.1 X 10⁻³¹ kg. If its K.E is 3.0 X 10⁻²⁵ J, Calculate its wavelength.
 - (g) State Pauli Exclusion Principle.

*** Best of luck***