R.D. RAJPAL SCHOOL
SESSION 2024-25
MID-TERM EXAMINATION

CLASS: XI
TIME ALLOWED: 3 HOURS

SUBJECT: CHEMISTRY (SET B)
MAXIMUM MARKS: 70
NO. OF PAGES:4

General Instructions: -
i. The question paper contains 33 questions in 5 sections.
ii. All questions are compulsory.
iii. Section A contains 16 Objective type questions carrying 01 mark each.
iv. Section B contains 5 Very short answer questions carrying 02 marks each. Answers to these questions should be in the range of 30 to 50 words.
v. Section C contains 7 Short answer questions carrying 03 marks each. Answers to these questions should be in the range of 50 to 80 words.
vi. Section D contains 2 Source based /case-based units of assessment of 04 marks each with sub parts.
vii. Section E contains 3 Long Answer type questions of 05 marks each. Answers to these questions should be in the range of 80 to 120 words.

SECTION A

1. What is the mass per cent of carbon in carbon dioxide?
(a) 0.034%
(b) 27.27%
(c) 3.4%
(d) 28.7%

2. The density of a solution prepared by dissolving 120 g of urea (mol. Mass = 60 u) in 1000 g of water is 1.15 g/mL. The molarity of this solution is:
(a) 1.02 M
(b) 2.05 M
(c) 0.50 M
(d) 1.78 M

3. Magnetic quantum number specifies
(a) Size of orbitals
(b) Shape of orbitals
(e) Orientation of orbitals
(d) Nuclear Stability

4. Which of the following molecules have trigonal planar geometry?
(a) BF_3
(b) NH_3
(c) PCl_3
(d) IF_3

5. Which of the following is correct for NH_3 and H_2O:
(a) Both has sp^3 Hybridization
(b) Bond angle of $NH_3 > H_2O$:
(c) Both a &b are correct
(d) None of the above

6. According to Aufbau principle a new electron enters the orbitals when:
(a) (n + l) is minimum
(b) (n + l) is maximum
(c) (n + m) is minimum
(d) (n + m) is maximum

7. Which of the following pairs are isobars?
(a) $_{17}Cl^{35}$ & $_{17}Cl^{37}$
(b) $_{18}Ar_{40}$ & $_{20}Ca^{40}$
(c) $_6C^{12}$ & $_6C^{14}$
(d) None of these

8. Total number of nodes for 3d orbital is _____
(a) 3
(b) 2
(c) 1
(d) 0

9. The number of significant figures in 6.200
(a) 2
(b) 3
(c) 4
(d) 5

10. The percentage of nitrogen in urea is about
(a) 46
(b) 85
(c) 18
(d) 28

11. The correct shape of $[NH_4]^+$ ion on the bases of VSEPR theory is
(a) Trigonal bipyramidal
(b) Square pyramidal
(c) Pentagonal planer
(d) Tetrahedral

12. On the basis of VSEPR Theory, the Hybridization present in BrF_3 molecule is
(a) sp^2
(b) sp^3
(c) sp^3d
(d) sp^3d^2

13-16 consists of two statements-Assertion(A) and Reason(R). Answer the following by selecting the appropriate options given below:
(A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true and R is not the correct explanation of A
(C) A is true but R is false
(D) A is false but R is true

13. Assertion : Electron gain enthalpy becomes less negative as we go down the group.
    Reason : Size of the atom increases on going down the group and the added electron would be farther from the nucleus

14. Assertion : All isotopes of a given element show the same type of chemical behavior.
    Reason : The chemical properties of an atom are controlled by the number of electrons in the atom.

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 : Alkali metals have least value of ionization energy within a period.
    Reason : They precede alkaline earth metals in periodic table.

SECTION –B

17. What is the Screening effect or Shielding effect?
18. Why NF_3 is pyramidal but BF_3 is triangular planar?
19. Draw the resonating structure of Nitrate ion.
20. What is the formal charge on various atoms in Carbonate (CO_3^{2-}) ion?
21. Explain the shape of the following:
    (i) SF_6 (ii) PCl_3F_2

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SECTION –C

22. Calculate the percent composition of the various elements like Mg, S & O in $MgSO_4$.

23. Consider the following species: $N^{3-}, O^{2-}, F^-, Na^+, Mg^{2+}, Al^{3+}$
(a) What is common in them?
(b) Arrange them in order of increasing ionic radii?

24. The dipole moment of CH_4 is zero but the dipole moment of CH_2Cl_2 is not zero. Justify the statement.

25. The first ionization enthalpy values (in kJ mol^{-1}) of group 13 elements are:

B	Al	Ga	In	Tl
801	577	579	558	589

How would you explain this deviation from the general trend?

26. Calculate the uncertainty in the position of a particle when the uncertainty in momentum is (a) 1×10^{-3} g cm Sec^{-1}, (b) zero

27. According to de Broglie, the matter would exhibit dual behavior, that is, both particle and wave-like properties. However, a cricket ball with a mass of 100 g doesn't move like a wave when a bowler throws it at the speed of 100 km/h. Calculate the ball's wavelength and explain why it does not show wave nature.

28. Write the factors governing the Electronegativity in periodic table.

SECTION –D
29-30 Read the following passage and answer the questions that follow:

29. (A) In polyatomic molecules (i.e., molecules made up of three or more atoms), one of the constituent atoms is identified as the central atom to which all other atoms belonging to the molecule are linked. The total number of valence shell electron pairs decides the shape of the molecule. The electron pairs have a tendency to orient themselves in a way that minimizes the electron-electron repulsion between them and maximizes the distance between them. The valence shell can be thought of as a sphere wherein the electron pairs are localized on the surface in such a way that the distance between them is maximized.

1. Find the number of bond pair and lone pair electrons present on N atom in NO_3^-.

2. Find the molecule with: -
(a) The least bond angle among the following elements: BeF_2, CH_4, NH_3, H_2O
(b) The maximum bond angle among the following elements: $NH_4^+, SCl_2, NH_3, PCl_3$

3. Which of the following has a linear shape and why?
$NO_2^-, NO_2^+, O_3, SO_2$

30. The properties which are directly or indirectly related to their electronic configuration and which show a regular gradation when we move from left to right in a period or from top to bottom in a group are called periodic properties. Atomic radius or Atomic Radii is the total distance from the nucleus of an atom to the outermost orbital

of its electron. Electronegativity is a measure of an atom's ability to attract shared electrons to itself. It basically indicates the net result of the tendencies of atoms in different elements to attract the bond-forming electron. Electron gain Enthalpy of an element on the other hand are related to energy changes associated with the acceptance of electrons.

1. The first ionization energy of carbon atom is greater than that of boron atom, whereas reverse is true for the second ionization energy. Explain

2. Why electron gain enthalpies of Be and Mg are positive?

3. Why do elements in the same group have similar physical and chemical properties?

4. What is the general trend for the atomic radii when move from left to right across the period in periodic table?

SECTION –E

31. Use Molecular orbital theory to draw MOT diagram of Oxygen molecule. (O_2) Calculate the bond order and give reason for its stability. Will it be diamagnetic or paramagnetic in nature?

32. (A). An organic compound contains 10.4%Carbon, 0.84%Hydrogen and 89.12% chlorine. Derive its empirical formula and molecular formula. Molecular mass of the compound is 119.5 amu.

(B). What do you understand by Law of definite proportions?

33(a). Calculate the kinetic energy of the electron ejected when yellow light of frequency 5.2×10^{14} sec^{-1} falls on the surface of potassium metal. Threshold frequency of potassium is 5×10^{14} sec^{-1}.

(b). The wave length of a photon is 5000 Å. Calculate its energy in electron volts.