

O.P.JINDAL SCHOOL,SAVITRINAGAR
HALF YEARLY EXAMINATION-(2023-24)

CLASS-XI
SUBJECT-CHEMISTRY

MAX.MARKS-70
MAX.TIME-3HOURS

General Instruction:-

- (i) All questions are compulsory .There are 35 questions in all.
(ii) SECTION –A: Question numbers 1 to 18 are MCQs carrying one mark each.
(iii) SECTION –B: Question numbers 19 to 25 are short answer type-I questions, carrying 2 marks each.
(iv) SECTION –C: Question numbers 26 to 30 are short answer type-II questions , carrying 3 marks each.
(v) SECTION –D: Question numbers 31 and 32 are case-based questions carrying 4 marks each.
(v) SECTION –E: Question numbers 33 to 35 are al long answer type questions and carrying 5 marks each.
(vi) There is no overall choice. However,an internal choice has been provided in some questions.
(vii) Use of calculator is not permitted. However, you may use log tables, if necessary.

SECTION-A

1. The position of an element having e.c.e. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$ is
(a) Period 3 and group 2 (b) Period 6 and group 4
(c) Period 4 and group 7 (d) Period 7 and group 5
2. Be^{2+} is isoelectronic with which of the following ions?
(a) H^+ (b) Li^+
(c) Na^+ (d) Mg^{2+}
3. Consider two elements P and Q.If P has 2 and Q has 7 electrons in their outermost shell, then the formula of the compound is
(a) P_2Q (b) PQ
(c) P_2Q_3 (d) PQ_2
4. 2.0g of oxygen contains number of atoms same as in
(a) 4 g of S (b) 7g of Nitrogen
(c) 0.5g of H_2 (d) 11g of Na
5. 4d,5p,5f and 6p orbitals are arranged in the order of decreasing energy.The correct option is:
(a) $6p > 5f > 5p > 4d$ (b) $5p > 5f > 4d > 5p$
(c) $5f > 6p > 4d > 5p$ (d) $5f > 6p > 5p > 4d$
6. What is the molality of pure water ?
(a) 1 (b) 18
(c) 55.5 (d) 1.81

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7. Which of the following hydrogen bonds is the strongest?
 (a) F—H --- F (b) O—H --- O
 (c) O—H --- F (d) O—H --- N
8. Which of the following orders of ionic radii is correctly represented?
 (a) $H^- > H^+ > H$ (b) $Na^+ > F^- > O^{2-}$
 (c) $F^- > O^{2-} > Na^+$ (d) $Al^{3+} < Mg^{2+} < N^{3-}$
9. How many electrons can fit in the orbital for which $n=3$ and $l=1$.
 (a) 2 (b) 6
 (c) 10 (d) 14
10. The species, having bond angles of 120° is:
 (a) PH_3 (b) ClF_3
 (c) NCl_3 (d) BF_3
11. The spectral line in hydrogen spectrum obtained when the electron jumps from $n=5$ to $n=2$ energy level belongs to:
 (a) Lyman series (b) Balmer series
 (c) Paschen series (d) Pfund series
12. The number of neutrons present in ammonium ion :
 (a) 7 (b) 10
 (c) 11 (d) 4
13. Which of the following has highest boiling point?
 (a) NH_3 (b) PH_3
 (c) SbH_3 (d) AsH_3
14. Which one of the following ion has electronic configuration $[Ar]3d^6$?
 (a) Fe^{3+} (b) Co^{3+}
 (c) Ni^{3+} (d) Mn^{3+}

Questions 15-18 are Assertion and Reason questions:

In these questions(15-18) a statement of assertion followed by a statement of reason is given.

Choose the correct answer out of the following choices:

- (a) Assertion and reason both are correct statements and reason is the correct explanation for assertion.
 (b) Assertion and reason both are correct statements and reason is not the correct explanation for assertion.
 (c) Assertion is correct statement but reason is wrong statement .
 (d) Assertion is wrong statement but reason is correct statement .

15. Assertion: Both 32g of SO_2 and 8 g of CH_4 contain same number of molecules.

Reason: Equal moles of two compounds contain same number of molecules.

16. Assertion: Cl^- ion and K^+ ion are isoelectronic.

Reason: Isoelectronic ions have same charge.

17. Assertion: Atomic radius in general decreases along a period.

Reason: In a period, effective nuclear charge increases.

18. Assertion: NO_3^- is planar while NH_3 is pyramidal.

Reason: N in NO_3^- has sp^2 and NH_3 has sp^3 hybridisation.

SECTION-B

19. How many moles of methane are required to produce 22 g of CO_2 after combustion?

OR

Calculate the mass of sugar and mass of water are required to make 250 g of 15% solution of sugar.

20. Give two differences between sigma bond and pi bond.

OR

Bond angle in NH_3 is more than in H_2O . Justify.

21. Write the electronic configuration of the following (i) Cu^{2+} (ii) Cr^{3+}

22. Calculate the molality of the solution containing 20.7 g of potassium carbonate dissolved in 500 mL solution. (density of the solution = 1 g mL^{-1}).

23. XeF_2 molecule is a linear molecule but it is a sp^3d hybridized. Why?

24. Explain giving reasons, which of the following sets of quantum numbers are not possible.

(i) $n=0, l=0, m_l = +0, m_s = +\frac{1}{2}$ (ii) $n=1, l=0, m_l = 0, m_s = -\frac{1}{2}$

(iii) $n=1, l=1, m_l = 0, m_s = +1$ (iv) $n=2, l=1, m_l = 0, m_s = -\frac{1}{2}$

25. Write the IUPAC name and symbol for the following elements with atomic number:

(i) 120 (ii) 109

SECTION-C

26. (i) Using s, p, d, f notations describe the orbitals with following quantum numbers: $n=2, l=1$.

(ii) How many subshells are there in M shell?

(iii) How many orbitals (of all kinds) are possible in $n=4$ energy level.

OR

Calculate the wave number for the longest wavelength in Balmer series of atomic hydrogen. ($R_H = 109677 \text{ cm}^{-1}$)

27. Explain the structure of $\text{CH}_2 = \text{CH}_2$ on the basis of hybridization.

OR

What is meant by hydrogen bond? What is the bond energy of hydrogen bond? Why is H_2O is liquid where as H_2S is gas?

28. Give reason for the following:

(i) Ionization enthalpy of nitrogen is more than that of oxygen.

(ii) Na and Mg^+ have same number of electrons but removal of electron from Mg^+ requires more energy.

(iii) Anions are bigger in size than their parent atoms.

29. 0.90 g of glucose (molar mass=180) are dissolved in 60 g of water. Calculate the mole fraction of glucose and water.

30. Explain the Lewis structure of nitrite ion.

SECTION-D

31. Molecular orbitals are formed by linear combination of atomic orbitals. Schrodinger's equation can be written for any molecule. However, since it can not be solved exactly for any system containing more than one electron. Molecular orbitals which are one electron wave function for molecules are difficult to obtain directly from the solution of Schrodinger equation. This difficulty is overcome by resorting to an approximate method called the linear combination of atomic orbitals (LCAO) method.

(i) How is molecular orbital different from atomic orbital?

(ii) Write the molecular orbital configuration of O_2 . Predict its magnetic behavior.

(iii) Compare the relative stability of the following species : O_2^+ and O_2^- on the basis of molecular orbital theory and indicate their magnetic properties.

32. Modern periodic law may be stated as :

The physical and chemical properties of the elements are the periodic functions of their atomic numbers. Consequently, when the elements are arranged in the order of their increasing atomic numbers, it is observed that the elements of similar properties recur at regular intervals or periodically. As a result of this, the elements fall in certain groups and lead to an arrangement called periodic table.

(i) Why do elements in the same group have similar physical and chemical properties.

(ii) Assign the group number and period number of an element having outer electronic configuration $ns^2 np^4$ for $n=3$.

(iii) How would you explain the fact that the first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium?

SECTION-E

33. (i) The wave number of a beam of light is 400 cm^{-1} . What is the wavelength of the light in nanometer? Also find out the frequency of the light.
(ii) Calculate the wave length of a body of mass 1 mg moving with a velocity of 10 m s^{-1} .

OR

- (i) A 200 watt bulb is emitting monochromatic light having wavelength 600 nm. Calculate the number of photons emitted by the bulb in one minute.
(ii) If the energy of an electron in 3rd Bohr orbit is $-E$, then what is energy of the electron in 1st Bohr orbit?

34. (i) Compare the relative stability of the following species and indicate their magnetic properties; N_2 , N_2^+ , N_2^- , N_2^{2-}

- (ii) Out of o-nitrophenol and p-nitrophenol which has higher boiling point and why?

OR

- (i) Using VSEPR theory draw the molecular structures of the following.

(a) NH_3 (b) SF_4 (c) ClF_3

- (ii) Calculate the formal charges on the various atoms in ozone molecule.

35. (i) A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96 g. What are its empirical and molecular formula.

- (ii) 8.4 g of KOH is dissolved in water to give 250 mL solution. Calculate the molarity of the solution.

OR

- (i) The density of 3M solution of NaCl is 1.25 g mL^{-1} . Calculate the molality of the solution.

- (ii) How many atoms of oxygen are present in 200 g of CaCO_3 ?
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