DOON PUBLIC SCHOOL, PASCHIM VIHAR, NEW DELHI

Examination: Half yearly (2024-25) SET 2

Subject: Chemistry

Class: 11

Duration: 3 Hrs.   Date: 17.09.2024   Maximum Marks: 70

General Instructions:

1. Attempt all the questions section-wise.

2. This question paper has 5 sections.

Section A has 16 questions. Each question carries 1 mark.

Section B has 5 questions of 2 marks each.

Section C has 7 questions of 3 marks each.

Section D has 2 questions (case-based) of 4 marks each.

Section E has 3 questions of 5 marks each.

3. Take the margin on the right-hand side of the sheet for calculations.

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Section A (1 mark each)

Q1 In which of the following molecules octet rule is not followed?
(a) BCl_3
(b) CO_2
(c) CH_4
(d) CO

Q2 Which of the following types of hybridisation leads to the planar geometry of bonds around the carbon atom?

(a) sp3

(b) sp2

(c) sp3d

(d) None of these

Q3 What is the mass of 12.044×10^{23} Nitrogen atoms ?
(a) 12 g   (b) 36 g   (c) 36 g   (d) 28 g

Q4 44 g of CO_2 has same number of molecules as
(a) 16 g of CO   (b) 28 g of N2   (c) 14 g of N2   (d) 1 g of H2

Q5 In which of the following compounds Oxygen exhibits +ve oxidation state?
(a) CO_2 (b) OF_2 (c) Na_2O (d) O_2

Q6 The ionisation potential of a hydrogen atom is –13.6 eV. What will be the energy of the atom corresponding to n = 2.
(a) – 3.4 eV
(b) – 6.8 eV
(c) – 1.7 Ev
(d) –2.7 eV

Q7 In the conversion of Cl_2 to ClO_4^- the oxidation number of Cl changes from:

(a) zero to +5

(b) -1 to +7

(c) +2 to +5

(d) 0 to +7

Q8 The mixing of one s and one p - orbital resulting in the formation of two equivalent sp - hybrid orbitals. Which of the following orbitals are used for sp - hybridisation by convention.

(a) s and p_x

(b) s and p_y

(c) s and p_z

(d) s and p_T

Q9 Among the following pairs of orbitals which orbital will experience the larger effective nuclear charge? (i) 2s and 3s, (ii) 4d and 4f, (iii) 3d and 3p:

a) 4f, 3d, and 3s respectively

b) 2s, 4d and 3p respectively

c) 2s, 4d and 3d respectively

d) 4d, 3p and 2s respectively

Q10 The only series of lines appear in the Ultraviolet region of the electromagnetic spectrum of hydrogen is

a) Pfund series

b) Paschen series

c) Balmer series

d) Lyman series

Q11 The shape of ClF3 molecule is

a) square planar

b) T shape

c) trigonal bi - pyramidal

d) bent

Q12 Which of the following reaction defines ΔHf ?

(a) $C(\text{Diamond}) + O_2(g) \rightarrow CO_2(g)$

(b) $1/2\ H_2(g) + 1/2\ F_2(g) \rightarrow HF(g)$

(c) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

(d) $CO(g) + 1/2\ O_2(g) \rightarrow CO_2(g)$

Q13-16 are Assertion reason questions

2

(i)Both Assertion and Reason are true and the Reason is the correct explanation for Assertion.

(ii) Both Assertion and Reason are true and the Reason is not the correct explanation for Assertion

(iii) Assertion is true but the Reason is false.

(iv) Assertion is false but Reason is true.

(v) Both Assertion and reason are false

Q13 Assertion: 22.4 L of N_2 at NTP and 5.6 L of O_2 at NTP contain an equal number of molecules.

Reason: Under similar conditions of temperature and pressure, equal volumes of all gases contain an equal number of molecules.

Q14 Assertion: In an isothermal process, whole of heat energy supplied to the body is converted into internal energy.

Reason: According to first law of thermodynamics $q=\Delta U+P\Delta V$

Q15 Assertion: Second ionization enthalpy will always be higher than the first ionization enthalpy.
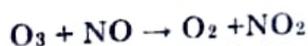
Reason: Ionization enthalpy is a quantitative measure of the tendency of an element to lose electron.

Q16 Assertion : The number of O atoms in 16 g of oxygen and 16 g of Ozone is same .

Reason: Each of the species represent 1g atom of oxygen.

Section B (2 mark questions)

Q17. NO_2 is formed when 0.740 g of O_3 reacts with 0.670 g of NO. What is the limiting reagent?

$$O_3 + NO \rightarrow O_2 + NO_2$$

Q18. Two elements 'P' and 'Q' combine to form a compound. Atomic mass of 'P' is 14 and 'Q' is 16. percentage of 'P' in the compound is 30.4 . What will be the empirical formula of the compound ?

Q19 Calculate the wave number for the longest wavelength transition in the Balmer series of atomic hydrogen.

Q20. All C-C bonds in benzene are equal. Comment.

Q21. Consider the elements
          Na, Ar , Cl , F

and identify the element that exhibits,

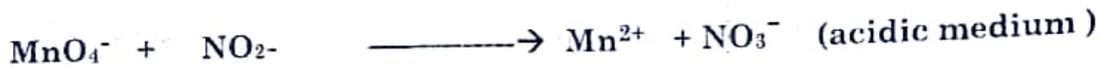1. both +ve and - ve oxidation states.

2. +ve oxidation state.

3

3. - ve oxidation state.
4. neither exhibits neither +ve nor - ve oxidation state.

Section C (3 mark questions)

Q22. a) Balance the following redox reactions

$$MnO_4^- + NO_2^- \longrightarrow Mn^{2+} + NO_3^- \text{ (acidic medium)}$$

$$Cl_2 + OH^- \longrightarrow Cl^- + ClO_3^-$$

Q23.(a) If the uncertainty in the positions of two particles A and B with masses of 2×10^{-27} kg and 4.0×10^{-31} kg, respectively, is the same, what will be the ratio of uncertainty in their velocities?

(b) When an electron from an excited hydrogen atom undergoes the transition from energy level $n = 4$ to $n = 3$, which spectral series will this emission of radiation fall into?

Q24. (a) Which orbital does not have angular node?

(b) What is the significance of ψ^2?

(c) What is the wave number of yellow radiations having a wavelength of 4000 Å ?

Q25. The combustion of one mole of benzene occurs at 298 K, and 1 atm after combustion, CO_2 (g) and H_2O (l) are produced, and 3267.0 KJ of heat is liberated. Calculate the standard enthalpy of formulation ΔHf of benzene. Given the standard enthalpy of formation of CO_2 (g) and H_2O (l) are – 393.5 KJ mole-1 and – 286 KJ mole-1.

Q26. (a) Under what condition is $\Delta H > \Delta U$?

(b) 5 litres of an ideal gas at a pressure of 10 atm expands isothermally into vacuum until its volume is 20 litres . How much heat is absorbed and how much work is done in expansion ?

(c) Consider the combustion of methane (CH_4) in the presence of oxygen (O_2) to form carbon dioxide (CO_2) and water (H_2O) at standard temperature and pressure.

$$CH_4 \text{ (g)} + 2 O_2 \text{ (g)} \rightarrow CO_2 \text{ (g)} + 2 H_2O \text{ (l)}$$
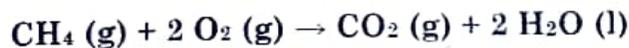
Calculate ΔHr for the reaction given above .Given

Bond	Bond Enthalpy (kJ/mol)
C – H	413
O = O	495

4

C = O	799
O – H	463

Q27. (i) The first ionization enthalpy values (in kJ mol $^{-1}$) of group 13 elements are:

B - 801,   Al – 577 ,   Ga - 579,   In - 558,   Tl - 589

How would you explain deviation from the general trend?   2

(ii) Based on quantum numbers, justify that the fifth period of the periodic table should have 18 elements.   1

Q28. Calculate the oxidation number of underlined atoms in the following species

$H_2\underline{P}O_4^-$ $\underline{S}_8$ $\underline{Cr}_2O_3$ $H_2\underline{O}_2$ $\underline{Cl}F_3$ $\underline{Mn}O_4^{2-}$

Section D (Case Based Questions)

Q 29. The molecular orbital theory is based on the principle of a linear combination of atomic orbitals. According to this approach when atomic orbitals of the atoms come closer, they undergo constructive interference as well as destructive interference giving molecular orbitals, i.e., two atomic orbitals overlap to form two molecular orbitals, one of which lies at a lower energy level (bonding molecular orbital). Each molecular orbital can hold one or two electrons in accordance with Pauli's exclusion principle and Hund's rule of maximum multiplicity.

Answer the following questions

   a. Compare bond order of O_2 , O_2^+ , O_2^- and   on the basis of MO theory.   2
   b. What are the two major conditions for combination of atomic orbitals ?   2

Q30 The period indicates the value of n for the outermost or valence shell. In other words, a successive period in the Periodic Table is associated with the filling of the next higher principal energy level (n = 1, n = 2, etc.). Elements in the same vertical column or group have similar valence shell electronic configurations, the same number of electrons in the outer orbitals, and similar properties. Atomic Radius refers to both covalent or metallic radius depending on whether the element is a non - metal or a metal.
The elements are classified into four blocks viz., s - block, p - block, d - block, and f - block depending on the type of atomic orbitals that are being filled with electron. helium belongs to the s - block but its positioning in the p - block along with another group of 18 elements is justified because it has a completely filled

valence shell $(1s^2)$ and as a result, exhibits properties characteristic of other noble gases.

Answer the following questions

1. What is the group number, number of valence electrons, and valency of an element with the atomic number 18 ?

2. The electronic configuration of an element is $1s^2$, $2s^2$ $2p^6$, $3s^2$ $3p^1$. What is the atomic number of the element which is just below the above element in the periodic table?

3. What is the trend for electron gain enthalpy in a period ? Explain.

Section E (5 mark questions)

Q31. a. Discuss the shape and geometry of SF_4 with the help of VSEPR theory.
b. How many sigma and pie bonds are there in a molecule of Ethyne and benzene ?
c. What is the hybridisation of O in H_3O^+ ?
d. Out of NH_3 and PH_3 which one has higher boiling point and why?

Q32. a. Show resonance in SO_4^{2-} and define resonance energy.
b. Which one is more covalent ? LiCl or NaCl .Discuss reason also
c. Compare dipole moment of NH_3 and NF_3 .
d. What is the formal charge on C atom in CO_3^{2-} ?

Q 33. a) Find the number of unpaired electrons in Cr^{2+} and Sc^{3+}
a)Which among the following orbitals have lobes along the axis ?
    dxy   dyz dz^2 dx^2-y^2
c) A proton of wavelength 400 nm strikes metal surface. The electrons are ejected with velocity 5.85×10^5 m/s. Calculate min. energy required to remove electron from metal surface. (Mass of electron $= 9.1 \times 10^{-31}$ kg) What is the maximum wavelength that will cause a photoelectron to be emitted?