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| **HY/CHQP/1123/A 06-NOV-2023** | | | | | |
| **HALF YEARLY EXAMINATION (2023-24)** | | | | | |
| **Subject: CHEMISTRY**  **Grade: XI** | | Max. Marks:70Time:3Hours | | | |
| **Name:** | | | **Section:** | **Roll No:** | |
| **General Instructions:**  **Read the following instructions carefully. There are 33 questions in this question paper with internal choice.**   1. **SECTION A consists of 16 multiple-choice questions carrying 1 mark each.** 2. **SECTION B consists of 5 very short answer questions carrying 2 marks each.** 3. **SECTION C consists of 7 short answer questions carrying 3 marks each.** 4. **SECTION D consists of 2 case- based questions carrying 4 marks each.** 5. **SECTION E consists of 3 long answer questions carrying 5 marks each.** 6. **All questions are compulsory.** 7. **Use of calculators is not allowed** | | | | | |
|  | **SECTION A** | | | |  |
| 1 | Hot concentrated sulphuric acid is a moderately strong oxidizing agent. Which of the following reactions does not show oxidizing behaviour?  (a) Cu + 2H2SO4 → CuSO4 + SO2 + 2H2O  (b) S + 2H2SO4 → 3SO2 + 2H2O  (c) C + 2H2SO4 → CO2 + 2SO2 + 2H2O  (d) CaF2 + H2SO4 → CaSO4 + 2HF | | | | 1 |
| 2 | In which case is number of molecules of water maximum?  (a) 18 mL of water  (b) 0.18 g of water  (c) 0.00224 L of water vapours at 1 atm and 273 K  (d) 10–3 mol of water | | | | 1 |
| 3 | Which of the following statements do not form a part of Bohr’s model of hydrogen atom?  (a) Energy of the electrons in the orbits are quantized.  (b) The electron in the orbit nearest the nucleus has the lowest energy.  (c) Electrons revolve in different orbits around the nucleus.  (d) The position and velocity of the electrons in the orbit cannot be determined simultaneously | | | | 1 |
| 4 | In which of the following options the order of arrangement does not agree with the variation of property indicated against it? Choose all the correct options.  (a) I < Br < Cl < F (increasing electron gain enthalpy)  (b) Li < Na < K < Rb (increasing metallic radius)  (c) Al3+ < Mg2+ < Na+ < F– (increasing ionic size)  (d) B < C < N < O (increasing first ionisation enthalpy) | | | | 1 |
| 5 | In NO3 – ion, number of bond pair and lone pair of electrons on nitrogen atom are  (a) 2, 2  (b) 3, 1  (c) 1, 3  (d) 4, 0 | | | | 1 |
| 6 | In element, X has the following isotopic composition:  200X: 90% ; 199X : 8.0% ; 202X : 2.0%  The weighted average atomic mass of the naturally occurring element X is closest to  (a) 201 amu  (b) 202 amu  (c) 199 amu  (d) 200 amu | | | | 1 |
| 7 | Which of the following reactions are disproportionation reactions?    Select the correct option from the following.  (a) (i) and (iv) only  (b) (i) and (ii) only  (c) (i), (ii) and (iii)  (d) (i), (iii) and (iv) | | | | 1 |
| 8 | Select the pairs of ions which have same electronic configuration?  (a) Cr3+, Fe3+  (b) Fe3+, Mn2+  (c) Fe3+, Co3+  (d) Se3+, Cr3+ | | | | 1 |
| 9 | Which of the following molecules has trigonal pyramidal geometry?  (a) BF3  (b) XeO3  (c) PCl5  (d) IF3 | | | | 1 |
| 10 | Which of the following pairs of d-orbitals will have electron density along the axes?  (a) dz2, dxz  (b) dxz, dyz  (c) dz2, dx2 – y2  (d) dxy, dx2 – y2 | | | | 1 |
| 11 | For the redox reaction,  MnO4– + C2O42– + H+ → Mn2+ + CO2 + H2O  The correct coefficients of the reactants for the balanced equation in acidic medium are   |  |  |  |  | | --- | --- | --- | --- | |  | MnO4– | C2O42– | H+ | | a. | 16 | 5 | 2 | | b. | 2 | 5 | 16 | | c. | 2 | 16 | 5 | | d. | 5 | 16 | 2 | | | | | 1 |
| 12 | The formation of the oxide ion, O2– (g) from oxygen atom requires first an exothermic and then an endothermic step as shown below:    Thus, the process of formation of O2– in gas phase is unfavourable even though O2– is isoelectronic with neon because,  (a) O– ion has comparatively smaller size than oxygen atom  (b) oxygen is more electronegative  (c) addition of electron in oxygen results in larger size of the ion  (d) electron repulsion outweighs the stability gained by achieving noble gas configuration. | | | | 1 |
|  | Select the most appropriate answer from the options given below:   * 1. Both A and R are true and R is the correct explanation of A   2. Both A and R are true but R is not the correct explanation of A.   3. A is true but R is false.   4. A is false but R is true. | | | |  |
| 13 | Assertion: Molality of any solution decrease by increase in temperature.  Reason: Volume is directly proportional to temperature. | | | | 1 |
| 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. | | | | 1 |
| 15 | Assertion: If the size of the atom is small then electron gain enthalpy is high.  Reason: Electron gain enthalpy of Fluorine is higher than Chlorine. | | | | 1 |
| 16 | Assertion: CsF has higher ionic character than NaCl and hence, bond in CsF is stronger than in NaCl.  Reason: According to Fajans rule, ionic character increases with increase in size of the cation, and with decrease in size of the anion. | | | | 1 |
|  | **SECTION B** | | | |  |
| 17 | 2.38 g of uranium was heated strongly in a current of air. The resulting oxide weighed 2.806g. Determine the empirical formula of the oxide. (At. Mass of U = 238) | | | | 2 |
| 18 | Write the net ionic equation for the reaction of potassium dichromate (VI), K2Cr2O7 with sodium sulphate, Na2SO3, in an acid solution to give chromium (III) ion and the sulphate ion.  **Or**  Permanganate ion reacts with bromide ion in basic medium to give manganese dioxide and bromate ion. Write the balanced ionic equation for the reaction. | | | | 2 |
| 19 | 1. Out of 1Molar and 1molal aqueous solution, which is more concentrated and why? 2. Why is molality does not affect by the temperature? | | | | 2 |
| 20 | The uncertainty for the calculation of radius of the 1st Bohr orbit is 2% for the hydrogen atom. What will be the uncertainty in velocity of electron in the 1st Bohr orbit.  (h = 6.626 × 10–34 Joule sec, me = 9.1 × 10–31 kg**)** | | | | 2 |
| 21 | Using s, p, d notations, describe the orbital with the following quantum numbers.  (a) n=1, l=0; (b) n = 3; l=1 (c) n = 4; l =2; (d) n=4; l=3. | | | | 2 |
|  | **SECTION C** | | | |  |
| 22 | (a) Define the following:  (i) Hund`s rule of maximum multiplicity.  (ii) Paul`s exclusion principle  (b) Name the orbital having 3 angular nodes and 3 total nodes | | | | 3 |
| 23 | (a)The first ionization enthalpy (∆*i H)* values of the third period elements, Na, Mg and Si are respectively 496, 737 and 786 kJ mol–1. Predict whether the first ∆*i H* value for Al will be closer to 575 or 760 kJ mol–1? Justify your answer.  (b) Explain the deviation in ionisation enthalpy of some elements (B and Be, N and O) from the general trend by using the graph. | | | | 3 |
| 24 | (a) Assign oxidation numbers to the underlined elements in each of the following species  (i) NH4NO3 (ii) CrO3  (b)Write the stock notation formulae for the following compounds:  (i) Thallium(I) sulphate  (ii) Auric chloride | | | |  |
| 25 | (a) Define lattice enthalpy.  (b)Predict the shapes of the following molecules using VSEPR Theory:  (i)     SF4 (ii)      AsF5 | | | | 3 |
| 26 | (a) Define limiting reagent.  (b) A mixture of CaCO3 and MgCO3 weighing 1.84g on heating left a residue weighing 0.96g. Calculate the percentage of each carbonate compound in the mixture. | | | | 3 |
| 27 | (a) Define Degenerate orbitals.  (b) Out of 3dz2, 3dxy, 4p , 3p, 3dx2-y2 which all are degenerate orbitals.  (c) Draw the boundary surface diagram for dxz orbital | | | | 3 |
| 28 | (a) Define Law of multiple proportions.  (b) Three common gaseous compounds of nitrogen and oxygen of different elementary  composition are known, (A) laughing gas containing 63.65% nitrogen, (B) a colorless gas containing 46.68% nitrogen, and (C) a brown, toxic gas containing 30.45% nitrogen. Show how these data illustrate the law of multiple proportions. | | | | 3 |
|  | **SECTION D** | | | |  |
| 29 | Electron moves around the nucleus in circular orbitals in fixed energy paths. As far as electron moves in these orbits neither energy is absorbed nor liberated. But when electron moves from lower energy level to higher energy level energy is absorbed while when it comes back from higher energy level to lower energy level energy is liberated in the form of photon & a spectral line is formed. Corresponding to different possible transitions, different lines are formed which form the particular series viz. Lyman, Balmer, Paschen, bracket, Pfund, Humphery etc. Suppose e– in hydrogen atom is present in 10th excited state,  Answer the following questions based on paragraph:  (a) If electron present in 10th excited state liberate one visible quantum, then next quanta liberated will correspond to following transition –               (i) 10 → 2   (ii) 11 → 2  (iii) 11 → 1   (iv) 2 → 1  (b) Total number of spectral lines which can be obtained during the transition to ground level  (i) 45 (ii) 55 (iii) 66  (iv) 36  (c) Which are the initial and final state orbits for a second transition in Paschen series.  (d) Find out the longest wavelength line in Balmer series of spectrum? | | | | 4 |
| 30 | The concept of resonance was introduced to deal with the type of difficulty experienced in the depiction of accurate structures of molecules like O3. According to the concept of resonance, whenever a single Lewis structure cannot describe a molecule accurately, a number of structures with similar energy, positions of nuclei, bonding and non-bonding pairs of electrons are taken as the canonical structures of the hybrid which describes the molecule accurately. Thus, for O3, the two structures shown above constitute the canonical structures or resonance structures and their hybrid i.e., the III structure represents the structure of O3 more accurately. This is also called resonance hybrid. Resonance is represented by a double headed arrow.  In general, it may be stated that.  • Resonance stabilizes the molecule as the energy of the resonance hybrid is less than the energy of any single canonical structure; and,  • Resonance averages the bond characteristics.  Thus, the energy of the O3 resonance hybrid is lower than either of the two canonical forms I and II.  Answer the following questions based on paragraph:  (a) Which of the following structures is the most preferred and hence of lowest energy for SO3?    (b) The correct order in which the O – O bond length increases in the following is  (i) O2 < H2O2 < O3  (ii) O3 < H2O2 < O2  (iii) H2O2 < O2 < O3  (iv) O2 < O3 < H2O2  (c) Define resonance energy?  (d) Draw resonating structures of Acetate ion. | | | | 4 |
|  | **SECTION- E** | | | |  |
| 31 | (a) Calculate the mass percentage of nitrogen in  (i) urea [CO(NH2)2]  (ii) Ammonium carbonate. (NH4)2CO3  (b) How are 0.50 mol Na2CO3 and 0.50 M Na2CO3 different?  (c) You are given 2m CH3OH solution and density of solution is 0.981kg/litre. Calculate the number of moles of CH3OH in 5 litre vessels.  **OR**  (a) How many atoms are there in the following:  (i) 52u He  (ii) 52g He  (b) If the density of methanol is 0.793 kg L–1, what is its volume needed for making 2.5 L of its 0.25 M solution?  (c) What is the mole fraction of the solute in 2.5m aqueous solution? | | | | 5 |
| 32 | 1. Which quantum gives us information about the following: 2. Orientation of orbitals 3. Energy of the orbitals. 4. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition n =4 to n = 2 of He+ spectrum?   **OR**  (a) Draw the structure of dx2-y2 orbital?  (b) The electronic configuration of valence shell of Cu is 3d104s1 and not 3d9 4s2. How is this configuration explained?  (c) The K.E. of a subatomic particle is 5.65 x 10-25 J. Calculate the frequency of the particle. | | | | 5 |
| 33 | Account for the following: (Attempt any 5)  (a) MgO has more lattice enthalpy than NaCl.  (b)Axial bonds are longer as compared to equatorial bonds in PCl5.  (c)Lone pairs are normally present in an equatorial position rather than axial position.  (d) PCℓ5 is trigonal bipyramidal whereas IF5 is square pyramidal.  (e) Bond angle in NH3 is more than H2O,  (f) NF3 is pyramidal while BF3 is triangular planar. | | | | 5 |

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