|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
| **HY/CHQP/1122/C** | | | | | |
| **HALF-YEARLY EXAMINATION(2022-23)** | | | | | |
| **Subject: CHEMISTRY – SET 2**  **Grade: XI** | | Max. Marks:70Time: 3 Hrs | | | |
| **Name:** | | | **Section:** | **Roll No:** | |
| ***General Instructions:***   * GENERAL INSTRUCTIONS: Read the following instructions carefully.   1. There are 37 questions in this question paper.  2. SECTION A - Q. No. 1 to 10 are multiple choice questions carrying 1 mark each.  3. SECTION B - Q. No. 11 to 20 are short answer questions with 1 mark each.  4. SECTION C- Q. No. 21 to 27 are short answer questions carrying 2 marks each.  5. SECTION D- Q. No. 28 to 34 are short answer questions carrying 3 marks each.  5. SECTION E- Q. No. 35 to 37 are long answer questions carrying 5 marks.  6. All questions are compulsory.  7. Use of calculators is not allowed | | | | | |
|  | **SECTION A** | | | | |
| 1 | The number of atoms present in one mole of an element is equal to the Avogadro number. Which of the following element contains the greatest number of atoms?   1. 4g He 2. 46g Na 3. 0.40g Ca 4. 12g He | | | | 1 |
| 2 | If traveling at the same speeds, which of the following matter waves have the shortest wavelength?   1. Electron 2. Alpha particle (He2+) 3. Neutron 4. Proton | | | | 1 |
| 3 | Which of the following species has a pyramidal shape?   1. BH4– 2. CO2 3. CO32– 4. H3O+ | | | | 1 |
| 4 | In which of the following compounds, an element exhibits two different oxidation states.   1. NH2OH 2. NH4NO3 3. N2H4 4. N3H | | | | 1 |
| 5 | One mole of oxygen gas at STP is equal to \_\_\_\_\_\_\_.   1. 6.022 × 1023 molecules of oxygen 2. 6.022 × 1023 atoms of oxygen 3. 16 g of oxygen 4. 8 g of oxygen | | | | 1 |
| 6 | ln which of the following pairs is the greatest difference in the oxidation number of the underlined elements?  (a) SO2 and SO3  (b) P2O5 and P4O10  (c) N2O and NO  (d) NO2, and N2O4 | | | | 1 |
| 7 | Which molecule/ion out of the following does not contain unpaired electrons?   1. N2+ 2. O2 3. O22– 4. B2 | | | | 1 |
| 8 | In the reaction,  2FeCl3 + H2S →2FeCl2+2HCl+S   1. FeCl3 acts as an oxidizing agent 2. Both H2S and FeCl3 are oxidized' 3. FeCl3 is oxidized while H2S is reduced 4. d) H2S acts as an oxidizing agent | | | | 1 |
| 9 | When 1L of 0.1M sulphuric acid solution is allowed to react with 1L of 0.1M sodium hydroxide solution, the molarity of sodium sulphate in the solution obtained is   1. 0.1 mol L–1   b) 1 mol L-1  c) 0.025 mol L–1  d) 0.55 mol L–1 | | | | 1 |
| 10 | Which of the following options represents the correct bond order:   1. O2– > O2 > O2+ 2. O2– < O2 < O2+ 3. O2– > O2 < O2+ 4. O2– < O2 > O2+ | | | | 1 |
|  | **SECTION B** | | | |  |
| 11 | Draw the Lewis structure for the nitrate ion. | | | | 1 |
| 12 | Calculate the oxidation number of underlined elements in the followings:   1. CaO2  b) MnO4 2- | | | | 1 |
| 13 | All the C—O bonds in carbonate ion (CO32–) are equal in length. Why? | | | | 1 |
| 14 | Arrange s, p, and d sub-shells of a shell in the increasing order of effective nuclear charge (Zeff) experienced by the electron present in them. | | | | 1 |
| 15 | Write the empirical formula for acetic acid (ethanoic acid). | | | | 1 |
| 16 | What is the threshold frequency? | | | | 1 |
| 17 | Identify the species being oxidized and reduced in the following reaction:  2As (s) + 3Cl2 (g) → 2AsCl3 | | | | 1 |
| 18 | How many molecules of cane sugar (C12H22O11) are present in 34.20 grams of it? | | | | 1 |
| 19 | HNO3 acts only as an oxidant whereas HNO2 acts both as an oxidant and reductant. Why? | | | | 1 |
| 20 | Write the formula of any one compound/ion where the oxidation state of chlorine is +4. | | | | 1 |
|  | **SECTION C** | | | |  |
| 21 | The arrangement of orbitals based on energy is based upon their (n +l) value. The lower the value of (n + the l), the lower is the energy. For orbitals having the same values of (n + I), the orbital with the lower value of n will have lower energy. Based upon the above information, solve the questions given below:   1. Which of the following orbitals has the lowest energy? 4d, 4f, 5s, 5p 2. Which of the following orbitals has the highest energy? 5p, 5d, 5f 6s, 6p | | | | 2 |
| 22 | How is mole related to-   1. number of atoms/molecules 2. mass of the substance? | | | | 2 |
| 23 | Calculate the wave number of line associated with the transition in the Balmer series when the electron moves to n = 4 orbit. (RH = 109677 cm-1). | | | | 2 |
| 24 | What is meant by the term average bond enthalpy? Why is there a difference in bond enthalpy of the individual O—H bonds in water? | | | | 2 |
| 25 | Balance the following equation in an acidic medium by the ion-electron method.  Cr (OH)4- (aq) + H2O2(aq) → CrO42-(aq) + H2O (l) | | | | 2 |
| 26 | What is the type of hybridization of carbon atoms marked with the asterisk? | | | | 2 |
| 27 | Calculate the velocity of electrons in the first Bohr orbit of the hydrogen atom.  (Bohr’s radius = 0,529 Ao. Planck’s constant = 6.626 × 10-34 Js  mass of electron = 9.11 × 10-31 kg, and, 1 J = 1 kg m2 s-1) | | | | 2 |
|  | **SECTION D** | | | |  |
| 28 | 1. State Heisenberg's uncertainty principle. 2. Write the electronic configuration of the element with 29 electrons and 35 neutrons. 3. Write the rule disobeyed while writing the following electronic configuration for Nitrogen —   1s2, 2s2, 2px2, 2py1 | | | | 3 |
| 29 | 1. State the law of constant composition (definite proportion). 2. 2.16 g of copper metal, when treated with nitric acid followed by ignition of the nitrate, gave 2.70 g of copper oxide. In another experiment, 1.15 g of copper oxide upon reduction with hydrogen gave 0.92 g of copper. Show that the above data illustrates the law of definite proportions. | | | | 3 |
| 30 | Give reasons for the following:   1. The electronegativity difference between N and F is greater than that between N and H, yet the dipole moment of NH3 (1.47D) is larger than that of NF3 (0.23D). 2. H2O has a bent structure whereas the CO2 molecule is linear. 3. Which of the following species given below has the minimum bond length?   O2+, O2, O2 -, O22- | | | | 3 |
| 31 | 1. Write the electronic configuration of Cr2+ 2. Write all four quantum numbers for the unpaired electron of copper. 3. Which out of Cu2+, Fe2+ and Cr3+ have the highest paramagnetism and why? | | | | 3 |
| 32 | A solution of glucose in water is labelled as 10% (w/w). The density of the solution is 1.20 g/mL. Calculate the molality, molarity, and mole fraction of each component in the solution. | | | | 3 |
| 33 | Write the balanced chemical equation for the following reaction (steps required):  Dichlorine heptoxide (Cl2O7) in a gaseous state combines with an aqueous solution of hydrogen peroxide in an acidic medium to give chlorite ion (ClO2- ) and oxygen gas. | | | | 3 |
| 34 | 1. To which molecular orbital does the electron go when O2 molecule converts to the O2**-** ion as shown below,   O2 + e- → O2-   1. What is the common name for the given species-   NO+, CO, and N2   1. Arrange the following molecules in decreasing order of bond angle:   BCl3, NH3, CH4, H2O | | | | 3 |
|  | **SECTION E** | | | |  |
| 35 | 1. An organic compound containing C, H, and O gave the following percentage composition: C = 40.687%, H = 5.085% O = 54.228%. The vapor density of the compound is 59. Calculate the molecular formula of the compound**.** 2. Define 1 molal solution.   **OR**   1. Calcium carbonate reacts with aqueous HC1 to give CaCl2 and CO2 according to the reaction given below:   CaCO3(s) + 2HCl(aq) → CaCl2(aq) + CO2(g) + H2O(l)   1. What mass of CaCl2 will be formed when 250 mL of 0.76 M HC1 reacts with 1000 g of CaCO3? 2. Name the limiting reagent. 3. Calculate the number of moles of CaCl2 formed in the reaction.   (At masses: Ca =40 u; Cl = 35.5u)   1. How many molecules of water are present in a drop of it having a mass of 0.05 g? | | | | 5 |
| 36 | 1. According to de Broglie, the matter should exhibit dual behavior, that is both particle and wave-like properties. However, a cricket ball of mass 100 g does not move like a wave when it is thrown by a bowler at a speed of 100 km/h. Calculate the wavelength of the ball and explain why it does not show wave nature. 2. Show that the circumference of the Bohr orbit for the hydrogen atom is an integral multiple of the de Broglie wavelength associated with the electron moving around the orbit.   **OR**   1. Calculate the velocity of a moving electron that has a wavelength of 4.9 pm.   b) Calculate the wave number for the longest wavelength transition in the Balmer series of the hydrogen atom.  c) Which of the following orbitals are degenerate?  3px, 4dxv, 3s, 3dz2:, 4dyz., 4dz2 | | | | 5 |
| 37 | 1. Arrange the following in increasing order of ionic character: LiCl, LiBr, and LiI.   b) Give reasons:   1. BF3 is planar but NH3 is not. 2. Although carbon-oxygen bonds are polar, CO2 is non-polar.   c) Using VSEPR theory draw the shapes of XeF2 and BrF5.  **OR**  a) Draw the Lewis structure of the molecule in which the octet rule is violated.   1. PCl5 2. SO2 3. Out of o-nitrophenol and p-nitrophenol which has a higher boiling point and why?   c) Making use of the concept of hybridization, explain the shape of the C2H2 molecule using the following points:   1. Ground and excited states of the central atom 2. Orbital diagrams showing hybridized orbitals and overlapping 3. Geometry and type of hybridization | | | | 5 |

\*\*\*