

Time : 3hrs

Max. Marks - 70

No. of printed pages: 3

General Instructions:

- All questions are compulsory.
- Questions nos. 1 to 5 are very short answer questions and carry 1 mark each.
- Questions nos. 6 to 10 are short answer questions and carry 2 marks each.
- Questions nos. 11 to 22 are also short answer questions and carry 3 marks each.
- Question nos. 23 is a value based question and carry 4 marks.
- Question nos. 24 to 26 are long answer questions and carry 5 marks each.
- Use of calculators is not permitted.

- 1 Is ionization enthalpy of the isotopes of an element same or different? Give reason. 1
- 2 What is the law of chemical combination deals with the ratio of volumes of gaseous reactants and products under similar conditions of temperature and pressure conditions? 1
- 3 Why alkali metals form only +1 ions? 1
- 4 Mention two causes of water pollution. 1
- 5 Write one similarity and one difference in the shapes of $d_{x^2-y^2}$ and d_{xy} orbital. 1
- 6 In the reaction,
 $2A + 4B \rightarrow 3C + 4D$, when 5 moles of A react with 6 moles of B, then 2
(i) Calculate the limiting reactant.
(ii) Calculate moles of C formed.
- 7 (i) Why Beryllium (Z=4) has higher first ionization enthalpy than Boron (Z=5)? 2
(ii) Na^+ (Z=11) and Ne (Z=10) do not have same ionization enthalpy, though both are isoelectronic. Give reason.
- 8 Distinguish between a sigma and a pi bond. How many σ and π bonds are present in $\text{CH}_2=\text{CH}-\text{C}\equiv\text{CH}$. 2
- 9 What is Green Chemistry? Give two examples where it is made use of. 2
- 10 A molecule of O_2 and a molecule of SO_2 travel with the same velocity. What is the ratio of their wavelengths? (Atomic mass of O=16u, S=32u) 2

- 11 (i) 5.675 litres of methane gas are ignited in oxygen gas. Calculate number of moles of CO_2 formed? 3
 $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$. (Atomic mass of C=12u, H=1u, O=32u)
 (ii) Chlorophyll contains 2.68% of magnesium by weight. Calculate the number of magnesium atoms in 2.0 g of chlorophyll (Atomic mass of Mg=24u)
- 12 Arrange the following in the increasing order of the property indicated: 3
 (i) P, S, Cl, F (electron gain enthalpy)
 (ii) Mg, Al, Si, Na (ionization enthalpy)
 (iii) I, I⁺, I⁻ (atomic radii)
- 13 (i) Write the IUPAC name and give symbol of the element with atomic number 112. 3
 (ii) An element has atomic number 33. Write the electronic configuration and find the group and the period in which the element is present.
- 14 Answer the following: 3
 (i) What is the significance of ψ^2 ?
 (ii) How many unpaired electrons are present in Mo (Z=42)?
 (iii) Which orbital does not have any directional properties?
- 15 (i) An electron orbiting in nth energy level of hydrogen atom is associated with $-2.18 \times 10^{-18} \text{J/atom}$ energy. What will be the energy associated with first orbit of He^+ ion. What is the energy in joules required to shift the electron of He^+ ion from the first Bohr orbit to the fifth Bohr orbit. 3
 (ii) What is the radius of the first orbit of He^+ ion?
- 16 (i) Draw Lewis structure of COCl_2 and find the formal charge of C atom. 3
 (ii) Explain why CO_2 has no dipole moment but SO_2 has.
- 17 (i) Write MO configuration for O_2 molecule. 3
 (ii) Indicate its magnetic property. (paramagnetic or diamagnetic)
 (iii) Find the bond order of O_2^+ and O_2^- and compare their relative stabilities
- 18 Account for the following: 3
 (i) Beryllium and Magnesium do not give colour to flame whereas other alkaline earth metals do so.
 (ii) Alkaline earth metals have higher lattice enthalpy than the corresponding alkali metals.
 (iii) Caesium is used in photoelectric cells.
- 19 (i) Draw resonance structures of NO_3^- ion. 3
 (ii) Draw the structure and name the shape of
 (a) XeF_4 (b) BrF_3 .
- 20 The elements Na, Mg, Al, Si, P, S, Cl and Ar are arranged in the increasing order of their atomic numbers. 3
 (i) Which element is most electronegative?
 (ii) Which element is least reactive?
 (iii) Which element exists as a gas at room temperature?

- 21 (i) Arrange the following in decreasing order of mobility in aqueous : 3
 Li^+ , Na^+ , K^+ , Rb^+ , Cs^+ . Give reason for your answer.
 (ii) Why is Li as good a reducing agent as Cs in solution?
- 22 Explain why: 3
 (i) NH_3 has higher boiling point than PH_3 .
 (ii) SnCl_2 is ionic but SnCl_4 is covalent.
 (iii) Although geometries of NH_3 and H_2O molecule is distorted tetrahedral, bond angle in water is less than that of ammonia.
- 23 An ozone-layer is present at a height of 25-30 km from earth-surface which protects us from U.V. radiation. A hole in the ozone-layer is created due to human activity. 4
 Now answer the following questions:
 (i) Which activity has been causing ozone-hole?
 (ii) Give harmful effects of ozone depletion on plant or animal life.
 (iii) What has been done to protect ozone layer?
 (iv) How does excess CO_2 gas pollute the atmosphere?
- 24 (i) How many grams and how many moles of Barium chloride (BaCl_2) are present in 100ml of 0.250M BaCl_2 solution? (M Mass of $\text{BaCl}_2=208\text{g/mol}$) 5
 (ii) The density of 3M aqueous solution of NaCl is 1.25 gmL^{-1} . Calculate the molality of the solution. (M Mass of $\text{NaCl}=58.5\text{g/mol}$)
 (iii) Why is molality preferred over molarity in expressing the concentration of solution?
- 25 (i) Draw emission spectrum of Hydrogen atom showing all possible lines/ series and also label the region in which they fall. What does this spectra predict about an atom 5
 (ii) State Hund's Rule of maximum multiplicity.
 (iii) Neon is generally used in sign boards. If it emits strongly at 616nm, calculate
 (a) the frequency of emission
 (b) energy of the quantum. ($h= 6.6 \times 10^{-34}\text{ Js}$)
- 26 (i) Define hybridization. With box diagram, explain hybridization in C_2H_4 molecule. Also draw the labelled orbital overlap diagram. 5
 (ii) Out of o-nitrophenol and p-nitrophenol, which has higher boiling point and why?
 (iii) What is the hybridization of P in PCl_5 molecule. Why are the axial bonds longer as compared to equatorial bonds in PCl_5 molecule?