PLUS ONE BOARD EXAM 2023

CHEMISTRY ANSWER KEY PART 2

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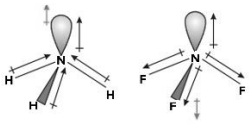
Qn No	Answer
11	Hess's law of constant heat summation states that "Overall the enthalpy change for a reaction is equal to the sum of enthalpy changes of individual steps in the reaction". Means the total amount of heat evolved or absorbed in a reaction is the same whether the reaction takes place in one step or in a number of steps. Example : The synthesis of NH_3 1. $2\,H_{2(g)} + N_{2(g)} \longrightarrow N_2H_{4(g)},\ \Delta_r\,H_1^0 = +95.4\,kJ$ 2. $N_2H_{4(g)} + H_{2(g)} \longrightarrow 2\,NH_{3(g)},\ \Delta_r\,H_2^0 = -187.6\,kJ$ $H_{2(g)} + N_{2(g)} \longrightarrow 2\,NH_{3(g)},\ \Delta_rH^0 = -92.2\,kJ$ The sum of the enthalpy changes for steps (1) and (2) is equal to the enthalpy change for the overall reaction. (Any example like this)
12	(i) According to Bronsted-Lowry theory, acid is a substance which donates an H+ ion or a proton and forms its conjugate base and the base is a substance which accepts an H+ ion or a proton and forms its conjugate acid. (ii) pH is defined as the negative logarithm of H+ ion concentration.
13	A decomposition reaction can be defined as a chemical reaction in which one reactant breaks down into two or more products. Examples: The decomposition of carbonic acid in soft drinks, which can be represented by the chemical equation $H_2CO_3 \rightarrow H_2O + CO_2$ OR The electrolysis of water to yield hydrogen and oxygen.
14	1,3-diene Sigma bond 9 Pi bond 2
15	(i) Cyclohexane (ii) CH_3-CH_2-CH_2-CH_3
16	(i) The empirical formula is the type of chemical formula representing the simplest ratio of atoms that are involved in the chemical formula. The general relation between both the empirical and molecular formula is, (**Molecular Formula = n × Empirical Formula**). (ii) 192 gm
17	**Observations of Rutherford's alpha ray scattering experiment:** 1. Most of the α-particles passed straight through the gold foil without any deviation. 2. Some of the α-particles were deflected by the foil by some angles. 3. Interestingly one out of every 12,000 alpha particles appeared to rebound. **Conclusion of Rutherford's scattering experiment:**

	1. Most of the space inside the atom is empty because most of the α-particles passed through the gold foil without getting deflected. 2. Very few particles were deflected from their path, indicating that the positive charge of the atom occupies very little space. 3. A very small fraction of α-particles were deflected by very large angles, indicating that all the positive charge and mass of the gold atom were concentrated in a very small volume within the atom.	
18	(i)	Na+ is smaller than Na because it has one electron less, so, it has more effective nuclear charge. Thus, there is more attraction on existing electrons, making Na+ smaller in size compared to Na.
	(ii)	PCl_5 forms five bonds by using the d-orbitals to "expand the octet" and have more "places" to put bonding pairs of electrons. NCl_5 does not exist because there are no d-orbitals in the second energy level. Therefore, there is no way to arrange five pairs of bonding electrons around a nitrogen atom.
	(iii)	In F, the electron will be added to quantum level n = 2, but in Cl, the electron is added to quantum level n = 3. Therefore, there are less electron- electron repulsions in Cl and an additional electron can be accommodated easily. Hence, the electron gain enthalpy of Cl is more negative than that of F.
19	(i)	A dipole moment arises in any system in which there is a separation of charge. They can, therefore, arise in ionic bonds as well as in covalent bonds. Dipole moments occur due to the difference in electronegativity between two chemically bonded atoms.
	(ii)	The structure of NF_3 and NH_3 is as follows:-  The dipole moment of ammonia (1.47D) is higher than the dipole moment of NF_3 (0.24D). The molecular geometry is pyramidal for both the molecules. In each molecule, N atom has one lone pair. F is more electronegative than H and N−F bond is more polar than N−H bond. Hence, NF_3 is expected to have much larger dipole moment than NH_3 . However reverse is true as in case of ammonia, the direction of the lone pair dipole moment and the bond pair dipole moment is same whereas in case of NF_3 it is opposite. Thus, in ammonia molecule, individual dipole moment vectors add whereas in NF_3 , they cancel each other.
20	(i)	The octet rule dictates that atoms are most stable when their valence shells are filled with eight electrons. It is based on the observation that the atoms of the main group elements have a tendency to participate in chemical bonding in such a way that each atom of the resulting molecule has eight electrons in the valence shell. The octet rule is only applicable to the main group elements.
	(ii)	**Limitations of Octet rule:**

		The octet rule is applicable only for atoms in their ground state. It does not take account into the number of electrons in an atom. It failed to explain the relative stability of molecules. The shape of the molecule is not predicted by the octet rule.