Department of
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Assignment

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Assignment

Questions

5. (a) Give the defects of Rutherford's model of the atom. What suggestions were given by Bohr to remove these defects?

5. (b) What do you understand by the term 'Quantum number'? How many quantum numbers does an electron in an orbital have? Explain the significance of each quantum number.

6. (a) Compare the properties of ionic and covalent compounds. Give two examples of each type of compound.

6. (b) What is a co-ordinate covalent bond? How does it differ from a normal covalent bond?

7. (a) What do you understand by hydrogen bonds? Classify them with examples. Explain why water has an abnormally high boiling point.

7. (b) Why are the bond angles of H_2O and NH_3 104.5° and 107° respectively, although the central atoms are sp^3 hybridized?

8. (a) What do you mean by the 'ionization potential' of an element? Why is the first ionization potential of an element less than the second ionization potential? How does the ionization potential of an element vary with atomic volume?

8. (b) What do you mean by f-block elements? Why are f-block elements called inner transition elements?

Answers

5. (a) Defects of Rutherford's Model and Bohr's Suggestions

****Defects:****
- According to classical electromagnetic theory, an accelerating electron should emit radiation continuously. Thus, it would lose energy and spiral into the nucleus, leading to the collapse of the atom.
- The model could not explain the stability of atoms.
- Rutherford's model failed to explain the atomic line spectra.

Bohr's Suggestions:
- Electrons revolve in fixed, stable orbits without emitting radiation.
- Energy is absorbed or emitted only when an electron jumps between orbits.
- The energy difference corresponds to the frequency of the emitted/absorbed radiation ($E = h\nu$).

(b) **Quantum Numbers:**

Quantum numbers describe the unique state of an electron.
Each electron has four quantum numbers:

- **Principal Quantum Number (n):** Energy level and size.
- **Azimuthal Quantum Number (l):** Shape of the orbital.
- **Magnetic Quantum Number (m):** Orientation in space.
- **Spin Quantum Number (s):** Spin direction (+½ or -½).

6. (a) Comparison of Ionic and Covalent Compounds:

(a) Comparison between Ionic and Covalent Compounds

Property	Ionic Compounds	Covalent Compounds
Formation	Transfer of electrons	Sharing of electrons
Nature	Crystalline solids	Solids, liquids, or gases
Melting and Boiling Points	Very high	Relatively low to moderate
Electrical Conductivity	Conducts electricity when molten	Poor conductor (except polar covalent compounds)
Examples	Sodium chloride (NaCl), Potassium bromide (KBr)	Water (H_2O), Methane (CH_4)

(b) **Co-ordinate Covalent Bond:**

A bond where both shared electrons come from one atom.
- Normal Covalent Bond: Each atom shares one electron.
- Co-ordinate Bond: One atom donates both electrons.
Example: Ammonium ion (NH_4^+).

7. (a) **Hydrogen Bonds:**

Attractive interaction between a hydrogen atom attached to an electronegative atom and another electronegative atom.

Types:
- Intermolecular (e.g., H_2O)
- Intramolecular (e.g., o-nitrophenol)

Water's High Boiling Point:
Due to strong hydrogen bonding between water molecules.

(b) **Bond Angles of H_2O and NH_3:**

- Both are sp^3 hybridized.
- H_2O: Two lone pairs lead to a bond angle of 104.5°.
- NH_3: One lone pair leads to a bond angle of 107°.
- Lone pair repulsions reduce bond angles.

8. (a) **Ionization Potential:**

Energy needed to remove an electron from an atom.
- First ionization potential is lower as it removes from neutral atom.
- Second is higher due to removal from positively charged ion.
- Ionization potential decreases with increasing atomic volume.

(b) **f-block Elements:**

Elements where electrons fill the (n-2)f orbitals.
- Called inner transition elements because their f-orbitals lie inside the outermost shell.
Examples: Lanthanides and Actinides.