

B.Sc. (Honours) Part-I
Paper-I
Topic: Inert Pair Effect

UG

Subject-Chemistry

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Inert pair effect

The inert pair theory was proposed by Sidgwick. He along with Powell accounted for the shapes of several molecules and correlated the shapes with some of their physical properties.

OR

The non-participation of the two s electrons in bonding due to the high energy needed for unpairing them.

Inert pair effect occurs when electrons are pulled closer to the nucleus, making them more stable and more difficult to ionize.

An electron around the nucleus requires sufficient kinetic energy in order not to be pulled towards the nucleus.

Examples

The inert pair effect among group 4 and group 5 elements. Sn^{2+} and Pb^{2+} and Sb^{3+} and Bi^{3+} which are the lower oxidation states of the elements are formed because of the inert pair effect. When the s electrons remain paired the oxidation state is lower than the characteristic oxidation state of the group.

Properties & Effects:

- The inert pair effect is apparent from the chemistry of the Group III and Group IV elements and beyond.
- The lighter elements in Group IV tend to have a oxidation state of +4, whereas the heavier elements form 2+ ions that are more stable than 4+ ions.
- Heavy elements in certain groups of the periodic table form compounds in which they exist with oxidation states two less than the common oxidation state for that group.

- For example, although the common oxidation state for elements in group 4 is +4, most elements in the group can also exist in oxidation state +2
- This is because of the inert pair effect. In large atoms, such as those of tin and lead, some outer-shell electrons are not as well shielded as those in the inner core.
- They are therefore sucked into the inner core of electrons and thus become inert.
- This results in it having higher speeds, with a higher force acting on it by the nucleus.
- The effects for the heavier elements are appreciable, as electrons travel closer to

the speed of light, c .

- The s-orbital electrons are more affected in this way since they have a greater penetrating power.