1. The correct sequence of increasing covalent character is represented by:

A. $LiCl < BeCl_2 < NaCl$

B. $BeCl_2 < LiCl < NaCl$

C. $NaCl < LiCl < BeCl_2$

D. $BeCl_2 < NaCl < LiCl$

Covalent character in an ionic compound is predicted by Fajan's rule.
According to Fajan's rule:
(i) Greater the size of the cation, lesser will be its polarizing power and lesser will be the covalent character.
(ii) Greater the size of anion, greater will be its polarizability and greater will be the covalent character.
(iii) Greater the charge on the cation and anion, more will be its polarizing power and polarizability respectively and therefore more will be its covalent character.

The size of cations increases in the order
$Be^{2+} < Li^{+} < Na^{+}$

Hence, $BeCl_2 > LiCl > NaCl$ (Covalent character)

2. In the case of alkali metal halides, the covalent character decreases in the order:

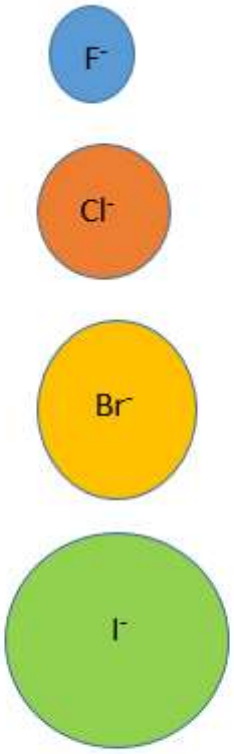
A. $MF > MCl > MBr > MI$

B. $MF > MCl > MI > MBr$

C. $MI > MBr > MCl > MF$

D. $MCl > MI > MBr > MF$

According to Fajan's rule:
Covalent character in an ionic compound is inversely proportional to the size of cation and directly propotional to the size of anion.
In the options, the cation is the same but the anions are different. Among the halides, the order of size is:
$F^- < Cl^- < Br^- < I^-$
Therefore, the order of covalent character is:
$MI > MBr > MCl > MF$

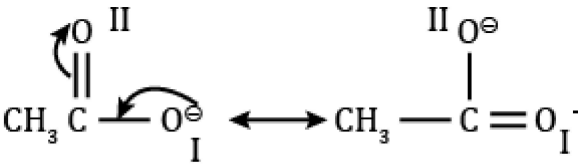


Size increases from top to bottom, So polarisation increases and hence, the covalent character.

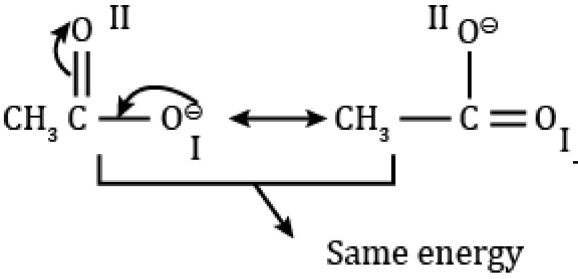
3. The resonance structure of a molecule should not have:

- ✗ **A.** Identical arrangement of atoms
- ✗ **B.** Nearly the same energy
- ✗ **C.** The same number of paired electrons
- ✓ **D.** Identical bonding

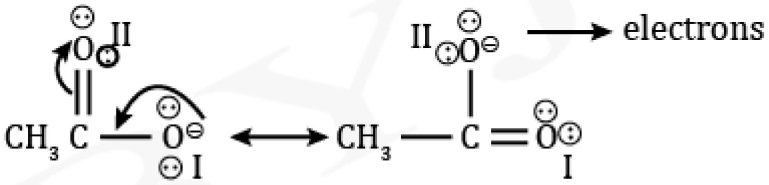
From the resonance structures, it is understood that the position of all atoms is the same.



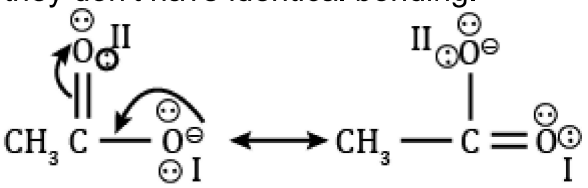
The structures should have nearly the same energy to exhibit resonance, otherwise they will become unstable.



The number of bonds (double + single) are the same in both the structures. Hence, they possess the same number of paired electrons.



In resonance structure I, we can see that the 1st oxygen has a single bond and the 2nd oxygen has a double bond. But in the second structure, the 1st oxygen has a double bond whereas the 2nd one has a single bond. Hence, they don't have identical bonding.



4. $AlCl_3$ is covalent while AlF_3 is ionic. This can be justified on the basis of:

- ✗ **A.** Valence-bond theory
- ✓ **B.** Fajan's rule
- ✗ **C.** Molecular-orbital theory
- ✗ **D.** Hydration energy

Fajan's Rule : It says covalency (covalent character) is introduced in a bond due to the polarization of the anion by the cation. Factors affecting this polarization are:
1. Cation's size (smaller the size, more is the polarization)
2. Anion's size (greater the size of the anion, more is its polarizability)
3. More the charge on the cation and the anion, more is the covalency introduced in the bond.
Considering these factors, $AlCl_3$ can form a better covalent bond because of the larger size of the anion.

5. Which of the following compounds is colored?

- ✓ **A.** HgI_2
- ✗ **B.** $AgCl$
- ✗ **C.** $NaCl$
- ✗ **D.** $HgCl_2$

HgI_2 is red colored. The color is due to the polarisation of I^- by Hg^{2+}. $AgCl$ is colorless since Cl^- is small and cannot be polarsized by Ag^+. $NaCl$ and $HgCl_2$ are colorless for the same reason.