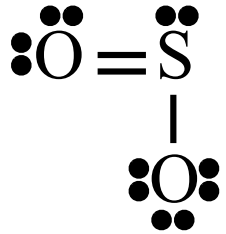
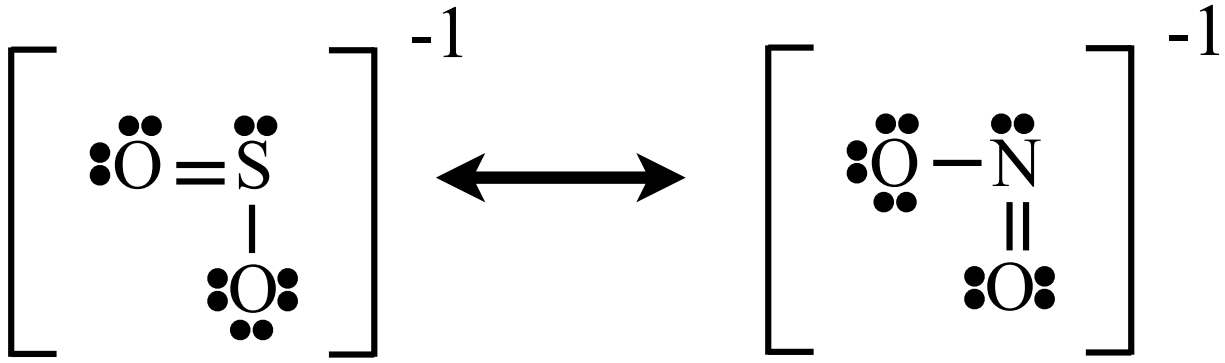
8.55

a)

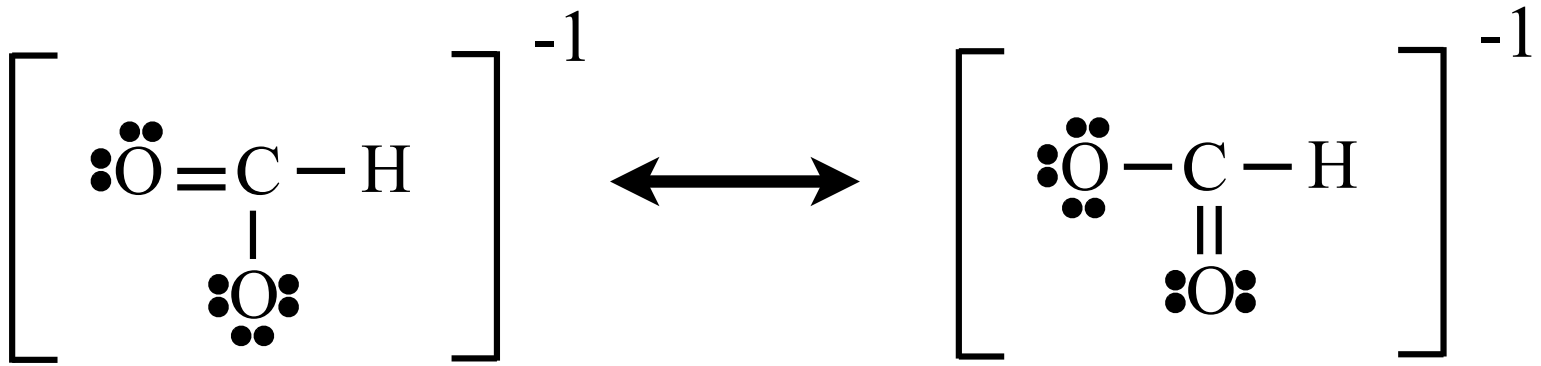


c) Yes, there are two equivalent resonance structures for this molecule.



d) Delocalize pi bonds are shorter than the single bonds, but longer than the double bonds formed by any pair of atoms. As such, I predict the bond length to be between the bond length of single and double bonded S—O.

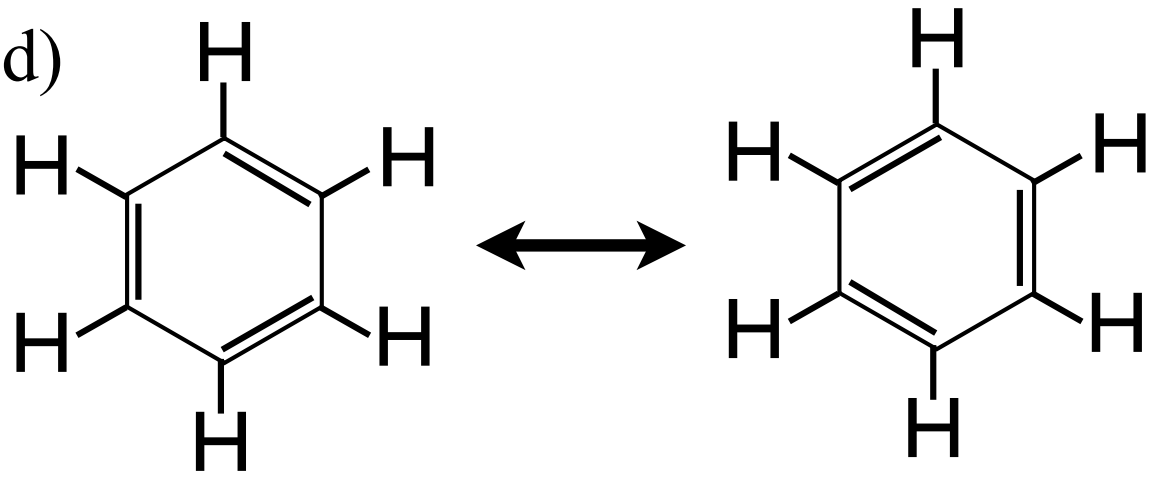
8.56

a) 

b) As seen in 55, resonance structures are needed to describe HCO_2^-

c) CO_2 molecules contain C-O double bonds. Formate contains delocalized pi C-O bonds, which will be longer than the C-O double bonds in CO_2.

8.57 (old)



a) All the C-C bonds in benzene are delocalized pi bonds and are therefore the same length.

b) The C-C bonds in benzene are longer than C=C double bonds and shorter than C-C single bonds.

8.57 (new)

CO is triple bonded; CO_2 is double bonded, CO_3^{2-} is resonance stabilized. As such, relative to C-O bond length: $CO_3^{2-} > CO_2 > CO$.