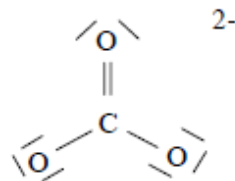
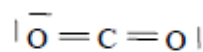


Bonding – Class FRQ #1 Answer Document

Part 1:

8 points

(a) (i)

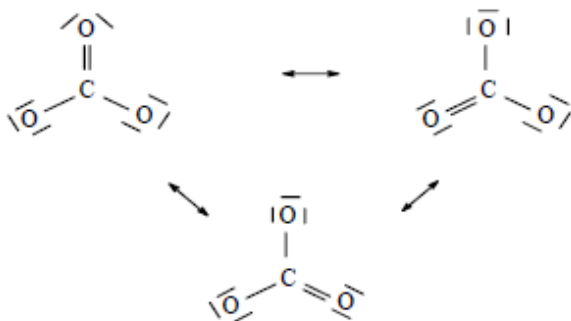


2 pts

- One point earned for each Lewis electron-dot structure
- Indication of lone pairs of electrons are required on each structure
- Resonance forms of CO_3^{2-} are not required

(ii) In CO_2 , the C–O interactions are double bonds, **OR**, in CO_3^{2-} the C–O interactions are resonance forms (or figures below.)

1 pt

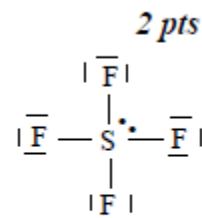
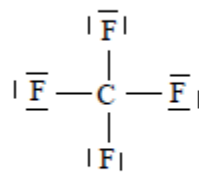


The carbon-oxygen bond length is greater in the resonance forms than in the double bonds.

1 pt

- 1st point earned for indicating double bonds are present in CO_2 **OR** resonance occurs in CO_3^{2-}
- 2nd point earned for **BOTH** of the above **AND** indicating the relative lengths of the bond types

(b) (i)



- One point earned for each Lewis electron-dot structure
- Lone pairs of electrons are required on each structure

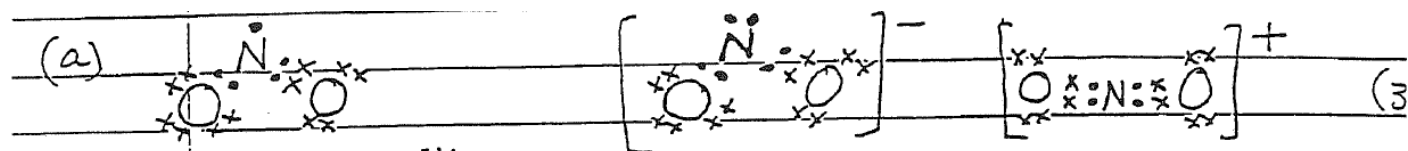
(ii) CF_4 has a tetrahedral geometry, so the bond dipoles cancel, leading to a nonpolar molecule. 1 pt

With five pairs of electrons around the central S atom, SF_4 exhibits a trigonal bipyramidal electronic geometry, with the lone pair of electrons. In this configuration, the bond dipoles do not cancel, and the molecule is polar. 1 pt



- One point earned for each molecule for proper geometry and explanation

Part 2:



[a correct structure with one e^- on oxygen is ok.]

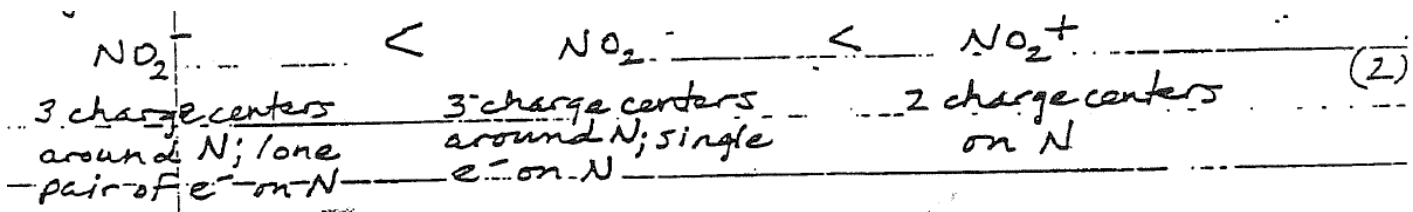
— (-1 pt/structure; -1 pt for one or more missing charges) —



— [This order, whether or not structures drawn in (a) are correct, receives 1 pt. If structure(s) in (a) are incorrect, an order that is consistent with the structures actually given in (a) receives 1 pt.] —

Whether structures in (a) are correct or incorrect, 1 pt is awarded for any one correct angle or ranking consistent with a particular structure, with appropriate justification;

— 2 pts are awarded for two correct comparisons with justifications; for the correct order: —



(C) NO_2^+ is linear, has sp hybridization (1)

OR

$\text{NO}_2/\text{NO}_2^-$ have sp^2 hybridization

(d) NO_2 will dimerize, because it contains an odd electron that will pair readily with another, forming N_2O_4 . (1)

49