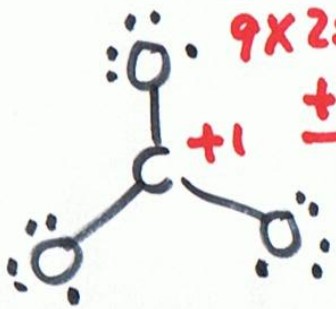
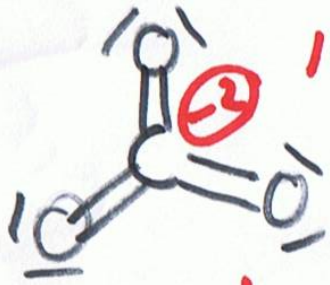
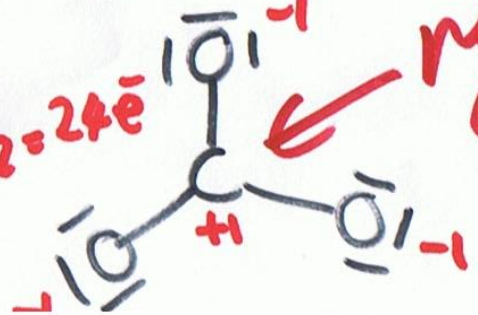
Which of the following is a valid Lewis Dot trial or final structure

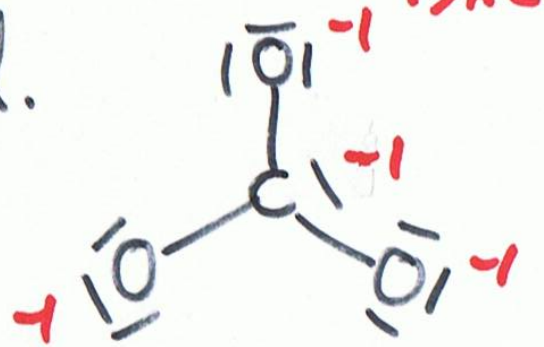
Hand written clicker question #1

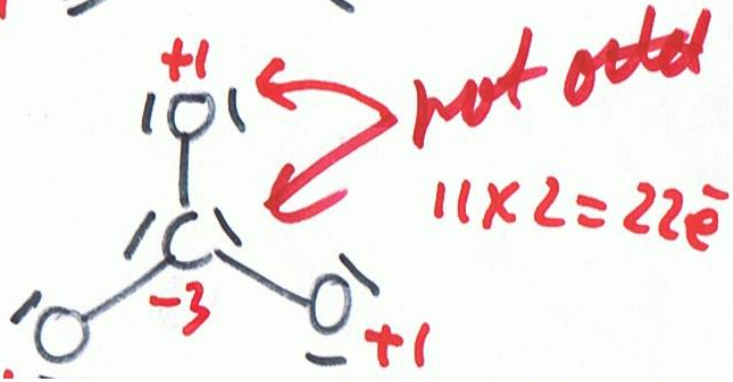
a. 

# ē (valence) = 24

b. 


c. 


d. 


e. 

Some suggestions about doing Lewis Dot structures (from looking at all of your impossible Lewis Dot structures on Quiz VI – while I was burning the midnight oil grading your quizzes until 2 am on 11/15/11) the following is an explanation for the clicker question.

in general **to count the number of electrons around an atom**, you count each of the lone pair electrons and 2 electrons per bond to the atom

an **octet** is 8 electrons – the stable electron configuration of electrons around the atom s and p block elements (the main group elements)

to count valence electrons in a Lewis Dot structure, take the molecular formula and add up all of the individual valence electrons (see your handout about how to do Lewis Dot structures while reading this for further information)

a. **The problem with this structure is the single unpaired electrons**. You should always draw Lewis Dot structures with pairs of electrons. There are very few Lewis dot structures with unpaired electrons. (Unpaired electron Lewis dot structures represent very unstable molecules called "radicals". It is physically impossible to have a stable molecule with multiple single unpaired electrons in the molecule. You don't need to know about radicals now but you should avoid drawing single unpaired electrons in your Lewis dot structures. The **second problem is that none of the atoms has an octet**.

carbon in (a) has 6 electrons around it (less than an octet) = 2 electrons per bond x 3 bonds = 6 electrons

b. **The problem with this structure is the expanded octet on an element in the second period.** Avoid expanding the octet if you can get an uncharged Lewis dot structure without expanding the octet. (Actually first and second period elements are not able to expand the octet because to expand the octet, an empty d orbital must be available. According to quantum mechanical rules, n=1 (the first period of the periodic table) and n=2 (the second period of periodic table) do not have a d subshell. Expanding the octet involves going into the d subshell and since they are not available, you cannot expand the octet in the first and second period elements. You should know this but this will not be a 10 point question on the exam or final exam.

This structure also has 2 negative charges on the carbon. Carbon is electropositive (less electronegative than the oxygen) so if it has a charge, it should be a positive charge not a negative charge.

carbon in (b) has 12 electrons on it. (more than octet) = 2 electrons per bond x 6 bonds = 12 electrons

c. **The problem with this structure is that the central carbon has less than an octet**. Structure (c) is an OK Lewis dot structure. The major problem with this structure is that the central carbon does not have an octet. The only elements which form Lewis dot structures without an octet are Group IIA and Group IIIA elements (like Be, Al, B) Hydrogen is the other exception to the octet rule. A hydrogen can have a maximum of 2 electrons. Additionally it is not considered a "good" Lewis dot structure because of the excel formal charges on the structure. There may be short lived species like intermediates and transition states (invisible molecules in between reaction steps) which may have a non octet structure but any covalent molecule element in a Lewis dot structure (not in Group IIA and Group IIIA) should have an octet.

The problem with this structure is that if you draw a trial structure like this, then you will probably stop with this structure and not recognize that your Lewis Dot structure would be better if you put in a multiple bond. More examples with this problem follow after the end of the explanation.

carbon in (c) has 6 electrons on it. (less than octet) = 2 electrons per bond x 3 bonds = 6 electrons

d. The problem with this structure is that it has too many electrons to fit the valence electrons. **It does have an octet around every atom of the structure**. (too many electrons in trial structure means that you need to add multiple bonds to the structure ) It is the correct trial Lewis Dot structure. Following the Lewis dot structure rule handout # 6, since this structure has too many electrons, you would put in a multiple bond and then iteratively add multiple bonds in trial Lewis dot structures until the number of electrons in your structure matches the # of valence electrons.

carbon (d) has 8 electrons = (2 electrons per bond x 3 bonds) + (one lone pair x 2 electrons per pair) It has an octet.

e. **The problem with this structure is that it has too few electrons** (22 in structure vs. 24 valence electrons available). It also has less than an octet on all of the oxygens and more than an octet on the carbon. It also have a very large negative charge on the electropositive carbon and a positive charge on the electronegative oxygen. The general rule is that negative charge should go on the electronegative atom and the positive charge should go on the electropositive atom.

carbon (e) has 10 electrons = (2 electrons per bond x 3 bonds ) + (2 electrons per lone pair x 2 lone pairs) more than an octet