**CHE2060 Resonance electron-pushing boot-camp worksheet**

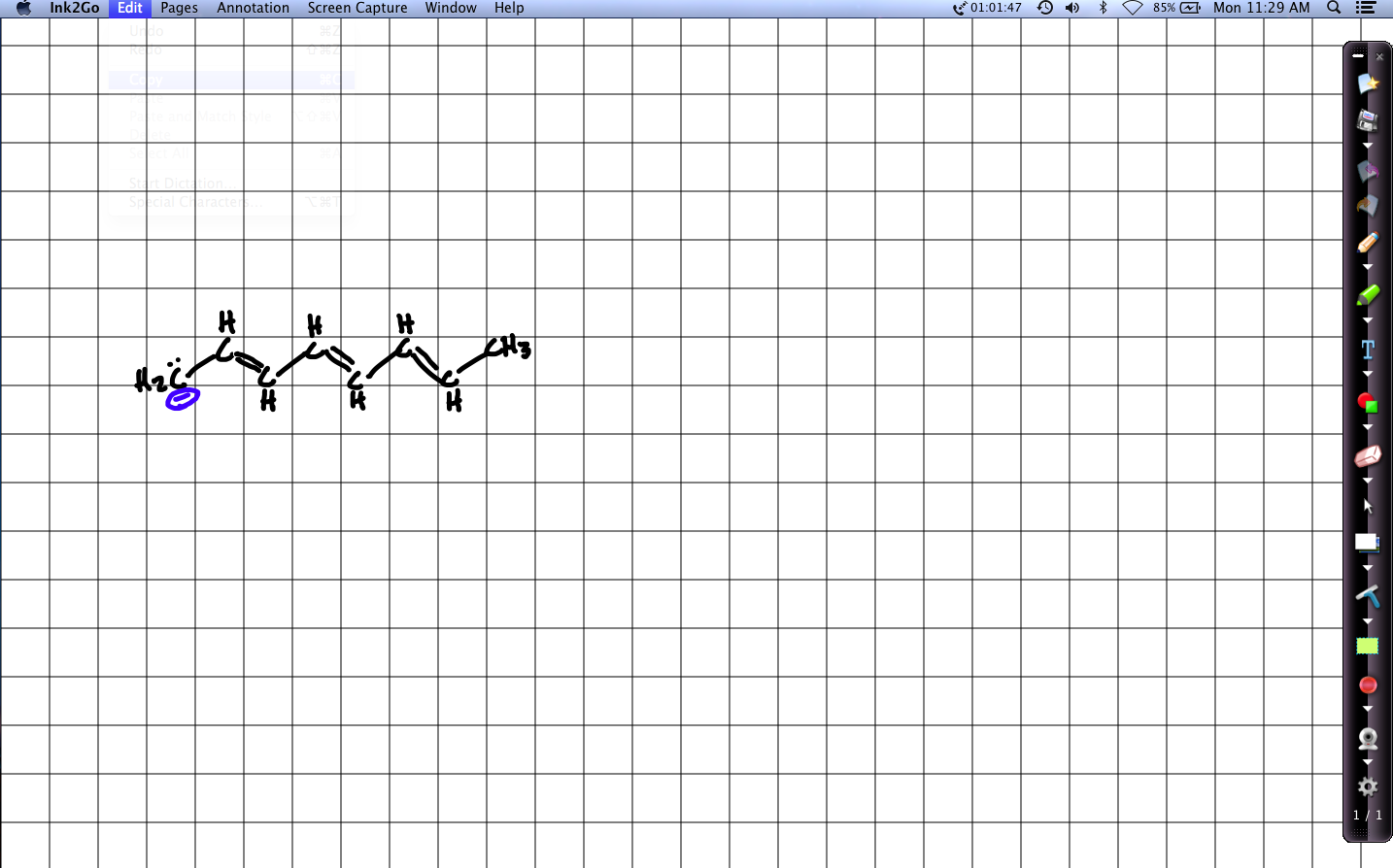
We’ve done a worksheet lab that introduced the idea of pushing electrons, either as free (aka lone or unbounded) electron pairs or as pi bonds, to switch between a series of resonance structures. This worksheet gives you an opportunity to test that new skill-set and offers a few challenges.

1. One resonance structure for a carbon chain with three double bonds and one negatively charged carbon is shown below.

a. How many other resonance structures are possible?

b. Draw all of them.

c. Add arrows to convert each resonance structure into the next.



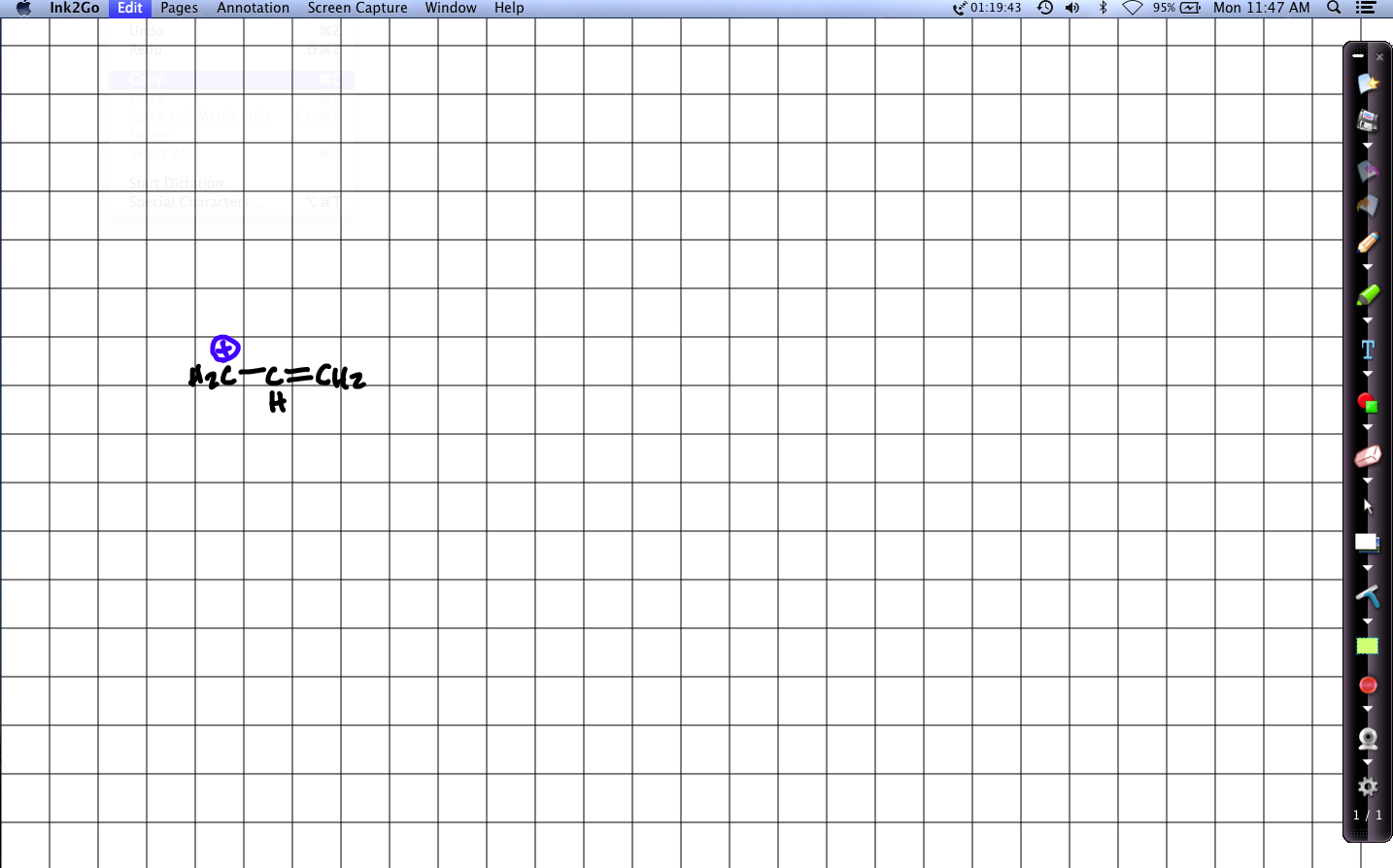
2. The resonance structure shown here has a positively charged carbon and a π bond.

a. Draw the second resonance structure by moving the π bond.

b. Locate the charge on the new resonance structure.

c. Add an arrow to show how the electrons moved to create the second resonance structure.

d. Is one of the two resonance structures the major contributor, or do both structures contribute equally?



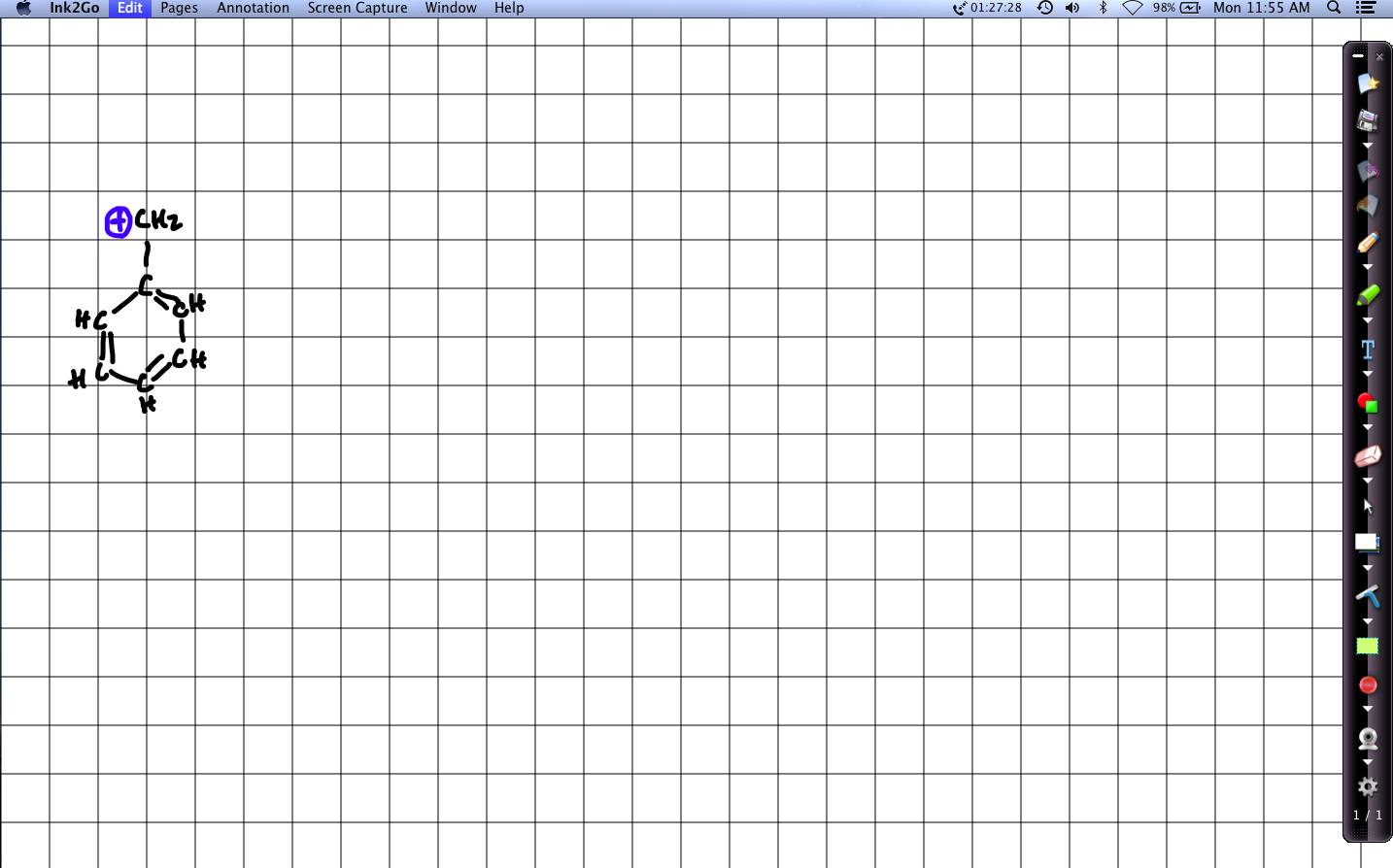
3. The ring structure shown below is a resonance structure with one positively charged carbon.

a. How many resonance structures are there?

b. Draw each and be sure to show the new location of the positive charge?

c. Add arrows to convert one resonance structure to the next.

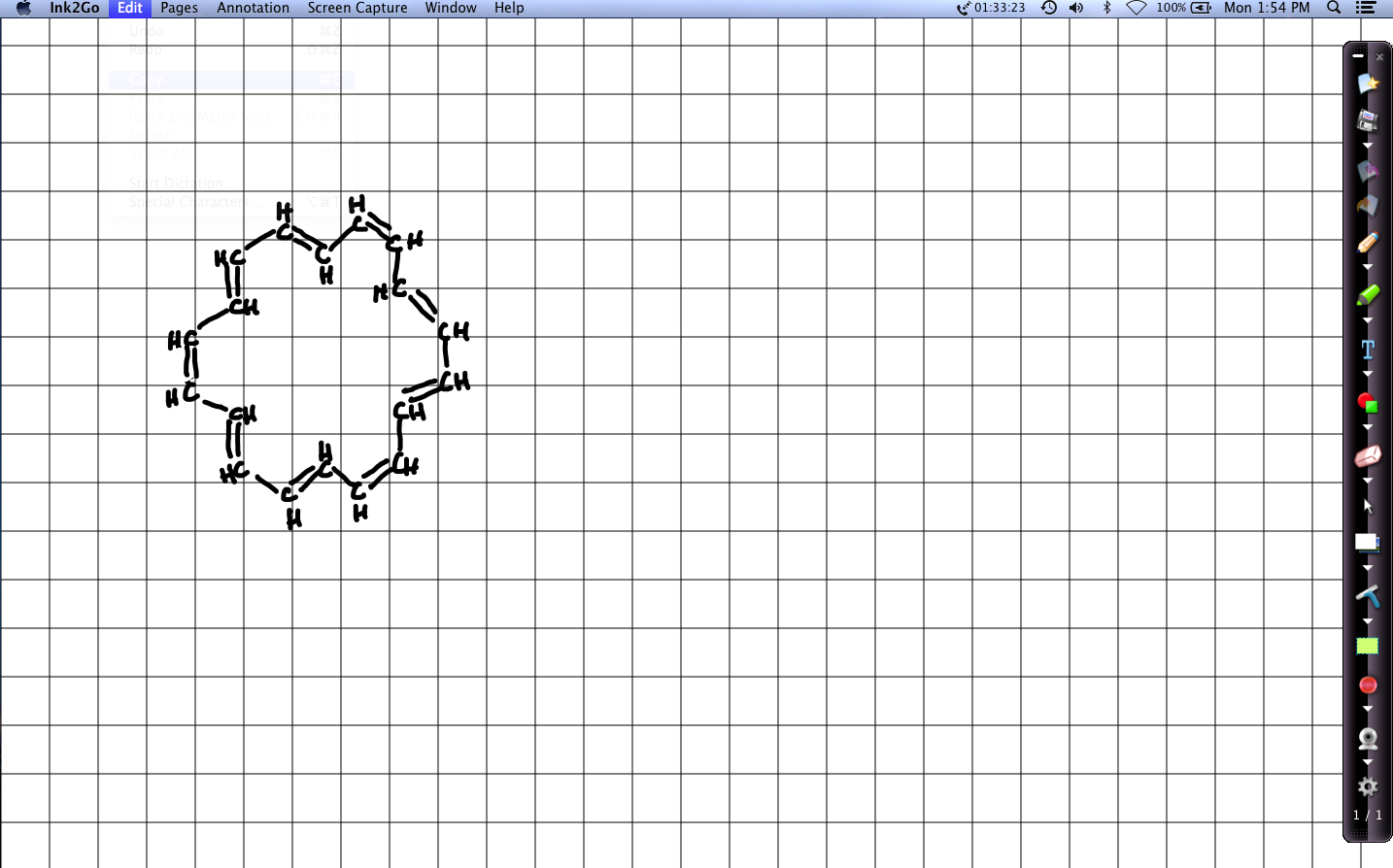
d. Are all structures equal contributors to the resonance hybrid?



4. This elaborate resonance structure has mobile π bonds, but no free electron pairs.

a. Draw a second resonance structure.

b. Add arrows to convert the first resonance structure to the second.



5. For the abbreviated molecular formulas CH3CO2-1,

1. Draw all resonance structures for the molecule.
2. Add arrows to convert each resonance structure to the next.

6. For the abbreviated molecular formulas CH3CHCHCH2+1 (There are two C – C single bonds.)

1. Draw all resonance structures for the molecule.
2. Add arrows to convert each resonance structure to the next.

7. For the abbreviated molecular formulas C5H5N (The C and N atoms form a ring, and Hs are bonded to C.),

1. Draw all resonance structures for the molecule.
2. Add arrows to convert each resonance structure to the next.

8. For the abbreviated molecular formulas C4H5N (A ring formed from C and N with a H bonded to each C and N.),

1. Draw all resonance structures for the molecule.
2. Add arrows to convert each resonance structure to the next.

9. In sulfuric acid, H2SO4, the S is bonded to all four O atoms.

1. Draw all resonance structures.
2. Which resonance structure contributes the most to the resonance hybrid?
3. Which resonance structure contributes the least to the resonance hybrid?

10. The molecule shown below has resonance.

1. Draw the other resonance structure.
2. Add arrows to move π bonds or free electron pairs to convert one structure to the next.
3. Draw the resonance hybrid.

