1. a. First, we need to find out the mass of leftover chlorine so we know the correct recipe.

Initial mass = 63.55 g + 100.00 g = 163.55 g

Mass of leftover chlorine = 163.55 g – 134.45 g = 29.10 g

Actual mass of chlorine used: 100.00 g – 29.10 g = 70.90 g

That means the actual recipe is 63.55 g + 70.90 g. Now we just need to scale up:

Factor = $\frac{500.0\ \cancel{g}}{134.45\ \cancel{g}}$ = 3.719

Mass of copper = 3.719×63.55 g = 236.3 g

Mass of chlorine = 3.719×70.90 = 263.7 g

b. To determine whether or not it is the same compound, we have to determine the proportions of the compounds. Thus, we need the ratio of copper to chlorine for the light blue powder. We can use either the original recipe or the scaled-up one. I will use the original:

Ratio of copper to chlorine in a: $\frac{63.55\ \cancel{g}}{70.90\ \cancel{g}}$ = 0.8963

Now we need the ratio for this new solid:

Ratio of copper to chlorine in the new solid: $\frac{100.00\ \cancel{g}}{111.57\ \cancel{g}}$ = 0.89630

This is the same ratio, so it is the same compound.

c. We know the ratio of copper to chlorine for the compound made in a (0.8963). For the compound discussed here:

Ratio of copper to chlorine in the new solid: $\frac{63.55\ \cancel{g}}{35.45\ \cancel{g}}$ = 1.793

This is a different ratio, so it is a different compound.

d. For this we use the Law of Multiple Proportions. 63.55 grams is the same in both a and c. So, there is a fixed mass of copper. The ration of chlorine masses that react to that fixed mass of copper is:

Ratio of chlorine masses: $\frac{70.90\ \cancel{g}}{35.45\ \cancel{g}}$ = 2

There is twice as much chlorine in the compound made in a, so there are twice as many atoms. Since the problem told you that compound had two chlorine atoms, the compound in c must have one chlorine atom.

2. First, we need to find out the mass of leftover silicon so we know the correct recipe.

Initial mass = 30.00 g + 32.00 g = 62.00 g

Mass of leftover silicon = 62.00 g – 60.09 g = 1.91 g

Actual mass of silicon used: 30.00 g – 1.91 g = 28.09 g

That means the actual recipe is 28.09 g + 32.00 g. Now we just need to scale up:

Factor = $\frac{150.00\ \cancel{g}}{60.09\ \cancel{g}}$ = 2.496

Mass of silicon = 2.496×28.09 g = 70.11 g

Mass of oxygen = 2.496×32.00 = 79.87 g

3. In #2, the mass of silicon was 28.09 g. Thus, we have a fixed mass of silicon. The Law of Multiple Proportions says that the ratio of masses of oxygen to a fixed mass of silicon is the ratio of atoms in the molecule. We want half as many atoms, so we need half as much mass. If the compound in #2 had 32.00 g of oxygen, then, this compound needs 16.00 g of oxygen reacting with the fixed amount of silicon.