ORDERS OF REACTION and MECHANISMS

1. a) When a reaction takes place in a number of steps, and one of those steps is much slower than the other(s), the overall rate of the reaction is governed by the rate of this slow step. This is called the "rate-determining step".

   b) The molecularity of a step simply counts the number of species (molecules, ions, atoms or free radicals) taking part in each step of a reaction. In Step 1 of this reaction, there is only one species reacting, and so it has a molecularity of 1. In the second step, there are two species reacting, and so it has a molecularity of 2.

   c) Order of reaction is found experimentally, and the results in this case suggest that, in the rate determining step, something happens to a single molecule (or ion, etc) of A without any involvement of B. The molecularity of the various steps can only be decided after a mechanism has been worked out consistent with the overall order of the reaction. A suggested mechanism will be consistent with the order of reaction, but may not necessarily be the only possibility - other evidence may be needed to be sure.

2. For simple reactions, where the slow (rate determining) step of the reaction is the first one, the experimentally found order gives you a count of the number of species (molecules, ions, etc) taking part in that slow step. Assuming for simplicity that we are talking about molecules, the question tells you that the experimentally found order is 2 overall, which means that the slow step might involve 2 different molecules or 2 molecules of the same substance reacting together.

   Mechanism 1 isn't consistent with an overall order of 2, because there is only one molecule taking part in the slow step. If the first equation said "2E = something", then that *would* be consistent with a second order reaction, but it doesn't - there is only one E involved in this suggested mechanism.

   Mechanism 2 is consistent with an overall order of 2, because the mechanism has a molecule of E and of F taking part in the slow step.

   Mechanism 3 is also consistent, because although there is only one substance involved, there are two molecules of it.

3. The whole of this question is taken directly from the Chemguide page, starting about 2/3 of the way down under the sub-title ***Cases where the slow step* isn't *the first step in the mechanism***. Check your answers against that page. There's nothing I need to add to that.

   If you got it right, well done! If you didn't, are you sure that you need to be able to do this anyway? If possible, check past papers from your examiners together with their mark schemes.