GAS-LIQUID CHROMATOGRAPHY

1. a) Helium. (You may, of course, know of some other carrier gas. If that is what your examiners want, then that is what you should use.)

   b) To vaporise the entire sample so that it can pass into the column.

   c) Diatomaceous earth coated with a high boiling point liquid.

   d) It may condense on the stationary phase. It may dissolve in the stationary phase. It may remain in the gas phase. All of these things are reversible so that the compound will move between the stationary phase and the gas phase.

   e) It will divide itself between the stationary phase and the carrier phase, spending some time in each.

   f) From the time of injection of the sample to the maximum peak height for the compound.

   g) (i) A compound with a boiling point higher than the column temperature will condense at the beginning of the column and only move through very slowly, and so has a very long retention time. A compound with a low boiling point will spend most of its time in the carrier gas, and so move through very quickly, with a short retention time.

   (ii) The more soluble a compound is in the stationary phase, the less time it will spend being carried through the column by the gas. Compounds which are very soluble in the stationary phase will have a longer retention time than those which are less soluble.

   (iii) The higher the temperature of the column, the more time everything will spend in the carrier gas simply because all the particles are more energetic and so less likely to remain condensed or in solution. The retention times of everything will be shorter at higher temperatures.

   h) This gives good separation without having to wait for a very long time until everything comes through at a lower temperature. If you used a higher temperature throughout, everything would come through quickly and the amount of separation would be less.

2. a) When something burns, small amounts of various ions are formed in the flame together with free electrons. The negative ions and electrons will be attracted to the positive electrode (the anode). The free electrons move onto the anode, and the negative ions release electrons to the anode.

   Positive ions are attracted to the cathode where they pick up electrons and are neutralised. The cathode therefore loses electrons.

   Electrons flow around the external circuit from the anode to replace those being removed from the cathode. This is measured as an electric current (small, but it can be amplified). For mixtures of similar compounds, the size of the current is proportional to the amount of compound in the flame.

b) So that nothing condenses in the detector.

c) Burning destroys each of the compounds coming through the flame detector.

d) Provided you have mixtures of similar compounds, the areas under the peaks give you a measure of the relative amounts of each compound.