1. Read the text and answer the questions below.

STUDENT A

a. Explain the term: 'anomalous properties of water'.
b. Why is liquid water atypical?
c. Why is water an excellent solvent?

STUDENT B

d. Why does the molecule of water have an anomalous character?
e. Which three factors contribute to thermal regulation?
f. What is the result of the fact that water ionizes?

ANOMALOUS PROPERTIES OF WATER

Adapted from http://www.lsbu.ac.uk/water/anmlies.html

The anomalous properties of water are those where the behavior of liquid water is quite different from what is found with other liquids. Frozen water (ice) also shows anomalies when compared with other solids. Although it is an apparently simple molecule (H_2O), it has a highly complex and anomalous character due to its intra-molecular hydrogen bonding . As a gas, water is one of lightest known, as a liquid it is much denser than expected and as a solid it is much lighter than expected when compared with its liquid form. An interesting history of the study of the anomalies of water has been published.

As liquid water is so common-place in our everyday lives, it is often regarded as a 'typical' liquid. In reality, water is most atypical as a liquid, behaving as a quite different material at low temperatures to that when it is hot. It has often been stated that life depends on these anomalous properties of water. In particular, the high cohesion between molecules gives it a high freezing and melting point, such that us and our planet is bathed in liquid water. The large heat capacity, high thermal conductivity and high water content in organisms contribute to thermal regulation and prevent local temperature fluctuations, thus allowing us to more easily control our body temperature. The high latent heat of evaporation gives resistance to dehydration and considerable evaporative cooling. Water is an excellent solvent due to its polarity, high dielectric constant and small size, particularly for polar and ionic compounds and salts. It has unique hydration properties towards biological macromolecules (particularly

proteins and nucleic acids) that determine their three-dimensional structures, and hence their functions, in solution. This hydration forms gels that can reversibly undergo the gel-sol phase transitions that underlie many cellular mechanisms. Water ionizes and allows easy proton exchange between molecules, so contributing to the richness of the ionic interactions in biology.

2. Work in pairs and explain the answers to the questions above.

3. Now read the text below and complete the gaps.

The anomalous _ _ _ _ _ _ _ _ _ _ of water are those where the behavior of liquid water is quite different from what is found with other liquids. _ _ _ _ _ _ water (ice) also shows anomalies when compared with other _ _ _ _ _ _. Although it is an apparently simple _ _ _ _ _ _ _ _ (H_2O), it has a highly complex and anomalous character due to its intra-molecular hydrogen _ _ _ _ _ _ _ . As a gas, water is one of lightest known, as a liquid it is much _ _ _ _ _ _ than expected and as a solid it is much lighter than expected when compared with its liquid form. An interesting history of the study of the anomalies of water has been _ _ _ _ _ _ _ _ _.

As liquid water is so common-place in our everyday lives, it is often regarded as a 'typical' liquid. In reality, water is most atypical as a liquid, behaving as a quite different material at low temperatures to that when it is hot. It has often been stated that life depends on these anomalous properties of water. In particular, the high cohesion between molecules gives it a high freezing and _ _ _ _ _ _ _ point, such that us and our planet is bathed in liquid water. The large heat capacity, high thermal _ _ _ _ _ _ _ _ _ _ _ _ and high water content in organisms contribute to thermal _ _ _ _ _ _ _ _ _ _ and prevent local temperature _ _ _ _ _ _ _ _ _ _ _ _, thus allowing us to more easily control our body temperature. The high latent heat of _ _ _ _ _ _ _ _ _ _ _ _ gives resistance to dehydration and considerable evaporative cooling. Water is an excellent solvent due to its _ _ _ _ _ _ _ _, high dielectric constant and small size, particularly for polar and ionic compounds and _ _ _ _ _. It has unique hydration properties towards biological macromolecules (particularly _ _ _ _ _ _ _ _ and nucleic acids) that determine their three-dimensional structures, and hence their functions, in solution. This hydration forms gels that can reversibly undergo the gel-sol phase transitions that underlie many _ _ _ _ _ _ _ _ mechanisms. Water ionizes and allows easy _ _ _ _ _ _ exchange between molecules, so contributing to the richness of the ionic interactions in biology.