

**Question 33****(11 marks)**

Consider the compounds and their properties listed in the table below.

Compound	Boiling point (°C)	Solubility in water (g L <sup>-1</sup> )
Butane C <sub>4</sub> H <sub>10</sub>	-0.5	0.061
Butan-1-ol C <sub>4</sub> H <sub>10</sub> O	117	73.0
Butanone C <sub>4</sub> H <sub>8</sub> O	79.6	27.5

- (a) Given that the molecular formulas indicate that the compounds contain the same number of carbon atoms and differ only in the number of one or two hydrogen or oxygen atoms, propose an hypothesis for why there is a variation in the boiling points of these compounds. (2 marks)

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(b) Explain why these organic compounds have very different solubilities in water. (6 marks)

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Butanoic acid,  $\text{C}_4\text{H}_8\text{O}_2$ , is another organic compound that contains four carbon atoms in each molecule and, like butan-1-ol, it is a colourless liquid.

- (c) Complete the table below to describe a chemical test that could be used to distinguish between butan-1-ol and butanoic acid by stating the reagent/s used and the distinguishing observations. (3 marks)

Reagent/s used		
Substance being tested	Butan-1-ol	Butanoic acid
Observations		