1. These three molecules include an alkane, an alkene and an alcohol.

   a) State which molecules belong to which group.
      Write your answer underneath each molecular structure.

      \[
      \begin{array}{ccc}
      \text{H} & \text{C} & \text{H} \\
      \text{H} & \text{H} & \text{H} \\
      \text{H} & \text{H} & \text{H}
      \end{array} \quad \begin{array}{c}
      \text{H} \\
      \text{C} \\
      \text{H}
      \end{array} \quad \begin{array}{c}
      \text{H} \\
      \text{H} \\
      \text{H} \\
      \text{H}
      \end{array}
      \]

      \text{Answer: Alkene: ethene.} \quad \text{Answer: Alkane: methane.} \quad \text{Answer: Alcohol: ethanol.}

   b) Name each of the substances in part a).
      Write your answer in the same boxes.

      \text{Answer: See answers above.}

   c) Indicate the alcohol functional group on one of the molecules shown.

      \text{Answer: See diagram of ethanol in which the O-H (hydroxyl) group is circled.}

   d) Use the molecular structure of ethanol to write down the chemical formula for ethanol.

      \text{Answer: C}_2\text{H}_5\text{OH, or C}_2\text{H}_6\text{O.}

2. Janice and Matt set up this equipment then waited for one week.
   A chemical reaction takes place in which new substances are made.

   a) Complete the word equation for this reaction:

      \text{Glucose} \rightarrow \text{ethanol} + \text{carbon dioxide}
b) What is the name given to the type of reaction taking place?

**Answer:** Fermentation.

c) Explain why yeast is used in the experiment.

**Answer:** Yeast contains an enzyme that makes the fermentation happen at a faster rate.

Janice and Matt then add the mixture from the conical flask to the round-bottom flask in a different experiment.

d) What is the purpose of this new experiment?

**Answer:** To separate the ethanol from the aqueous solution.

e) Explain how this experiment works.

**Answer:** Ethanol has a lower boiling point than water, so is able to form a vapour that can be removed and condensed.

f) What is the name of this technique or experiment?

**Answer:** Fractional distillation.
g) Janice and Matt add a small sample of the ethanol they have made and add it to a crucible. They add a lighted splint to the ethanol and notice that it catches fire. Complete the equation to show what happens when ethanol burns:

\[ C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O \]

3. Ravi carries out an experiment with a mixture of ethanol dissolved in water. He leaves the ethanol open to the air for two weeks. He notices that a very slow chemical reaction takes place. He removes a few drops of his new mixture and adds some universal indicator solution. He notices that the indicator turns orange.

a) What type of substance has formed?

**Answer:** A weak acid.

b) What is the name of the new organic product formed?

**Answer:** Ethanoic acid.

c) State the name of the chemical substance that reacts with ethanol in this reaction.

**Answer:** Oxygen.

d) What type of reaction has taken place?

**Answer:** Oxidation.

e) Complete the diagram to show the structure of the new organic product made.

![Structure of Ethanoic Acid]