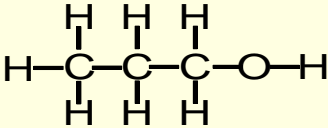




REACTIONS OF ALCOHOLS

Answers all the questions below then check your answers

1. The table below shows the formula and structure for the first 4 alcohols. Complete the table.

alcohol	Structural formula	Displayed formula
methanol	CH_3OH	
ethanol		
		
butanol		

2. What functional group do all alcohols contain?
- a. Draw the functional group found in alcohols.

3. Describe how the solubility of alcohols change as you increase the chain length of the alcohol molecule.

4. Alcohols are all excellent fuels, they can be burned in lamps and burners. Complete the word and symbolic equations for the combustion of ethanol and butanol.



i. ethanol + oxygen \longrightarrow

ii. $C_2H_5OH + O_2 \longrightarrow$

iii. butanol + oxygen \longrightarrow

iv. $C_4H_9OH + O_2 \longrightarrow$

5. Alcohols react with reactive metals such as sodium and magnesium to form salts and hydrogen gas.

a. How is the reaction of sodium with water similar to that with alcohols and how is it different?

6. Complete the equations below:

a. sodium + ethanol \longrightarrow

ii $Na + C_2H_5OH \longrightarrow$

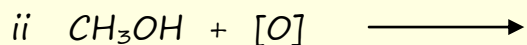
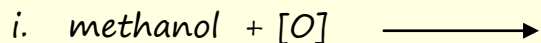
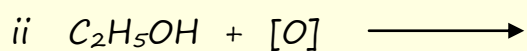
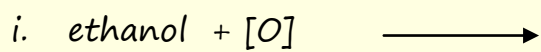
b. sodium + propanol \longrightarrow

ii $Na + C_3H_7OH \longrightarrow$

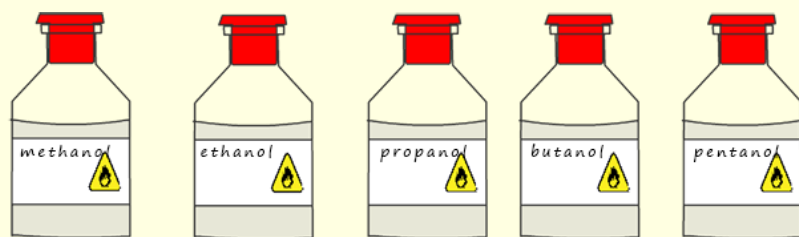
7. Alcohols can be oxidised to form carboxylic acids.

a. Name a suitable oxidising agent to carry out this reaction >

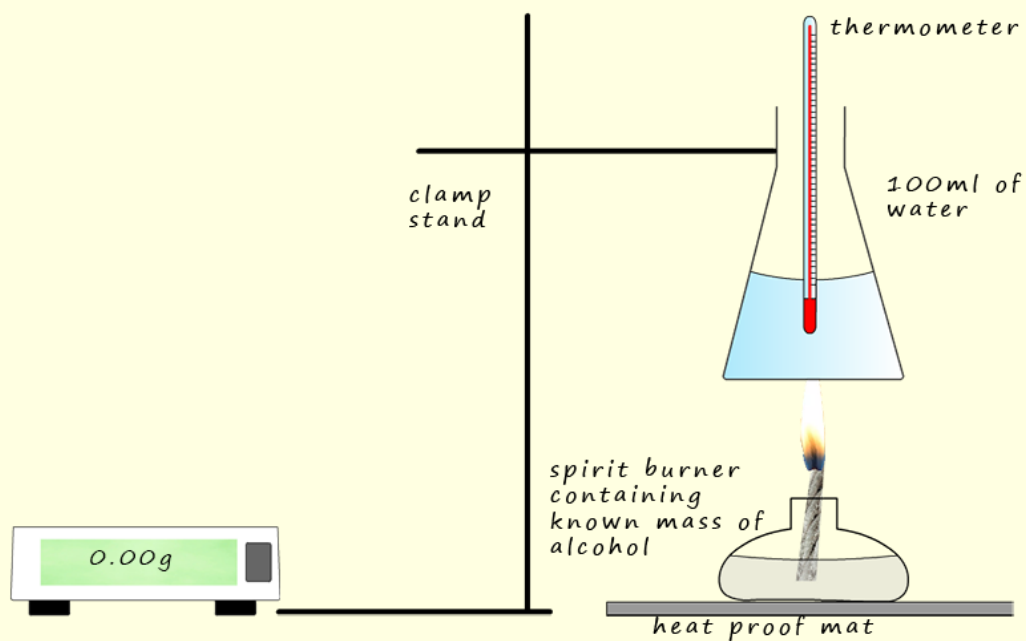
b. Complete the equations below to show this oxidation reaction. [O] is used to represent the oxidising agent.



8. A student was planning an investigation to find out which alcohol releases the most energy when it is burned. She plans to use the apparatus below to carry out this investigation.



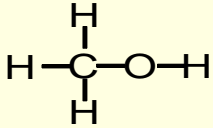
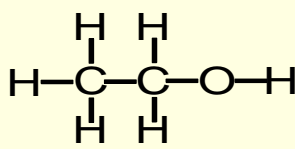
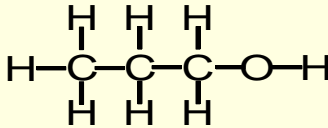
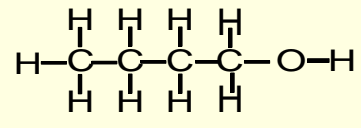
5 different alcohols to be tested.




- a. What is the independent variable in this investigation?
- b. What will the dependent variable be.
- c. The student plans to burn a known mass of alcohol and record the temperature change in the water. From this she can calculate the temperature rise per gram of alcohol burned.
 - i. What measurements will the student have to make to successfully carry out this investigation?
 - ii. What are the control variables in this investigation?
 - iii. What do you think will be the biggest source of error in this experiment?
 - iv. What safety precautions should be taken during this investigation?

Answers

1. The table below shows the formula and structure for the first 4 alcohols. Complete the table.

alcohol	Structural formula	Displayed formula
methanol	CH_3OH	
ethanol	C_2H_5OH	
propanol	C_3H_7OH	
butanol	C_4H_9OH	

2. What functional group do all alcohols contain? *Hydroxyl group -C-OH*
- a. Draw the functional group found in alcohols. 
3. Describe how the solubility of alcohols change as you increase the chain length of the alcohol molecule.

The longer the chain length the less soluble the alcohol will be in water.

4. Alcohols are all excellent fuels, they can be burned in lamps and burners.
Complete the word and symbolic equations for the combustion of ethanol and butanol.

i. ethanol + oxygen \longrightarrow carbon dioxide + water

ii $C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$

iii butanol + oxygen \longrightarrow carbon dioxide + water

IV. $C_4H_9OH + 6O_2 \longrightarrow 4CO_2 + 5H_2O$

5. Alcohols react with reactive metals such as sodium and magnesium to form salts and hydrogen gas.

a. How is the reaction of sodium with water similar to that with alcohols and how is it different? Produces a salt and hydrogen gas. The reaction with alcohols is much slower than with water.

6. Complete the equations below:

a. sodium + ethanol \longrightarrow sodium ethoxide + hydrogen

ii $2Na + 2C_2H_5OH \longrightarrow 2C_2H_5ONa + H_2$

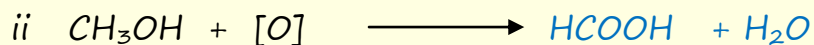
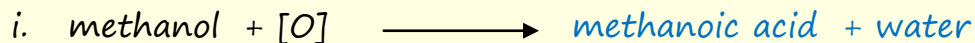
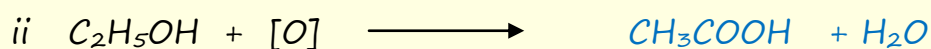
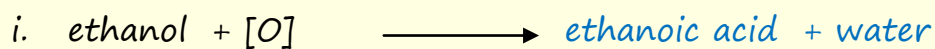
b. sodium + propanol \longrightarrow sodium propoxide + hydrogen

ii $2Na + 2C_3H_7OH \longrightarrow 2C_3H_7ONa + H_2$

7. Alcohols can be oxidised to form carboxylic acids.

a. Name a suitable oxidising agent to carry out this reaction - acidified potassium dichromate

b. Complete the equations below to show this oxidation reaction. [O] is used to represent the oxidising agent.



8. A student was planning an investigation to find out which alcohol releases the most energy when it is burned. She plans to use the apparatus below to carry out this investigation.

a. What is the independent variable in this investigation?

types of alcohol used, methanol, ethanol, propanol, butanol, pentanol

b. What will the dependent variable be.

Temperature rise of the water

c. The student plans to burn a known mass of alcohol and record the temperature change in the water. From this she can calculate the temperature rise per gram of alcohol burned.

i. What measurements will the student have to make to successfully carry out this investigation?

- *Mass of alcohol in spirit burner before it is burned and mass of alcohol in spirit burner after it is used to heat the water. From this the mass of alcohol burned can be calculated.*
- *Temperature of water before heating and after heating to work out the temperature rise.*
- *Volume of water in the conical flask.*

ii. What are the control variables in this investigation?

- Volume of water in the conical flask
- Starting temperature of the water in the conical flask

iii. What do you think will be the biggest source of error in this experiment?

Heat loss. Most of the heat energy from the burning alcohol will escape into the air and not be used to heat the water. Also there will be heat loss from the water itself.

iv. What safety precautions should be taken during this investigation?

- Safety goggles and gloves
- Fire extinguisher
- Use a well ventilated room or a fume cupboard as long chain alcohols have an unpleasant and irritating odour.