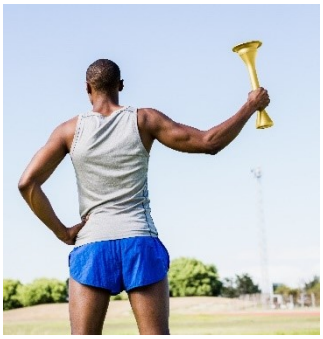
In context

Subject area: Organic chemistry | **Level: 14–16 years (Foundation)**

Topic: Hydrocarbons | **Source: rsc.li/34Fv93j**

1. The torch used to start the modern Olympic Games uses a mixture of propane and butane.

When propane and butane burn in air, they produce heat energy, and a flame.



Source: Envato Elements

a) Propane and butane are chemical compounds.

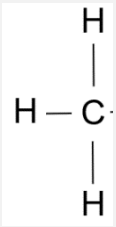
Name the two elements that make these compounds.

b) State the name of the compounds that contain the elements in part a).

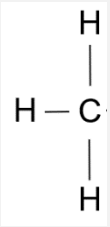
c) To which homologous series do propane and butane belong?

d) Below are the incomplete molecular structures for propane and butane.

Complete these structures.



Propane



Butane

e) Using your answers to part d), explain what is meant by the word 'saturated'.

f) When propane and butane burn in air, the same two products are made in each case.

State the names of the products formed.

g) Complete the word equation to show what happens when these gases burn in air:

Propane + oxygen → ..... + ...

Butane + ... → ..... + ...

h) The chemical formula for propane is C_3H_8.

Complete the symbol equation below to show propane burning in air.

$C_3H_8 + 5O_2 \rightarrow$ ..... + ... H_2O

The ratio in which propane and butane are mixed together as a fuel in the torch (by volume) is 2 : 1.

i) What fraction of the fuel is butane?

j) An Olympic torch contains 37.8 cm^3 of fuel.

Calculate the volume of butane in the fuel.
Show your working.

2. The image to the right shows a car called the 'Bio-Bug'.

You can find out more at www.geneco.uk.com/Case_study_Bio_bug/.
Solid human waste decomposes to make a gas that powers the car.
This gas is a hydrocarbon containing only one carbon atom.
The gas is the first member of the alkane homologous series.

Source: Wessex Water

a) What is the name of the gas?

b) State the chemical formula for the gas.

c) Explain how the gas powers the car.

d) Complete the symbol equation to show the gas burning in air.

_____ + oxygen → _____ + water

e) Suggest why this car is considered to be more environmentally friendly, or 'greener', than a car that runs on petrol or diesel.

f) When 16.0 g of methane burns, 890 kJ of heat energy is produced.

Calculate how much heat energy is produced when 1.00 kg of methane burns.
Give your answer in MJ and to 3 significant figures.
Show your working.