



E10 petrol and climate change – teacher notes

Education in Chemistry

Sustainability in chemistry 2021

Goal 8: promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

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This resource provides a real-life example of the use of ethanol. It can be used after teaching this topic, in the lesson or as a homework, and will give your learners a chance to consider the underlying chemistry and assess the claims made about E10 petrol.

A new mixture of petrol is now available at pumps in the UK. It contains an increased proportion of ethanol from renewable sources and is claimed to help lower the carbon emissions contributing to climate change.

Ask your learners to read each extract (source <https://www.bbc.co.uk/news/business-57585105>) and answer the questions that follow.

Extract 1

A more eco-friendly petrol is being introduced to filling stations.

The government intends to make E10 the new standard petrol grade.

The change is being made to cut carbon dioxide emissions the Department for Transport (DfT) says – but not all cars will be able to run on it.

What is E10 petrol?

It's a motor fuel that contains less carbon and more ethanol than fuels currently on sale.

Ethanol is a kind of alcohol manufactured from plants, including sugar beet and wheat.

It is possible to run cars on pure ethanol, **as has been done in Brazil for many years.**

But in the UK and other European countries, it is normally blended with fuel derived from oil.

Current petrol grades in the UK – known as E5 – contain up to 5% ethanol, with the other 95% being regular unleaded petrol.

Their replacement, E10, will see this percentage increased to 10% – a proportion that would bring the UK in line with countries such as Belgium, Finland, France, and Germany.

Answers to questions

Questions (ethanol revision)

1. What is the chemical formula for ethanol?
C₂H₅OH Don't allow C₂H₆O
2. What part of the structure means ethanol belongs to the alcohol family?
The OH group.

- Name the process for obtaining ethanol from plants?
Fermentation.
- What conditions and reagents are needed for the process named in Q3?
35–37 °C, water, yeast, sugar.
NB Most students won't realise that everything needs to be in solution as in some cases such as grape juice, you don't have to add the water.

Extract 1 questions

- Why is the new fuel called 'E10 petrol'?
It contains 10% ethanol.
- Why is E10 classed as a 'more eco-friendly' fuel?
It contains less petrol which comes from fossil fuels.

Extract 2

How green is this really?

That's a matter of some debate.

Ethanol is seen as a carbon-neutral fuel, since the plants absorb carbon dioxide from the air while they are growing, offsetting the CO₂ emitted when the fuel is burnt.

However, no one is quite sure whether the two really cancel each other out.

And some people have moral objections to using food crops to produce fuels. They say it could cause food shortages or increases in food prices.

Still, if ethanol is genuinely good for the planet, then perhaps there ought to be even more of it in petrol, some environmental campaigners say.

After all, Brazil, which pioneered its use in the 1970s, has so-called 'flex-fuel' vehicles on its roads that run on any mixture of petroleum and ethanol, right up to the all-ethanol E100.

Answers to questions

Extract 2 questions

- What does carbon-neutral mean?
The amount of carbon dioxide taken in by the plant when it was growing equals the amount of carbon dioxide given out when the plant is burnt as a fuel.
- Why might the second sentence (in Italic) be misleading?
You have to look at the whole process not just the chemical reaction. Carbon dioxide will be given out to make the fertiliser used on the plants. Tractors and lorries used to transport the plants to the factory give out carbon dioxide.

There are other examples in the complete process that also give out carbon dioxide so there will inevitably be more carbon dioxide given out in the process than was taken in by the plant growing.
- State and explain one advantage and one disadvantage of using ethanol as a fuel.
Advantage: it is a renewable fuel. (Don't allow 'it doesn't give out greenhouse gases' as it does give out carbon dioxide when burnt).

Disadvantage: the plants used to make the ethanol take up valuable land that could be used for growing food and a reduction in land used for growing food could lead to food shortages. (Don't allow just 'more expensive food' without a justification).

Extension

After completing this worksheet, learners could be asked to produce a leaflet to hand out at petrol stations to let the public know why we have the new petrol, and to persuade them to buy it. The learner would have to decide on what the important points are for the customer, how much science to include and present the science in an easy-to-understand format for the members of the public who are not scientists.

Careers

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