

Quiz 3 - Biofuels

“Biofuel” is a fuel produced from renewable plant and animal biomass. Four distinct groups of biofuels exist:

- alcohols such as ethanol, which is produced from the fermentation of sugar.
- biodiesel made of plant oils
- biogas obtained from the decomposition of organic matter.
- organic matter that can be burnt to produce heat such as wood fibre or plant oils.



- 1) Palm tree oil is a precursor to the production of biodiesel and is heralded as a way of bringing economic prosperity to poor countries. Many people argue that fuels such as ethanol and biodiesel produced from corn and palm trees respectively are unsustainable. Suggest reason why?

Fuels are now being synthesised from fatty acids derived from plants and animals to form biofuels that are quickly becoming common fuels for public transport.

Fatty acids derived from plants are usually unsaturated and exist as oils rather than solid fats as are some animal products.

- 2) A biofuel is formed from the esterification of methanol and one of three fatty acids, oleic ($C_{18}H_{34}O_2$), stearic ($C_{18}H_{36}O_2$), and linolenic ($C_{18}H_{30}O_2$), fatty acids.

- a) Classify each fatty acid as saturated, monounsaturated and polyunsaturated.
- b) Which methyl ester exhibits the lowest viscosity at SLC? Explain your reasoning.
- c) Which methyl ester is best suited to cold climates? Explain your reasoning?
- d)
- e) Which methyl ester has the highest flash point? Justify your answer.

- 3) A scientist synthesised three alkyl esters using oleic acid, methanol, ethanol and butan-1-ol.

Each alkyl ester performed differently when it was tested for viscosity at SLC.

- a) Place the three alkyl esters in order of lowest to highest viscosity. Justify your answer.
- b) **Cloud point** refers to the temperature below which diesel or biodiesels starts to solidify to form a cloudy appearance. Which alkyl ester has the lowest cloud point and why is this an important consideration when choosing a fuel for a cold environment?

