

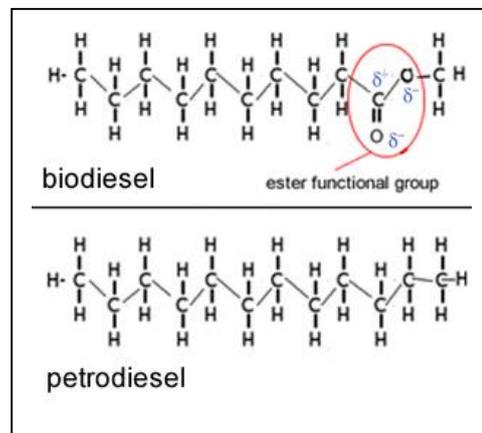
Fuels Biodiesel vs Petrodiesel

- 1) Pictured on the right are molecules of bio-diesel and petro-diesel. Their physical properties are determined by their molecular structure and their intermolecular bonding.

Cloud point is defined as the temperature at which a fuel starts to turn cloudy. Cloud point is used to determine how likely the fuel is to crystallise in filters and obstruct fuel lines.

Flash point is the lowest temperature at which the vapour above a fuel ignites in air when exposed to flame.

Hygroscopic is the ability to attract water from the atmosphere at normal room temperature.



Looking at the structure of each molecule, fill in the table below.

Type of fuel	Type of intermolecular bonding. Circle the appropriate terms.	Melting temperature	Flash point	Cloud point
Petro-diesel	Hydrogen bonding	Relatively high	Relatively high	Relatively high
	Dispersion forces	Relatively low	Relatively low	Relatively low
	Dipole-dipole			
Bio-diesel	Hydrogen bonding	Relatively high	Relatively high	Relatively high
	Dispersion forces	Relatively low	Relatively low	Relatively low
	Dipole-dipole			

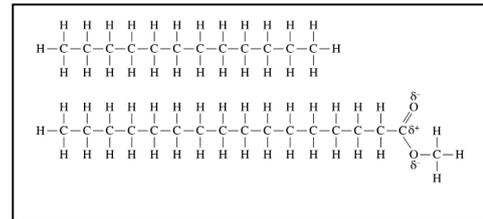
- 2) Which one of the two diesels is hygroscopic and explain your reason.
- 3) Which one of the two fuels is more likely to undergo incomplete combustion to produce CO? Explain why

- 4) Petro-diesel consists of molecules that are, on average, smaller than those found in biodiesel. The table on the right shows the major component of each fuel.

Fuel	Major component
petrodiesel	$C_{12}H_{26}$
biodiesel	$C_{19}H_{32}O_2$

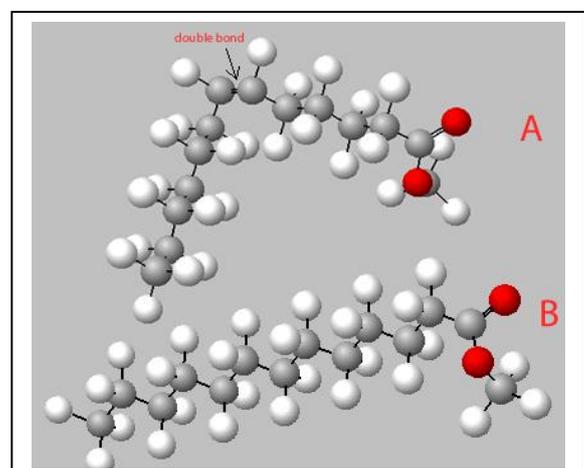
- a) Which fuel has the greatest viscosity and explain why you have come to this conclusion.

- b) On the right are the structural formulae of a typical molecule in both petro-diesel and biodiesel. In cold, Northern hemisphere countries, which fuel is more likely to be used? Explain why.



- c) Provide three balanced chemical equations, those of photosynthesis, fermentation and combustion, to support the notion that ethanol is a carbon neutral fuel. Discuss why, in reality, ethanol is not totally carbon neutral.

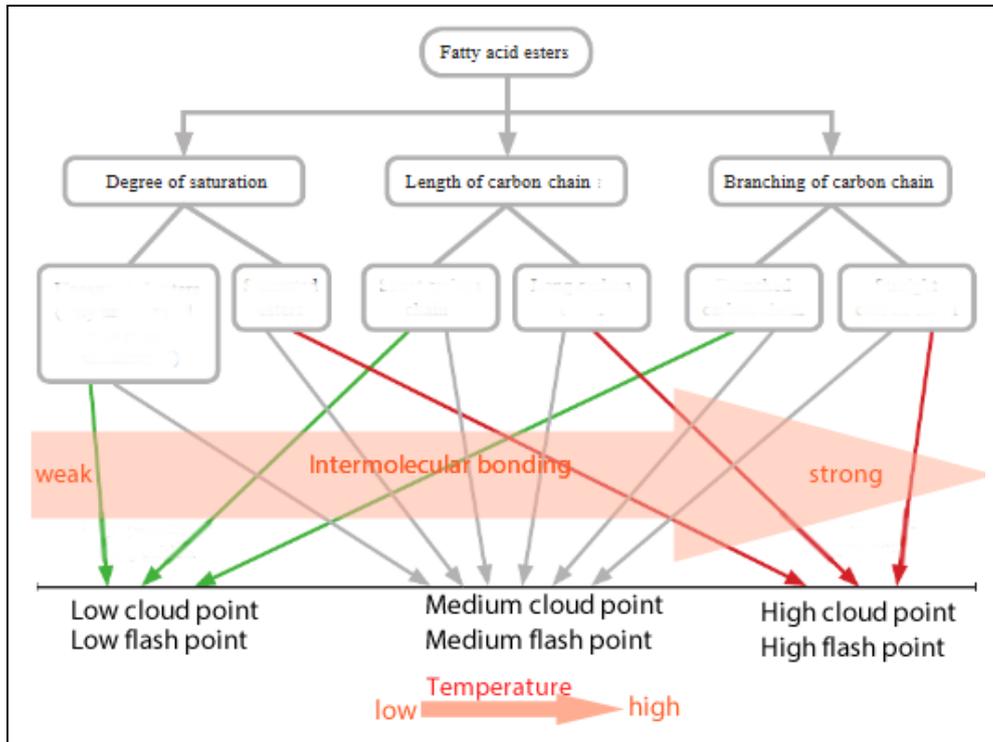
- d) Consider the two methyl esters shown on the right. Both have 14 carbon atoms, however, A has a double bond as indicated by the arrow. Suggest why one of this esters can be used as a biofuel in a cold climate while the other cannot.



5) The diagram below was adapted from the internet at:

(https://www.researchgate.net/publication/268186300_Factors_Affecting_the_Cold_Flow_Behaviour_of_Biodiesel_and_Methods_for_Improvement_-_A_Review)

Complete the diagram below by choosing from the list of words and statements below.



Saturated, unsaturated, long carbon chain, short carbon chain, straight chain, branched.