Introduction to fuels

1. A teacher dropped two equal sized and weighted balls into two containers at the same time. Each container contained a different biofuel, made from methyl esters and the other from fatty acids. Both fuels were made from the same palm oil.

a. Which container, the left or the right, contains the biofuel with the methyl esters? 1 mark

b. Justify your answer to a. above. 3 marks

c. Flash point is the lowest temperature at which a fuel can form vapours that can be ignited with a naked flame. Which fuel will have the highest flashpoint. Explain why. 3 marks

2. Give the balanced chemical equations, states included, for the following processes.

i. Photosynthesis 1 mark

ii. Anaerobic fermentation of glucose. 1 mark

iii. Complete combustion of ethanol, at SLC. 1 mark

iv. Assuming the production of bioethanol does not contribute to atmospheric CO_2, justify using the three equations above why bioethanol is considered a carbon neutral fuel. 3 marks

3. Natural gas is predominantly composed of methane gas and a small percentage of other hydrocarbons such as ethane, propane and butane. A 5.00 gram sample of natural gas was burnt in oxygen to release 300 kJ of heat energy.

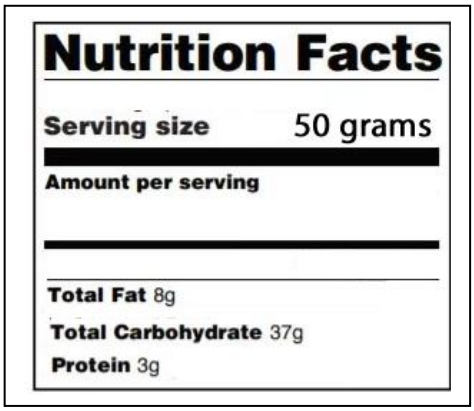
a. Select, from the options below, the appropriate units to express the energy content of natural gas. Circle the correct response. 1 mark

kJ/kg or kJ /mol

b. Justify your answer to a. above. 1 mark

c. Calculate the energy content of natural gas in the appropriate units as selected in b. above. 1 mark

4. A food label from an energy bar is shown on the right.

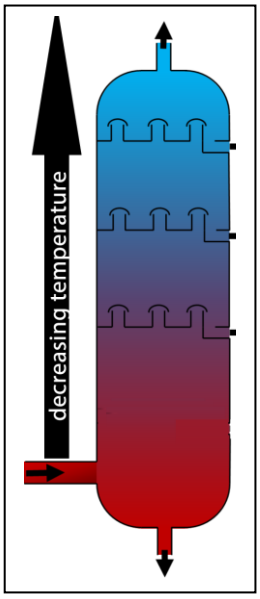


a. Calculate the amount of energy, in kJ, delivered per serving. 1 mark

b. Calculate the energy density of the energy bar. Give the answer to the right number of significant figures. 2 marks

.

5. Ethanol is to be purified from a mixture of ethanal, ethanol and ethanoic acid using a fractional distillation column as shown on the right. There are three collection points on the column B, C and D. Identify the outlet at which each component of the mixture will be collected from and offer a clear explanation as to why with reference to structure. 4 marks



.