Part 2: Biofuel Chemistry: What are Biofuels and How are They Made?

The term biofuels refers to a wide range of fuels which are in some way derived from biomass, organic matter. The most widely recognized biofuel is likely corn or sugar based ethanol. This is created through the fermentation of plant products. Biodiesel is another form of biofuel that is made from vegetable oils, animal fats, or recycled greases. It is produced from oils or fats through a process called transesterification. The Internation Energy Agency predicts that biofuels have the potential to meet more than a quarter of world demand for transportation.

Advantages of Biofuels

Biofuels are a renewable energy source in that they are created from plants that can be regrown each year. Biofuels also do not require many changes(if any) in cars and other places of use to be utilized. Some consider the use of biofuels as carbon neutral since the carbon produced when burning them is offset by the carbon consumed by the plants they came from.

Disadvantages of Biofuels

While some consider their use "carbon neutral," the machniery required to farm the plants for biofuels does create carbon emissions, this machinery is also typically not powered by biofuels. Research suggests despite this fact, that biofuels help to reduce carbon emissions by 50-60%.

One of the main detractors to the use of biofuels is that setting aside land for biofuel crops means less land for food production. Some foreign countries have said that it is unethical to use crops for biofuel when global hunger is an ever present problem.

Using the link below, answer the following questions on biofuels.

http://biofuel.org.uk/how-are-biofuels-produced.html

1 What is a biofuel?

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2 The combustion of all fuels produces carbon dioxide. Why are biofuels considered carbon neutral?

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3 Petroleum diesel is a pure hydrocarbon. What does this mean?

4 a) Petroleum diesel (petrodiesel) is a product produced through the fractional distillation of crude oil. What property is used to separates the various products of fractional distillation?

b) Why would straight distillation not be successful in separating all the fractions of crude oil.

5 What are hydrocarbons?

6 Petrodiesel contains a mixture of hydrocarbon molecules that range in size. Draw the structural formula of octane (C_8H_{18}).
The following link will help:
https://www.youtube.com/watch?v=DSf0yOyMh4c

7 What is the main chemical difference between petrodiesel and biodiesel?

8 Draw the structural formula of ethanol.

9 Write balanced chemical equations for the combustion of ethanol (C_2H_5OH), butanol (C_4H_9OH) and gasoline (C_8H_{18})

10 Comparison of energy output:

(complete table - **<u>show full working, logically set out on attached pages</u>**).

	Ethanol	**Butanol**	**Gasoline**
Energy density (MJ/kg)	20	30	33
Molecular formular	C_2H_5OH	C_4H_9OH	C_8H_{18}
Molar mass			
Energy density (MJ/mole)			
Moles of CO_2 produced per mole fuel			
Energy (MJ) produced per mole CO_2			
Energy (MJ) produced per kg of CO_2			

11 Give two advantages of using biofuels.

12 Give two disadvantages of using biofuels.

working for calculations