
Background Information

Alcohol is a homologous series in which the compounds contain a functional group called the hydroxyl group (-OH). The general molecular formula for alcohols is $C_nH_{2n+1}OH$. Alcohols are all derivatives of hydrocarbons in which one or more of the hydrogen atoms in the hydrocarbon have been replaced by a hydroxyl group. The hydroxyl group is also responsible for imparting certain chemical and/or physical properties to the compound. The four most common alcohols, which are also the simplest, are methanol (CH_3OH), ethanol (C_2H_5OH), propanol (C_3H_7OH) and butanol (C_4H_9OH).

Alcohols completely combust in the presence of oxygen to form carbon dioxide and water. This reaction produces heat energy that can be measured when conducted under controlled conditions.

Task Details

Your task is to complete an investigation in class that compares the amount of heat energy produced by different alcohols. You are required to produce a scientific report of your finding, based on the requirements set out below.

Time allowed for completion of the task:

- Four Lessons of class time dedicated to completing the investigation report
- A device (ipad/laptop) may be used to access research material on Seqta and on the internet.

Class allocated time: Term 3, Week 5/6 (4 lessons)

Task Due Date: 31st August Monday (Term 3, Week 7)

Weighting: 10%

Useful Documents

Use your notes from prior classwork, lessons and the following internet resources to answer the knowledge-based questions for this assessment.

The Chemistry of Petrol and Diesel

<https://www.compoundchem.com/2016/05/17/petrol/>

Fuel Properties Comparison

<https://afdc.energy.gov/fuels/properties>

Hydrocarbons in Fossil Fuels

<http://chemistry.elmhurst.edu/vchembook/509fossilfuel.html>

<https://www.intechopen.com/books/diesel-and-gasoline-engines/fuels-of-the-diesel-gasoline-engines-and-their-properties>

Marking Guide

DESCRIPTION	MARKS AVAILABLE
<p>Introduction</p> <p><u>Investigation Aim</u> Use correct scientific terminology to accurately describe the aim of the investigation using specific examples.</p> <p><u>Hypothesis</u> Formulate a testable hypothesis that clearly states the relationship between dependent and independent variables.</p> <p><u>Background Information</u> Communicate information and concepts logically, using correct scientific language, conventions and representations. You must include the following:</p> <ul style="list-style-type: none"> Create a table that lists the following properties of alcohols & hydrocarbons (methanol, ethanol, propanol, butanol, unleaded, diesel) <ul style="list-style-type: none"> Chemical formula Molecular structure Density Boiling temperature Describe the common combustion reaction for alcohols and provide balanced chemical equations for each alcohol type (methanol, ethanol, propanol, butanol). Compare and contrast the similarities and differences in the chemical structure and composition between alcohols and hydrocarbons. Explain why it is important to understand the amount of energy produced by each fuel (methanol, ethanol, propanol, butanol, unleaded, diesel) in relation to where each fuel type is used. 	<p>/2</p> <p>/2</p> <p>/4</p> <p>/6</p> <p>/3</p> <p>/3</p>
<p>Material & Method</p> <p><u>Variables</u> Correctly identify the independent, dependent and at least 3 control variables (including how and why they will be controlled), including any relevant units.</p> <p><u>Material Setup</u> Draw a labelled scientific diagram of the experimental setup</p> <p><u>Safety Considerations</u> Describe the safe and appropriate laboratory behaviour required for this experiment. Discuss what the implications could be if these measures are not adhered to.</p>	<p>/6</p> <p>/2</p> <p>/3</p>
<p>Results</p> <p><u>Table of Results - Observations</u> Add your results to the class data table, include a copy of the class results in your report. Table must include relevant title and units.</p> <p><u>Calculations</u> Show a representation of the calculations that have been used to determine the amount of energy produced by each reaction</p>	<p>/4</p> <p>/3</p>

<u>Table of Averages</u> Collate your average data from the investigation into a separate table.	/4
<u>Graph of Results</u> Graphically represent the data into a relevant graph type. Graph must include relevant title, axes labels/unit, incremental scale.	/5
Discussion <u>Introduction paragraph</u> Identify what the investigation was comparing and use your results to rank the fuels in terms of energy produced. Justify your results using the chemical composition of each alcohol.	/5
<u>Scientific Explanation of Results</u> Provide responses for each of the following topics. <i>Energy Loss in Chemical Reactions</i> Describe the process where energy is lost in a chemical reaction and how heat can be produced by combustion to cause the temperature of the water to increase.	/4
<i>Effect of Molecular Size on the Amount of Energy Produced in Combustion Reactions</i> Explain the effect that the size of the molecule has on the amount of energy produced in a combustion reaction.	/3
<i>Similarities and Difference between Diesel and Unleaded Fuels</i> Identify the similarities and differences between diesel and unleaded fuels. Use this information to explain why trucks and 4WD vehicles primarily use diesel, while family cars tend to use unleaded fuels.	/4
<i>Fuel Type and the Environment</i> Discuss which fuel type is better for the environment, in terms of the amount of CO ₂ that is produced.	/3
Conclusion Summarise the investigation results and use evidence to draw conclusions that are related to the hypothesis.	/3
References Incorporate in-text referencing (where appropriate) and provide a reference list in correct format (e.g. APA).	/4
TOTAL MARKS	/75