Chemistry
University Preparation
(SCH3U)

Analysis of Fuels Report

The Task

Students were presented with the following scenario:

> You are a chemical consultant who is being hired by a major oil company to find the most efficient type of fuel that will run its new experimental vehicle. Your task includes designing, building, and testing a piece of equipment (calorimeter) that will measure energy changes during physical and chemical changes. You should include hydrocarbons and inorganic chemicals in your study.
>
> Once you have built your apparatus, use it to compile a set of data for changes that involve at least one safe hydrocarbon (paraffin) and at least one inorganic chemical (metal hydroxide).
>
> Using your own data, as well as data researched for other chemicals, write a report of your findings. The report must address three issues:
>
> – data analysis, including percent error calculations, and any changes you suggest to your apparatus design to improve your results
> – comparison of the energy produced by changes to the hydrocarbons and inorganic chemicals that were tested
> – suitability of other hydrocarbons that could be used as fuels

Final Product

Each student was to have submitted an Analysis of Fuels Report that contained the following:

- the purpose of the report
- a labelled scientific diagram of the apparatus used to test the energy output of the chemicals
- a clear explanation of how the apparatus functions
- a table of experimental data and results, along with researched results for other hydrocarbons and/or inorganic chemicals that could be used as fuels
- calculations showing the amount of heat liberated by each physical or chemical change, and showing the percent error
- balanced chemical equations representing the changes to all chemicals tested
- a discussion of any suggested changes to the apparatus design
- a comparison of the results for hydrocarbons and inorganic chemicals
- an analysis of other hydrocarbons that could be used as fuels, including their advantages and disadvantages to society and the environment
- a conclusion
- a bibliography

Note: Although students were required to submit a bibliography, it was not assessed as part of the exemplar task.

Expectations Addressed in the Exemplar Task

This task gave students the opportunity to demonstrate achievement of all or part of each of the expectations listed below. Expectations 1–6 are from the Hydrocarbons and Energy strand of the course. Expectations 7 and 8 are from the list of expectations that precedes the strands of the course in the curriculum document and that applies to all strands of the course.

Students will:

1. explain how mass, heat capacity, and change in temperature of an object determine the amount of heat it gains or loses;
2. identify ways in which reactants, products, and a heat term are combined to form thermochemical equations representing endothermic and exothermic chemical changes;
3. use appropriate scientific vocabulary to communicate ideas related to hydrocarbons and the energy changes involved in their combustion;
4. carry out an experiment involving the production or combustion of a hydrocarbon and write the corresponding balanced chemical equation;
5. gather and interpret experimental data and solve problems involving calorimetry and the equation $Q = mc\Delta T$;
6. demonstrate an understanding of the importance of hydrocarbons as fuels and in other applications, such as the manufacture of polymers, and identify the risks and benefits of these uses to society and the environment;
7. select and use appropriate numeric, symbolic, graphical, and linguistic modes of representation to communicate scientific ideas, plans, and experimental results;
8. communicate the procedures and results of investigations for specific purposes by displaying evidence and information, either in writing or using a computer, in various forms, including flow charts, tables, graphs, and laboratory reports.

For information on the process used to prepare students for the task and on the materials and resources required, see the Teacher Package reproduced on pages 153–157 of this document.