# Which is the best fuel?

Hot stuff – what are the characteristics of different fuels?

# SAILS inquiry and assessment unit overview

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| **Name** | Which is the best fuel? |
| **Key content/concepts** | * Enthalpy * Heat energy * Heat energy changes * Calorimetry |
| **Level** | * Lower second level * Upper second level |
| **Inquiry skills assessed** | * Planning investigations * Developing hypotheses * Forming coherent arguments * Working collaboratively |
| **Assessment of scientific reasoning and scientific literacy** | * Scientific reasoning (collection of scientific data; defining variables) * Scientific literacy (analysis and interpretation of scientific data) |
| **Assessment methods** | * Classroom dialogue * Teacher observation * Peer-assessment * Self-assessment * Worksheets * Student-devised materials (documentation of inquiry) * Presentations |

Table 1: Assessment opportunities identified in the unit activities

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| **Objective** | **Achieved by...** | **Skill/competency** |
| 1. To appreciate that “best” can have more than one interpretation and to suggest the most appropriate meaning in this context | ...the students discussing their suggestions given for the “best” fuel. They need to give reasons for their suggestion from a social and scientific point of view. | Scientific literacy (making informed choices of fuel for particular functions) |
| 2. Planning an investigation, interpreting experimental instructions and carrying out an experimental procedure | ...the students discussing how to measure the heating ability of a fuel and then carrying out the actual experiment in small groups. They should follow experimental procedures that are an adaptation of those put forward by the students. | Developing hypotheses, planning investigations, working collaboratively, scientific reasoning (identifying variables, collecting scientific data) |
| 3. Undertaking calculations to determine the link between amount of fuel, temperature changes and time taken | ...the students calculating the calorific value and heat of combustion from the readings taken during the experiment. | Scientific literacy (explaining phenomena scientifically) |
| 4. Cooperating as a member of a group | ...the students working as a group in carrying out the experiment and in the results from the whole class being pooled to obtain a set of results from which the “best” fuel can be determined. | Working collaboratively |
| 5. Communicating orally and by means of a written interpretation | ...discussing within a group the meaning of “best fuel” and in developing the working procedures for the experiment. The written interpretation is undertaken by each individual student. | Working collaboratively, forming coherent arguments, scientific literacy (presenting scientific information) |
| 6. Explaining the meaning of fuel and introducing the heat of combustion | ...the individual classwork in which students give their ideas in writing, followed by the blackboard summary. Heat of combustion is introduced as the conclusion of the experiment, based on parameters used in the experiment. (An extension could be for students to base the heat of combustion on standard parameters e.g. 1 mole of water heated by 1 °C). | Developing hypotheses, planning investigations, forming coherent arguments, scientific reasoning, scientific literacy (understanding enthalpy in an everyday context) |

Table 2: Checklist used to evaluate skills in the Which is the best fuel? SAILS unit

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| **Objectives** | **Acceptable** | **Needs improvement** | **Poor/NA** |
| 1. Formulate a hypothesis |  |  |  |
| 2. Design and conduct an experiment |  |  |  |
| 3. Identify and define variables operationally |  |  |  |
| 4. Collect meaningful data, organise, analyse data accurately and precisely and draw appropriate conclusions |  |  |  |
| 5. Explain any unexpected results |  |  |  |
| 6. Support conclusions, using reasoned arguments and evidence |  |  |  |
| 7. Collaborate with others to work towards common goals |  |  |  |
| 8. Report and discuss results, get feedback and deal positively with praise, setbacks and criticism |  |  |  |