

Overview

A scientific problem may be approached by generating scientific theories, which may then be tested by experiment. Ethical problems cannot be approached in the same way, since there are no 'theories of morality' that correspond to theories in the sciences. However, this does not mean that all possible answers to ethical problems have the same merit or that ethical problems cannot be the subject of rigorous analysis.

In this unit the ethical questions arise from the conflict between the increasing use of energy and the need to reduce energy consumption and the use of fossil fuels.

The aim is to introduce the idea that the discussion of controversial issues relating to the conduct and application of science involves making decisions. In any situation, there is usually more than one choice available. Often, a course of action may seem like a good solution, but it may also have some undesirable outcomes.

The activities

There is one activity in this unit. For other units about ethical issues see the units 'Difficult decisions' and 'Animal research – right or wrong?'. Research on the use of different fuels for transport could be set as homework prior to the work on this unit. The activity would be suitable after students have completed work on fossil fuels, generating electricity, energy or climate change. The approach in the activity could be used for other topics, for example the use of plastics (bags) or waste disposal and recycling.

In the activity students carry out an analysis of the advantages and disadvantages (costs/benefits) of various suggestions for reducing energy consumption and consider the social, ethical, environmental and economic consequences of these choices.

Curriculum links (for students aged 14–16)

How Science Works (from POS KS4 for England)

Communication skills

3a recall, analyse, interpret, apply and question scientific information or ideas

3b use both qualitative and quantitative approaches

3c present information, develop an argument and draw a conclusion, using scientific, technical and mathematical language, conventions and symbols and ICT tools

Applications and implications of science

4a about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.

4b to consider how and why decisions about science and technology are made including those which raise ethical issues, and about social, economic and environmental effects of such decisions.

GCSE or equivalent 14–16 specifications

England (GCSE)

AQA Science A 4461

Biology 1b: Evolution and Environment: 11.8 How do humans affect the environment?
Chemistry 1a: Products from Rocks: 12.3 How do we get fuels from crude oil?
Chemistry 1b: Oils, Earth and Atmosphere
12.4 How are polymers and ethanol made from oil?
12.5 How can plant oils be used?
12.6 What are the changes in the Earth and its atmosphere?
Physics 1a: Energy and Electricity: 13.4 How should we generate the electricity we need?

AQA Science B 4462

Biology Unit 1: 11.8 How do humans affect the environment?
Chemistry Unit 1:
12.3 How do we get fuels from crude oil?
12.4 How are polymers and ethanol made from oil?
12.5 How can plant oils be used?
12.6 What are the changes in the Earth and its atmosphere?
Physics Unit 1: 13.4 How should we generate the electricity we need?

AQA Biology 4411

Unit Biology 1: 11.8 How do humans affect the environment?

AQA Chemistry 4421

Chemistry 1a: 11.3 How do we get fuels from crude oil?
Chemistry 1b:
11.4 How are polymers and ethanol made from oil?
11.5 How can plant oils be used?
11.6 What are the changes in the Earth and its atmosphere?

AQA Physics 4451

Unit Physics 1: 11.4 How should we generate the electricity we need?

AQA Applied Science (Double Award) 4861

Science for the Needs of Society Unit 2:
11.3 Countryside and Environmental Management – Energy resources; Environmental management
11.5 Transport and Communication – Fuel for Transport

Edexcel 360 Science 2101

Chemistry C1 b: Topic 7 There's One Earth
Physics P1 a: Topic 10.1 You're in Charge

Edexcel 360 Additional Science 2103

Biology B2: Topic 3 Energy Flow; Topic 4 Interdependence

Edexcel 360 Science extension

Physics 2109 P3: Topic 6 – Medical Physics

The transport problem

OCR Science A (21C science) J630

Module C1: Air Quality

OCR Chemistry A (21C) J634

Module C1 – Air Quality

Module C7: Further Chemistry – C7.5 Green Chemistry

OCR Science B (Gateway Science) J640

Module C1: Carbon chemistry; Item C1g: Using carbon fuels

Module C2: Rocks and metals; Item C2f: Clean air

OCR Additional Science B (Gateway Science) J641

Module P3: Forces for transport: Item P3e: Energy on the move

OCR Biology B (Gateway Science) J643

Module B6: Beyond the microscope: Item B6d: Biofuels

OCR Chemistry B (Gateway Science) J644

Module C1: Carbon chemistry: Item C1g: Using carbon fuels

Module C2: Rocks and metals: Item C2f: Clean Air

Module C6: Chemistry out there: Item C6a: Energy Transfers – Fuel cells

OCR Physics B (Gateway Science) J645

Module P3: Forces for transport: Item P3e: Energy on the move

OCR Applied Science (Double Award) J649

Section 2.5.1 Energy Resources- Fuels

Scotland (SCE standard grade)

Science

Topic 3: Energy and its Uses:

3 Non-renewable Sources of Energy; 5 Renewable Sources of Energy

Biology

Topic 7 Biotechnology: Sub-Topic b – Problems and Profit with Waste

Chemistry

Topic 5: Fuels

The transport problem

Wales (WJEC GCSE)

Science

Chemistry C1: 6. The production and use of fuels

Physics P1: 1. Generation of electricity

Additional Science

Biology B2: 7. The impact of human activity on the environment

Chemistry

Chemistry 3: 1. Organic chemistry

Applied Science (Double Award)

Science & Society Unit 2 – (d) Energy, electricity and radiations

NI (CEA GCSE)

Science (Single Award)

Module 2 Human Activity and Health: Man's activity on earth

Module 4 Materials and their Management: Oils, Polymers and Materials

Module 5 Electricity, Waves and Communication: Household electricity

Biology

Section 3.2 Environment: Pollution 3.2.12; Conservation 3.2.13

Applied Science (Double Award)

The importance of energy: Energy resources

Learning objectives

This unit introduces students to the idea that discussion of controversial issues related to science involves making decisions about what is possible, what should be done and the consequences of different choices.

By working through the unit, students come to understand that:

- decisions about controversial issues involving science require scientific information to decide what is possible
- science alone does not provide a method for making decisions about controversial issues
- the discipline of ethics provides ways of making decisions about controversial issues involving notions of right and wrong
- in any given situation, there is usually more than one choice available
- a course of action may seem like a good solution, but it may also have some undesirable consequences.

The transport problem

Teaching and learning approaches

- Discussing ideas in a small group ✓ (LSS2)
- Devising 'visual' ways of expressing and communicating ideas (including maps, diagrams, charts) ✓ (LSS3) (LSS6)
- Argumentation

For further information about Learning Skills for Science (LSS) [click here](#).

Downloads

- PowerPoint presentation
 - slide 1 – the energy problem
 - slide 2 – vehicle fuels
 - slide 3 – making decisions
 - slide 4 – some energy facts
 - slide 5 – some transport facts
- Activity sheet A – The transport problem
- Activity sheet B – The transport problem (with tick boxes)

Acknowledgements

This unit was written by Silvia Newton and is based on the original SATIS unit 1010. It also draws on 'Difficult decisions' in *New SATIS 14–16* published in *The World of Science* in 1997. The unit has been influenced by ideas related to ethics in science education in Patrick Fullick, Mary Ratcliffe (eds.), *Teaching Ethical Aspects of Science*, Bassett Press (1996) and those on the websites of BEEP (BioEthics Education Project), PEEP (Physics Ethics Education Project), New Economics Foundation – DEMOCS and Nuffield Foundation Science for Public Understanding.