

1 Types of energy

Learning outcome

LO1 Be able to investigate energy transformations

Assessment criteria

Assignment preparation lesson

Planning and resources

This lesson will take one hour.

You will need the following resources:

- selection of everyday items using/storing different forms of energy:
 - light – e.g. lamp, torch, candle, mobile phone screen, solar-powered calculator
 - sound – e.g. radio, your voice
 - thermal – hot drink, heat from a radiator or heater, kettle
 - electrical – e.g. battery or socket
 - chemical – e.g. food or fuel
 - kinetic – e.g. electric motor, toy car, rolling ball
 - potential (gravitational) – e.g. ball rolling down a ramp
 - potential (elastic) – e.g. pull-back toy, inflated balloon
 - nuclear – e.g. picture of nuclear power station
- Student Book page 48
- Worksheet WS1 Types of energy
- (optional) *Collins BTEC First Applied Science Interactive Book* Interactive presentation 'Energy transformations'; Video 'Windy Britain's off-shore boast'

Real-life links

Relate the lesson content to everyday objects.

Setting the scene

Ask students to think about what energy is. Establish that energy is needed whenever something happens.

Class activity

In this lesson students will carry out preparatory work for Assignment 2.1.

- Before the students start the Assignment tasks, they need to understand that there are different types of energy. Use the Student Book page 48 to introduce this. Demonstrate some different types of energy using everyday objects. Show these to the class or have a small display of objects labelled with the energy type.
- Students look at a wider selection of items around the lab and work through **Worksheet WS1 Types of energy**. Make sure you have an example of each type of energy in the room (see the Resources list above). There is some help on the second page of the worksheet which you may or may not choose to give to students.

- Faster-working students should list of additional equipment/activities that use/produce the different types of energy.
- Discuss students' responses.
- Some students will recognise that for some items more than one form of energy is involved, e.g. an electric motor changes electrical energy to kinetic energy. This will lead into the next lesson.

Teacher guidance

Students should work individually.

If time permits:

- discuss grouping the displayed items that *use* a particular form of energy, and those whose *output* is a particular form of energy; e.g. solar cells use light energy, but lamps give out light energy
- students could identify forms of energy that are *stored* energy (gravitational/elastic potential energy and chemical energy)
- they could identify any unwanted forms of energy produced by the item.

This is the basis for a fair amount of work on energy and so it is worth spending time ensuring students have a full understanding.

Delivering PLTS and functional skills

PLTS

Creative thinkers – connecting own and others' ideas and experiences in inventive ways

Self-managers – working towards goals, showing initiative, commitment and perseverance

2 Energy transformations I

Learning outcome

LO1 Be able to investigate energy transformations

Assessment criteria

- P1** Carry out practical investigations that demonstrate how various types of energy can be transformed
M1 Describe the energy transformations and the efficiency of the transformation process in these investigations

Planning and resources

This lesson will take up to two hours.

You will need the following resources:

- photograph of a street scene
- selection of everyday equipment that transforms energy:
 - electricity → light – e.g. lamp
 - chemical → electricity → sound – e.g. battery-powered radio
 - potential (elastic) → sound – e.g. plucked guitar string or similar
 - potential (gravitational) → kinetic – e.g. ball rolling down a slope
 - electrical → thermal – e.g. kettle
 - chemical → light and thermal – e.g. candle
 - electrical → kinetic and sound – e.g. fan
 - electrical → light and sound – e.g. TV/computer
 - light → electrical → kinetic – e.g. solar-powered fan
- small selection of different, preferably household equipment with different energy transformations from those above, e.g. electric bar heater, wind-up radio, item such as an electric toothbrush with a battery-operated motor, hair dryer, etc.
- large sheets of paper for students to make posters
- coloured pens
- Student Book pages 48–49
- Worksheet WS2 Energy transformations
- Task sheet A2.1 TS1.1
- Help sheet A2.1 HS1

Real-life links

Keep examples linked to pupils' everyday lives and activities.

Setting the scene

Tell students they are working for a company that designs buildings for large sporting events. They are asked to gather information and produce posters and leaflets for new employees, to explain energy transformations and efficiency.

Class activity

P1

Display a typical street scene. (This could be the one on **Worksheet WS2 Energy transformations**, or a different one.) Point out some examples of energy transformations from one type to another, for example chemical energy to kinetic energy (and thermal energy and sound energy) in a car.

Using **Worksheet WS2 Energy transformations**, students label the transformations shown in the picture.

Assignment activity

P1 M1

In this lesson students work on Tasks 1a and 2a of Assignment 2.1.

- For Task 1a (P1), lay out energy-transforming equipment so students can try it out. Students use **Task sheet A2.1 TS1.1** to match the energy transformations to each piece of equipment, completing the table. Make sure you have an example of each of the energy transformations in the room (see the Resources list above); if any equipment is not available, amend the student Task sheet accordingly.
- For Task 2a (M1), lay out a selection of typical household items for students to investigate (see the Resources list above). Students should try them out and write down the type of energy input and the types of energy output for three items. They can use **Help sheet A2.1 HS1**. Page 49 of the Student Book may help them.
- Explain how to draw block diagrams for energy transfers. This is also shown on the Help sheet. Students then draw block diagrams for the three energy-transforming items of equipment, as a poster which will form part of their portfolio of evidence for M1.

Teacher guidance

Students can work in teams, but need to fill in the Task sheet and produce their poster individually.

If time allows, students could include more examples on their posters.

To take things further, you can introduce the concept of wasted energy (see the Student Book page 49). Students could then compare the wasted energy for similar items, e.g. a filament bulb heats up much more than the equivalent energy-efficient compact fluorescent bulb.

Delivering PLTS and functional skills

PLTS

Creative thinkers – selecting and describing energy transformations

Useful websites

For several suitable sites, search for energy transfers KS3

<http://www.eon-uk.com> and go to Educational Resources Energy Experience for a range of relevant activities, graded by age, fun for those who may need extra support

3 Energy transformations II

Learning outcome

LO1 Be able to investigate energy transformations

Assessment criteria

P2 Calculate the efficiency of energy transformations

M1 Describe the energy transformations and the efficiency of the transformation process in these investigations

Planning and resources

This lesson will take two hours.

You will need the following resources:

- calculators
- electrical item such as a hair dryer to demonstrate unwanted (sound) energy
- selection of light bulbs of (similar light output) in lamps, plus packets of identical spare bulbs to avoid students handling hot bulbs
- light meters
- rulers
- metre rules
- pieces of carpet, wood flooring, vinyl flooring etc. for the ball-bouncing activity
- Student Book pages 50–53
- Task sheet A2.1 TS1.2
- Task sheet A2.1 TS2
- Technician sheet 3
- (optional) *Collins BTEC First Applied Science Interactive Book* Interactive presentation 'Light work'; Video 'Changing energy'

Setting the scene

Tell students that some fridges or freezers are more efficient than others. Use pages from a catalogue, or from the Internet, to compare fridges or freezers. They will have efficiency ratings (e.g. A*, A, B, etc.) and running costs may be given. Explain that all fridges do the same job, so if the running costs are lower, less energy is needed to do the job, with less energy wasted – so the fridge is more efficient.

Class activity

P2

Use the introductory idea to reinforce the fact that some equipment wastes less energy than other equipment. Homes and other buildings with efficient equipment use less energy. Also, some buildings are more effective at reducing heat losses, so less energy is needed to keep them warm. These are called energy-efficient buildings.

Explain how to calculate efficiency (useful output energy ÷ input energy).

Demonstrate some examples e.g. switch on a hair dryer. Explain that the electricity changes to sound, heat and kinetic energy, but the sound is unwanted energy. Quieter hairdryers are likely to be more efficient. Or ask pupils to identify the unwanted thermal energy given out by a computer.

Assignment activity

P2 M1

In this lesson students will be working on Tasks 1b and 2b of Assignment 2.1b

- For Task 1b, students need to calculate efficiency by comparing energy input and energy output. They use **Task sheet A2.1 TS1.2** to do a practical investigation using light bulbs and a light meter. Show students how to use the light meters. The lab should be dimmed if possible. Emphasise to students that they must not touch the bulbs that are in the lamps.
- The task also includes calculations. (Question 2 is about the efficiency of electric heaters. Some people consider that all electric heaters are 100% efficient. However, ceramic heaters also give out light, and fan heaters change some energy to kinetic energy and sound.)
- For Task 2b (M1), students investigate one energy transformation in detail. A straightforward experiment (depending on your class) is to drop balls from a height of 1 m onto different surfaces and measure the height to which they rebound.
- The energy transformation is
potential energy → kinetic energy → potential energy
- Although students do not need to know the theory, potential energy is proportional to height. This means that calculating the ratio of the final height to the original height will give the efficiency of the energy transfer, e.g. if a ball falls 100 cm and rebounds to 60 cm the efficiency of the energy transfer is 60%.
- Discuss with students what happens to the 'lost' energy – it changes to sound and heat as the ball hits the floor.
- Students use **Task sheet A2.1 TS2** to guide them and to record their results. Point out that repeating results makes them more reliable.

Teacher guidance

The tasks should be carried out in pairs or small groups.

If the ball-bouncing experiment is not thought suitable as a class practical, it can be teacher-led. Individual students can be asked to measure the height of rebound.

Task sheets must be written up individually.

Delivering PLTS and functional skills

PLTS

Independent enquirers – identifying questions to answer and problems to resolve

Team workers – co-operating with others to work towards common goals

Self-managers – working towards goals, showing initiative, commitment and perseverance

Functional skills

Mathematics: calculating efficiency

Writing: writing a short report

Useful websites

<http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/energy/heatrev3.shtml> – shows a thermal image of a house

<http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/energy/heatrev5.shtml> – discusses energy transfers

<http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/energy/heatrev6.shtml> – Sankey diagrams, which may be useful for D students

Search on Google Videos for 'ball bouncing' for a slow-motion film showing the ball and surface distort

4 Sources of energy

Learning outcome

LO1 Be able to investigate energy transformations

Assessment criteria

Assignment preparation lesson

Planning and resources

This lesson will take one hour.

You will need the following resources:

- Internet access
- Student Book pages 54–55
- Worksheet WS3 Energy sources

Setting the scene

Ask students to suggest renewable and some non-renewable energy sources used to generate electricity. This should be revision of Key Stage 3 work.

Class activity

In this lesson students are doing preparatory work for Task 3 of Assignment 2.1.

Students do some Internet research about different choices of energy sources for generating electricity. They can complete the table on **Worksheet WS3 Energy sources**.

The list of useful websites below suggests two very informative sites. Check these are still active and appropriate, and provide alternatives if necessary.

Teacher guidance

Although this is background research for the D1 task of the assignment, this lesson is suitable for all students. Interactive websites allow different groups to cover a different range of activities. Faster students can extend their work by attempting the full range of activities, while others may be limited to basic factual research.

Delivering PLTS and functional skills

PLTS

Team workers –

co-operating with others to work towards common goals

reaching agreements, managing discussions to achieve results

Self-managers – working towards goals, showing initiative, commitment and perseverance

Functional skills

ICT – using a variety of sources of information independently for a complex task

Useful websites

<http://www.darvill.clara.net/altenerg/index.htm> – facts, a summary and quizzes about energy sources

<http://www.eon-uk.com/EnergyExperience/557.htm> – interactive activities that can be carried out individually or in groups

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