

# Energy from Fuels

**Aim: to investigate the energy released from burning fuels.**

## Equipment:

- spirit burners containing paraffin and ethanol;
- small conical flasks;
- stands and clamps;
- heat-proof mats;
- splints;
- thermometers;
- stop clocks;
- goggles;
- measuring cylinders.

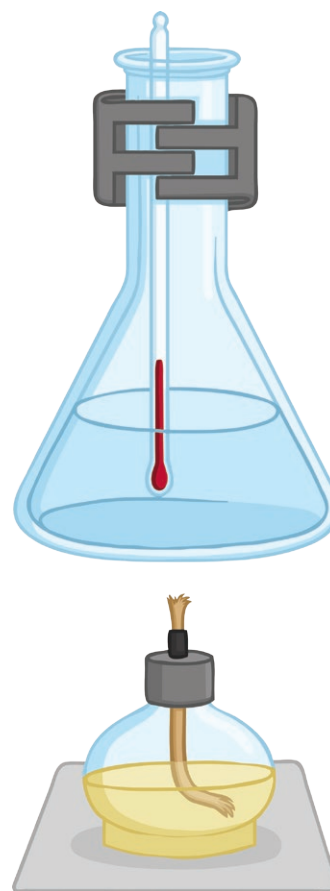
## Safety:



- Wear goggles at all times.
- Paraffin and ethanol are very flammable.
- Ensure you know how to use the spirit burners properly.
- Test tubes and water will become very hot after heating.
- Stand up whilst completing the experiment.

## Method

1. Set up the equipment as shown at right:
2. Using the measuring cylinder, measure  $100\text{cm}^3$  of tap water and pour into the conical flask.
3. Record the temperature of the water.
4. Place the spirit burner containing paraffin under the conical flask and light.
5. Record the temperature of the water every minute until it reaches a temperature of  $50^\circ\text{C}$ , or for no longer than 5 minutes.  
**Replace the cap on the spirit burner.**
6. Repeat the experiment using fresh water, and this time using the spirit burner containing ethanol.
7. Remember to record your results on the tables below.



**Aim: to investigate the energy released from burning fuels.**

**Variables:**

independent variable: \_\_\_\_\_

dependent variable: \_\_\_\_\_

control variables: \_\_\_\_\_

**Results:**

Paraffin:

Time (min)	Temperature °C
1	
2	
3	
4	
5	

Ethanol:

Time (min)	Temperature °C
1	
2	
3	
4	
5	

Once you have completed the experiment, please present your results in a line graph. You will need to collect a piece of graph paper from the teacher.

If you are unsure how to do this, ask your teacher for the graph help sheet.

Once you have drawn your graph, please complete the tasks below:

**Conclusion:**

The \_\_\_\_\_ released the most amount of heat energy. I know this because \_\_\_\_\_

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**Evaluation:**

Most experiments have some errors, or encounter some problems. What was the biggest error, or problem, with your experiment and how would you overcome it next time? \_\_\_\_\_

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# Energy from Fuels

## Learning Objective


- To investigate the energy released from burning fuels.

## Success Criteria

- To define the terms independent, dependent and control variables.
- To identify the variables within an experiment.
- To evaluate the success of the experiment.

# Fuel Anagrams

Rearrange the letters to spell the names of different fuels.

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1. alco  
2. loi  
3. rneapop  
4. neatub  
5. sag

# Variables

There are 3 types of variables.

**independent variable:** The thing you change in the experiment.

**dependent variable:** The thing you measure.

**control variables:** The things you kept the same.



# Recognising Variables



## Example:

How does the volume of water affect the height of sunflower plants?

What are the following variables:

**independent:** The thing you change in the experiment.

**dependent:** The thing you measure.

**control:** The things you kept the same.

independent: Volume of water.

dependent: Height of sunflower.

control: Type of soil, same conditions, measured to the same point.

## Variables: Example 2

How does the temperature of the water affect the rate at which sugar cubes dissolve?

**independent variable:** Temperature of the water.

**dependent variable:** Time taken for the sugar cube to dissolve.

**control variable:** Same size sugar cube.





# Quick Assessment: Recognising Variables

For each of the following, state the...

- independent variable;
- dependent variable;
- control variable.



1. An investigation into how the angle of a ramp affects the distance a toy car travels.
2. Look at the results below and state the variables.

Height the Stone Is Dropped from (m)	Depth of Hole in Sand (cm)
0.5	0.5
1	1.2
1.5	2.5
2	3.2

# Investigation: Comparing the Energy Released from Different Fuels

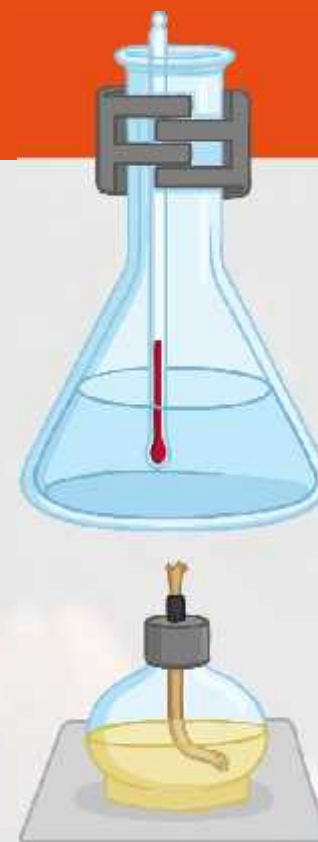
How to use a spirit burner safely - teacher demonstration.



# Investigation: Comparing the Energy Released from Different Fuels

## Method

- Set up the equipment as shown.
- Using the measuring cylinder, measure 100cm<sup>3</sup> of tap water and pour it into the conical flask.
  - Record the temperature of the water.
  - Place the spirit burner containing paraffin under the conical flask and light.
  - Record the temperature of the water every minute until it reaches a temperature of 50°C, or for no longer than 5 minutes. Replace the cap on the spirit burner.
  - Repeat the experiment using fresh water and this time using the spirit burner containing ethanol.
  - Remember to record your results.



# Safety



- Wear goggles at all times.
- Paraffin and ethanol are very flammable.
- Ensure you know how to use the spirit burners properly.
- Test tubes and water will become very hot after heating.
- Stand up whilst completing the experiment.



# What next?

Using the Energy from Fuels Instructions, complete all of the tasks.

Ask if you need help!



# Plenary: Change the World

How could what you have learnt today change the world?  
Discuss your ideas with a partner.



# Home Learning

What will I tell someone who was absent from today's lesson?

**Write 5 key points.**





# Graph Help Sheet

## Axes

The independent variable (change) should go on the x axis, and the dependent variable (measure) on the y axis. Make sure you use a sharp pencil and ruler.

Dependent variable goes here.

Remember to add the units!



Independent variable goes here. Are there any units? Remember to write these too!

# Graph Help Sheet

## Axes

The independent variable (change) should go on the x axis, and the dependent variable (measure) on the y axis. Make sure you use a sharp pencil and ruler.

Dependent variable goes here.

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Independent variable goes here. Are there any units? Remember to write these too!

# Quick Assessment Recognising Variables

For each of the following, state the...

- independent variable;
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1. An investigation into how the angle of a ramp affects the distance a toy car travels.

2. Look at the results below and state the variables.

Height the Stone Is Dropped from (m)	Depth of Hole in Sand (cm)
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1.5	2.5
2	3.2

# Answers

For each of the following, state the...

- independent variable;
- dependent variable;
- control variable.

1. An investigation into how the angle of a ramp affects the distance a toy car travels.

**Independent variable: angle of the ramp.**

**Dependent variable: distance car travelled.**

**Control: same car, car not pushed but allowed to roll, measuring to the same point on the car.**

2. Look at the results below and state the variables.

Height the Stone Is Dropped from (m)	Depth of Hole in Sand (cm)
0.5	0.5
1	1.2
1.5	2.5
2	3.2

**Independent variable: height stone dropped from.**

**Dependent variable: depth of hole in sand.**

**Control: same size stone, dropped with the same force.**



## Energy from Fuels Teaching Ideas

**Learning Objective:** To investigate the energy released from burning fuels.

- Success Criteria:**
- To define the terms independent, dependent and control variables.
  - To identify the variables within an experiment.
  - To evaluate the success of the experiment.

**Context:** This is lesson 4 in the energy topic for key stage 3.

### Resources

#### [Lesson Pack](#)

glue

For the experiment:

spirit burners containing ethanol and paraffin;

small conical flasks;

stands and clamps;

heat-proof mats;

splints;

thermometers;

stop clocks;

safety goggles;

measuring cylinders.

## Starter

### Fuels Anagrams

Ask the student to rearrange the letters to make the names of well-known fuels.

1. alco **coal**
2. loi **oil**
3. rneapop **propane**
4. neatub **butane**
5. sag **gas**

## Main Activities

### Variables

Slides 4-7: This activity introduces pupils to the three variables; independent, dependent and control. It leads them through a series of examples where pupils are required to identify the variables. Having shown pupils two examples and worked through the answers as a class, slide 7 contains assessment questions to enable the teacher to assess pupil progress. The questions are also available on the [Variables Assessment Activity Sheet](#) and can be glued into books on completion.

### Investigation: Comparing the Energy Released from Different Fuels (slides 8-12)

This is the main activity of the lesson and involves pupils carrying out a practical to compare the heat energy released from two fuels. The teacher should demonstrate how to use a spirit burner as many pupils will not have seen or used them before. It is important that they realise to put out the burner the cap is replaced, all too often pupils will try to blow out the flame (slide 8). It is also important that they have been given clear instructions (slide 9) about what is expected of them, and clear safety instructions (slide 10). [The Energy from Fuels Activity Sheet](#) explains how to carry out the experiment and includes a set of tasks for pupils to complete when they have finished.

By the end of the activity, pupils will have:

- carried out the investigation;
- recorded their results;
- drawn a graph from their results (a [Graph Help Sheet](#) is available for pupils who may need additional support);
- written a conclusion;
- suggested any errors or problems they encountered.

**Teacher note –the fuels used in the practical sheet are ethanol and paraffin, but it is possible to substitute these with propanol and methanol. Please check your learning environment’s safety policy before conducting this experiment, and also take into consideration the maturity of your class. Twinkl does not accept any responsibility for any accidents or injuries that could arise from conducting this experiment.**

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## Plenary

Slide 13 - Asks the question, 'How could what you have learnt today change the world?' Give pupils a couple of minutes to discuss this idea with a partner and then get the class to share their ideas.

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## Home Learning

**What will I tell someone who was absent from today’s lesson?**

Write 5 key points.

This activity provides a perfect opportunity for pupils to synthesise and consolidate what they have covered in today's lesson.