

# Lesson Activities

## Lord Kelvin



## Lesson Activities

### The Three Big Temperature Scales

Firstly, depending on the age and experience of the pupils, you may wish to recap on their understanding of scales and measures.

The children will need to understand that we can decide to use anything as a unit of measure. For example, for measuring lengths we can use hands, large steps or books but instead we use centimetres or metres, which are standardised and more accurate.

However, the people who invented the scales to measure temperature had a harder job. To decide upon the scale that they would use for their thermometer, they had to find two fixed points. Fixed points are certain recognisable changes, which always take place at the same temperature. Once a lower and an upper fixed point are found, these would be used to set the scale (this is called calibration).

Each point on the thermometer can be represented by any number as long as the rest of the scale is relative.

Next, explain to the children that the three scales used today to measure temperature are shown below:

### Fahrenheit

The Fahrenheit scale was created in 1724 and is named after its creator, Gabriel Daniel Fahrenheit. In the early 1700s, Fahrenheit invented alcohol and mercury thermometers. He used his scale on these thermometers.

The lower fixed point that Fahrenheit used was the lowest temperature he could reach in his lab. A salt and water solution froze at this temperature. He called this temperature zero degrees ( $0^{\circ}\text{F}$ ).

# Lesson Activities

## Lord Kelvin



For his upper fixed points, Fahrenheit decided to use two different things: his own body temperature and the boiling point of water. He recorded his body temperature as  $96^{\circ}\text{F}$  and the boiling point of water, which he recorded as  $212^{\circ}\text{F}$ . He then added another lower fixed point of the freezing point of water, recorded at  $32^{\circ}\text{F}$ .

It may seem strange that he used seemingly arbitrary numbers to record these fixed points. However, he was not using a decimal system which is more common to us nowadays, and perhaps instead, his measurements were based on fractions which were more convenient at the time.

Some countries, including the US, still use Fahrenheit as their general scale for measuring temperature.

### Celsius

Celsius is the system of measuring temperature that we use today. A Swedish astronomer, Andres Celsius, developed this temperature scale in 1742. He used two fixed points, which were the freezing point of water and the boiling point of water. However, when Celsius created the scale, he had the boiling point fixed at  $0^{\circ}\text{C}$  and the freezing point set at  $100^{\circ}\text{C}$ ! After he died, the decision was made to turn his scale the other way around, giving us the scale we use today with  $0^{\circ}\text{C}$  as the freezing point of water and  $100^{\circ}\text{C}$  as the boiling point of water. Each Celsius degree is larger than a Fahrenheit degree.

### Kelvin

The Kelvin scale is named after Lord Kelvin who was born in Belfast in 1824. Read the information on the 'Our Innovators: An Ulster-Scots Legacy' website about Lord Kelvin with the children.

Kelvin is an important scale used in most of science. The big difference between the Kelvin scale and Celsius or Fahrenheit is that it is based on just a single fixed point called absolute zero ( $0^{\circ}\text{C}$ ). Absolute zero is a physically impossible-to-reach temperature at which scientists think that the atoms would stop moving completely. Therefore, nothing can be colder than absolute zero on the Kelvin scale.



# Lesson Activities

## Lord Kelvin



Although the idea of absolute zero was known before Kelvin, the scale is named after him because he was the one who was able to successfully determine its correct value as  $-459.67^{\circ}\text{F}$  or  $-273.15^{\circ}\text{C}$ .

From 0, the Kelvin scale increases by degrees that are the same size as Celsius degrees. Water freezes at the value 273.15 Kelvin (K) and boils at 373.15 K.

Depending on their reading ability the children could work in pairs to read through a copy of Resource 1. Ask them to read through the information, and underline any important points, such as the freezing point of water and so on.

Alternatively you could read through the information together, underline important information and explain any words that the children don't understand.

### Hotter or Colder? Discuss and Decide

Give each pupil a copy of Resource 2, 'Hotter or Colder? Discuss and Decide'. This can be done in pairs or small groups of three or four if you prefer. The children should cut out the statements and lay them on the table. They should discuss and debate with each other, an order for the statements, from hottest to coldest.

When they have had some time to complete this part of the activity, ask each group for a consensus on which is the coldest statement, which statement is next and so on. Encourage them to justify the order that they decided upon. You may wish to use a strategy such as 'Card Ranking' from the [CCEA Active Learning and Teaching Methods for Key Stage 1 and 2 book](#).

When you are happy that the children have arranged the statements from hottest to coldest (teacher answers are provided in Resource 4), give each child (or pair/group) an A3 page. Ask the children to stick the statements in order from hottest to coldest, down the side(s) of the page (with the page in landscape profile).



# Lesson Activities

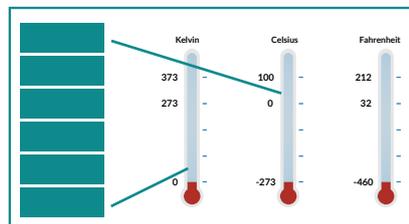
## Lord Kelvin



### Hotter or Colder? Equal to?

Next, give each pupil (or pair/group), a copy of Resource 3, 'Hotter or colder? Equal to?' The children should stick their thermometer page in the middle of their A3 sheet of paper (the A3 page should be arranged in landscape).

Using their knowledge of the temperature of some fixed points, such as the boiling and freezing points of water, ask the children to mark the temperature of each thing described on the cards which they now have in order from hottest to coldest. Using the information available on the statements, they should mark the Fahrenheit, the Celsius and the Kelvin temperature for each statement and draw a straight line from the measurement to the statement at the side of the page, as a means of labelling the thermometers. Their page should look something like this:



### Which Thermometer?

Explain to the children that even though we may use only a few main scales to measure temperature, there are lots of different types of devices that measure temperatures. All of these devices are called thermometers because they measure temperature.

Use a suitable website such as [BBC Bitesize](https://www.bbc.com/bitesize) to show the children some images of different types of thermometers. These should include:

- bulb thermometers;
- spring thermometers;
- digital thermometers; and
- temperature sensitive materials.



# Lesson Activities

## Lord Kelvin



Discuss with the children that temperature sensitive materials (which are known as 'thermochromic') are a new innovation, and like Lord Kelvin's discovery many years ago, the innovative idea has been useful in many aspects of modern life. Ask them to think of anything they know of which has these properties. Some suggestions are:

- car window blinds which say 'hot' if the car is very hot;
- bath grips which change colour if the water is too hot;
- frying pans which have a spot which turns red when the pan has heated up;
- clothes which change colour; and
- a mood ring.

Next, ask the children to explain what the words 'accurate' and 'sensitive' mean. Take some suggestions and then lead them to an understanding of what these words mean in relation to measuring temperature.

For example, a thermometer can be quite accurate but maybe not very sensitive; it would take a while to respond to a slight change in the temperature. Some thermometers would be slightly less accurate, but that might be OK depending on what you are using it for. Other thermometers, such as digital thermometers would be both accurate and sensitive so that we can be very sure that the right temperature is always shown and always picked up.

Give each pupil a copy of Resource 4 and Resource 5. Ask them to cut out the statements on Resource 5 and, after discussion and agreement with a partner, stick them onto the table (Resource 4) in the correct place.



# Lesson Activities

## Lord Kelvin



## Assessment for Learning Idea

### Traffic light Self-Evaluation

Ask the children to stick their name next to a traffic light image:

**Green:** I understand

**Amber:** I'm not sure

**Red:** I need more help

## Connected Learning Opportunities

### The World Around Us (Science)

Create their own thermometer and scale. Use a suitable search engine to find out how.

### Language and Literacy (Reading)

In order to check their understanding, get the children to complete a comprehension activity based on the information in Resource 1.

### The Arts

Find out about how Kelvin's scale is used as a colour scale. Get the children to paint a blend of colour, starting from the darkest shade (temperature) to the lightest.



# Lesson Activities

## Lord Kelvin



### What's Next?

