aerozone
STANSTED

Heat-proof suit

Activities for pupils at Key Stage 2

Heat-proof suit

SESSION FOR PUPILS AT KEY STAGE 2

In this activity, pupils will investigate the ability of materials to insulate from heat. The context is finding the best material for a heat-resistant firefighters' protective suit. The activities cover the science curriculum topics of:

- Working scientifically - taking measurements, interpreting data, making predictions and communicating findings
- Materials - give reasons, based on tests, for the use materials.

The activity offers an opportunity for firefighters, or other personnel, to pass on their experience of how materials are chosen to fulfill the specific needs of working at the airport.

FIGHTING FIRES

Around 20 minutes

This activity gives an opportunity for children to get settled and introduces them to the topic of the session which is the use of materials.

If possible, have a firefighter talking with the pupils about their job and the way that their personal equipment helps to protect them from extremes of heat. Bring examples of their clothing and kit as examples of the materials they use.

As an alternative, have an outer uniform (trousers, jacket, helmet and gloves) and dress a volunteer in them to act as a 'stand-in' firefighter.

Show pupils the equipment used. Have them work in small groups to start off with and get them to discuss what properties the equipment needs to have. What types of situations will the firefighter be in and what does their equipment need to be able to do? Some ideas may include:

- Protect them from heat of a fire
- Be waterproof so that it does not become waterlogged and it keeps them dry
- Be flexible so that firefighters can move easily
- Be as light as possible
- Be able to be put on and off quickly (firefighters won't be wearing it when there is not an emergency but need to be able to put it on quickly)
- Be brightly coloured to allow firefighters to be visible.

No doubt there will be many others.

After some time to discuss in groups, have pupils feed back their ideas and make a note of them on the board. This will then feed into the next part of the investigation.

PROTECTING FROM HEAT

Around 60 minutes

In this activity pupils test a range of materials, or combinations of materials, to see which offers the best protection from heat.

Explain that this is a model and is the type of thing that scientists do to test materials before going on to make and test full-size garments.

Safety note:

A full risk assessment should be performed before any practical activity, taking into account local conditions, regulations and the abilities of the pupils involved.

In this activity, one of the hazards is from the hot water put into the plastic bottles. A properly regulated hot water tap should be a sufficient source for the hot water. Check it before use and, if necessary, make sure that the water is cooled to a safe temperature with cold water before it is used. Minimise handling and when necessary, have pupils handle the hot bottles using heat-resistant gloves. Ensure the screw top is on to prevent spillage of any hot water.

Scissors should be chosen so that they are blunt-ended.

Materials

Have pupils work in groups of three or four. This is to allow discussion as well as reducing the amount of equipment required.

Each group should have access to:

- 500 cm^3 plastic bottle with screw top (lemonade bottle or similar will be sufficient)
- Range of insulating materials to wrap around the bottle, for example, textiles, foams, newspaper, plastic, bubble-wrap, aluminium foil
- String or tape to secure the materials
- Scissors to cut the materials (blunt-ended)
- Heat resistant gloves (oven gloves)
- Infra-red thermometer to measure heat getting through the insulation
- Planning sheet (attached below).

Activity

The activity is an investigation but the planning part should not be rushed.

Slides in the accompanying presentation may also be used.

Begin by showing the pupils the materials that are available and setting out the problem. Have each group talk about how the investigation could be performed. After a few minutes have them feedback their ideas. At this stage the ideas may need refining and there may be a variety of suggestions. Attempt to steer groups with clearly unworkable ideas to a more achievable approach.

Remind pupils that we will see how much heat escapes from the hot water bottle. This is a model but effectively shows what materials would keep heat away from the firefighter's body.

<u>What question are we going to try and answer?</u>

Have each group use the planning sheet to define what they are going to test. This also offers an opportunity to go around each group and check what they are planning to do.

<u>What one thing will we change?</u>

Using the planning sheet have children specify the one thing they are going to change (variable). This will probably be the types of materials used as insulators.

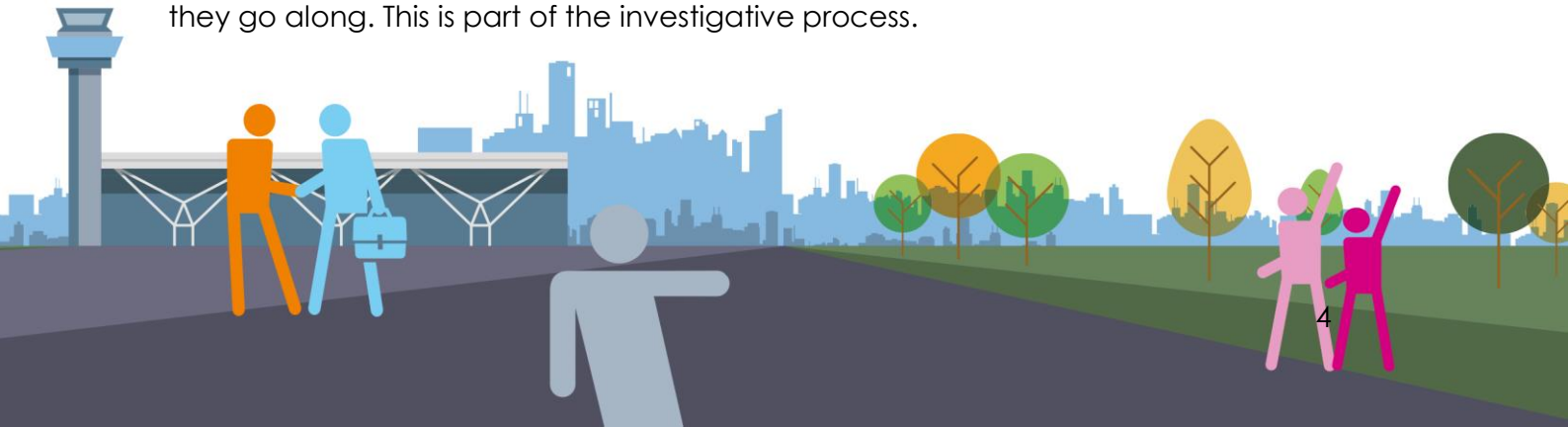
<u>What are we going to keep the same?</u>

Groups complete this section by defining what will be controlled. It may be tricky to keep the thickness of the material constant but this could feed back into a slightly revised question, in that a thinner and lighter heat-retardant suit may be better than a thicker and more bulky one.

<u>What are we going to measure?</u>

The simple answer here is the amount of heat given off. This is correct if the temperature of the water remains the same at the start of each test. Some groups may use fresh water at the start of each test or others may not consider this. If the latter is the case, then measuring the temperature of the bottle without any insulation (starting temperature) and then after the insulation will allow comparisons to be made.

Whilst pupils should be encouraged to think about their experiment before they start the practical aspect, allow children to make improvements to their design as they go along. This is part of the investigative process.



Reporting findings

Remind pupils that they will need to record, analyse and present their results. Have them consider how they will do this before they start gathering the data.

Draw a line under the planning phase by demonstrating how the pupils can use the infra red thermometers to measure the amount of heat escaping from the bottle. Remind them that this equates to the amount of heat that would be getting to a firefighter from a heat source.

This demonstration also allows the group to be pulled together and reminded of safety before starting the practical element of the investigation.

Once the investigation has been completed, have pupils present their findings to the class. Is there a consensus as to the best type of material to use? How do their findings tie-in with the properties of a firefighter's suit that they suggested at the start of the session?

PLENARY

The final activities depend on the time available.

If possible, go to the viewing area and see any safety vehicles and personnel that are on the airport site.

Alternatively, an activity could be to produce a letter to a garment manufacturer describing the best materials to use when designing a new firefighter's protective suit.

Firefighters' protective suit

What question are we going to try and answer?

What one thing will we change?

What are we going to keep the same?

What are we going to measure?

How will we record and report what we find?