6. Oil as a lubricant

1 hour

The children are challenged to find out which oil would be the best lubricant.

OBJECTIVES

- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces (Y5 Forces)
- Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations

RESOURCES

Per group

- Activity sheets 2 and 4
- A range of oils and fats, e.g. corn oil, groundnut (peanut) oil, almond oil, rapeseed oil, sunflower oil, sesame oil, olive oil, vegetable oil.
- Depending on the investigative methods chosen, some of: Ramp
- Foil
- Margarine tub filled with dried peas or marbles
- Timer
- Detergent and paper towels
- 3 Elastic bands and force meter (1-10N scale)
- Metre stick/long ruler

Safety note

Be careful not to include nut oils if involving children with nut related intolerance or allergies.

INTRODUCING THE ACTIVITY

Reread the e-mail from the company (Activity sheet 2).

Ask the class "What is a lubricant?". Discuss occasions when they have used oil as lubricants, or seen others using them, e.g. oiling a squeaky hinge, oiling a bicycle chain, etc. What does the oil do in each of these examples? Children's understanding of lubricants may be expressed in terms of reducing noise, rubbing, grinding, and friction. You may wish to link to literacy and create a class description of lubricant, e.g. "A type of liquid that is spread over two touching surfaces to help them move freely over each other and therefore reduce the friction."

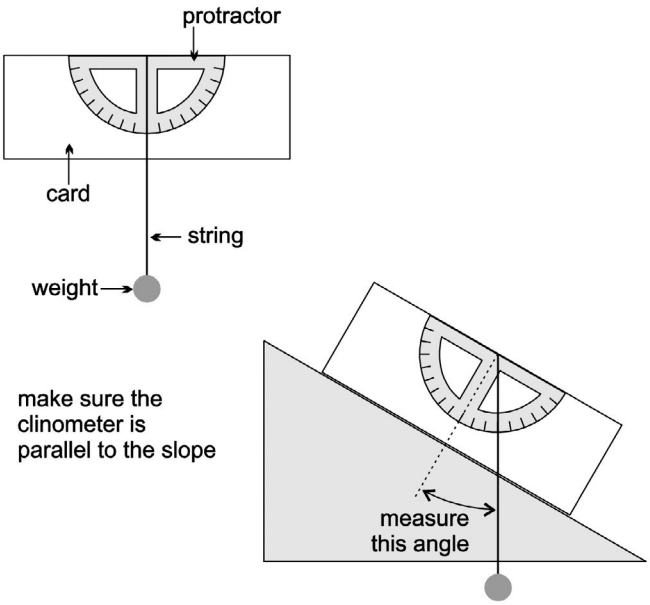
MAIN ACTIVITY

The children can design an investigation to find the best lubricant, or use one of the methods below, depending on the investigative focus of the lesson.

Method One

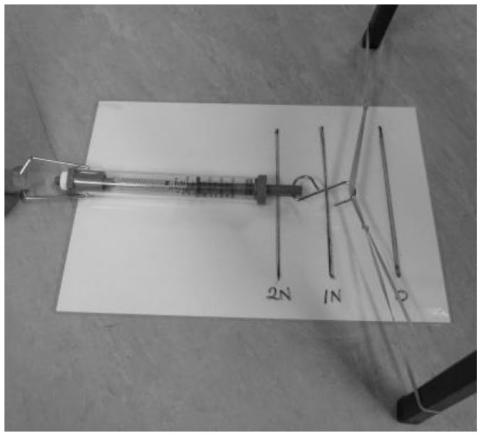
1. Cover a board with foil or use a non-stick baking tray and smear with oil.
2. Fill a margarine tub with the marbles or dried peas to add weight.
3. Smear the base of the margarine tub with the same oil.
4. Place the margarine tub on the end of the board and slowly lift until the tub starts to slide.
5. Either measure the height of the end of the board or the angle that the board makes with the floor when the tub starts to slide. Take repeat readings and calculate an average for each oil under test.
6. Clean and dry the base of the tub and the foil thoroughly before testing the next oil.
7. Tabulate results (Activity sheet 4) and represent them graphically to report back to the company.

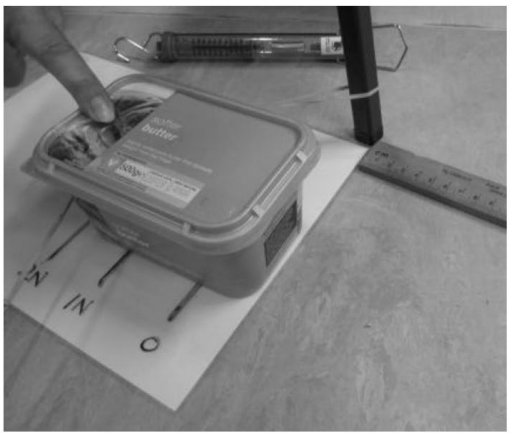
Extension: Children make a clinometer to measure the angle.



Method Two

Using an elastic band launcher along the board or across a table. The force can be controlled by making a scale for the launcher using a force meter, and marking lines for each 1 or 2N. The tub is then pulled back a designated force each time.





Method Three

Use a ramp at a set angle and measure the time taken for the tub to travel a fixed distance down the ramp.

PLENARY

The class share the results and conclusions they have drawn from the investigation. Discuss which of the oils would be the best lubricant for the machinery and why. What are the advantages and disadvantages of using vegetable oils or petrochemical oils, e.g. vegetable oils come from a sustainable source and decompose more easily but may smell strongly. Petrochemical oils are a finite resource which are being used faster than they can be made, they have to be processed and refined before they can be used, and they decompose more slowly.

This is also an opportunity to evaluate the success of the different investigative methods.

Extension: Children can investigate the effect of heat on a lubricant (the viscosity of the oil will change). Does this make a difference to the efficiency of the lubricant?

Appendix 1: Sourcing dried sunflowers

Dried sunflower head bird feeders can be purchased from some garden centres or via the internet from sites such as www.franceshilary.com

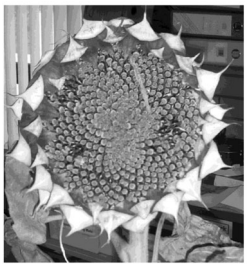
Drying Sunflowers

Outlined below are two different ways to dry sunflowers. Harvest the sunflowers when their heads become brown and dry and most of the leaves have fallen off the stem (the plant will look wilted).

Method 1 – In the garden

The first method is to dry the head and the stem naturally. When the back of the flower's head turns yellow and the petals have fallen off, cover it with a brown paper bag. This prevents the seeds falling to the ground and it will also protect it from birds, squirrels and other animals. The bag allows the plant to 'breathe' and prevents moisture from building up which could cause the seeds to becoming mouldy. If it rains and the bag becomes soggy, it may need replacing. If just the flower head is needed it can be removed from the plant once the head has turned brown about 30cm down the stem, making sure the bag does not fall off in the process. If the whole plant is required, the plant can be removed from the garden at this stage and stored somewhere dry.

Method 2 – Drying indoors



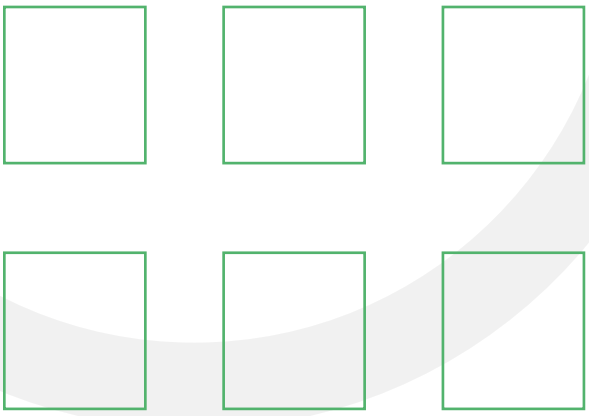
The sunflower head can be dried away from the plant if there is a strong risk of losing the seeds to wildlife. When the flower head starts to yellow and the petals have died away, harvest the head approximately 30cm down the stem. The head can be dried in any location which is warm, dry and has good ventilation to prevent the seed head becoming mouldy. As with the natural method, a brown bag can be placed over the seed head to prevent losing any seeds, and will protect against wildlife attack.

Further information regarding sunflowers can be obtained from www.sunflowerguide.com

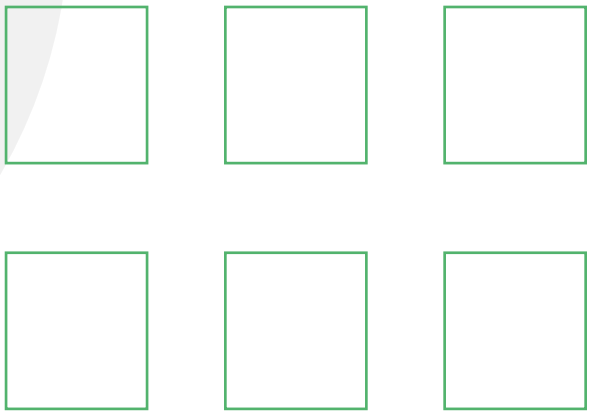
Appendix 2: Planning

We are investigating.....

We could change



We could measure/observe



We will change

We will measure/observe

Our investigation question is.....

We will keep these the same...

When we change

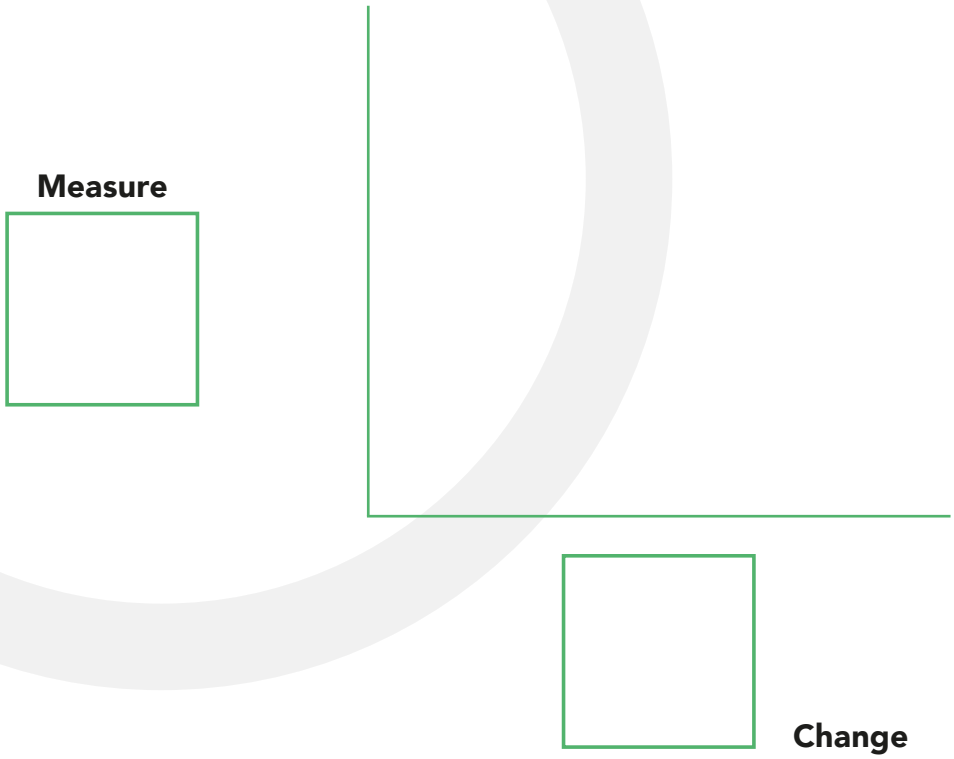
What will happen to...?

Why?

APPENDIX 2: OBTAINING EVIDENCE

Change	Measure/observe
	

APPENDIX 2: CONSIDERING EVIDENCE AND EVALUATING



When we changed . . .	What happened to . . .

Was our prediction correct?

How could we improve what we did?

Appendix 3: The effect of temperature change on oils and fats

The following table lists the softening (melting) and boiling points for commonly used oils and fats. It is not a definitive list and there may be slight variances depending on the purity of the oil. Because of the impurities, the change to a liquid takes place over a temperature range when the solid will soften.

Oil	Softening (melting) point ˚C	Boiling point ˚C
Linseed (Flax seed)	-24	316
Olive	-6	191
Peanut	3	227
Rapeseed	-10	200
Sunflower	-17	230
Palm Kernel	24	350
Palm	35	n/a
Grapeseed	10	230
Coconut	25	177
Hempseed	-8	166
Corn	-20	246
Sesame	-6	216
Lard	33	n/a
Butter	35	n/a

Palm oil, lard and butter do not have a specific boiling point. These fats are likely to break down before they change to a gas state. Oils and fats are the same chemical composition but they are described as fats when solid at room temperature.

Appendix 4: Game cards for dominoes and loop game

Organic material which can be used to produce energy.	**Liquid**
A state of matter. It can be poured and take on the shape of the container.	**Evaporation**
The process of change from a liquid into a gas.	**Melting**

The process of changing a solid to a liquid.	**Biofuels**
A source of fuels which comes from plants or animals.	**Fuel**
A source of energy, e.g. wood, gas, coal.	**Volume**

The space taken up by a substance.	**Burning**
To be in flames, a change that is irreversible which involves fuel, oxygen and a flame.	**Heating**
The process of increasing the temperature of an object.	**Reversible change**

A change that can be easily reversed e.g. freezing water to make ice.	**Irreversible change**
A change that cannot easily be reversed e.g. burning.	**Renewable energy**
A source of energy that does not involve the burning of fossil fuels and won't run out.	**Weight**

The downward force on an object caused by gravity.	**Friction**
A force affecting movement between two materials.	**Lubrication**
The method to reduce the friction between two surfaces.	**Filtration**

The process of separating a solid from a liquid.	**Biomass**

Game card solutions and glossary

Organic material which can be used to produce energy.	Biomass
A state of matter. It can be poured and take on the shape of the container.	Liquid
The process of change from a liquid into a gas.	Evaporation
The process of changing a solid to a liquid.	Melting
A source of fuels which comes from plants or animals.	Biofuels
A source of energy, e.g. wood, gas, coal.	Fuel
The space taken up by a substance.	Volume
To be in flames, a change that is irreversible which involves fuel, oxygen and a flame.	Burning
The process of increasing the temperature of an object.	Heating
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A change that cannot easily be reversed e.g. burning.	Irreversible changes
A source of energy that does not involve the burning of fossil fuels and won't run out.	Renewable energy
The downward force on an object caused by gravity.	Weight
A force affecting movement between two materials.	Friction
The method to reduce the friction between two surfaces.	Lubrication
The process of separating a solid from a liquid.	Filtration

Appendix 5: Spinner

- Cut out the spinner and paste on to a piece of card. Place a paper clip to the centre of spinner.
- Put the point of a pencil in the middle of the spinner through the paper clip.
- Spin the paper clip round.
- Where the paper clip stops indicates how the word should be represented.