TIDY AND SORT

A science investigation pack for teachers of 5-7 year olds

CENTRE for INDUSTRY EDUCATION COLLABORATION

ExxonMobil

Contents

Introduction

The material in this book is aimed at teachers of 5-7 year olds, though the activities can be modified for use with other age groups.

Tidy and sort can be taught through the following cross-curricular themes; Materials, magnetism, shape and water.

CONTEXT

This package provides an opportunity for the children to investigate a variety of 'mixtures' and the means by which they are best separated.

The activities are put in context using a storybook, in which two sisters are presented with tubs of mixed objects to sort out. One of the sisters always wants to find the easiest way to sort the objects, and the other sister begins to use the same approach.

In the first activity the children tackle the problem of sorting marbles from Lego bricks, in which they are encouraged to use the rolling property of the marbles.

Other mixtures they are asked to sort include: paper-clips and stamps, sand and dried rice, and ice and plastic cutlery.

In the final activity, the children are presented with a sample of muddy water to 'clean'. They are encouraged to make use of the problem-solving techniques they have learned in the previous activities.

The number of activities used and the order in which they are done can be varied. A description of each activity and its approximate duration is given overleaf.

ACTIVITY SUMMARY

Title	Description	Timing
Introduction	Ideas for tidying the bedroom and classroom.	30 mins
1. Marbles and Lego	Sorting marbles and bricks by rolling the marbles away from the Lego.	30 - 60 mins
2. Paper clips and stamps	Collecting paper-clips with a magnet from a tub which also contains stamps.	30 - 60 mins
3. Rice and sand	Sieving rice from a mixture of rice and sand.	1 - 1.5 hours
4. Cutlery from ice	Melting ice to remove plastic cutlery trapped inside.	1 - 2 hours
5. Muddy water	Improving the clarity of 'muddy' water by filtration.	1.5 - 2 hours

Teachers' notes

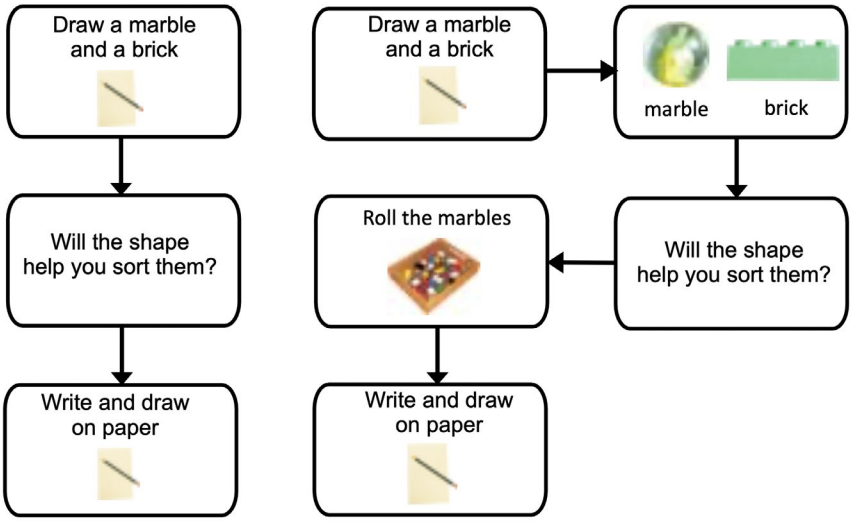
DIFFERENTIATION

Each activity follows a question posed in the storybook. The presentation of these activities, and the manner in which the children report their findings will depend largely on their reading and writing ability. The children's sheets that accompany the activities suggest a variety of formats to cater for this ability range. The teacher must choose the appropriate format for the children concerned.

The storybook can be read in its entirety, as the introduction to the activities in this package. Alternatively the relevant pages can be read to introduce each activity, and provide the stimulus for discussion, e.g. pages 3-4 are read to the class to introduce activity 1. In this way the length of discussion at the start of the activity is limited. The story can be recorded so that children can listen to the story in the 'listening corner'.

Some of the storybook has been reproduced as activity sheets, so that a page can be made into a story card. Presenting a story card alongside a box of resources leaves the task open-ended for the children to carry out their own investigations.

Small prompt cards can be made from further activity sheets. These cards guide the children through the task in a more directed manner, and allow the children to follow instructions and complete the activities independently. The same instructions could be given by the teacher if desired. Throughout these notes the teacher is referred to as the provider of the relevant instructions, though the prompt cards play a similar role. The teacher chooses the selection of cards that are given to the children, depending on the children's ability. The cards can be stuck to a sheet of sugar paper, or joined using a treasury tag, and displayed with the required resources. Here are two possible selections for activity 1:



Finally, there are some record sheets to help the children to report their findings. These can be enlarged to provide younger children with more space to write and draw. Lines to write on can be blanked out or added to, according to the ability of the child. Some children will be able to write independently, others will require teacher support during the activity. Teachers can incorporate predictions etc. on these sheets if desired. Children can also report their findings orally (possibly using recording equipment) or pictorially.

INTRODUCTORY ACTIVITY

A discussion of the illustration on pages 1-2 of the storybook (reproduced on Activity sheet 1) provides a useful starting point for the sorting activities. The children are asked to think of ways in which Brenya's side of the room could be tidied. Simple examples include:

- folding the clothes and sorting into separate drawers or shelves
- sorting the toys to put back into the toy box
- making the bed.

The children may also point out possibilities for sorting the stamps/paper-clips and the Lego/marbles.

The children could try to think of ways of tidying and sorting activities in their own school. For example; sorting the box of lost property; tidying clothes in the role play area; improvements to other areas of the classroom, such as the maths equipment or art materials, etc. Many of the children's ideas can be followed up with sorting activities, and the teacher can decide how many ideas to use at this stage. These activities are important as they establish the need to be able to sort mixtures.

Beth and Breya share a bedroom. They are twin sisters.

Beth is very tidy.
Beth tidies up carefully.

Brenya is not tidy.
Brenya tidies up quickly.

1. Marbles and Lego

1 hour

Sorting marbles and bricks by rolling the marbles away from the Lego.

OBJECTIVES

- To distinguish between an object and the material from which it is made.
- To identify and name a variety of everyday materials, including wood, plastic, glass, metal, water and rock.
- To describe the simple physical properties of a variety of everyday materials.
- To compare and group together a variety of everyday materials on the basis of their simple physical properties .
- To use their observations and ideas to suggest answers to questions.

RESOURCES

(Per group of 4 children unless otherwise stated)

- 20-30 marbles, minimum (or conkers, counting beads, etc.)
- 20-30 Lego bricks, minimum (6-8 peg pieces)
- 3 tubs
- Tray[1]
- Tea-towel[1]
- Activity sheet 2, made into story cards and/or
- Activity sheet 3, made into prompt cards[1] and/or
- Activity sheet 4 (per child)

INTRODUCING THE ACTIVITY

The children are given a tub of Lego bricks and marbles mixed together, as shown in the storybook. The story card is used to encourage the children to think of their own ideas of how they might separate the marbles and bricks without lifting them out one at a time, e.g. fixing all the Lego bricks together, adding water to see if the bricks would float, taping card over most of the tub to 'pour out' the marbles, blowing bricks up a sloping surface away from the marbles, etc.

The children can use Activity sheet 4 to record the activity. More able children could use this sheet to record predictions before carrying out their test, record what they do and give reasons for the outcome.

1 Denotes items required for a structured rather than an open-ended approach.

For a more structured approach, the teacher can provide extra information with prompt cards or questions to encourage the children to think about the differences between the two types of objects that they want to separate. This should lead the children to think about marbles being round and the bricks having corners, and how the round marbles roll but the bricks do not.

The following questions may help promote ideas:

- How might you sort the marbles and Lego bricks?
- How are the marbles different from the Lego bricks?
- What else is the same shape as a marble?
- Do marbles/Lego bricks move easily?
- How do marbles move down a slope?
- Can you make a slope with this tray?
- What will happen if we put a tea-towel on the tray? Why?

The teacher can suggest using the tray, and ask how this might help the children separate the marbles from the Lego. The Lego and marbles may slide down the slope together, as a tray provides a smooth and slippery surface. Adding a tea-towel provides a rough surface to which the bricks stick. The children try to roll the marbles away from the Lego bricks, by shaking and sloping the tray and removing the marbles, several at a time, when they slide to one end.

EXTENSION ACTIVITY

Groups of children brain-storm methods which use the property of shape to sort objects, or where the property of shape is useful in other ways. Examples could include; wheels and balls being round to move or roll along the ground easily; games for pushing blocks through holes of different shapes; keys fitting key holes; assortments of biscuits in which varieties are separated into hollows of different shapes and sizes. They produce pictorial lists of their ideas and compare these with the lists of others during whole class discussion.

Beth starts picking the marbles out of the box. Beth tells Brenya that she must help.

How will Brenya sort the

Activity Sheet 3

Draw a marble and a brick.

marble brick

Will the shape help you sort them?

Roll the marbles.

Write and draw on your paper.

Activity Sheet 4: Cards for marbles and Lego

Draw

marble

brick

2. Paper clips and stamps

1 hour

Collecting paper-clips with a magnet from a tub which also contains stamps.

OBJECTIVES

- To distinguish between an object and the material from which it is made
- To identify and name a variety of everyday materials, including wood, plastic, glass, metal, water and rock.
- To describe the simple physical properties of a variety of everyday materials.
- To compare and group together a variety of everyday materials on the basis of their simple physical properties.
- To use their observations and ideas to suggest answers to questions.

RESOURCES

(Per group of 4 children unless otherwise stated)

- 20-30 paper-clips
- 20-30 old stamps (or small squares of paper, cut with pinking shears)
- Tub
- Magnet[1]
- Activity sheet 5, made into story cards and/or
- Activity sheet 6, made into prompt cards[1] and/or
- Activity sheet 7 (per child)

INTRODUCING THE ACTIVITY

The children think of ideas for separating the mixture, e.g. making chains of paper clips or clipping sets of stamps together (slow but effective sorting), blowing the stamps gently away, picking up stamps with a damp sponge, etc. If moving on to the structured activity the children should be encouraged to look for differences between the items, and to think about what the stamps and paper- clips are made from. Using the story picture showing a magnet, children can be asked what Brenya is using to sort the mixture.

- How are the paper-clips different from the stamps?
- What are paper-clips made from?
- What do magnets do? Would a magnet help you?

1 Denotes items required for a structured rather than an open-ended approach.

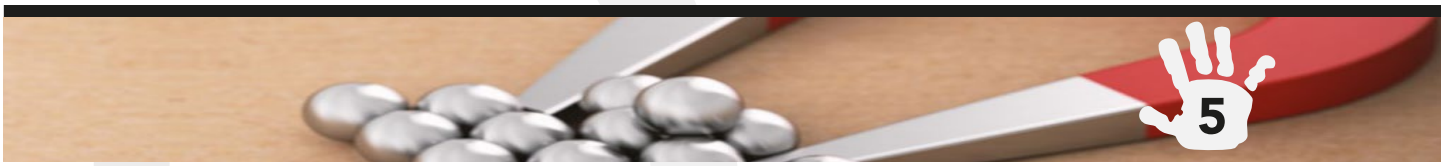
Choosing the magnet as a means to separate the paper-clips will depend on the previous experience the children have had with magnets. If they have had little or no experience, the teacher may want to precede this task with an exploration activity using magnets. Otherwise, the teacher suggests the children rest the magnet on the stamps and paper-clips to find out what happens. In this way the children will be able to lift out the paper-clips from the tub. They could have a competition to see who can lift the most paper-clips with one touch of the magnet.

N.B. Stamps are sometimes lifted with the paper-clips. To avoid this, the tub can be shaken to reveal paper-clips. The children place the magnet near the exposed metal.

Activity sheet 7 can be used by children of varying abilities, either as a record of what they did, or to record predictions and explanations also.Magnets only attract materials containing iron. The children should realise that the mixture must contain metal and non-metal objects for the magnet to be a useful 'sorter'. Some may be able to understand that not all metal objects can be sorted in this way, but only a 'special' metal - namely iron. N.B. Nickel is magnetic and some stainless steel is not magnetic, although it contains iron. These cases should not be covered at this stage.

EXTENSION ACTIVITY

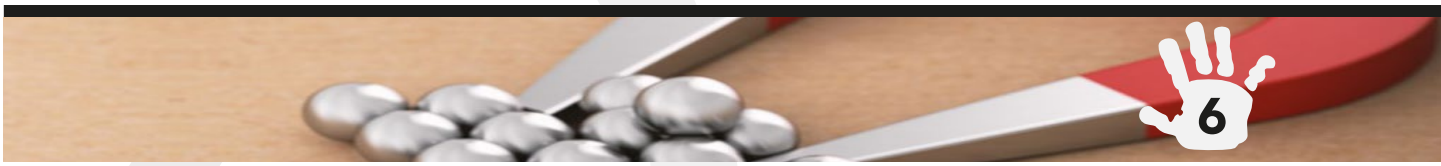
The children investigate other mixtures, such as pennies and crayons, rubber bands and badges, etc. to see if they can sort these out in a similar way. They could also suggest other mixtures that can be separated using a magnet. For example, aluminium cans can be separated from steel ones for recycling purposes.



Beth looks at the box of paper-clips and stamps.

She asks Brenya if she can think of a fast way to sort them. What will Brenya do?

Activity Sheet 6: Cards for stamps and paper-clips



Draw a stamp and a paper-clip.

stamp paper-clip

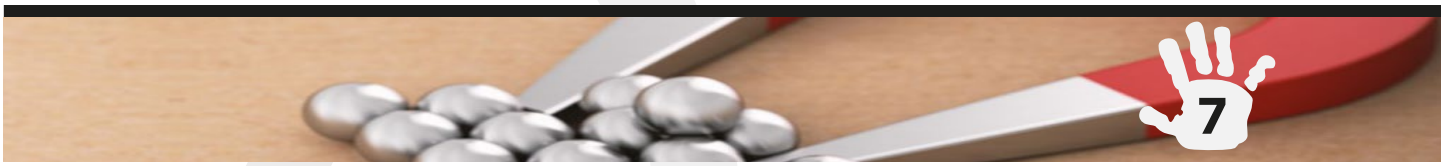
Will a magnet help you sort them?

Put the magnet near the paper-clips.

Write and draw what happened.

Can you use a magnet to sort anything else?

Activity Sheet 7: Sorting stamps and paper-clips



Sorting stamps and paper-clips

stamp	paper-clip

Write and draw what you did.

3. Rice and sand

1 hour

Sieving rice from a mixture of rice and sand.

OBJECTIVES

- To distinguish between an object and the material from which it is made.
- To identify and name a variety of everyday materials, including wood, plastic, glass, metal, water and rock.
- To describe the simple physical properties of a variety of everyday materials.
- To compare and group together a variety of everyday materials on the basis of their simple physical properties.
- To use their observations and ideas to suggest answers to questions.

RESOURCES

(Per group of 4 children unless otherwise stated)

- Bucket of dry fine sand
- 250-500g dried rice
- Large sieve or colander[1]
- Large tub (wider than the sieve) or spare bucket Tub (to gather the rice in)
- Activity sheet 8, made into story cards and/or Activity sheet 9, made into prompt cards S and/or
- Activity sheet 10 (per child)

INTRODUCING THE ACTIVITY

The idea of looking for differences is reinforced, observing the sand and rice in the mixture. The children should realise that the grains of rice are larger than the grains of sand. However, they should test ideas of their own before using a sieve or colander. Ideas may include 'sprinkling' the rice out of the sand through the fingers of their hands, using a fork or spoon, wetting sand, finding out if the rice will float, etc.

If wetting sand, ensure only a small quantity of sand has water added, so enough dry sand is available to carry out other ideas.

- How is the sand different from the rice?
- Can any differences help you sort the rice out quickly?
- Is there anything in the picture that gives you an idea for sorting rice from sand?

1 Denotes items required for a structured rather than an open-ended approach.

On page 8 of the storybook sieves and colanders are shown near the sand tray. If the children still need help, the teacher can give the children a box of resources containing sieves and colanders amongst other things, for them to investigate.

The children pour the mixture into the sieve or colander, holding the colander over an empty bucket. The sand is replaced in the sand tray, and the rice put in a labelled tub.

EXTENSION ACTIVITY

The children investigate the use of sieves with holes of different sizes. More able children can make their own sieves for sorting mixtures such as dried peas and lentils or marbles and Lego bricks. The children must realise that the holes must be bigger than the marbles/lentils, but smaller than the Lego bricks/dried peas.

Top view

Side view

A sieve can be made from a circular piece of card with holes for the marbles, dried peas, etc. to fall through. A strip of card is then taped around the edge.

Conical sieves can also be made from a circular piece of card with holes in for the sand to fall through.

Cut the card to the centre, to overlap the cut edges to make a cone. Secure the shape with tape.

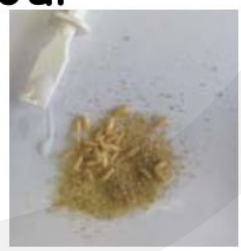
8

On Monday the sisters tell the teacher about the tidying they did at home.

Mr Wilson asks them to sort some rice and sand out. What will they do.

Activity Sheet 9: Cards for rice and sand

Stick rice and sand on your paper.



rice

sand

How will a sieve help you?

Pour the sand and rice into the sieve.

Write and draw what happened.

Can you sieve anything else?

Activity Sheet 10: Sorting rice and sand

Write and draw what you did.

4. Cutlery from ice

2 hours

Melting ice to remove plastic cutlery trapped inside.

OBJECTIVES

- To distinguish between an object and the material from which it is made.
- To identify and name a variety of everyday materials, including wood, plastic, glass, metal, water and rock.
- To describe the simple physical properties of a variety of everyday materials.
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- To use their observations and ideas to suggest answers to questions.

RESOURCES

(Per group of 4 children unless otherwise stated)

- Tall plastic beaker or yoghurt pot[1] (about the same height as the plastic cutlery) 1 plastic knife, fork, and spoon[1] (per child)
- Freezer compartment[1]
- Source of hot water/radiator
- Stopclock or egg-timer
- Pair of gloves
- Salt (optional)
- Activity sheet 11, made into story cards and/or
- Activity sheet 12, made into prompt cards[2] and/or
- Activity sheet 13 (per child)

Safety note

It must be emphasised that children need close adult supervision when using hot water. The temperature of the water used should not exceed 60°C.

1 The teacher must freeze the sets of cutlery in the container of water prior to the lesson. They should be taken out of the freezer just before the children need them. Alternatively, 'lollipops' can be made by freezing lollipop sticks in water (mixed with food colouring) inside small yoghurt pots. N.B. These 'lollipops' should not be eaten.

2 Denotes items required for a structured rather than an open-ended approach.

INTRODUCING THE ACTIVITY

The task is for each child in the group to get a knife, fork and spoon as quickly as possible, without breaking the ice.

The children will now be more familiar with looking for differences between the components in the mixture they are trying to separate. They should be thinking about the properties of ice and the fact that it will melt at room temperature, but the cutlery will not.

This task could be tackled at different levels and possible solutions are listed below. All these methods will enable the children to obtain their sets of cutlery from the cup, the first four methods being slower than the others:

- Waiting for the ice to melt
- Putting their hands around the container (wearing gloves, as the container is very cold)
- Putting the container on a radiator
- Putting the container in a sunny place
- Pouring out the cold water surrounding the ice as it melts
- Placing the container in a bowl of hand-hot water (the hot water can also be replaced at regular intervals)
- Holding the container under a tap of running hot water.

The first method is used as a control, to demonstrate how long the ice takes to melt if nothing is altered to accelerate the melting of the ice. This will take several hours and will be a great deal slower than any of the other methods.

Some methods used will allow children to begin filling in their record sheet whilst waiting for the ice to melt.

Children may suggest methods that will insulate the ice, e.g. wrapping the tub in a scarf, as children associate this with warmth. The teacher can allow children to try these ideas. After the test an explanation can be offered for the ice melting slowly, e.g. clothes slow down the movement of heat (energy) in order to keep our body warmth in.

The children time how long it takes to complete the task, so the fastest method of melting the ice can be determined. If using an egg-timer, a child can be responsible for seeing when the sand runs out and turning the timer over. Each time it is turned, the children put a tick or tally mark on their record sheet. Stopclocks could also be used by those children who can operate and read them.

EXTENSION ACTIVITY

The effect of sprinkling salt on top of the ice could be investigated. Adding salt to the surface of the ice will lower its melting point by several degrees Celsius, which accelerates the melting of the ice. As the ice melts, the layer of water could be poured away and fresh salt sprinkled on the surface of the ice.

The children can then discuss the reasons for spraying the roads with salt in winter, i.e. the salt prevents water on the roads from turning to ice, therefore reducing skidding and road accidents.

The effect of changing the temperature of warm water surrounding the ice can be investigated.

On Tuesday Mr Wilson gives all the children a cup of ice, with cutlery trapped inside.

He asks them to get the cutlery out of the ice. What will Beth and Brenya do?

Activity Sheet 12: Cards for ice and cutlery

knife

spoon

fork

How will warm things help you get the cutlery?

water

radiator

Time how long it takes to get the cutlery.

Write and draw what you do.

Activity Sheet 13: Cutlery from ice

What we did.

How long?

5. Muddy water

2 hours

Improving the clarity of 'muddy' water by filtration.

OBJECTIVES

- To distinguish between an object and the material from which it is made
- To identify and name a variety of everyday materials, including wood, plastic, glass, metal, water and rock
- To describe the simple physical properties of a variety of everyday materials
- To compare and group together a variety of everyday materials on the basis of their simple physical properties
- To use their observations and ideas to suggest answers to questions

RESOURCES

(Per group of 4 children unless otherwise stated)

- Sample of 'muddy water' containing;
- 1 litre water
- 3-4 leaves
- 3-4 teaspoons gravel/small stones
- 3-4 teaspoons sand
- 3-4 teaspoons garden soil (see safety note)
- Range of sieves and colanders, e.g. tea-strainers, flour sieves, tights, fishing nets, cotton-wool, paper towels, etc.
- Funnel
- Large jugs
- Plastic apron/old shirt (per child)
- Magnifiers (optional)
- Activity sheets 14, 15 made into prompt cards and/or
- Activity sheet 16 (per child)

The teacher could present this activity in a similar manner to 'Mr Wilson' in the storybook, or could play the role of an inspector from the Water Authority who visits the school. The inspector brings the water samples and asks the class to do something about the muddy water that is in the reservoir (or 'lake') where our water comes from.

This activity requires a similar solution to the sand/rice task that the children have carried out. It can be left open-ended to assess whether the children can use the investigative approach independently. The teacher provides the children with the necessary resources and asks the group to try and clean the water.

INTRODUCING THE ACTIVITY

The teacher could present this activity in a similar manner to 'Mr Wilson' in the storybook, or could play the role of an inspector from the Water Authority who visits the school. The inspector brings the water samples and asks the class to do something about the muddy water that is in the reservoir (or 'lake') where our water comes from.

This activity requires a similar solution to the sand/rice task that the children have carried out. It can be left open-ended to assess whether the children can use the investigative approach independently. The teacher provides the children with the necessary resources and asks the group to try and clean the water.

- What can you see in the water?
- How is the water different from the things in the water?
- How might the things in the box/on the display help you?

If direction is required, the teacher asks the children to try and work out what the mixture is made up of. They are asked to think of the differences between the sand, compost, stones and leaves in the mixture, and how the box of resources could be used to sort these out from the water. They can be asked which of the resources have got holes in which could be used as a sieve (they should hold the paper towels or tights up to the light).

N.B. The finer filters such as the paper towels take 30 minutes or more to separate the compost out. The children can be asked to draw or write about their test whilst waiting for the filtering to finish.

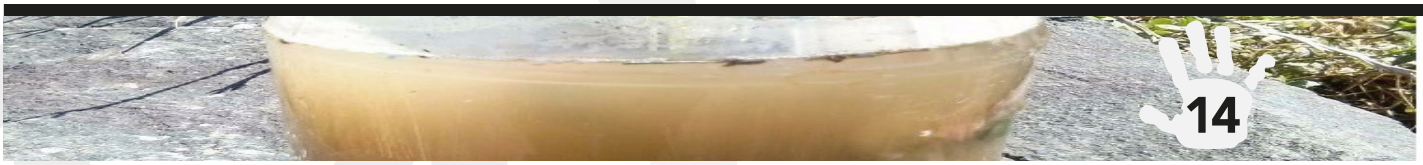
Children might think of allowing the mixture to settle for 10-15 minutes and then decanting the contents. This will remove a lot of the solids before filtration is required.

More able children may be able to set up series of 2-3 filters, to filter large stones and leaves first and fine compost last.

The children in the different groups then compare the clarity of their water samples, by holding them up to the light to see if there are any particles in suspension, or any sediment at the bottom. They can also observe their 'clean' water using magnifiers such as hand lenses, bug boxes or microscopes.

The teacher could resume the role of the Water Inspector to 'judge' the water samples and possibly choose the group that has produced the clearest water for special mention.

Activity Sheet 14: Cards for Muddy water



Draw the jar of water.

Clean the muddy water.

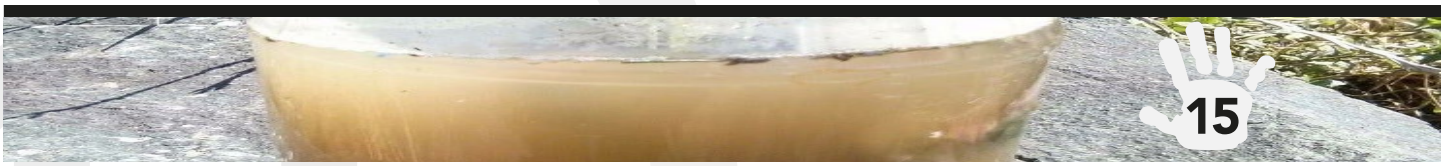
Which things will help you?

Time how long it takes to filter the water.

Write and draw what you do.

colander

Activity Sheet 15: Cards for Muddy water



fishing net

filter paper

sock

sieve

tea strainer

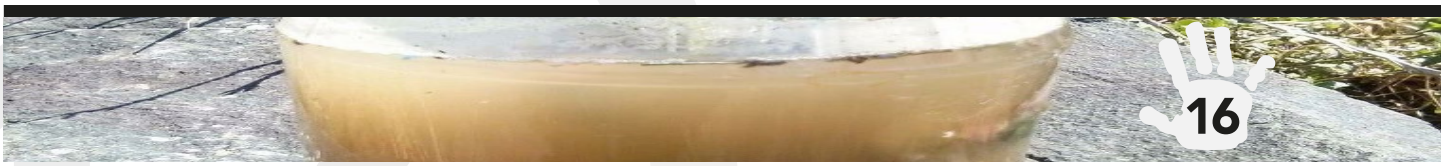
paper towel

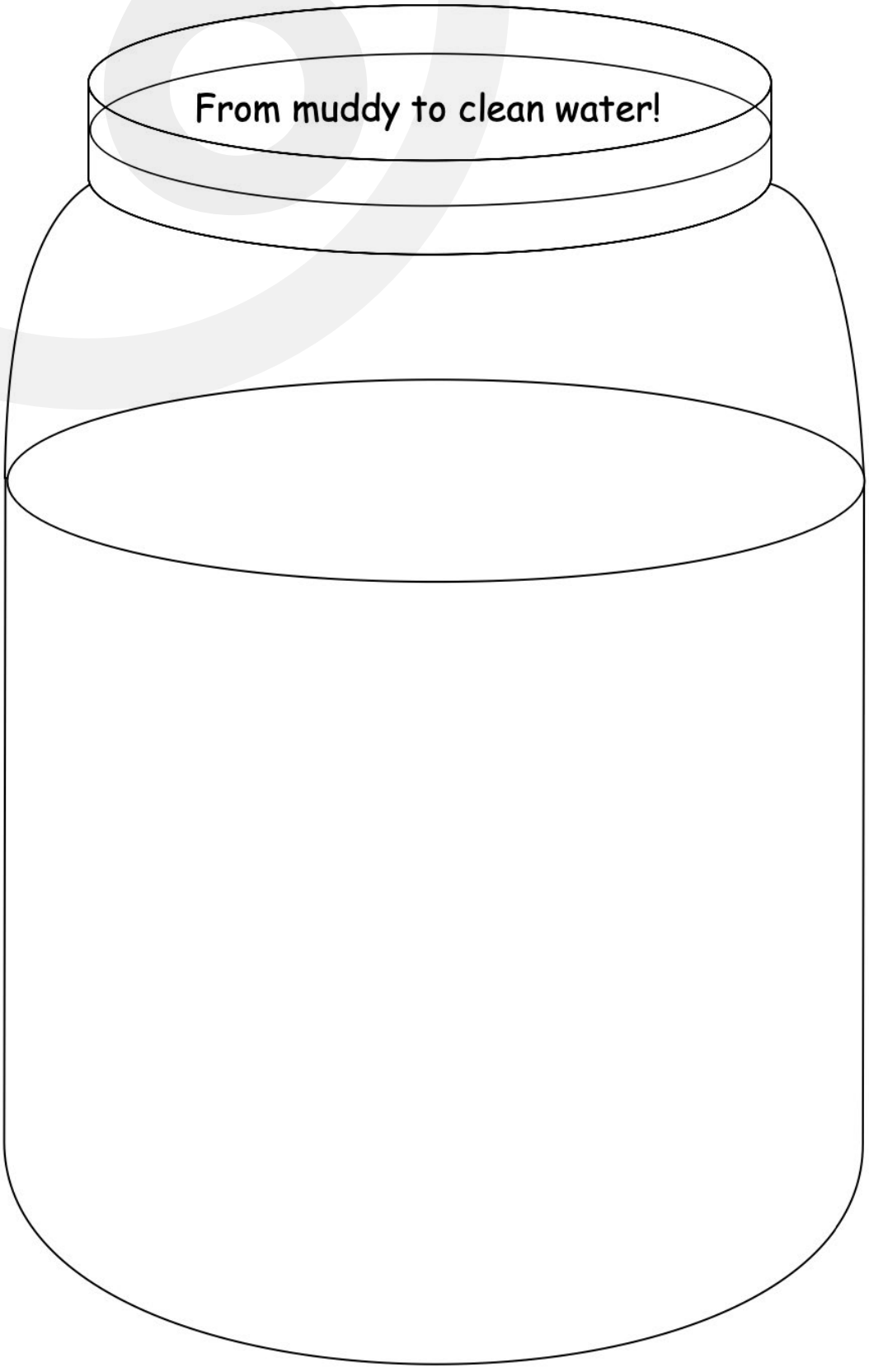
tissue

egg timer

funnel

Activity Sheet 16





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