RAiSE
Raising Aspirations in Science Education

STEM IN THE OUTDOORS

FIRST – SECOND LEVEL (P4-7)

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Introduction

This resource was created for a small rural school in Aberdeenshire, comprising 2 classes: P1-4 and P4-7; these are the activities for P4-7. The activities were undertaken in a whole day of STEM Outdoor learning which was also attended by parents and grandparents who participated in the activities alongside their children.

The programme for the day was as follows:

STEM IN THE OUTDOORS FAMILY LEARNING DAY

9.15 am – 10.15 am

- UV bead investigations – P1-4/P4-7
- Build a raft from natural materials – P1-4

BREAK

10. 30 – 11.30 am

Build a shelter for UV sensitive animals – 7 groups of 3 children

11.30am - 12.30pm

- Tree activity P1-4/P4-7
- Water Race (20 minutes) - 3 teams of 7 children

LUNCH

1.30 – 3.15 pm

Bug hunt P1-4/P4-7

Bug hotels P1-4/P4-7

The bug hotels were constructed in the classroom and were started but were completed the next day due to lack of time.

A risk assessment was undertaken for the day and is included in this document. This should be regarded as an example; each establishment should complete their own to reflect their own setting.

Many thanks to Forgue School, Head Teacher Mrs Matthew, staff, pupils and parents for piloting this resource and for providing the example programme for the day and the risk assessment.

Activity assessed	Family Learning – STEM Outdoor Learning Day
Date of assessment	
School	

Step 1	Step 2	Step 3		Step 4		
List Significant hazards here:	*Who might be harmed and how?*	*What are you already doing?*	*What further action is needed?*	*Action by whom?*	*Action by when?*	*Done*
Use of bench hooks and junior hacksaws Use of hammers and panel pins. Handling of sticks, stones, grass etc.	Pupils may be harmed by the saw Pupils may be harmed by hammer/panel pins Pupils – contamination from dirty fingers	Children are appropriately supervised when using hand tools. Children are instructed in the use of tools. The tools are adequately maintained by a competent person. The tools are stored correctly in a secure place. Pupils to be reminded to wash hands and not touch mouth etc.	Teacher to set up area in classroom where tools can be used safely with adequate supervision. Tools should be tidied away immediately when finished. Ensure hands are washed frequently on the day.			

Description of activity:

Making bug hotels.

Step 1	Step 2	Step 3		Step 4		
List Significant hazards here:	*Who might be harmed and how?*	*What are you already doing?*	*What further action is needed?*	*Action by whom?*	*Action by when?*	*Done*
Children to be supervised when investigating the local area	Members of group	Brief group about environment – children know that they must be in sight of an adult at all times.	Remind children on the day that they must be able to see an adult at all times.			
Injury from branches when looking at branches/plants on paths	Members of group	Avoid pulling branches. Ensure that observers are beyond reach of low branches. Long sleeves/trousers to be worn				
Slips and trips on wet paths/grass	Members of group	Brief group for conditions. Advise suitable footwear.				
Skin damage from UV in sunlight	Members of group	Advise wearing hats and taking water. Parents to provide sunscreen.				
Risk of injury when exploring the environment – nettles, lifting stones, slips/trips	Members of group	Long sleeves/trousers to be worn. Remind pupils to get adults to help when lifting stones. Replace stones carefully to prevent injury to fingers.				
Handling of sticks, stones, grass etc.	Pupils – contamination from dirty fingers.	Pupils to be reminded to wash hands and not touch mouth etc.				

Description of activities:
UV Bead investigations; Minibeast hunt; Building UV shelters – gathering plants, natural materials; Water race; Tree activities – investigating the local environment

ACTIVITY 1: Revealing UV light with colour changing beads

Background information:

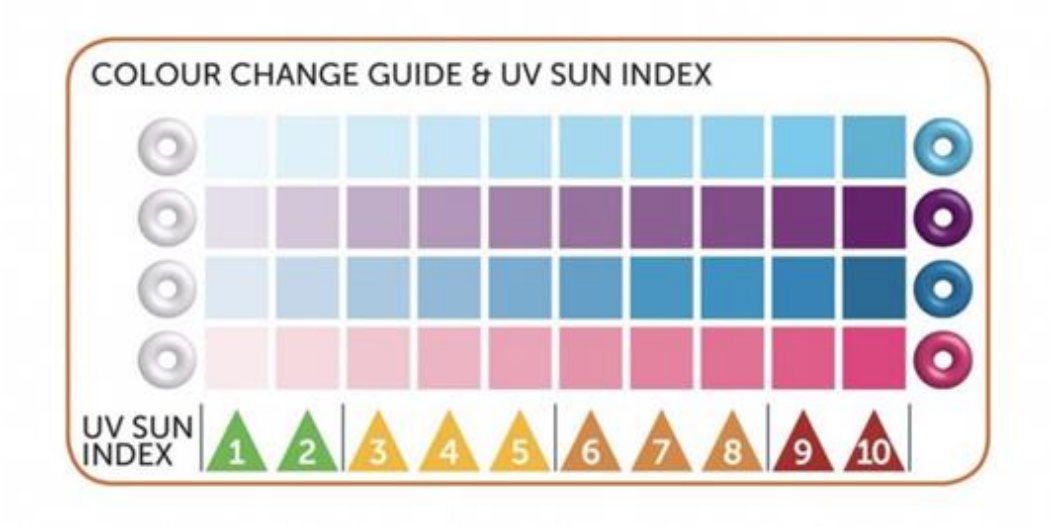
Ultraviolet radiation (also called UV light) is a type of light energy also called electromagnetic radiation. There are many forms of light energy and UV is one form of light energy; other forms include incandescent light, fluorescent light, halogen lights, LEDs, sunlight, neon etc. They are different based on the wavelengths they produce and how the light is produced. Some of these wavelengths create the visible spectrum and allow us to see colours. None of the energy present in the UV part of the spectrum is visible to the human eye; the only light energy that can be seen is called "visible light." Thus, UV light is not visible.

UV Beads: The beads are white in ordinary, visible light but in UV light. While you cannot see UV light, this high-energy light excites the dye molecules in the beads resulting in a change in the shape of the dye molecules. The new shape affects the light colours the molecules absorb and reflect. Beads that turn red when exposed to UV light contain a dye whose molecules absorb all the visible light colors except red. Any red light striking the bead is scattered in all directions resulting in the beads' red colour; they become assorted colours depending on the pigment added to each bead.

I have contributed to discussions of current scientific news items to help develop my awareness of science. ***SCN 1-20a***

By contributing to investigations into familiar changes in substances to produce other substances, I can describe how their characteristics have changed. ***SCN 2-15a***

I can report and comment on current scientific news items to develop my knowledge and understanding of topical science. ***SCN 2-20b***



0 = no UV light gets to the beads (i.e., it's a great UV blocker); 10 = all the UV light gets to the beads (i.e., it's a poor UV blocker) (Full sized chart on page 16).

Most weather forecasts now include a UV Index, so you know when it's safe to stay out in the sun a little longer. The UV Index goes from 0 to 11+; the higher the number, the less time you should be in the sun. The index changes according to the time of day and the season as well as the weather conditions. UV – how to stay safe in the sun - BBC Weather

Take the beads outside and pupils observe what happens. Discuss. Let them investigate what happens in different places using the colour change guide. E.g., in the shade, under a tree, etc.

Qu: Will the beads still react to UV light if they are put into different liquids?

Groups will need:

- Approximately 5 transparent cups/containers; enough to test each of the liquids
- 5 beads per cup
- a variety of liquids e.g., milk, water, coco cola, orange juice, sugar solution etc.,
- measuring cylinders/beakers to measure amount of liquid to put in each cup
- colour change guide chart

Talk about predictions and why; set up investigation with a control (no liquid) Cover up for a minute and then uncover and observe change in colour.

What happens if the liquids are stirred? What happens if you cast a shadow over the cups/beads? Do any of the beads stay the same colour?

Discuss observations. How do the results compare to the beads in the control cup without liquid?

Did any of the liquids protect from UV light? *Relate this to e.g., sun protection when swimming etc. UV reflects off the water which can cause sun burn if no sun protection is used.*

What happened when the beads were in the milk? *White reflects UV rays which can result in the beads being affected by reflected/increased UV radiation*

Suggested extension/additional activities:

- Observe how well the beads change colour when exposed to sunlight at different times of the day. Can you identify what time of day the sun gives off its most intense UV light?

- Test a variety of glass and plastic containers, or even prescription bottles, to determine which materials might block UV light. Place different transparent materials over the beads and observe what happens.
- The front windshield of most cars absorbs some UV radiation, so that the driver gets less eye strain. Usually, the side windows in a car do not have this built-in protection. Can you test this?

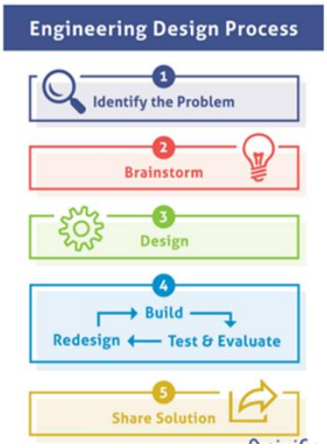
- Investigate sunscreens with different SPF and how effective they are in protecting us from the sun or test sunscreens of different brands with the same SPF. Do they all work as well?

The easiest way to do this is to put an equal number of beads into sealable plastic bags. Use one as the 'control' so this one will not have any sunscreen. Label the other bags with whatever is being tested and evenly spread a half-teaspoon of sunscreen directly onto the bag. Let the sunscreen dry completely and lay the bags next to each other in direct sunlight and watch them for two to three minutes. Sort the bags by the brightness of the colours by placing the brightest colours on the left (starting with the Control) and the palest colours on the right, and the other bags by decreasing colours in between.

Now check the labels to see how effective the sunscreens are. If the sunscreen products are performing as advertised, you should easily see colour differences in the bags. The Control bag on the left is full of colourful beads. At the right should be the palest beads under the highest SPF product with lower numbers on the other bags as the colours get less bright.

This links to HWB:

I am learning to assess and manage risk, to protect myself and others, and to reduce the potential for harm when possible. ***HWB 0-16a / HWB 1-16a / HWB 2-16a***



- The children could also design and make a decorated sunhat that incorporates UV sensitive beads. How will the hat be constructed? What will it look like? Who is it for? It will need to keep the wearer cool, protect them from the sun but what other features could it have?

This activity lends itself to the Engineering Design process and the opportunity to research different hats as they brainstorm their ideas.

I can design and construct models and explain my solutions. ***TCH 1-09a***

I can extend and enhance my design skills to solve problems and can construct models. ***TCH 2-09a***

Design and build a shelter to protect an animal from the sun

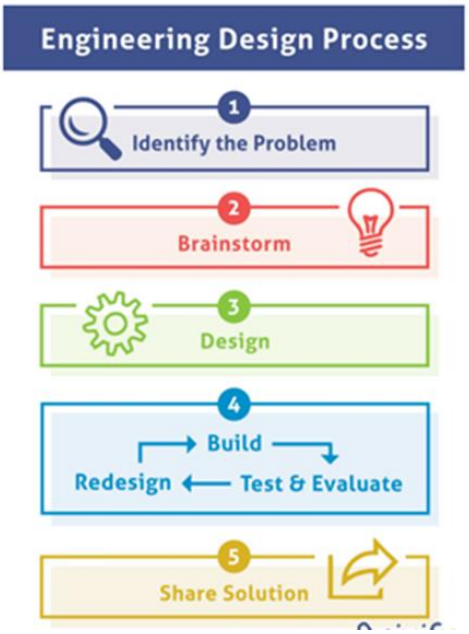
I can design and construct models and explain my solutions. ***TCH 1-09a***

I can extend and enhance my design skills to solve problems and can construct models. ***TCH 2-09a***

Each group to make a creature with a pipe cleaner and UV beads. The beads are white in the shade/inside but coloured outside. Talk about how we keep ourselves safe in the sun (*sun hats, sunglasses, long sleeves t-shirts, suntan lotion etc).* How could we protect our creatures from the sun? *By building a shelter – either from natural materials found outside or from recycled/craft materials.* Test them out! (Set some design criteria: must have a door, must be free standing etc)

This activity should involve the engineering design process to ensure it is a STEM activity rather than an arts and craft activity:

The groups will need time to brainstorm and maybe sketch ideas out for their design and have time to build, test and improve their shelters.



ACTIVITY 2: Bug Hunt!

Background information:

96% of all known animals are invertebrates (animals without backbones). Animals are either vertebrates (animals with a backbone e.g., birds, fish, mammals, and there are 60,000 species) or invertebrates (animals without backbones e.g., insects, worms, spiders, and there are 1.3 million species).

It is important that all living creatures are disturbed as little as possible and returned to the exact spot where they were caught. Learners should be encouraged to replace rocks and stones gently back where they found them and follow all health and safety advice given e.g., washing hands before eating.

I can distinguish between living and non-living things. I can sort living things into groups and explain my decisions. ***SCN 1-01a***

I can identify and classify examples of living things...to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction. ***SCN 2-01a***

This activity is based on 'Bugs Count' by the Natural History Museum and uses the OPAL Bugs Count Pocket ID Guide (see pages 17 – 40). It involves 3 x 15-minute challenges – the children could be grouped in 3s and do all 3 or each group could just do 1 but for longer?

Challenge 1: Search for bugs on soft ground surfaces

Each group will need:

- A container to put the bugs in while they identify them
- A tray or ice cream tub (for searching leaf litter)
- Survey sheet
- iPad to photograph the invertebrates (optional)

Search for 15 minutes on soil and short grass, amongst fallen leaves and compost for as many invertebrates as you can find.

- Try disturbing the top layer of soil.
- Look amongst short grass.
- Put a few handfuls of fallen leaves in a tray then watch to see what moves.
- Look underneath stones, pots or logs standing on soil or grass

Identify the bugs using the Pocket ID Guide within the15 minutes

Record the number of each type of bug that you find

If you cannot identify it, record it as 'Other invertebrates'

Challenge 2: Search for bugs on human-made hard surfaces?

Each group will need:

- A container to put the bugs in while they identify them
- Survey sheet
- iPad to photograph the invertebrates (optional)

Spend 15 minutes looking for invertebrates on all the human-made hard surfaces in your area, like paving, fences, and the outside of buildings.

- Check under windowsills – a favourite place for spiders.
- Look on paving and under plant pots and other things standing on hard surfaces
- Some bugs like to sun themselves on walls, fences, and paving.

Identify the bugs using the Pocket ID Guide within the15 minutes

Record the number of each type of bug that you find

If you cannot identify it, record it as 'Other invertebrates'

Challenge 3: Search for bugs on plants

Each group will need:

- A container to put the bugs in while they identify them
- Dustpan and brush (optional)
- Magnifier
- Survey sheet
- iPad to photograph the invertebrates (optional)

Search for 15 minutes for bugs amongst the plants in the area, including long grass, flowers, climbing plants and trees.

- Look on leaves and stems - first use your eyes and magnifier only
- Look on flowers - record flying insects you can't identify as UFIs (Unidentified Flying Insects
- On trees & bushes - gently brush or sweep the plants to dislodge the bugs into your dustpan

Identify the bugs using the Pocket ID Guide within the15 minutes

Record the number of each type of bug that you find

If you cannot identify it, record it as 'Other invertebrates'

There are lots of opportunities to extend this Maths wise for older pupils: e.g., can they work out fractions and percentages from their survey, can they combine their results with the results of another group surveying the same habitat and tally the totals, work out fractions and percentages etc. Can they produce a graph etc.

The pupils come together and share and compare their results. Which habitat yielded the highest/lowest number of bugs/ the greatest /least diversity of bugs etc. Why? Were there any surprises

Survey Sheet: How many bugs did you see on soft ground surfaces?

Number of legs	Type of bug	How many did you see?
0	Snails	
0	Slugs	
0	Earthworms	
6	Beetles	
6	True bugs	
6	True flies	
6	Bees / wasps	
6	Ants	
6	Butterflies / moths	
6	Crickets /grasshoppers	
6	Earwigs	
8	Spiders / harvestmen	
More than 8	Woodlice	
More than 8	Centipedes	
More than 8	Millipedes	
Hard to see	Insect larvae	
n/a	Other invertebrates	
	Total found:	

Use tally marks

Survey Sheet: How many bugs did you see on human-made hard surfaces?

Number of legs	Type of bug	How many did you see?
0	Snails	
0	Slugs	
0	Earthworms	
6	Beetles	
6	True bugs	
6	True flies	
6	Bees / wasps	
6	Ants	
6	Butterflies / moths	
6	Crickets /grasshoppers	
6	Earwigs	
8	Spiders / harvestmen	
More than 8	Woodlice	
More than 8	Centipedes	
More than 8	Millipedes	
Hard to see	Insect larvae	
n/a	Other invertebrates	
	Total found:	
	Number of spider webs seen	

Use tally marks

Survey Sheet: How many bugs did you see on plants?

Number of legs	Type of bug	How many did you see?
0	Snails	
0	Slugs	
0	Earthworms	
6	Beetles	
6	True bugs	
6	True flies	
6	Bees / wasps	
6	Ants	
6	Butterflies / moths	
6	Crickets /grasshoppers	
6	Earwigs	
6	Unidentified Flying Insects (UFIs)	
8	Spiders / harvestmen	
More than 8	Woodlice	
More than 8	Centipedes	
More than 8	Millipedes	
Hard to see	Insect larvae	
n/a	Other invertebrates	
	Total found:	
	Number of spider webs seen	

Use tally marks

ACTIVITY 3: Trees!

I can estimate how long or heavy an object is, or what amount it holds, using everyday things as a guide, then measure or weigh it using appropriate instruments and units. ***MNU 1-11a***

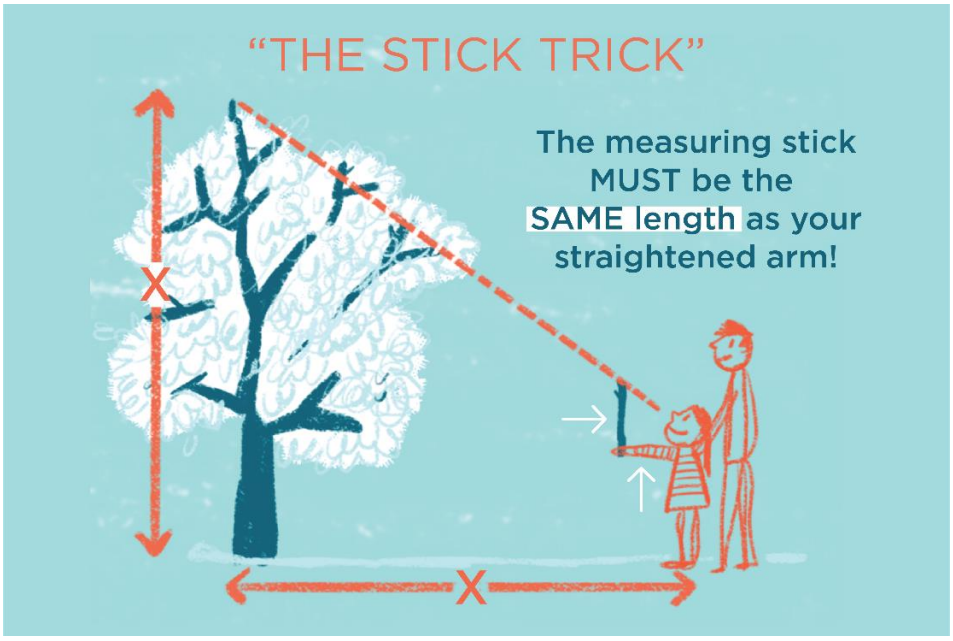
I can use the common units of measure, convert between related units of the metric system, and carry out calculations when solving problems. ***MNU 2-11b***

The ability to estimating the height of a tree is essential to people who work as an Arborist, or tree surgeon, if they need to cut down a tree safely and to avoid it hitting something on the way down.

Lots of opportunities for mental calculations in these activities too.

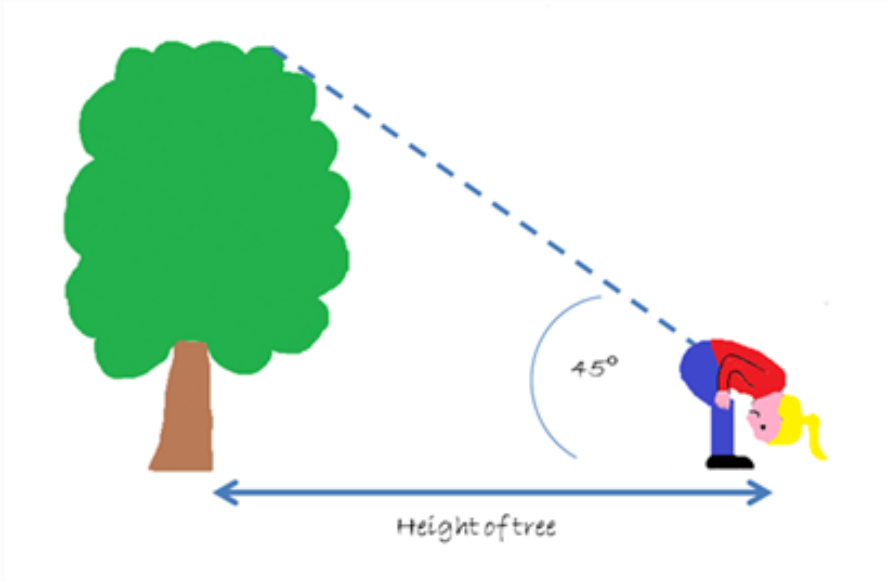
Stick method

- ☆ Use the metre stick to measure your arm from your shoulder to the tips of your fingers.
- ☆ Hold the metre stick upright so that the length of metre stick above your hand is the same as the length of your arm.
- ☆ Turn so that you can see the metre stick and the tree that you want to measure.
- ☆ Close one eye and check to see if the length of metre stick above your hand looks like it is the same size as the tree.
- ☆ If not, move backwards or forwards (carefully) until the length of metre stick above your hand appears to be the same size as the tree. This is the magic spot.
- ☆ Measure the distance from you to the tree. Measure your height.
- ☆ At the magic spot, the distance from you to the tree plus your height equals the height of the tree.



‘<u>Upside-down’ method</u>

- ☆ Walk away from the tree until you estimate that the distance from you to the tree is approximately the same as the height of the tree.
- ☆ To check this, turn so that you are facing away from the tree and place your feet about 50cm apart. Then bend down to put your head as close to the ground as you can – it’s OK to bend your knees a bit to make this easier (see diagram below).
- ☆ If you are at the right distance from the tree, you should just be able to see the top of the tree from this angle. If not, carefully shuffle forwards or backwards until the whole tree height is just visible.
- ☆ At this point, the distance from you to the tree is equal to the height of the tree. This distance can then be measured using a trundle wheel or a tape measure.



<u>How old is the tree?</u>

You can age a tree by counting its rings of growth. But that’s not very easy unless it has been cut down! Fortunately, the approximate age of a tree can be estimated from the girth (circumference) of the trunk at 1.5m above the ground.

Although each tree grows at a slightly different rate (just like us), on average the new growth on its girth is 2.5cm per year.

Dividing the tree girth (in cm) by 2.5 = age in years. Can the children find a tree their age?

Which is the oldest and fattest?

ACTIVITY 4: Build a Bug Hotel

There are many options here – from simple to the more complicated.

This is a useful video: https://www.youtube.com/watch?v=aQShgicRF5U

It demonstrates how to make a bug hotel from flowerpots and plastic pots and where to place them outside.

It also shows how to make a tub bird feeder, and bird feeders from pinecones and recycled plastic bottles. It also has some other suggested activities such as making 'climbing' beasts. life cycles on a paper plate and ways to find mini beasts.

These bug hotels involve the use of tools in their construction:

I can design and construct models and explain my solutions. ***TCH 1-09a***

I can extend and enhance my design skills to solve problems and can construct models. ***TCH 2-09a***

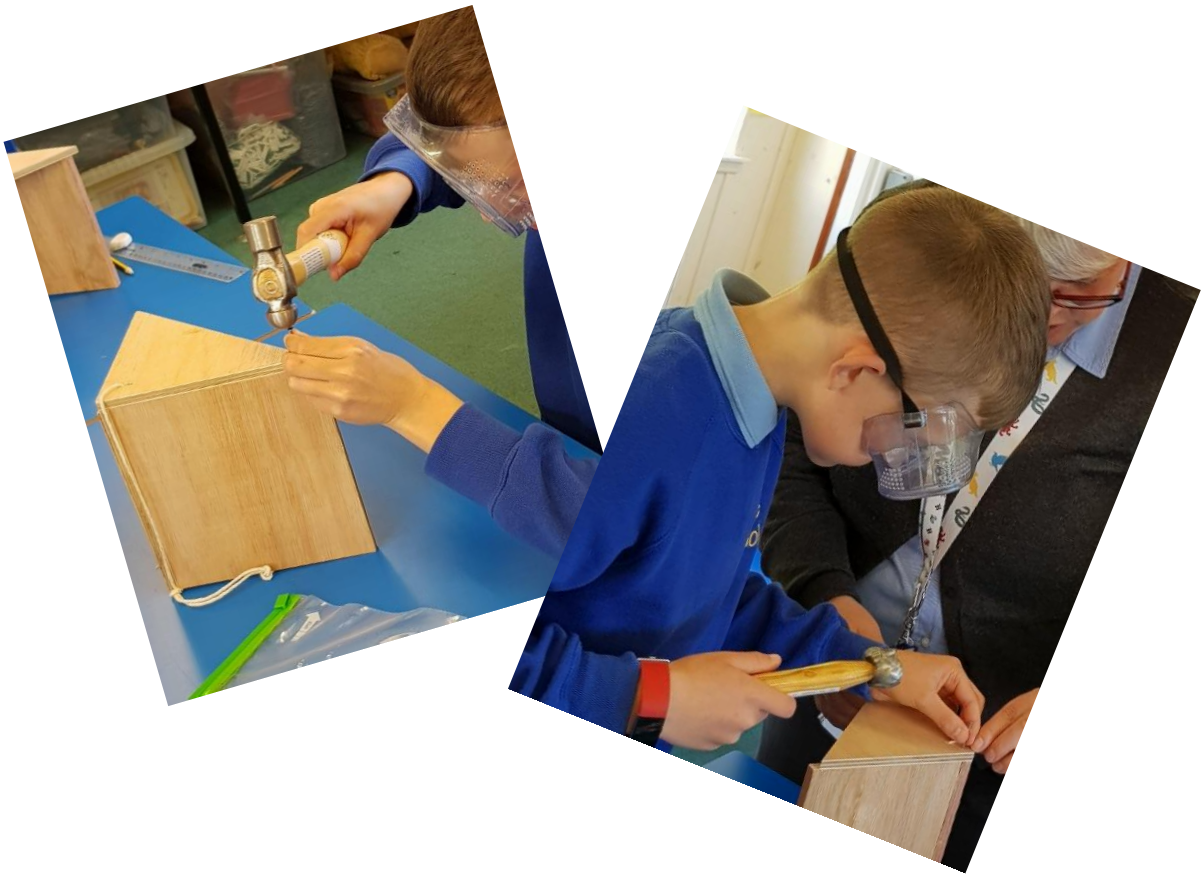
If tools are going to be used, it is important that a risk assessment is undertaken and that the children are taught to use the tools safely.

'An introduction to using practical tools in the Technologies' webinar can be viewed here:

https://www.youtube.com/watch?v=gxP4WZgeFYk

Help sheets to show how to use tools safely in the classroom. including videos of tools being used and Health and Safety Information can be found here:

https://blogs.glowscotland.org.uk/as/abshireprimaryscience/2022/05/31/how-to-use-tools-in-primary-school/



ACTIVITY 5:The Water Race!

(Fun activity to end the day?)

I value the opportunities I am given to make friends and be part of a group in a range of situations. ***HWB 0-14a / HWB 1-14a / HWB 2-14a***

*Through taking part in a variety of events and activities, I am learning to recognise my own skills and abilities as well as those of others****. HWB 1-19a***

Opportunities to carry out different activities and roles in a variety of settings have enabled me to identify my achievements, skills, and areas for development. This will help me to prepare for the next stage in my life and learning. ***HWB 2-19a***

I can design and construct models and explain my solutions. ***TCH 1-09a***

I can extend and enhance my design skills to solve problems and can construct models. ***TCH 2-09a***

Objective: to transport as much water as possible across a distance using only a container(s) constructed from the paper supplied.

Materials:

Each team needs:

5 sheets A4 paper

Bucket of water

Empty bucket

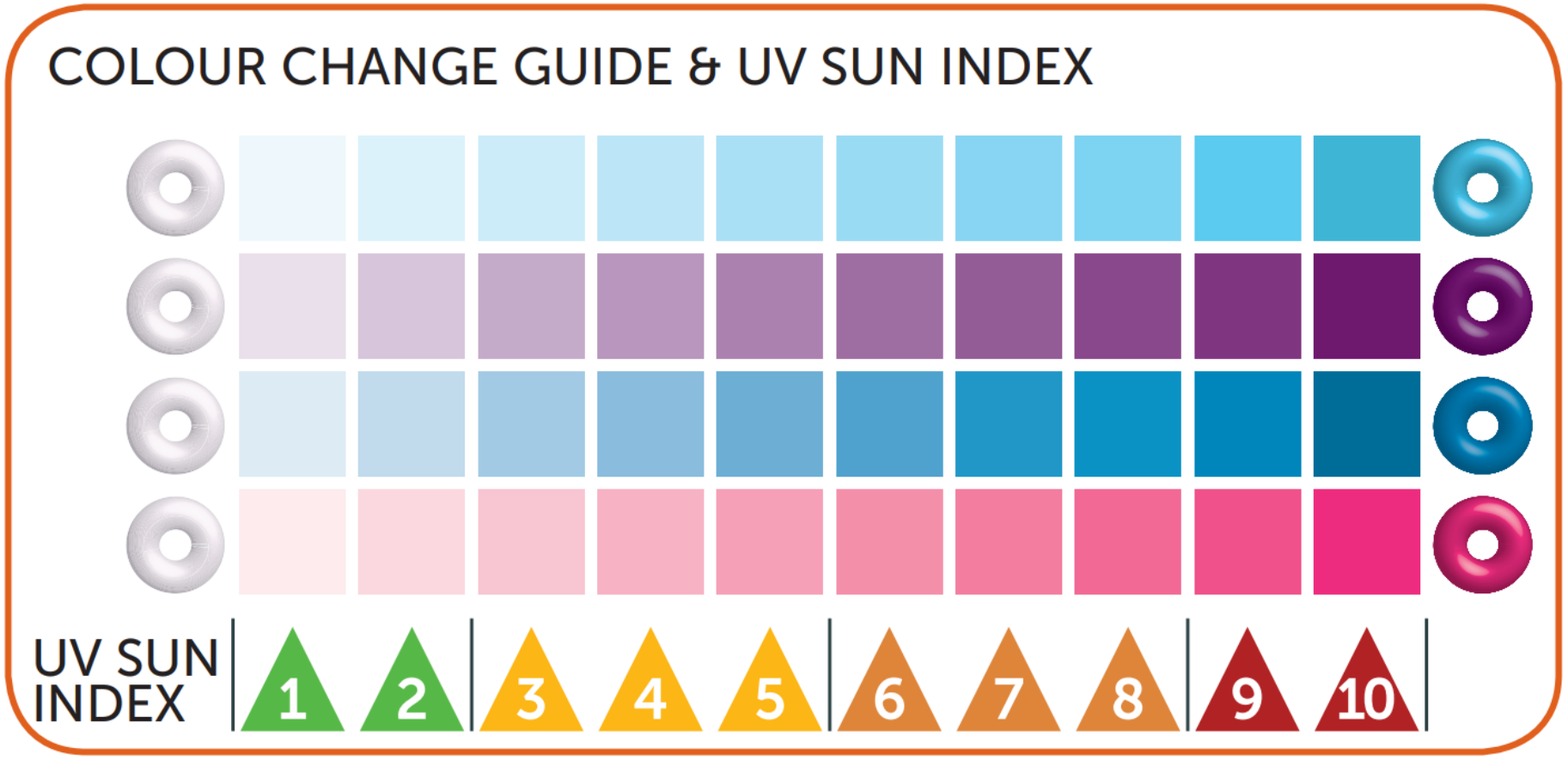
Rules:

1. Only one cup of water at a time can be transferred
2. A second water run can only be commenced when the first team member returns to the water bucket
3. Only the materials supplied can be used
4. The judge's decision in all matters is final

Judging:

The winning team will be the one that transfers the greatest volume of water across the distance in the time given (15 minutes)

The water carrying devices must be designed and made from paper. The teams have 5 sheets of paper so can make 5 cups or use more than one sheet per cup to make sturdier cups.



ROYAL SOCIETY OF CHEMISTRY

The OPAL Bugs Count
Pocket ID Guide

This **Pocket ID Guide** is part of the OPAL Bugs Count survey pack. Use it to identify the invertebrates that you find.

NATURAL HISTORY MUSEUM

FSC
Bringing Environmental Understanding To All

BIG LOTTERY FUND
LOTTERY FUNDED

Getting started with identification

You don't need fancy equipment to survey bugs. **Your eyes** are your most important tool, but these may help too.

this Pocket ID Guide

a magnifier

pencil and paper

a camera

a jar (to put bugs in while you identify them)

Look after yourself and the bugs you find

- Handle bugs gently. Only pick them up when necessary and always put them back where you found them.
- If you put a bug in a jar to look at it, don't keep it for too long, or leave it in the sun.
- Always act in a safe and careful manner and tell someone where you are going.
- See the Bugs Count Field Notebook for further advice.

To upload your Bugs Count results and learn more about OPAL, visit **www.OPALexplorenature.org**

OPAL
EXPLORE NATURE

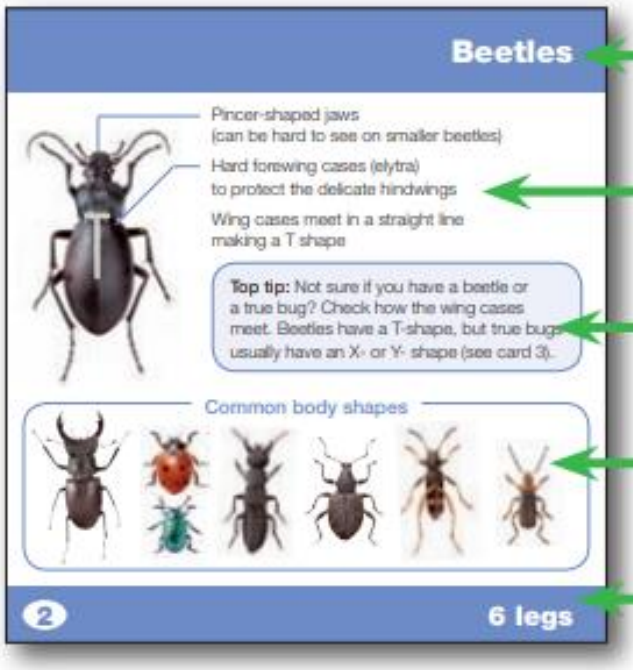
How to use this Pocket ID Guide

There are ten identification cards, covering different groups of invertebrates.

It's easiest to identify a bug by counting the **number of legs**. Then use the **colour coding** to skip to the right section.

1	Snails, slugs and earthworms	No legs
2	Beetles	6 legs
3	True bugs	
4	True flies	
5	Bees, wasps and ants	
6	Butterflies and moths	
7	Crickets, grasshoppers and earwigs	
8	Spiders and harvestmen	8 legs
9	Woodlice, centipedes and millipedes	Lots of legs
10	Insect larvae (young)	

How to use this Pocket ID Guide



Name of group

Main features to look for

Top tips to tell apart types of bug that look similar

Examples
(images not to scale)

Cards are colour coded by number of legs

Turn to the backs of the cards for great Fact Files

Want to do more? Doing the Bugs Count survey is just the start!

Across the UK, thousands of people spend their spare time recording wildlife. On each ID card we've included the web address of a group that enjoys recording those particular bugs. Why not visit their websites to find out about the activities they run and how you can join in?

Snails, slugs and earthworms

Snails

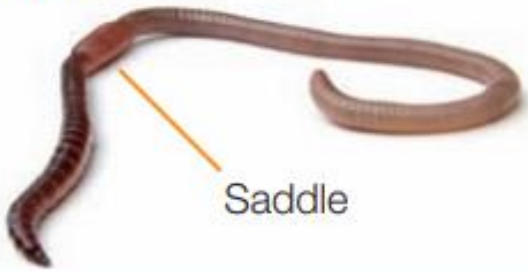
- Soft, slimy body
- Hard, coiled shell
- Shell can vary from a sphere, to a flattened disc or a pointed spire

Slugs

- Soft, slimy body
- Do not have a hard, coiled shell (although a few species have a tiny disc of shell towards the end of their body)

Earthworms

- Long, thin body divided into segments (which look like a series of rings or stripes)
- Thickened 'saddle' visible on adult worms



1 **No legs**

Snails, slugs and earthworms

- There are around 150 species of land snails and slugs in the UK.
- They belong to a group of molluscs called Gastropoda which means 'stomach-foot'!
- Earthworms belong to a group called Annelida – the segmented worms. There are 27 species in the UK.
- Slugs, snails and earthworms all need to keep their skin damp so that they can breathe. They are particularly active at night and when the ground is wet.
- All three groups are a vital food source for many other animals, including birds, mammals and amphibians.

Did you know? Reaching an incredible 16cm long, the Leopard Slug (scientific name *Limax maximus*) is one of the UK's largest slugs.

It eats fungi, rotting plants and other slugs. When mating, a pair of Leopard Slugs will often hang from a thread of mucus (slime).

Discover more about slugs and snails on the Conchological Society's website **www.conchsoc.org**

For earthworms visit **www.earthwormsoc.org.uk**

NATURAL HISTORY MUSEUM

Beetles

Pincer-shaped jaws
(can be hard to see on smaller beetles)

Hard forewing cases (elytra)
to protect the delicate hindwings

Wing cases meet in a straight line
making a T shape

Top tip: Not sure if you have a beetle or a true bug? Check how the wing cases meet. Beetles have a T-shape, but true bugs usually have an X- or Y- shape (see card 3).

Common body shapes

2 **6 legs**

Beetles

- There are over 4,000 species of beetle in the UK.
- Beetles belong to a group of insects called Coleoptera.
- Beetles can be found in a wide variety of habitats on land and in freshwater.
- Most beetles are beneficial, helping to pollinate plants, reduce pests and recycle nutrients.
- Many beetles eat living plants or fungi, others are active predators of invertebrates, whilst some eat dead plants and animals – even dung!

Did you know? The Stag Beetle (scientific name *Lucanus cervus*) is the biggest beetle in the UK, growing to an amazing 7cm long!

Their larvae (young) live in rotting wood for up to seven years, but the adult beetles only live for a few months.

UK Ladybird Survey

Love beetles? Why not join the UK Ladybird Survey?
www.ladybird-survey.org

NATURAL HISTORY MUSEUM

True bugs

True bugs

Wing cases usually meet in an X- or Y- shape

(not true for some true bugs, like aphids and scale insects)

Top tip: Unlike true bugs, the wing cases of beetles meet in a T-shape (see card 2)

Common body shapes

a scale insect

aphids (e.g. greenfly)

3

6 legs

True bugs

- Over 1,700 species of true bug have been found in the UK.
- They belong to a group of insects called Hemiptera, which means 'half-winged'.
- Most true bugs feed by puncturing their food and then sucking up juices using their tube-like mouthparts.
- Many species feed on plants and some can be important pests (e.g. aphids).
- Aphids feed on plant sap, which is full of sugars. They secrete some of this as honeydew. Ants often feed on this honeydew and in return protect the aphids from predators.

Photographs: Roger Key (aphids), Alan Stewart (cuckoo spit)

Did you know? The young of froghoppers protect themselves from predators and becoming too dry by surrounding themselves in patches of foam bubbles – often called 'cuckoo spit'. They create these bubbles whilst feeding on plant sap.

Terrestrial Heteroptera Recording Scheme for Britain & Ireland

Discover more about true bugs at **www.britishbugs.org.uk**

NATURAL HISTORY MUSEUM

True flies

Large eyes (may almost fill the head)

Antennae often very short

One pair of see-through wings

Top tip: Hoverflies have much shorter antennae than wasps and bees (see card 5)

Common body shapes

4

6 legs

True flies

- There are approximately 7,000 species known from the UK and more are discovered each year.
- True flies belong to a group of insects called Diptera which means 'two-winged'.
- Although we often think of them as pests, true flies are important, whether as predators, pollinators of plants, or as food for other animals (like bats and birds). Others help break down dead plants and animals.
- There are lots of insects that have the word 'fly' in their names that aren't true flies, e.g. dragonfly, butterfly, greenfly and mayfly.

Photograph: Martin Hall (bluebottle mouthparts)

Did you know? Apart from a few hoverflies which can crunch up pollen, all true flies must eat food in liquid form – whether that is nectar, dung, blood, or something else!

Mouthparts vary in shape from the long, sucking tubes of mosquitoes and bee flies, to the disc-shaped 'hoovers' of blowflies.

DipteristsForum

Fascinated by flies?
Find out more at
www.dipteristsforum.org.uk

NATURAL HISTORY MUSEUM

Bees, wasps and ants

Long antennae

See-through wings

Most have a narrow waist

Bees are often hairy.
Wasps and ants are not hairy.

Common body shapes

Bees

Wasps

Ants

usually do not have wings

Sawflies

usually lack narrow waist

Bees, wasps and ants

- Over 7,000 species of bees, wasps, ants and sawflies live in the UK.
- They belong to a group of insects called Hymenoptera.
- Ants evolved from wasp-like ancestors over 100 million years ago.
- Bees and wasps are incredibly important pollinators, carrying pollen from one plant to the next as they feed on nectar.
- Some (but not all) bees and wasps can sting if they feel threatened, whilst Wood Ants (below) defend themselves by biting and spraying formic acid.
- A diverse group of wasps called 'parasitoids' reproduce by laying their eggs inside living invertebrates.

Did you know? Ants are one of the most abundant organisms on earth. Colonies can exceed 1 million individuals. This picture shows Wood Ants (scientific name *Formica rufa*) massing outside their nest to absorb heat from the spring sunshine.

Buzzing about bees? Visit the Bees, Wasps and Ants Recording Society website **www.bwars.com**

NATURAL HISTORY MUSEUM

Butterflies and moths

Long antennae

Two wings on each side (but sometimes looks like just one)

Almost all have coloured wings that are not see-through

What is the difference between a butterfly and a moth?

Nothing really! They are very closely related and there is no one feature that separates the two. The following tips will help you decide, but there are always a few species that break the rules!

Butterflies

- usually fly during the day
- have 'clubs' (lumps) on the end of their antennae
- rest with wings closed vertically above their body

Moths

- usually fly at night but some fly during the day
- have pointed and often feathery antennae
- rest with their wings folded flat over their body

Butterflies and moths

- There are over 2,500 species of moth in the UK but fewer than 60 species of butterfly!
- They both belong to a group of insects called Lepidoptera.
- Adult moths and butterflies feed by sucking liquids such as nectar through a straw-like tube called a proboscis.
- Butterflies and moths are important pollinators, as well as being a vital food source for other animals. In Britain, Blue Tit chicks eat an estimated 35 billion moth caterpillars every year.
- Moths are often disliked because it is thought they eat clothes and other woollen fabrics. In fact, only two of the 2,500 species of moths in the UK are likely to eat clothes.

Photographs: Robert Thompson, Matt Berry, David Green

Did you know? Despite their gentle fluttering flight, some butterflies and moths like this Red Admiral (scientific name *Vanessa atalanta*) migrate all the way from southern Europe or North Africa to the UK. They arrive here in spring, breed over the summer and most leave again in autumn.

Butterfly Conservation

Discover more about these insects on the Butterfly Conservation website **www.butterfly-conservation.org**

NATURAL HISTORY MUSEUM

Crickets, grasshoppers and earwigs

Crickets and grasshoppers

Crickets and grasshoppers have long back legs that are strengthened for jumping

Crickets have long antennae
usually longer than their body

Grasshoppers have short antennae
much shorter than their body

Earwigs

Earwigs have a pair of pincer-shaped claspers called 'cerci' at the end of their brown body

Crickets, grasshoppers and earwigs

- There are 33 species of cricket and grasshopper in the UK and seven species of earwig.
- Crickets and grasshoppers belong to a group called Orthoptera, meaning 'straight-winged'. It refers to the way they hold their wings in a line along their back.
- Earwigs belong to a closely related group called Dermaptera.
- Grasshoppers only eat plants, whilst crickets and earwigs eat other invertebrates as well as plants.
- Grasshoppers sing ('chirp') by rubbing their back legs against their wings, or drumming them on a surface. Crickets chirp by rubbing their wings together.

Did you know? The Mole Cricket (scientific name *Gryllotalpa gryllotalpa*) is one of the UK's weirdest, rarest and most spectacular invertebrates. Like moles, they use their shovel-like front legs to dig tunnels through the soil. Mole Crickets live almost entirely underground, eating the roots of plants as well as a range of soil-living invertebrates.

Want to discover more about grasshoppers, crickets and their relatives? Visit **www.orthoptera.org.uk**

NATURAL HISTORY MUSEUM

Spiders and harvestmen

Spiders

Body clearly divided into two parts:

- The front part is called the cephalothorax (and includes the head)
- The back part is called the abdomen

Harvestmen

Long thin legs

One body part which is round or oval shaped

(unlike spiders which have two body parts)

8

8 legs

Spiders and harvestmen

- The UK has 27 species of harvestmen and 650 species of spider.
- All UK spiders are predators of invertebrates, especially insects. They immobilise them with venom injected through their jaws ('fangs').
- Not all spiders use silken webs to catch their prey. Some actively hunt, and others are ambush predators that sit in likely places and wait for prey to pass by.
- Harvestmen are at their most abundant and visible during the late summer and early autumn – the traditional crop 'harvest time'.
- Harvestmen do not produce silk or venom, but can produce a pungent smell to put off predators.

Did you know? Thin, whispy cobwebs in your house, garage or shed may well belong to the Daddy-long-legs Spider (scientific name *Pholcus phalangioides*). Originally a tropical species, it has spread around the world. In the UK it prefers to live indoors and in outbuildings. It eats a wide range of invertebrates, including other spiders!

Discover more at the British Arachnological Society's website
www.britishspiders.org.uk

NATURAL HISTORY MUSEUM

Woodlice, centipedes and millipedes

Woodlice

- Body divided into many segments
- 7 pairs of legs
- Oval shaped body (when viewed from above)
- Some woodlice can roll into a ball

Centipedes

- Long, thin body divided into many segments
- At least 15 pairs of legs, but can have many more
- 1 pair of legs on each body segment
- Usually orange or yellow

Millipedes

- Long, thin body divided into many segments
- Usually less than 50 pairs of legs
- 2 pairs of legs on each body segment
- Pill Millipedes can roll into a ball

9

More than 8 legs

Woodlice, centipedes and millipedes

- There are 39 species of woodlouse, 57 species of centipede and 60 species of millipede in the UK.
- Woodlice, centipedes and millipedes are not closely related. Centipedes belong to a group called Chilopoda, millipedes to the Diplopoda, and woodlice are crustaceans in a group called Isopoda.
- All have a large number of legs, but not thousands!
- They live on damp ground surfaces, amongst fallen leaves and decaying logs, and under objects like plant pots.
- Woodlice and millipedes mainly eat dead or damaged plants.
- Centipedes eat other invertebrates, which they immobilise using venom injected from a pair of poison claws near their head.

Did you know? Eating a woodlouse was once thought to cure stomach ache (but don't try this at home.)

Woodlice have been given many different nicknames including *cheeselogs*, *chiggypigs* and *gammerzows*!

British Myriapod and Isopod Group

Discover more at
www.bmig.org.uk

NATURAL HISTORY MUSEUM

Insect larvae (young)

What are insect larvae? Most insects reproduce by laying eggs. The young that hatch from these eggs are of two types:

1 Larvae look very different from the adults. They feed and grow, then their skin hardens and they turn into a pupa. Inside the pupa, they undergo a complete change, before hatching as adults.

2 Nymphs look quite like small versions of the adult. To grow, they moult their hard skin several times, each time getting bigger and looking more like the adult.

Butterfly and moth larvae (caterpillars)

butterfly caterpillar

moth caterpillars

Beetle larvae

ladybird larva

click beetle larva

stag beetle larva

ground beetle larva

True fly larvae and pupae

larva (maggot)

pupa

bluebottle fly

Can't find a match...?

There are well over 30,000 different species of invertebrate in the UK – far too many to include in this Pocket ID Guide.

If you can't match your invertebrate to any of the ten categories in this Pocket ID Guide – or if it is too small to identify – record it in your Bugs Count Field Notebook as 'Other invertebrates'.

To learn more about UK invertebrates visit **www.OPALexplorenature.org/bugscount**.

Great resources for identifying bugs include the OPAL iSpot website **www.iSpot.org.uk**, and the Natural History Museum's identification forums **www.nhm.ac.uk/identification**.

This guide has been developed by the Natural History Museum as part of the OPAL Bugs Count survey. Photos by Harry Taylor except where credited otherwise.

NATURAL HISTORY MUSEUM