REAL-LIFE SCIENCE

Materials and Forces

Teacher guide

For the National 2 Science in the Environment workbook



C. Blewis

Blewis LEARNING

Using the workbooks

The National 2 Science in the Environment workbook **Materials and Forces** covers the required unit **Exploring Everyday Materials** and the optional unit **Forces**. Every topic has picture-led learning pages, a hands-on activity with simple steps, a brain break and a check-up.

PRACTICALS

Learners follow picture steps with an adult and record what they see by ticking, circling, drawing or with a photo. Each activity has example results for when there is no kit.

PRACTICAL SAFETY

Every practical has a Stay safe table and a teacher note with hazards and adapted versions. The Stay safe tables and these notes are a starting point, not a complete risk assessment: the teacher or school must risk assess every practical for their own learners, room and kit before use, following their employer's policies and national guidance (in Scotland, SSERC). Always check learners' care plans and medical information. Anything hot, sharp or with chemicals is done by the adult, with the learner watching and recording.

NO LAB, NO KIT, OR A LEARNER ABSENT

Each activity includes example results so learners can still fill in their table and say what they found.

EVIDENCE

Evidence for N2 units is mostly naturally occurring: use the My adult saw me checklists, photos and the learner's own recording in the book. Each teacher note says which outcome the activity gives evidence for. Always check the latest course documents and your centre's arrangements.

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TEACHER NOTES

Let’s find out 1: Sort the jumble sale box

Time	20 to 30 minutes.
Kit	A box of 12 to 20 safe everyday objects in four materials (wood, metal, plastic, fabric): spoons, keys, wooden blocks, bottles, toys, socks, gloves. Four trays or hoops with picture labels.
Prep	Check every object: no glass, no sharp edges, nothing small enough to swallow for learners who mouth objects. Make picture labels for each tray.
What to expect	Learners sort most objects correctly. Objects made of two materials (a pencil, a toy car) make good talking points: ask what each part is made of.
Safety and inclusion	Some learners dislike certain textures: let them point and the adult handles the object. Use bigger objects for learners with limited fine motor skills. Seated work throughout.
Evidence	Shows what materials are like and records it (Materials, Outcome 1). Tick the ‘My adult saw me’ list and add a photo of the sorted trays.
No lab or at home	Sort things from a kitchen drawer or a toy box. Photos of objects work too.

Answers: Topic 1

Topic 1: What things are made of

2 What is it made of? 1 key: metal; sock: fabric; window: glass; book: paper. 2 the tin (metal can). 3 chair: wood; ball: rubber.

Let's find out 1 Any sensible sorting. Biggest group depends on the box. Key: metal. Sorted by material.

Check-up 1 glass 2 bottle and toy brick 3 e.g. a desk, a chair, a door, a pencil, a ruler.

TEACHER NOTES

Let’s find out 2: Which material is waterproof?

Time	20 to 30 minutes.
Kit	Per group: four plastic cups, squares (about 10 cm) of cotton fabric, kitchen paper, a plastic bag and kitchen foil, four elastic bands, a teaspoon, a small jug of water, paper towels.
Prep	Cut the squares in advance. Cover the table with a towel. Keep water away from electrical equipment.
What to expect	Plastic and foil keep the cup dry. Fabric and paper let water through. Paper also tears when wet: a good extra talking point.
Safety and inclusion	Wipe spills at once. Learners who find pouring hard can tell the adult when to pour. Use a pipette or dropper for more control if needed.
Evidence	Shows what materials are like and records it (Materials, Outcome 1). Tick the ‘My adult saw me’ list and add a photo of the cups.
No lab or at home	Test a tea towel, a crisp packet, a paper towel and a sandwich bag over a mug at the sink.

Answers: Topic 2

Topic 2: Testing materials

1 What is it like? 1 soft 2 yes

2 Magnets 1 paper clip: yes; plastic toy brick: no; steel tin: yes; sock: no. 2 a waterproof coat

Let's find out 2 Expected: plastic and foil keep the cup dry; fabric and paper let water through (paper may go soggy). The materials that kept the water out: plastic and foil. Paper soaks up water. A good raincoat is made of a waterproof material.

Check-up 1 stone: hard; elastic band: bendy; glass: see-through. 2 paper clip 3 plastic

TEACHER NOTES

Let’s find out 3: Build a strong bridge

Time	25 to 35 minutes.
Kit	Per group: two equal piles of books (about 10 cm high), strips about 30 cm by 5 cm of paper, thin card and wood (a ruler or lolly sticks taped together), 30 to 40 coins or plastic counters of the same size.
Prep	Mark the gap (about 20 cm) with tape so every test is the same. Pre-cut strips.
What to expect	Paper sags after 1 to 3 coins; card holds more; wood usually holds every coin. Folding the paper into a zigzag makes it much stronger: a great extension.
Safety and inclusion	Coins can be a choking risk: use large counters for learners who mouth objects. A learner who cannot place coins can say ‘add one’ while the adult places it.
Evidence	Shows what materials are used for and why (Materials, Outcome 1). Tick the ‘My adult saw me’ list and add a photo.
No lab or at home	Use two chairs or tins of beans as the piles and a cereal box strip, a paper strip and a wooden spoon.

Answers: Topic 3

Topic 3: Using materials

2 Good choice or silly choice? 1 paper umbrella: silly; glass window: good; chocolate teapot: silly; metal key: good; fabric frying pan: silly. 2 window: glass; coat: fabric; key: metal.

Let's find out 3 Expected: paper holds very few coins, card more, wood the most. Strongest: wood (in most tests). Weakest: paper. A real bridge needs a strong material.

Check-up 1 it is see-through 2 plastic 3 e.g. a key to open a door; a spoon to eat with; a tin to keep food in; a pan to cook in.

TEACHER NOTES

Let’s find out 4 and 4b: Ice and play dough

Time	Ice: set up 10 minutes, check every 5 minutes over a lesson. Play dough: 10 minutes while the ice melts.
Kit	Three ice cubes of the same size, three plates or bowls, a bowl of hand-warm water, a thermometer, a timer, paper towels, aprons. Play dough (gluten-free if needed) and a board for each learner.
Prep	Make ice cubes the day before. Use hand-warm tap water only, no hotter than 40 °C: check it with a thermometer. No kettle. Check the fridge is free to use.
What to expect	Ice in warm water melts in a few minutes; on the table in about 20 to 40 minutes; in the fridge it lasts much longer. Dough changes shape when squashed, rolled or stretched, and breaks if stretched too far.
Safety and inclusion	The adult handles the water. Wipe spills. Check care plans for wheat, latex and food allergies: use gluten-free dough and latex-free bands. Learners who dislike cold or sticky textures can use tongs, gloves or watch and direct. Practise lab rules: no eating or drinking, tidy up, listen to the adult.
Evidence	Two experiments that change materials, saying what caused each change and following safety rules (Materials, Outcome 2). Tick both ‘My adult saw me’ boxes and add photos.
No lab or at home	Melt chocolate buttons in a sandwich bag held in hand-warm water (adult), then let them set again. Stir sugar into a cup of water.

Answers: Topic 4

Topic 4: Changing materials

1 Hot and cold 1 it melts

2 Squash, bend, stretch, mix 1 play dough: squash; elastic band: stretch; sugar: mix in water. 2 dissolves (dissolving)

Let's find out 4 Expected order: warm water 1, table 2, fridge 3. Heat makes ice melt; it melted fastest in the warm water.

Let's find out 4b Squash, roll and stretch all change the shape (stretching too far may break it). Pushing and pulling changed the shape of the dough.

Check-up 1 heat 2 elastic band and sock 3 only the adult pours hot water

TEACHER NOTES

Let’s find out 5: Force test station

Time	25 to 35 minutes, as a carousel of five stations.
Kit	Straws and a ping-pong ball; a sheet of bubble wrap; an empty cardboard box; a large bar or horseshoe magnet and paper clips in a tray; play dough.
Prep	Set out the stations with picture cards. Clear floor space around the box station.
What to expect	Learners see forces start motion (ball, box, clips) and change shape (bubble wrap, dough). Many will notice the magnet pulls without touching.
Safety and inclusion	Use large magnets only: small magnets are dangerous if swallowed. Each learner has their own straw. The box can be pushed by hand instead of kicked, seated if needed. Popping bubble wrap can be loud: offer ear defenders, or squash a sponge instead. Check care plans for wheat and latex allergies: use gluten-free dough.
Evidence	Shows how pushes and pulls change things, and names the forces (Forces, Outcome 1). Tick the ‘My adult saw me’ list and add a photo.
No lab or at home	Push a toy car, pull a drawer, twist a bottle lid, squash a cushion, and pick up paper clips with a fridge magnet.

Answers: Topic 5

Topic 5: Pushes, pulls and twists

1 Push, pull or twist? 1 trolley: push; tap: twist; kite: pull.

2 What can a force do? 1 squash a sponge: it changes shape; kick a still ball: it starts moving; goalie catches: it stops. 2 magnet: magnetic pull; parachute: air resistance; falling ball: gravity.

Let's find out 5 Ball: started moving (push). Bubble wrap: changed shape (push/squash). Box: started moving (push). Magnet: clips started moving (magnetic pull). Play dough: changed shape (push, pull or twist). Blowing made the ball move; squashing changed the shape of the bubble wrap; the magnet pulled the clips.

Check-up 1 twist 2 changes its shape 3 any the learner used, usually push, pull and magnetic pull (twist if they twisted the dough).

TEACHER NOTES

Let’s find out 6: How heavy is my bag?

Time	20 to 30 minutes.
Kit	A 10 N newton meter (spring balance) per group, a carrier bag with handles, three or four paperback books of the same size.
Prep	Check each newton meter reads zero with nothing on it. Choose books that each weigh about 2 N (200 g) so 4 books stay under 10 N.
What to expect	The force goes up as books are added, about 2 N per paperback. Learners may need help reading between numbers: round to the nearest number.
Safety and inclusion	Keep loads under 1 kg and lift low over the table. The adult can hold the meter while the learner reads it, or the learner hangs things while seated.
Evidence	Measures how big a force is, safely (Forces, Outcome 2). Tick the ‘My adult saw me’ list and add a photo.
No lab or at home	Use luggage scales or kitchen scales with a bag of shopping, adding one tin at a time.

Answers: Topic 6

Topic 6: Measuring forces

2 Read the force 1 orange: 2 N; book: 4 N; trainer: 6 N; bag of sugar: 8 N. 2 bag of sugar

Let's find out 6 Readings depend on the books (sample: 0, 2, 4, 6 N). More books made the force bigger. The force is the pull of gravity. It is measured in newtons.

Check-up 1 6 N 2 forces 3 the bag of sugar

TEACHER NOTES

Let’s find out 7: Big or small parachute?

Time	25 to 30 minutes.
Kit	Two parachutes made from plastic bags (squares about 50 cm and 20 cm), string and the same small load on each (a lump of play dough or a clothes peg), a timer.
Prep	Make the parachutes in advance or with the learners. The adult drops from full arm’s reach, standing on the floor.
What to expect	The big parachute falls noticeably more slowly. Times vary: do each drop three times and pick the middle time if learners can.
Safety and inclusion	Learners stay on the floor; only the adult drops. Keep the landing area clear. A learner can press the timer button or say ‘go’ and ‘stop’.
Evidence	Measures how air slows a falling thing, safely (Forces, Outcome 2). Tick the ‘My adult saw me’ list and add a photo.
No lab or at home	Drop a flat sheet of paper and a scrunched-up sheet at the same time. Float and sink test in a washing-up bowl.

Answers: Topic 7

Topic 7: Gravity, air and water

1 Gravity and air 1 parachute 2 gravity

2 Float or sink? 1 rubber ball: float; stone: sink; wooden block: float; metal key: sink; toy boat: float.

Let's find out 7 The big parachute falls more slowly (sample: 4 s against 2 s). It catches more air. Gravity pulls it down.

Check-up 1 gravity 2 air resistance 3 rubber ball and wood

TEACHER NOTES

Let’s find out 8: Which floor slows the car most?

Time	25 to 35 minutes.
Kit	A toy car, a ramp (a tray or board on a pile of books, about 10 cm high), a carpet tile, a hand towel laid flat, a metre stick or tape measure. For the lever: a 30 cm ruler, a pencil and a few books.
Prep	Mark the release line at the top of the ramp with tape. Lay the carpet tile and towel flat at the bottom of the ramp.
What to expect	The car rolls furthest on a smooth floor, less far on the towel and least far on carpet. With the lever, pressing far from the pencil lifts the books easily.
Safety and inclusion	Clear floor space. Learners can work at a table with a shorter ramp. A learner with limited grip can release the car by lifting a card ‘gate’.
Evidence	Measures how friction slows a car and uses a lever to make a force bigger, following safety rules (Forces, Outcome 2). Tick the ‘My adult saw me’ list and add a photo.
No lab or at home	Roll a ball down a hallway onto a rug and a hard floor. Open a tin lid with a spoon as a lever (adult).

Answers: Topic 8

Topic 8: Friction and simple machines

1 Friction 1 on a smooth floor 2 stop the bike

2 Simple machines 1 lever: lift a heavy box with a small push; pulley: lift a flag; trolley (wheels): move shopping.

Let's find out 8 Expected: the car goes least far on carpet (sample: smooth floor 120 cm, towel 60 cm, carpet 40 cm). Carpet has more friction. Friction makes things slow down. Lever: easy when pressing near the end.

Check-up 1 slows things down 2 pulley 3 carpet

About the author

C. Blewis has taught for 17 years, including 10 years in Additional Support Needs (ASN) provision, teaching sciences, maths, PE and more.

In many schools, especially smaller and specialist settings, teachers are often asked to teach outside their own subject. These books are written for them, and for the young people they teach: clear, practical and ready to use from the first lesson.