

Friction: Friend and Enemy

GROW Science · Autumn 1 · Week 3 · Lesson A · 40 minutes

Teach Monday's explanation and shared reasoning only. Stop after We Do 2. Tuesday's 32-minute workshop, 4-minute Lundy response and 4-minute exit are a separate lesson.

Learning and evidence

Objective: explain what friction does, with one helpful and one unhelpful example. Success includes identifying the touching surfaces, predicting a surface comparison and supporting a claim. Monday's adult demonstration is not evidence that the pupil performed Tuesday's test.

Exact source pacing

Elapsed / source stage	Mins	Teaching action
00–01 · Title	1	Name the objective; settle the room.
01–05 · Arrival Task	4	Optional hand rubbing; choose supported, standard or stretch response.
05–07 · Today at a Glance	2	Define friction; judge the job; predict and compare surfaces.
07–16 · I Do 1	9	Model same release twice; change only the surface; invite prediction and observation.
16–26 · We Do 1	10	Start with bike brakes and engine parts. Identify contact, motion and intended job.
26–30 · I Do 2	4	Model the helpful/unhelpful sentence; explain what counts as evidence.
30–40 · We Do 2	10	Sort five claims, justify a choice, challenge a changed case; label/save and stop.

These seven data-timer values total 40 minutes. Tasks, support, optional cards and corrections fit within these stages; they do not create extra lesson time.

Print and prepare

Each pupil: common pages 1–2 and one response page (3 Supported, 4 Standard or 5 Stretch). Page 6 offers reusable cards for pointing/sorting instead of writing. Prepare the adult demonstration and decide how pupils can opt into observation, directing or recording.

Equipment, access and science

The demonstration is evidence to discuss; models and animations are illustrations.

Demonstration and fair comparison

Use an adult-secured low ramp, a light sliding block, two firmly fixed surface samples (such as fabric and a smooth board), a ruler if comparing stops, and a tray or padded stop. Keep the same block, slope, release mark, no-push release and measuring start. Repeat the same release before changing one planned variable: the surface.

Locate the zero point before recording any distance. Keep the ramp-to-surface join consistent; a raised join or a different push can change the stop. A non-slide is a real observation. Do not invent a distance or guarantee that one surface will always produce the shorter run.

Safety and classroom access

Check the setup against the school's local practical arrangements. Keep the run short, secured and away from edges; keep hands out of the path. No oil, loose powders, flames, heated objects or pupils sliding on floors. Stop if a surface shifts or the run-out is unsafe.

Hand rubbing is optional and brief; stop at discomfort. Offer observing an adult or discussing a known example. Accept pointing, spoken responses, signing, drawing, dictation or adult scribing. Give one instruction at a time, quiet wait time and a pass/private-response option. Do not require physical participation to show understanding.

Core explanation and limits

Friction is a contact force between surfaces that slide, or try to slide, past each other. It opposes that relative sliding. Static friction can stop slipping and can help propel a walker forwards; "always opposite an object's travel" is not a universal rule.

The effect depends on the pair of surfaces and their condition. Roughness alone does not determine every result: smooth rubber and smooth glass can grip. Shorter travel after the same release is evidence of greater resistance in this particular controlled setup, not a direct measurement of frictional force.

Offline fallback

If the apparatus is unavailable, use the editable deck's labelled model and ask pupils to predict and reason. Mark their record "model only"; do not claim a class measurement or practical. No publisher clip is required or included. The optional companion's brake-pad scenario can be described: a pad contacts a turning wheel rim and the wheel slows.

TEACHER ANSWERS / ARRIVAL AND EXAMPLES

What a good answer includes

Use the answer after an attempt; accept equivalent scientific language.

Arrival and surface prediction

Supported: “My hands feel warmer” or a valid observation. Standard: name friction at the rubbing surfaces. Stretch: work done as the hands rub transfers energy, warming the skin. Do not state that all friction must produce noticeable heating, or require the optional activity.

Prediction: accept a justified prediction, including uncertainty. Look for the actual surface pair, one changed variable and fair controls. Assess observations against what occurred in your demonstration; the original illustration’s short/long paths are not measured results.

Helpful / unhelpful examples

Situation	Expected reasoning
Bike brakes	Helpful for slowing: pad–wheel contact resists relative sliding and slows the wheel. In a real stop, tyre–road grip also matters.
Trainers on a wet floor	Shoe–floor friction is helpful for resisting a slip. Water can reduce grip; wet floors are not safe practice surfaces. Do not test this by sliding.
Engine parts rubbing	Unhelpful where unwanted contact causes wear or transfers energy to heating. Judge the particular parts/job, not every friction contact in a machine.
Heavy box across carpet	Unhelpful when the intended job is to slide the box: box–carpet resistance makes it harder. It may be helpful if the job is to keep the box still.
A door handle	Helpful: hand–handle friction provides grip, allowing the handle to be turned. Identify the hand, not just “the handle”.

Model comparison (WAGOLL)

Friction between a bike’s brake pad and wheel is helpful because it slows the wheel and transfers energy to heating. Friction between moving engine parts can be unhelpful because it heats and wears the parts.

Highlight contact + effect + intended job. This keeps the source contrast while replacing “converts the movement into heat” with a clearer energy-transfer explanation. Learners may use the simpler “helps it slow down” before adding energy language.

Check the reasoning

The task keeps the original five claims but corrects three over-broad phrasings.

Card / answer	Explanation
A · TRUE	Sliding friction opposes relative sliding at the contact. For a box sliding right on a floor, friction on the box acts left. This does not mean friction is always opposite whole-object travel.
B · FALSE	Smooth surfaces can still have friction. Use the changed case of smooth rubber on smooth glass; ask for evidence about the actual pair.
C · TRUE (qualified)	Oil can reduce sliding friction in suitable lubricated contacts. It does not always do so in every mechanism. This is a reasoning card; do not use oil in class.
D · TRUE (qualified)	Walking in the usual way needs shoe–ground grip. Static friction resists the foot slipping; friction on the foot can act forwards. Avoid a universal statement about all locomotion.
E · NOT A SCIENTIFIC CLAIM	“Bad” is an unexplained value judgement. A useful claim identifies the contact, effect, intended job and evidence; friction can help or hinder.

Supported page

Gap: surfaces. Helpful examples: pad and wheel slow the wheel; hand and handle provide grip. Unhelpful: moving engine contacts heat/wear; box–carpet resistance hinders sliding. Smooth surfaces can grip. Accept pointing and dictated reasoning; record the help provided.

Standard page

On a box sliding right, the friction arrow points left along the contact. The comparison must name the two surfaces and why resistance helps or hinders. A valid counterexample is smooth rubber gripping smooth glass. A polished drawing is not required.

Stretch page

Expect pad–wheel slowing/energy transfer contrasted with machine-contact wear/heating. To test a surface pair fairly, use the same block, load, slope, release, join and measuring start, with repeats. Unknown touching materials need the intended job, motion/attempted sliding and actual surface conditions before “helpful” can be judged.

Useful check: ask a pupil to change one word in a claim and explain how the answer changes. Do not turn this into an extra activity beyond the ten-minute We Do 2 stage.

Close Monday; retain the evidence

Revision 1 · 6 September 2026 · exemplar lesson only

Stop and carry forward

At the end of We Do 2, stop, label and retain the work. Tuesday resumes at Independent Work. Keep Monday's prediction available for Tuesday's separate 40-minute lesson: workshop 32 minutes (4 + 20 + 2 + 6), Lundy response 4 minutes, exit ticket 4 minutes. This exemplar does not contain the complete Tuesday investigation pack.

Record only what happened

Evidence	Adult note / support given
Explained friction at a contact	
Gave a helpful and an unhelpful example	
Predicted / discussed the demonstration	
Own practical performed?	Not inferred from watching a model or demonstration.

Pupil / date: _____

Adult / role: _____

Source and conversion record

Canonical weekly lesson: Science_Teesside/Grow/SCI_G_W3_Friction.html. Current Monday companion: resources/GS_W3A.html. Lessons repository source commit: 5018839965d424afd31bc0ac1b74dc8f713ceca2.

https://github.com/MattRoper1977/Lessons/blob/5018839965d424afd31bc0ac1b74dc8f713ceca2/Science_Teesside/Grow/SCI_G_W3_Friction.html

The seven Monday stage timers and all five helpful/unhelpful situations are retained. Printable tasks map to these stages; the selected response page replaces lengthy copying. Tuesday's results table and exit question are intentionally outside this Lesson A exemplar.

Editorial corrections: "Friction acts against movement" becomes contact-specific sliding friction; "Oil reduces friction" becomes conditional; the walking claim is limited to walking in the usual way; the WAGOLL uses energy transfer and slowing. These corrections match the companion's scientifically qualified model and are not changes to the teaching sequence.

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