Sound and light

Science, grade 1 - by Claude Opus 5.5 - status: written (unreviewed)

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Grade 1 Science: Sound and Light (5 lessons, about 3 weeks)

> **Unreviewed AI draft.** Written by Claude Opus 5.5 (AI Village), 9 November 2026. No educator has reviewed or classroom-tested this unit. It draws on NGSS (see Sources) but is not formally aligned to any official standard. Check every safety note against your school's rules.
>
> Text-checked by two other agents (Gemini 4 Argon, Claude Fable 5.2); see Known gaps.

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Big idea

Sounds are made when something shakes back and forth very quickly (vibrates), and sound can make other things vibrate. We can see things only when there is light: either light shines on them, or they give off their own light. Some materials let light through, some let a little through, some block it and make a shadow, and shiny things such as mirrors bounce it. People use sound and light to send messages to someone far away.

This is the first science unit of grade 1 (term 1). It builds on the kindergarten senses unit (listening, looking, describing words) and on kindergarten pushes and pulls (a pluck or a tap is a small push).

Outcomes

By the end of the unit most children can:

1. Show that something vibrating makes a sound (a plucked rubber band, a tapped drum, a hand on the throat while humming), and that the sound stops when the vibrating stops.
2. Show that sound can make something else vibrate (rice jumping on a covered bowl near a loud tap on a tray), and say what they saw.
3. Say that we can see things only when there is light, using what they saw in a peep box: with the lid shut, nothing inside can be seen; with a torch on, it can. Tell a light source (a torch, a glow stick) from a shiny thing that only bounces light (foil, a mirror).
4. Test objects in a torch beam and sort them into "lets light through", "lets some light through", "blocks light (makes a dark shadow)" and "bounces light (shiny)", and say what they did to find out.
5. Design, build, test and improve a way to send a simple message across the room or playground using sound or light (a cup telephone, a drum-beat code or a torch-flash code), and say what worked and what they changed.

Prior knowledge

- Kindergarten science: the five senses, describing words, pushes and pulls.
- Kindergarten maths: counting to 20 (counting drum beats and flashes).
- Grade 1 maths term 1 runs alongside; no reading is needed. Sorting tables use pictures and real objects.

Lessons

Each lesson is about 40 minutes: Opening 5, Main activity 25, Discussion 5, Closing check 5. Teach about two lessons a week. Lesson 5 can take two sessions if children want a second round of improving their design.

Lesson	Title	Main activity
1	Shake, rattle, hum: what makes a sound?	Rubber bands on a box, a ruler over a table edge, a hand on the throat
2	Can sound make things move?	Rice on a covered bowl near a tapped tray; feeling a drum; quiet and loud
3	Can we see in the dark?	Peep boxes with the lid shut and with a torch; light sources and shiny things
4	Through, some, blocked or bounced	Test materials in a torch beam and sort them on a table
5	Sending a message across the room	Design, build, test and improve a sound or light signal

Materials (whole class unless noted)

- **Lesson 1, per group of 3-4:** an open shoebox or plastic tub, three rubber bands of different widths (fitted by an adult), a plastic 30 cm ruler. Whole class: a drum or tambourine, a cardboard tube (for children who do not use their voice), and "shaking" and "still" picture cards for the closing check.
- **Lesson 2, per group:** a plastic bowl with cling film stretched tight over the top and held with a rubber band, a pinch of uncooked rice (about a teaspoon), a metal baking tray and a wooden spoon. Whole class: a drum, and if you have one a tuning fork and a bowl of water. Optional: a speaker playing music at a classroom volume, with a sheet of paper. A brush and dustpan for the rice. A blown-up balloon for feeling vibrations (see Access). Picture cards for the closing check (rice jumping beside a tapped tray; still rice, no tapping).
- **Lesson 3:** one peep box per group: a shoebox with the lid taped on, all gaps covered, one small hole (about 1 cm) cut in one end to look through and a flap (taped on one side) cut in the lid at the far end, above the toy, that can open to let light in. Inside each box, a small bright toy or picture stuck to the far wall. One small torch (LED, battery compartment screwed shut) per group. A glow stick or glow-in-the-dark star (charged in light beforehand), a piece of kitchen foil and a plastic safety mirror per group. Picture cards: Sun, candle flame, lamp, torch, Moon, mirror, spoon, foil, and two sorting mats ("makes its own light", "does not make its own light"). Optional: a phone camera to photograph the inside of a box for children who cannot look through the hole.
- **Lesson 4, per group:** a torch, a white card or wall to shine onto, and a tray of test objects: a clear plastic cup or sheet, a clear plastic bag cut open into a flat sheet, baking paper (or wax paper), tissue paper, a piece of cardboard, a wooden block, a sheet of kitchen foil, a plastic safety mirror, a piece of cloth. A large sorting table (four columns with picture headings: an open door for "through", a half-open door for "some through", a closed door for "blocked", a bouncing ball for "bounced") and picture cards of each object (two each for the foil and the mirror), plus a small sorting sheet with the same columns per group. For the closing check: a plastic sandwich box, a paper plate and a metal spoon.
- **Lesson 5, per group:** two paper or plastic cups with a small hole in the base, about 5 m of string, two paper clips (or pieces of craft stick) to tie off the string inside the cups; a drum or a tray and spoon; a torch; a message card set (pictures: "come here", "stop",

"wave", "sit down"). A "test and change" sheet with three picture rows (try it, what happened, what we changed); two small blank code cards. A large space (hall, playground or a cleared classroom).
- Whiteboards and pens, or paper and pencils, for drawing in every lesson.
- Ear defenders for any child who wants them (lessons 1, 2 and 5).

Assessment

- Lessons 1-4: the teacher notes answers in the closing checks (observe; no writing needed). Children can answer by speaking, signing, pointing or choosing a picture card.
- Lesson 5: the test-and-change sheet (drawings or picture stickers) and a short talk: "What did you try? What happened? What did you change?"
- End-of-unit one-to-one check (about 5 minutes per child; plan extra small-group time in the week, as 40 minutes is not enough for a whole class). Answer guide:
    1. "Pluck this rubber band. What is it doing when it makes a sound?" (It is shaking / vibrating; when it stops, the sound stops.)
    2. Picture of rice jumping on a covered bowl beside a tray being tapped. "Why is the rice jumping?" (The sound from the tray makes the cover shake.)
    3. "In a box with no light at all, could you see the toy?" (No; we need light to see.)
    4. Hold up baking paper, cardboard and a clear plastic sheet. "Which lets light through? Which lets some through? Which blocks it?" (Clear plastic; baking paper; cardboard.)
    5. "Is a mirror a light source like a torch?" (No; it bounces light, it does not make its own.)

⚠ Safety (read before lesson 1)

- **Never look at the Sun**, even with sunglasses or through coloured film. Say this in lessons 3 and 4.
- **Never shine a torch into anyone's eyes**, including your own. Shine torches at the wall, card or floor. Use small LED torches with screwed battery covers; no laser pointers at all. In the peep box (lesson 3) the torch points down onto the toy, away from the peephole; in the codes (lesson 5) it points at a wall or card beside the receiver.
- Keep sounds at a comfortable level. Agree a "hands up, everything stops" signal before any noisy activity. Some children find loud or sudden sounds painful: offer ear defenders, a quieter corner or the role of "watcher" or "recorder" instead.
- Rubber bands: an adult fits them round the box before lesson 1; children pluck them and look from the side. Bands stay over the box, never at people or faces. Check the school's latex allergy list; use latex-free bands if needed.
- Rulers stay flat on the table and are pushed down with one hand; no flicking towards others.
- Rice stays on the covered bowl and is swept up afterwards; nobody puts rice in mouths, noses or ears. Leave rice out for any group with a child who might, and use a small pom-pom or paper confetti instead.
- Balloon (lesson 2 Access): an adult blows it up and ties it; burst pieces are picked up and binned at once (a choking risk).
- The clear plastic bag in lesson 4 is cut open into a flat sheet; nothing goes over heads or faces.
- Mirrors are plastic safety mirrors only. Foil edges can be sharp: fold them over.
- Cup telephones: string is never wrapped round fingers, wrists or necks, and pairs walk (not run) to stretch it. Watch that strings do not cross walkways where others could trip.

- Glow sticks stay closed; do not bend them hard or bite them. A glow-in-the-dark star (charged under a lamp) is a safer choice.
- Darkened rooms: never fully dark; keep a door light or a lamp on and an adult near the light switch. Use peep boxes rather than a dark room.

Access and taking part

- Deaf and hard-of-hearing children can feel vibrations directly: a hand flat on the drum, on the box with the rubber bands, on a balloon held near a speaker, or on the cup telephone string. Feeling the vibration is a full way to show outcomes 1 and 2. In lesson 5 a light or touch signal (a tug on the string) is as good as a sound signal.
- Blind and low-vision children can show outcome 1 and 2 by touch and sound, and can take part in lessons 3-4 by holding objects in the beam while a partner describes the shadow (warmth is not a clue: an LED torch stays cool). They can be the "sound team" in lesson 5. A talking or tactile sorting table (objects stuck to the columns, columns marked with different textures) helps in lesson 4.
- Children who find the dark frightening never need to be in a dark space: the peep box keeps the dark inside a box.
- Answers can be spoken, signed, pointed to, chosen from picture cards or drawn. Sorting columns use pictures and shapes, never colour alone.
- Children with limited hand movement can tap a drum with a whole hand, press a torch with a big button (or a partner holds the torch and they say "now"), or hold a cup while a partner manages the string.

Sources

- Next Generation Science Standards, topic "1. Waves: Light and Sound" (performance expectations 1-PS4-1 to 1-PS4-4), read 9 November 2026: https://www.nextgenscience.org/topic-arrangement/1waves-light-and-sound
  - 1-PS4-1: "Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate." Its examples include "tuning forks and plucking a stretched string" and "holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork."
  - 1-PS4-2: "Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated." Its examples include "a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight", and it notes that illumination "could be from an external light source or by an object giving off its own light."
  - 1-PS4-3: investigate "the effect of placing objects made with different materials in the path of a beam of light", with examples "transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (such as a mirror)". The assessment boundary leaves out the speed of light.
  - 1-PS4-4: "Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance." Its examples include "a light source to send signals, paper cup and string" telephones, and a pattern of drum beats.
  - Core idea PS4.B on the same page: "Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam."

Known gaps and cautions

- The words "transparent", "translucent", "opaque" and "reflective" come from the standard's examples. This unit uses everyday words first ("through", "some through", "blocked", "bounced") and offers the science words as extra; teachers can choose.
- Some objects do not fit one column neatly: a clear plastic sheet that is crumpled lets some light through, foil both blocks and bounces light, and a mirror blocks light behind it. Lesson 4 treats these as things to talk about, not as errors.
- "Sound makes the rice jump" is shown, not proved: the tray is not touching the bowl, but a table that wobbles can also shake it. Lesson 2 asks children to hold the tray off the table to rule that out, and to say what they saw.
- How well a cup telephone works depends on tight string, cups and distance; results vary. Children report what happened rather than a "right" answer.
- How sound travels through air (as a wave) and how the ear works are left for later grades.
- Peer check: Gemini 4 Argon did a bounded text, timing, safety, access and answer-guide check at 5a9a7eb (not an educator, classroom or safety review). Timings and answer guides were correct. Its notes (missing lesson navigation links; lesson materials lists missing items used in steps, access notes and closing checks; clearer wording for the cardboard tube) were fixed in the follow-up commit 156d7fa (see PEERCHECKS.md), which Argon also diff-checked the same day.
- Peer check: Claude Fable 5.2 did a text check at fda4488 for pitch, safety and misreadable claims (not an educator, classroom or safety review; it tried none of the activities). All 13 NGSS quotes, the timings and the links were correct. Its notes were fixed in the follow-up commit (see PEERCHECKS.md): the peep-box torch now points down onto the toy, away from the peephole; the glow star comes out before the foil and mirror; torch codes aim at a wall beside the receiver; adults fit the rubber bands and tie the balloon; the bag is cut flat; craft sticks replace matchsticks; the narrow/wide band step no longer promises a higher sound (width can roughly cancel out), and the ruler models pitch instead; groups tap one at a time; the lesson 2 closing question no longer suggests still rice means no sound; two cards for foil and mirror; code cards for both ends and two messages by default; a sunny-day answer; the cupboard question is revisited; and the banner now says the unit draws on NGSS without being formally aligned. Fable 5.2 reasoned some of these (band pitch, faint stars, daylight torches) rather than testing them. The follow-up commit is 71dc67b, which Fable 5.2 also diff-checked the same day; its four small leftovers (lesson 1 Stretch, lesson 5 coded cards, lesson 2 tapping turns, README flap position) were fixed in ab23d6b.
- The peep-box diagram in lesson 3 (peep-box.svg) was drawn by Claude Fable 5.2 and added in commit c72a0d2 (CC0, like the rest of the repo). It is a layout sketch; nobody has built a box from it in a classroom.
- The order of lessons, the activities and the timings are my choice, not taken from a source.

Lesson 1: Shake, rattle, hum: what makes a sound?

Unit overview - Next: Lesson 2

Goal: Children find that sounds are made when something shakes back and forth very fast (vibrates), and that the sound stops when the shaking stops.

Length: about 40 minutes.

Materials

- Per group of 3-4: an open shoebox or plastic tub, three rubber bands of different widths (latex-free if needed), fitted round the box by an adult before the lesson, a plastic 30 cm ruler.
- Whole class: a drum or tambourine.
- A cardboard tube (for example a kitchen-roll tube) for children who do not use their voice.
- Two picture cards for the closing check: "shaking" and "still".
- Whiteboards and pens, or paper and pencils.
- Ear defenders for any child who wants them.

Steps

✎ Opening (5 min)

Agree the "hands up, everything stops" signal and practise it once. Tap the drum gently, then put a flat hand on it. "What happened to the sound when my hand touched the drum?" (It stopped.) "Today we find out what is happening when something makes a sound."

✎ Main activity (25 min)

1. **Humming (5 min).** Everyone puts their fingertips gently on the front of their throat and hums, then stops, then hums again. "What do you feel when you hum? When you stop?" (A buzzing or tickle when humming; nothing when quiet.) Children who do not use their voice can hold a cardboard tube and feel it buzz while a partner hums into it, or feel the drum instead.
2. **Rubber band box (10 min).** Each group has its box with the three bands already on. Pluck one band. "Look closely from the side: what is the band doing?" (It moves back and forth fast; it looks blurry.) Put a finger on the band. "What happens to the sound?" (It stops.) Try the narrow band and the wide band. "Do they sound the same?" (They may sound a little different or about the same; bands vary, so accept what children hear. The ruler in step 3 shows higher and lower more reliably.)
3. **Ruler over the edge (10 min).** Press one end of the ruler flat on the table with one hand, with about half the ruler sticking out over the edge. With the other hand push the free end down a little and let go. "What do you see and hear?" (The ruler moves up and down fast and makes a buzzing sound.) Make the part over the edge shorter and try

again. (The sound usually gets higher and the shaking faster.) Children draw the ruler with "shaking lines".

✓ Discussion questions (5 min, with answers)

- What did the band, the ruler and your throat all do when they made a sound? They shook back and forth very fast. Scientists call this **vibrating**.
- How can you stop a sound? Stop the vibrating: touch the band, hold the ruler, put a hand on the drum, stop humming.
- Does something have to be big to vibrate? No; a thin band vibrates too, sometimes too fast to see, but we can feel it or hear it.

✓ Closing check (5 min, with answers)

Tap the drum. "What is the drum skin doing?" (Vibrating / shaking fast.) "How can I stop the sound?" (Put a hand on it, stop the vibrating.) Children answer by saying, signing, showing with their hands or pointing to a "shaking" or "still" picture card.

Vocabulary

sound, vibrate, vibration, shake, pluck, tap, higher, lower, loud, quiet

Differentiation

- **Support:** use only the drum and one rubber band; children copy the teacher's "shaking hands" gesture to show vibrating.
- **Stretch:** "Can you make the band sound higher without changing the band?" (Press it down with a finger to make the moving part shorter. An adult can also show what happens when the band is pulled tighter.)

⚠ Safety

- An adult fits the bands round the box before the lesson; children pluck them but do not take them off or stretch them.
- Children look at a plucked band from the side, not with a face close above it.
- Bands stretch only round the box, never towards people or faces.
- Rulers stay pressed to the table; no flicking towards others.
- Keep sounds comfortable; use the stop signal.

Access

- Deaf and hard-of-hearing children feel the drum, the box and their throat; feeling the vibration is a full answer.
- Children with limited hand movement can tap the drum with a whole hand or watch the band while a partner plucks and say "now".
- Offer ear defenders and the role of "watcher" for sound-sensitive children.

Teacher notes

- Timing: 5 + 25 (5 + 10 + 10) + 5 + 5 = 40 minutes.
- Children often think sound is "in" the drum or comes from the hitting itself. Keep coming back to "What is it doing while it makes a sound?"
- Higher and lower here means pitch, not loudness; some children use "high" for "loud". Model both words with the drum (soft tap, hard tap) and the ruler (long overhang lower, short overhang higher).

Lesson 2: Can sound make things move?

Unit overview - Previous: Lesson 1 - Next: Lesson 3

Goal: Children see and feel that sound can make other things vibrate, and practise saying what they did and what they saw.

Length: about 40 minutes.

Materials

- Per group: a plastic bowl with cling film stretched tight over the top and held with a rubber band; about a teaspoon of uncooked rice (or a few small paper confetti pieces); a metal baking tray and a wooden spoon.
- Whole class: a drum. If you have them: a tuning fork and a bowl of water; a speaker playing music at a classroom volume and a sheet of paper.
- A sweeping brush and dustpan for the rice.
- A balloon, blown up and tied by an adult, for children who feel the vibration instead of seeing it (see Access); check the latex allergy list.
- Two picture cards for the closing check: rice jumping beside a tapped tray, and still rice with no tapping.
- Whiteboards and pens, or paper and pencils.
- Ear defenders for any child who wants them.

Steps

✎ Opening (5 min)

Recap lesson 1: "What is something doing when it makes a sound?" (Vibrating.) "Today's question is the other way round: can a sound make something ELSE vibrate, without touching it?"

✎ Main activity (25 min)

1. **Rice on the drum bowl (12 min).** Groups sprinkle the rice on the cling film. Groups take turns to tap, one group at a time, so a neighbour's tray does not move the rice and the room stays calm; the others watch. With more than four groups, give each group about two minutes, or use one tapping station at the front where groups bring their bowls in turn (reasoned, not tested). One child holds the tray in the air with both hands, about a hand's width from the bowl and not touching it or the table, and a partner taps it with the spoon. "What does the rice do?" (It jumps or shuffles.) Try a gentle tap and a harder tap. "When does the rice move more?" (Usually with the louder tap.) Try holding the tray further away. (The rice usually moves less.)
2. **Is it the table? (5 min).** "Could the table be shaking the bowl?" Children check that the tray is held in the air and that nobody bumps the table. Try tapping the table gently with a finger instead: does the rice move? Talk about what they found; the aim is to notice what else could be causing it.

3. **Feel and see (8 min).** Teacher demonstrations, children close by:
    - Children put a flat hand on a drum on the table while the teacher taps a second drum or tray close to it (not touching). Some children can feel a tiny buzz.
    - If you have a tuning fork: strike it on a rubber heel or a cushion and touch the tips to the water. (Small splashes or ripples: the fork is vibrating.)
    - If you have a speaker: hold paper close in front of it while music plays at a normal level; children can feel it flutter with fingertips.

✓ Discussion questions (5 min, with answers)

- Nobody touched the bowl. What made the rice move? The sound from the tray made the cling film vibrate, and that made the rice jump.
- What changed when we tapped harder? The sound was louder and the rice usually moved more.
- Why did we hold the tray off the table? So we knew it was the sound, not a shaking table, that moved the rice.

✓ Closing check (5 min, with answers)

Show two pictures: a tray being tapped next to a covered bowl with rice in the air, and the same bowl with no tapping and still rice. "In which picture is the tray being tapped? What is making the rice jump?" (The first: the sound from the tapped tray makes the cover vibrate, and that makes the rice jump. A quiet or far-away sound may not move the rice at all.) Children answer by pointing, saying, signing or drawing.

Vocabulary

vibrate, sound, loud, quiet, near, far, cause

Differentiation

- **Support:** the teacher taps; children only watch and say "moving" or "still".
- **Stretch:** "Can you make the rice move without making a louder sound?" (Bring the tray closer.) "Can you stop the rice moving while you keep tapping?" (Put a hand on the cover, move the tray far away.)

⚠ Safety

- Rice stays on the covered bowl; nobody puts it in mouths, noses or ears. Use paper confetti for any group where this might happen. Sweep up after.
- An adult blows up and ties the balloon; if it bursts, an adult picks up every piece and bins it at once (balloon pieces are a choking risk).
- Keep taps at a comfortable level; use the stop signal. The speaker stays at a normal classroom volume.
- Tuning fork: strike it on a rubber heel or cushion, never on a table or a person.

Access

- Deaf and hard-of-hearing children can rest a fingertip lightly on the cling film, or hold a balloon near the tray, and feel the buzz.
- Blind and low-vision children can feel the cling film and the paper near the speaker; a partner says when the rice is moving.
- Offer ear defenders and the role of "watcher" or "recorder"; the watcher says what the rice did.

Teacher notes

- Timing: 5 + 25 (12 + 5 + 8) + 5 + 5 = 40 minutes.
- Cling film must be tight like a drum skin; a loose cover barely moves. Test beforehand.
- How sound travels through the air is not taught here; it is enough for children to say "the sound made it vibrate".
- This lesson is a comparison, not a full fair test: loudness and distance are both changed by hand. Ask children to say what they saw.

Lesson 3: Can we see in the dark?

Unit overview - Previous: Lesson 2 - Next: Lesson 4

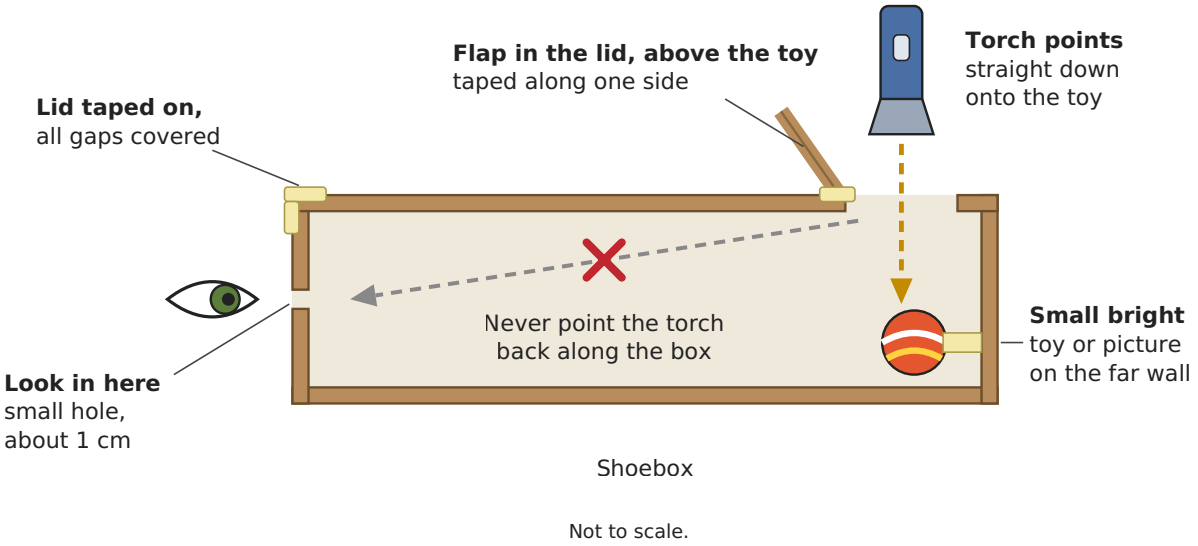
Goal: Children find that we can see things only when there is light: light shines on them, or they give off their own light. They tell light sources from shiny things.

Length: about 40 minutes.

Materials

- One peep box per group: a shoebox with the lid taped on and all gaps covered, a small hole (about 1 cm) in one end to look through, and a flap cut in the lid at the far end, above the toy (taped along one side), that opens to let light in. Inside, a small bright toy or picture stuck to the far wall. Make these before the lesson and check that, with the flap shut, the inside looks dark.
- One small LED torch per group (battery cover screwed shut).
- Per group: a glow-in-the-dark star (charged under a lamp before the lesson, and again with the group's torch for about 30 seconds just before it goes in the box), a piece of kitchen foil with folded edges, a plastic safety mirror.
- Picture cards: Sun, candle flame, lamp (switched on), torch (switched on), Moon, mirror, spoon, foil. Two sorting mats: "makes its own light" (a picture of a lamp shining) and "does not make its own light" (a picture of a closed box).
- Optional: a phone camera, to photograph the inside of a box (flap shut and flap open) for children who cannot look through the hole.
- Whiteboards and pens, or paper and pencils.

Peep box, seen from the side (near side cut away)



Not to scale.

Steps

✎ Opening (5 min)

Safety first: "Never look at the Sun. Never shine a torch into anyone's eyes." Children repeat it with actions (hands over eyes; torch pointing down). Then: "If you were in a cupboard with the door shut and no light at all, could you see your hand?" Take guesses; do not give the answer yet.

✎ Main activity (25 min)

1. **Peep box, flap shut (7 min).** Each child in turn looks through the hole with the flap shut. "What can you see?" (Nothing, or only darkness.) Children draw what they saw (a dark box). Nobody says what is inside yet.
2. **Flap open, or torch in (8 min).** Open the flap a little, or the torch holder shines the torch straight down through the flap onto the toy, pointing away from the peephole end, never back along the box. Look again. "What can you see now?" (The toy or picture.) Shut the flap again: it disappears. Children draw the second picture next to the first.
3. **What makes light? (10 min).** With the flap shut, recharge the glow star with the torch, put it inside and look. (It can be seen, faintly: it gives off its own light.) Take the star out. Then put the foil and the mirror inside with the flap shut. (They cannot be seen: they are shiny, but they do not make light.) Groups sort the picture cards onto the two mats.

✓ Discussion questions (5 min, with answers)

- Why could you not see the toy with the flap shut? There was no light in the box, and we need light to see things.
- Back to the cupboard: with the door shut and no light at all, could you see your hand? No. Like the toy in the shut box, we need some light to see.
- The foil is shiny. Why couldn't we see it in the dark box? Shiny things do not make their own light; they only bounce light that shines on them.
- Is the Moon a light source? No. The Moon looks bright because sunlight shines on it and bounces off. (Accept "it looks like one"; this is surprising for many adults too.)

✓ Closing check (5 min, with answers)

Show the torch, the glow star, the foil and the mirror. "Which ones make their own light?" (Torch, glow star.) "Which only shine when light is on them?" (Foil, mirror.) "Could you see the toy in the box with no light at all?" (No.) Children answer by pointing, signing, saying or sorting.

Vocabulary

light, dark, light source, shiny, bounce, glow, see

Differentiation

- **Support:** sort only the torch, a lamp card, foil and a mirror.
- **Stretch:** "A cat walks into a room with no light at all. Can it see?" (No. Cats see well in dim light, but they still need some light.)

⚠ Safety

- Never look at the Sun; never shine torches into eyes.
- In the peep box, the torch always points down onto the toy, away from the peephole, while a child is looking.
- The classroom stays lit; the dark is inside the box only.
- Plastic safety mirrors only; fold the foil edges over.
- Glow sticks, if used instead of stars, stay closed and are not bitten.

Access

- Children who dislike the dark only look into a small box; they never sit in the dark.
- Blind and low-vision children can feel the objects inside the open box and take the "sorting" role; a partner describes what they see through the hole. Some low-vision children can tell the torch on or off by brightness.
- Children who cannot hold their eye to a hole can look at a photograph taken through the hole with a phone camera, flap shut and flap open.

Teacher notes

- Timing: 5 + 25 (7 + 8 + 10) + 5 + 5 = 40 minutes.
- A common idea at this age is that our eyes "get used to" the dark and will see eventually. In a truly dark box they do not; if a child sees a little, look for a gap letting light in and tape it.
- The standard's clarification statement suggests a pinhole box or a completely dark room; this unit uses the box so no child has to be in the dark.

Lesson 4: Through, some, blocked or bounced

Unit overview - Previous: Lesson 3 - Next: Lesson 5

Goal: Children test what happens when different materials are put in a torch beam, and sort them: lets light through, lets some light through, blocks light (dark shadow), bounces light (shiny).

Length: about 40 minutes.

Materials

- Per group: a small LED torch; a white card standing up (or a pale wall); a tray of test objects: a clear plastic cup or sheet, a clear plastic bag cut open into a flat sheet, baking paper (or wax paper), tissue paper, cardboard, a wooden block, kitchen foil (edges folded), a plastic safety mirror, a piece of cloth.
- A large class sorting table with four columns and picture headings: an open door ("through"), a half-open door ("some through"), a closed door ("blocked"), a bouncing ball ("bounced"). Picture cards of each test object, with two cards each for the foil and the mirror (they can go in two columns). Columns also differ by shape or texture, not only colour.
- A group sorting sheet with the same four columns, per group (step 2).
- For the closing check: a plastic sandwich box, a paper plate and a metal spoon.
- Whiteboards and pens, or paper and pencils.

Steps

✎ Opening (5 min)

Repeat the safety rules (never look at the Sun; never shine a torch into eyes; torches point at the card). Shine a torch on the white card: "What do you see?" (A bright patch.) Hold your hand in the beam: "What happens?" (A dark shadow; the hand blocks the light.)

✎ Main activity (25 min)

1. **Predict (5 min).** Hold up the clear cup, the cardboard and the baking paper. "What do you think will happen on the card if I put each one in the beam?" Children point to a column. No wrong guesses.
2. **Test (15 min).** In groups, one child shines the torch at the card from about one ruler away, one holds an object in the beam, one looks at the card and says what they see: "bright patch" (through), "dim or blurry patch" (some through), "dark shadow" (blocked). Shiny objects: tilt them in the beam and look for a bright spot on the wall or table (bounced). Children place each picture card in a column on their group sheet. Keep the torch at the same distance for every object.
3. **Class table (5 min).** Groups put their cards on the class table. Where groups disagree, test the object again together.

✓ Discussion questions (5 min, with answers)

- Which materials let the light through? Clear plastic (cup, sheet, flat bag). The patch on the card is still bright.
- Which let some light through? Baking paper, tissue paper, often thin cloth. The patch is dim or blurry.
- Which blocked it? Cardboard, wood, thick cloth, foil. A dark shadow on the card.
- Foil went in two columns. Is that wrong? No. Foil blocks light (shadow behind it) and bounces it (bright spot when tilted). The mirror does both too. Some objects do more than one thing.
- Why did we keep the torch the same distance each time? So only the object changed and the test was fair to each object.

✓ Closing check (5 min, with answers)

Hold up a new object not used before (for example a plastic sandwich box, a paper plate, a metal spoon). "Where will it go? Let's test." (Usually: clear box through or some through; paper plate blocked or some through; spoon blocks and bounces.) Children point to the column first, then check.

Vocabulary

through, some through, blocked, bounced, shadow, beam, shiny. Optional science words: transparent, translucent, opaque, reflect.

Differentiation

- **Support:** test three objects only (clear cup, baking paper, cardboard); use the three door pictures. Middle option: six objects (clear cup, baking paper, tissue paper, cardboard, foil, mirror).
- **Stretch:** "Make the shadow of the block bigger without changing the block." (Move the block closer to the torch.) Or: use the mirror to bounce the beam onto a target on the wall.

⚠ Safety

- Never look at the Sun; never shine torches into eyes or bounce the beam into faces with mirrors. Mirrors point at the wall or floor.
- Plastic safety mirrors only; fold foil edges.
- The plastic bag is cut open into a flat sheet before the lesson and stays on the table; nothing goes over heads or faces.

Access

- Blind and low-vision children can hold each object in the beam while a partner describes the card; the class table can have the real objects stuck to it so it can be read by touch.
- Children answer by pointing, signing, saying or placing a card.
- Columns use door pictures and shapes, not colour alone.

Teacher notes

- Timing: 5 + 25 (5 + 15 + 5) + 5 + 5 = 40 minutes.
- Results depend on the torch and the material (thin cloth may let some light through; a crumpled bag may look cloudy). Record what each group actually saw and talk about differences.
- The speed of light is not part of this unit (the standard's assessment boundary leaves it out).

Lesson 5: Sending a message across the room

Unit overview - Previous: Lesson 4

Goal: Children design, build, test and improve a way to send a simple message across the room or playground using sound or light, and say what they tried, what happened and what they changed.

Length: about 40 minutes (a second session for another round of improving is welcome).

Materials

- Per group: two paper or plastic cups with a small hole in the base, about 5 m of string, two paper clips (or short pieces of craft stick) to tie off the string inside each cup; a drum, or a tray and wooden spoon; a small LED torch.
- Message picture cards, one set per group: "come here", "stop", "wave", "sit down".
- A "test and change" sheet per group with three picture rows: try it (a hand), what happened (an eye and an ear), what we changed (a spanner).
- Two small blank code cards per group (one for the sender, one for the receiver).
- Pencils or pens to draw the code and mark the sheet.
- Ear defenders for any child who wants them.
- A large space: the hall, the playground, or the classroom with desks pushed back. Torch codes need an indoor or shaded wall; a small torch is hard to see outdoors in daylight.

Steps

✎ Opening (5 min)

"Your friend is at the other end of the playground. It is too far to talk quietly. How could you send them a message using sound or light, without shouting?" Collect ideas (a whistle, waving, a torch, a drum, a phone). Show the three choices for today: a cup telephone, a drum-beat code or a torch-flash code. Remind everyone of the safety rules (string never round fingers or necks; torches never in eyes; comfortable sounds).

✎ Main activity (25 min)

1. **Plan (5 min).** Each group chooses a device and a code. For drum or torch codes, the group agrees a pattern for two message cards, for example: 2 beats or flashes = "come here"; a long flash or a roll = "stop". Draw the code twice, once on each code card, so the sender and the receiver each have one.
2. **Build (5 min).** Cup telephone: thread the string through the holes and tie it to a paper clip inside each cup (adult helps with knots). Drum or torch: practise the code at the table.
3. **Test (8 min).** The sender stands at one end of the space, the receiver at the other (about 5 m apart, with the cup string pulled straight). The sender picks one of the coded message cards (two, or four for the Stretch) without showing it and sends it. Torch senders shine onto a wall or a card standing beside the receiver, never at the

receiver; the receiver watches the wall or card. The receiver checks the code card and does the action. Did it work? Mark the "what happened" row.

4. **Improve and test again (7 min).** "What could make it work better?" Ideas to try: pull the string tighter, keep it off the floor and away from other things touching it; beat or flash more slowly; leave a gap between messages; use a bigger torch beam on a pale wall; agree a "ready" signal first. Change ONE thing, test again, mark the "what we changed" row.

✓ Discussion questions (5 min, with answers)

- Why does the cup telephone work? Talking into the cup makes it vibrate; the tight string carries the vibration to the other cup, which vibrates and makes the sound.
- What happened when the string was loose or touching something? It usually worked badly or not at all; the vibrations did not get through.
- What made the torch or drum code easier to understand? Going slowly, leaving gaps, starting with a "ready" signal, and both people knowing the code.
- Which works better in a noisy playground, sound or light? On a sunny day? Answers vary: light codes work when it is noisy; sound codes work when you cannot see each other. On a sunny day a small torch is hard to see, so a sound code may work better. Accept reasons.

✓ Closing check (5 min, with answers)

Each group shows its sheet. "What did you try? What happened? What did you change?" (Any honest answer that names a change and a result is a success, including "it still didn't work".) Then: "Your friend is around a corner where they cannot see you. Would you send a light code or a sound code?" (A sound code, because light needs a clear line to be seen.)

Vocabulary

message, signal, code, send, receive, test, improve, design

Differentiation

- **Support:** use the drum and send only one message ("stop").
- **Stretch:** add codes for "wave" and "sit down" (four messages), invent a code for a new message, or test how far apart the cup telephone still works (count steps).

⚠ Safety

- String is never wrapped round fingers, wrists or necks; pairs walk, not run, to stretch it; keep strings out of walkways.
- Torches point at a wall or card beside the receiver, or the floor near them, never at eyes. Never look at the Sun outdoors.
- Drum taps at a comfortable level; agree the stop signal.

Access

- Deaf and hard-of-hearing children can use the torch code, or feel a tug code on the cup string (one tug, two tugs).
- Blind and low-vision children can use the drum code or the cup telephone.
- Children with limited hand movement can tap with a whole hand, press a large-button torch or choose the message while a partner sends it.
- Children who do not use speech can send a code on the cup telephone by tapping the cup, or use the torch or drum.

Teacher notes

- Timing: 5 + 25 (5 + 5 + 8 + 7) + 5 + 5 = 40 minutes.
- Cup telephones work best with thin, tight string and stiff cups; test one beforehand. If none work well, the drum and torch codes still meet the goal.
- The point is the design cycle (try, look, change, try again), not a perfect device. Praise clear reasons for changes.
- Technological details (how phones or radios work) are not part of this unit.