

GAMES & ACTIVITIES (FULL INSTRUCTIONS)

Energy Card Match — the backbone game

Pieces: 4 title cards (HEAT · LIGHT · ELECTRICITY · MOVEMENT) + 20 action cards (game-components, printed and laminated). **LOOP:** action cards face-down in the middle; each child flips one, names it, deals it to the form that makes it go, and defends the call; the group may challenge. **ENDING:** deck exhausted. Then the overlap hunt: find every card that belongs under TWO titles at once (candle → heat AND light; toaster → heat and light) and lay it straddling the piles — say the word **overlap** aloud. **WIN/PAYOFF:** the children discover that only FOUR forms power everything. **Little:** match picture to medallion. **Older:** defend the both-cards. **TEACHER KEY** printed on the back of each title card.

“Does It Go By Magic?” — judgment circle

Semicircle. Teacher holds up a real object or names a storybook event (“the toaster pops” / “the wand lights the room”). Each child calls **REAL** or **MAGIC** — and if **REAL** must name the form of energy and where it comes from. Run ~12 calls, mixing appliances with spells. Key: magic is make-believe; every real go traces to heat/light/electricity/movement arriving from a real source.

Trace-the-Wire hunt + SAFETY

Follow a lamp’s cord to its plug, the plug toward the breaker box, then step outside and spot the line coming to the house: **the switch is only a gate** — the energy arrives by wire from somewhere. **SAFETY, verbatim:** there is electrical power behind every plug and socket; it can burn and even kill; fingers and objects NEVER go into a plug or socket; hands away from electrical lines and boxes.

Energy-changes-form demo bench

Four stations, each child makes one go, says “___ turned into ___” aloud, then makes it STOP and says what ran out: solar car (light→movement — shade the panel with a hand), wind-up toy (stored→movement), hand-crank flashlight (movement→light — dims the instant cranking stops), the owned hot-cup Stirling engine (heat→movement). Line all four up at the end: *something was spent every time*.

THE “DOWNHILL” Q&A (CLOSING DISCUSSION)

Ask, with Think Time: *Do you ever see room-temperature cocoa heat itself up? Light from the room flowing INTO a lamp and the room going dark? A dead battery charging itself?* Guide to the rule: energy always travels from more toward less — hot→cold, bright→dark, charged→drained. Invite counterexamples; every one dissolves on inspection (the downhill ball is pulled by gravity). Close: every conversion sheds some heat, heat drifts toward cooler places and finally to space — so the world always needs fresh energy. Where from? That is C-3’s secret: the sun.

COMMON MISCONCEPTIONS (FROM THE BOOK, KEEP AT HAND)

- “The switch makes it go” → the switch is a tap on a wire; no electricity behind it, no go.
- “The stove cooks” → the HEAT cooks; the stove converts electricity or gas to heat.
- “It takes batteries” → batteries are bottles for energy; that is why they go dead.
- “The toaster turns electricity into toast” → back up one step: electricity→heat, and the heat toasts.
- Energy vs force: force is the strength of a push or pull — mention once, park it for C-3A.

REVIEW HOOKS

- Science notebooks: the four forms + one observation proving a conversion (no paper-fold books in this kit).
- Every car ride this week: “what form of energy is making THIS go, and where did it come from?”
- Cartoon audit (book’s To-Parents): could that really happen? What would happen instead, and why?

PREP-AHEAD CHECKLIST (NIGHT BEFORE)

☐ print + laminate the energy card set ☐ wind the wind-up toys; pocket one for the oration ☐ candles, long-reach lighter, snuffer, metal tray staged out of reach (A-7 kit) ☐ test the lamp + darkenable room ☐ thermos filled with near-boiling water just before session; metal mug, spoon, cold butter standing by ☐ aerogel tile on its tray ☐ solar car + tissue + floor tape + timer at the sunny lane ☐ coins counted, one per child

Opening Oration — Nothing Goes by Magic

read aloud, 2–3 minutes • keep the wind-up toy hidden in a pocket until its moment

PROP: a wind-up toy — wound tight before you begin. Hold it still and silent through the first half; release it mid-sentence where marked.

“I want to tell you about the most honest rule in the whole universe. It is this: **nothing goes by itself**. Nothing. Not one thing.”

“In stories, a wand waves and a feather floats across the room. A broomstick flies. A castle lights itself. Have you ever tried it? Point at something right now — go on, point hard — and tell it to move.” (*Let them try. Nothing moves.*)

“Nothing happened. And nothing ever will — because in the real world, every single thing that moves, or glows, or warms up, got its go from somewhere. That go has a name. It is called **energy**.”

“There are only four kinds of go in all the world. **Heat** — the warm kind. **Light** — the bright kind. **Electricity** — the kind that travels through wires. And **movement** — the go itself. Four. That’s the whole list. Every machine, every fire, every sunbeam, every bouncing ball runs on one of those four.”

“But here is my favorite part. Energy can **hide**. It can curl up inside things and wait — inside a battery, inside a candle, inside your breakfast, and inside...” (*bring out the wound toy, hold it dead still*) “...this. Watch. My arm wound this spring up tight this morning. My movement went INTO it, and it has been waiting in there, all this time, for me to...” (*release it — let it clatter across the floor*) “...let it out!”

“Today we are going to catch energy doing everything it does: changing from one kind into another, hiding and coming out, and always, always arriving from somewhere real. And when anyone asks you how the lamp knows to light — you will be able to follow the wire and tell them.”

C-1 Supply List — Concepts of Energy I: Making Things Go

Everything for the full 9:30–2 day. Prices are rough. **Order-ahead flags matter:** the solar car, crank flashlight and pull-back/wind-up set all ship — allow a week. This lesson's purchases are the backbone of the whole C thread — nearly everything here is reused in C-2 through C-7.

ALREADY HAVE (TYPICAL HOUSEHOLD / PRIOR KITS)

☐	ITEM	USED IN
☐	Long-reach lighter + snuffer + metal tray (A-7 kit)	Candle demo (Card 5)
☐	The hot-cup Stirling engine (owned)	Demo bench — heat→movement
☐	The silica aerogel tile (owned)	Card 4 — conduction by refusal
☐	0.1g digital scale (A-8/A-9 kit)	(not needed today; C-3 will use it)
☐	A lamp on a cord + a darkenable room	Light-flows demo, Trace-the-Wire
☐	Thermos, metal mug, metal spoon, butter	Card 3 — three ways heat moves
☐	Coins (one per child)	Card 1 — movement makes heat
☐	Tissue paper, floor tape, 5-second timer	Card 2 — solar car fair test
☐	A basket of small appliances/objects to pass	"Does It Go By Magic?" circle

TO BUY

☐	ITEM	QTY	~PRICE	WHY	ORDER AHEAD?
☐	Solar toy car	1	\$10	Card 2's fair test — light→movement you can race; returns in Thread D for sunlight work	YES — ships
☐	Hand-crank flashlight	1	\$12	Demo bench — movement→light, dims when you stop; returns in C-6	YES — ships
☐	Pull-back cars + wind-up toys set	1 set	\$15	Stored-energy props; oration prop; reused in C-3's free-play stations	YES — ships

☐	ITEM	QTY	~PRICE	WHY	ORDER AHEAD?
☐	Rubber-band assortment	1 bag	\$5	Bought ONCE here; reused in C-2 pluck lab, C-3 free play, C-4 weigh-the-band	Yes
☐	Birthday candles	1 box	\$3	Card 5 — wax is a fuel	No
☐	Cardstock + lamination for the energy card set	—	\$5	The backbone game (print files in game-components/)	No

Total new spend: ~\$50 — and five of the six purchases are reused across at least one later lesson.

CHECK-YOU-OWN-IT NOTES

- **Do NOT buy a Stirling engine** — the household hot-cup one is exactly right; it runs on a mug of hot water at the demo bench.
- **Do NOT buy aerogel if a tile is owned** — buy the plain silica tile (~\$25) only if starting from nothing; never the powder or beads.
- The wind-up toy for the oration pocket comes out of the pull-back/wind-up set — no separate buy.

Tick the box beside each item as it goes in the box. Anything flagged **order ahead** ships — buy it a week before the lesson.

Movement Makes Heat

KIDS HANDS-ON

RUN AT 9:50

10 MIN

The point

One form of energy turns into another **in your own hands**: movement becomes heat you can feel.

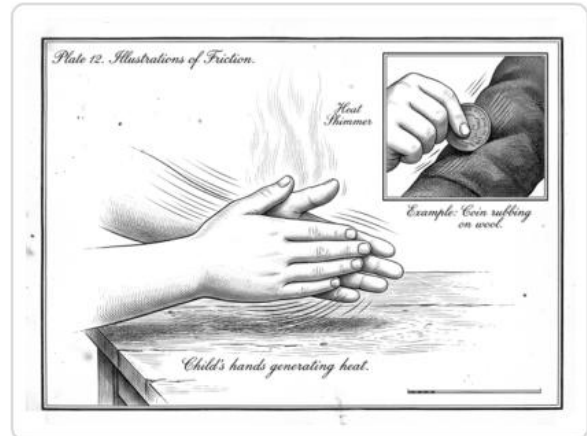
Materials

- One coin per child
- Bare palms • a pant leg or carpet patch

Steps

- 1 **PREDICT** on the worksheet first: after 20 seconds of rubbing, hands will feel **warmer** / **the same**.
- 2 Everyone rubs palms together **hard and fast for 20 seconds**, then presses them to a cheek.
- 3 Now the coin: rub it fast on a pant leg for 15 seconds, then touch it to the lip (the lip feels small heat best).
- 4 Circle what really happened on the worksheet. Which form went IN? Which came OUT?

Say: “Nobody lit a fire. Your **MOVEMENT** became the heat — one form of energy turning into another, right in your hands.”



TEACHER PREP

Wipe a stretch of tabletop; hand out coins. Nothing else — this one runs on muscle.

What to watch for

- The cheek/lip test lands better than asking “are they warm?” — the sensing skin is the instrument
- Kids who rub gently feel nothing — effort IS the energy input

EXPECTED RESULT

Palms and coin come out genuinely warm. Movement energy became heat energy — the lesson's first conversion, owned by every child.

The Solar Car Fair Test

KIDS HANDS-ON + MEASURE

RUN AT 10:40

25 MIN

The point

No energy in, no going. Light is the car's **ONLY** fuel — so dimming the light must change the going. A real **fair test**: change one thing, keep everything else the same.

Materials

- Solar toy car
- Tissue paper (several layers)
- Floor tape • a taped start line and lane in full sun
- A 5-second timer

Steps

- 1 Tape the lane where the sun lands. Same lane, same car, same start line, every run.
- 2 **HYPOTHESIS on the worksheet first**: more light means the car will go... (child's own words, grown-up scribes).
- 3 Run 1 — full sun: release at the line, time 5 seconds, tape-mark where it reached.
- 4 Run 2 — ONE tissue layer over the panel. Mark.
Run 3 — TWO layers. Mark.
- 5 Run 4 — a hand fully shading the panel. Watch what happens. Mark (if there is anything to mark!).
- 6 Stand back and read the tape marks like a staircase. What did the light DO?

*Say: "Same car, same floor, same five seconds. The **ONLY** thing we changed was the light — so the light is what makes it go."*

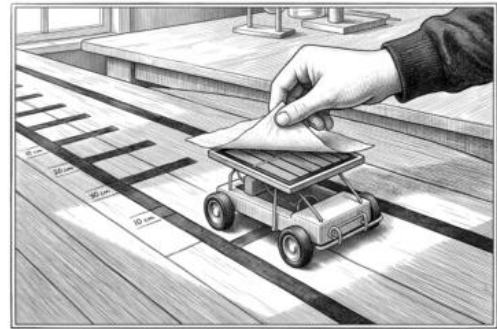


PLATE 7. FIG. 2. — Observation of Solar Car Efficiency Under Varied Shading Conditions. A. Child's hand applying a thin tissue filter to the solar array. B. Experimental track with marked distance intervals. Note the influence of direct illumination and partial shading on propulsion velocity.

TEACHER PREP

Charge nothing — the car has no battery, which **IS** the point. Scout the sunniest floor patch at the session hour; have the timer and tape pre-torn.

What to watch for

- The staircase of marks — each tissue layer shortens the run
- The hand-shade run: the car does not move **AT ALL** — say "no energy in, no going" out loud
- Fair-test talk: why the same lane? why five seconds every time?

EXPECTED RESULT

Distance falls as light falls, and dies to zero with the panel covered. The hypothesis is checked against the tape marks, not against opinions.

Three Ways Heat Moves

TEACHER POURS, KIDS OBSERVE

RUN AT 11:35

20 MIN

The point

Heat travels three ways, and each gets its NAME said out loud: **RADIATION** (felt from the side), **CONVECTION** (warm air rising above), **CONDUCTION** (heat walking up the metal spoon).

Materials

- Thermos of near-boiling water (filled at home)
- Metal mug • metal spoon
- A pat of cold butter
- A timer

Steps

- 1 Teacher pours the thermos into the metal mug. Kids keep hands OFF the mug.
- 2 **RADIATION:** each child holds a palm near the mug's SIDE (not touching, not above). Feel the warmth arriving through the air. Name it.
- 3 **CONVECTION:** hold the palm ABOVE the mug — warmer than beside it! Warm air is rising in a column. Name it.
- 4 **CONDUCTION:** stand the spoon in the mug, press the butter pat onto the spoon's TOP end. **PREDICT the slump time.** Start the timer.
- 5 Watch the butter slump as heat climbs the metal. Stop the timer. Name it.

Say: “Three roads for the same traveler: heat **BEAMS** out sideways, heat **RIDES** the rising air, and heat **WALKS** up the metal — radiation, convection, conduction.”



TEACHER PREP

Fill the thermos just before session so the mug is properly hot on cue. Cold butter straight from the fridge slumps more visibly than soft.

What to watch for

- The above-the-mug hand always surprises — hotter than beside it
- The butter slump is slow — let the timer build suspense
- All three NAMES said aloud by the kids, not just the teacher

EXPECTED RESULT

Warmth beside (radiation), more warmth above (convection), and a slumped butter pat some minutes later (conduction) — three ways, three names, one mug.

The Material Heat Cannot Cross

KIDS OBSERVE, ADULT HANDLES

RUN AT 12:00

15 MIN

The point

Aerogel is 99.8% air held in a glass skeleton — the best solid insulator there is. It teaches **conduction** by flatly refusing to do it.

Materials

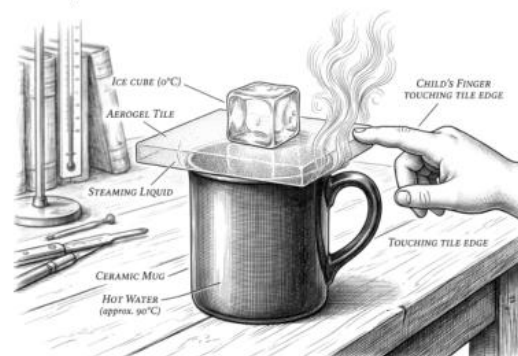
- The silica aerogel tile (owned — handle over a tray, it sheds dust)
- Mug of very hot water • an ice cube
- A metal spoon or coin for contrast

Steps

- 1 Set the mug of hot water on the table. Lay the aerogel tile flat on top of the mug.
- 2 **PREDICT:** will heat cross the tile? Will an ice cube on top melt?
- 3 Set the ice cube on the tile. Kids touch the tile's TOP with one finger — cool! — while the mug below is too hot to hold.
- 4 Swap: metal spoon flat over the mug, finger on top — hot within seconds. The metal conducts; the aerogel refuses.
- 5 Pass the tile over the tray: it looks like solid frozen smoke and weighs nearly nothing — call back A-4: matter is mostly empty space, and here is that emptiness in your hand.

Say: "The heat is right there, pushing — and this ghost-solid just will not carry it. That carrying is called CONDUCTION, and aerogel is the world's worst at it. That is exactly what makes it precious."

PLATE 24. THERMAL INSULATION DEMONSTRATION OF AEROGEL.



TEACHER PREP

NO flames — hot water only. Tray under the tile at all times; brittle, sheds dust; adult places and removes it.

What to watch for

- The unmelting ice cube — give it real minutes while talk continues
- The metal-spoon contrast lands the concept in seconds
- Every child gets the weight moment — it is unforgettable

EXPECTED RESULT

Ice sits unmelted on a tile above steaming water; the same setup with metal is hot in seconds. Conduction has a name, a hero, and a refusal.

The Candle Is a Fuel

TEACHER DEMO

RUN AT 12:20

10 MIN

The point

Wax is **stored energy**. Burning lets it out — as heat AND light at once — and the wax's tiny particles are NOT destroyed: like a block tower falling, the blocks all remain; only the arrangement changes.

Materials

- Birthday candles • metal tray
- Long-reach lighter + snuffer (A-7 kit)

Steps

- 1 **PREDICT on the worksheet:** the wax will stay the same / slowly get shorter; its stored energy leaves as nothing / heat and light.
- 2 Teacher lights one birthday candle standing on the metal tray. Kids observe from a seated ring.
- 3 Feel-from-a-distance: palms toward the flame — heat arriving. Eyes: light arriving. TWO forms leaving at once.
- 4 Watch the candle shorten. Where is the wax going? NOT into nothing — its particles go off into the air; only the STORED ENERGY has left.
- 5 Snuff it. The wax that remains is the same stuff it always was.

Say: "Wax is a fuel — sunshine a plant packed away long ago. Burning does not destroy the blocks; it only lets the tower down, and the energy comes out as heat and light."

PLATE 14. - STUDIES OF COMBUSTION AND LUMINOUS PHENOMENA.



TEACHER PREP

Candle upright on the tray before kids arrive; lighter and snuffer stay in adult reach; hair tied back in the ring.

What to watch for

- The two-forms moment: heat to the palms AND light to the eyes, simultaneously
- The shortening wax — revisit at the end of session for proof
- The block-tower phrasing for atoms-remain — use it verbatim

EXPECTED RESULT

The candle burns shorter, giving heat and light together; the group can say where the wax went and what actually left it — energy, not matter.



THE BIG IDEA

Nothing goes, works, moves, or changes **by itself**. It always takes **energy** — and energy comes in just four active forms: **heat**, **light**, **electricity**, and **movement**. Four forms power everything you have ever seen go.

One form can **change into another**: a lamp turns electricity into light, rubbing your hands turns movement into heat, the sun's light warms the pavement. Energy can also **hide in storage** — in a battery, a wound spring, a candle, your breakfast — and come back out later. But it always **comes from somewhere**: the switch on the wall is only a gate for electricity arriving by wire.

Burning does not destroy the wax — its tiny particles all remain; only the stored energy leaves, as heat and light together.

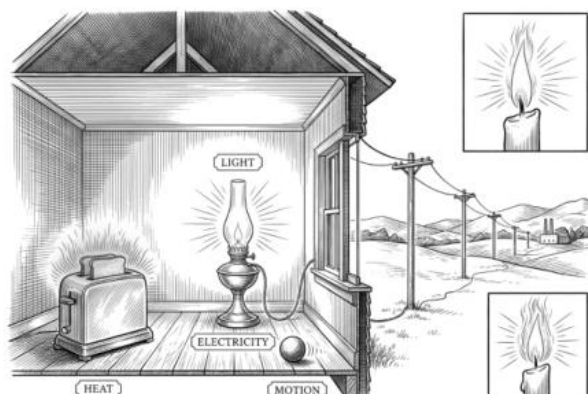


Fig. 1 — energy's four faces in one room: heat, light, electricity, motion — and the wire traced home to the power station

WORDS TO KNOW



energy

what makes things go, work, move, or change



heat

the warm form — it always flows toward cooler places



light

the bright form — it flows straight out from its source



electricity

the form that travels to us through wires



movement

the go itself — a push or a roll carrying energy along

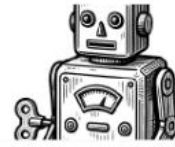


stored energy

energy waiting its turn — in a battery, a spring, a fuel

WATCH FOR THIS IN EVERYDAY LIFE

- Follow any cord in the house to the wall — “where is this lamp’s energy really coming from?”
- Rub your hands together fast, then touch your cheek — “which form just turned into which?”
- Next machine you see going, name its form — “heat, light, electricity, or movement?”



heat

heat

light

light

electricity

electricity



1 • MATCH THE MACHINE TO THE FORM THAT MAKES IT GO

Draw a line from each picture to its energy medallion. (A grown-up reads the words.) Careful — one belongs to TWO medallions: give it two lines.



toaster toasting



HEAT



lamp glowing



LIGHT



ball sailing



ELECTRICITY



water boiling



solar calculator



MOVEMENT



windmill turning



2 • GUESS FIRST, THEN CIRCLE WHAT REALLY HAPPENED

The palm rub

After 20 seconds of rubbing, my hands will feel...

☐ warmer

☐ the same

The candle burn

The wax will... ☐ stay the same

☐ slowly get shorter

Its stored energy leaves as...

☐ nothing

☐ heat and light

The covered lamp

When the lamp is covered, the room will...

☐ stay a little bright

☐ go fully dark



1 • THE HOME ENERGY HUNT

Walk the house with a grown-up. For each machine, circle the form of energy going IN, and the form coming OUT. (H = heat, L = light, E = electricity, M = movement)

THE MACHINE	ENERGY IN	ENERGY OUT
lamp	H L E M	H L E M
toaster	H L E M	H L E M
fan	H L E M	H L E M
sun on the pavement	H L E M	H L E M
my own legs running	food (stored)	H L E M
one more we found: (grown-up writes it)	H L E M	H L E M

2 • CIRCLE EVERYTHING THAT IS HOLDING ENERGY FOR LATER

Five things on the shelf. Circle each one that has stored energy waiting inside it. (Hint: more than one!)



battery



candle



wound-up toy



stretched band



log for the fire

Tell a grown-up: how does the energy come OUT of each one you circled?



VERSE 1

The lamp is bright, the kettle's hot,
The little car goes — but why?
Nothing goes by magic, no,
Something had to say GO.

CHORUS

Heat! Light! Electricity! Movement!
Four ways the going gets done.
Heat! Light! Electricity! Movement!
And every one came from somewhere — every
one!

VERSE 2

Rub your palms and count to ten,
You just made heat from moving again.
The sun on the pavement, warm to the toes —
One form turns into another, and away it goes.

(CHORUS)

VERSE 3

I flipped the switch, did the switch make the
light?
No! A switch is a gate, not a source, that's right.
So trace the wire, keep tracing the wire,
Back to the plug, back to the fire.

(CHORUS)

VERSE 4

The battery's tired, the wind-up's slow,
Stored-up energy lets go.
Nothing comes from nowhere and nothing's for
free —
So where did it come from? Come and trace it
with me.

(CHORUS ×2, SECOND TIME CLAP ON EVERY
FORM)

Tag (spoken, kids): "Heat... light... electricity...
MOVEMENT!"

How to use it. Play the recording once while everyone just listens. Play it again and join in on the chorus only — that is the part carrying the lesson. By the third time most children have the chorus. Then close the binder and ask what the words actually mean; a child who can sing it and explain it has the idea for good.