

Six experiments. **ZERO** boring summers!



Sunshine & Science

Vol. 3



**SCIENCE
AT HOME**



**FUN
BRAIN
BOOSTERS!**



**EXCITING
HANDS-ON
PROJECTS**

A magazine of family
STEM adventures!

READY TO EXPERIMENT?

This summer, you're going to do some things that might surprise you. You'll feed sugar to yeast and watch a balloon inflate on its own. You'll blast cocoa powder through a shoebox. You'll bury warm water underground and see what happens. Each one connects to how energy actually works in the world.

(Spoiler: It's messier than you'd expect.)

Grab a friend, a family member, or just your own curiosity, and flip to whatever looks most interesting. There's no wrong place to start.

– *The Switch Classroom Team*

HOW TO USE THIS PACKET

- Pick a section that looks fun.
- Grab what you need: most materials are already in your kitchen.
- Make a prediction, then test it.
- Talk about what you found!

AGES

Made for ages 7-12, but most labs work younger or older with a small tweak.



THIS IS GOING TO BE FUN!



PARENTS:

Want to go deeper?

Every activity in this packet has a full lab version available free at switchclassroom.org. Full labs include data tables, analysis questions, graphics, and more... great for going deeper after the fun.

Find them all in the Sunshine and Science Vol. 3 collection in our resource library.



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MAKE WAVES

Two water labs that get you wet:

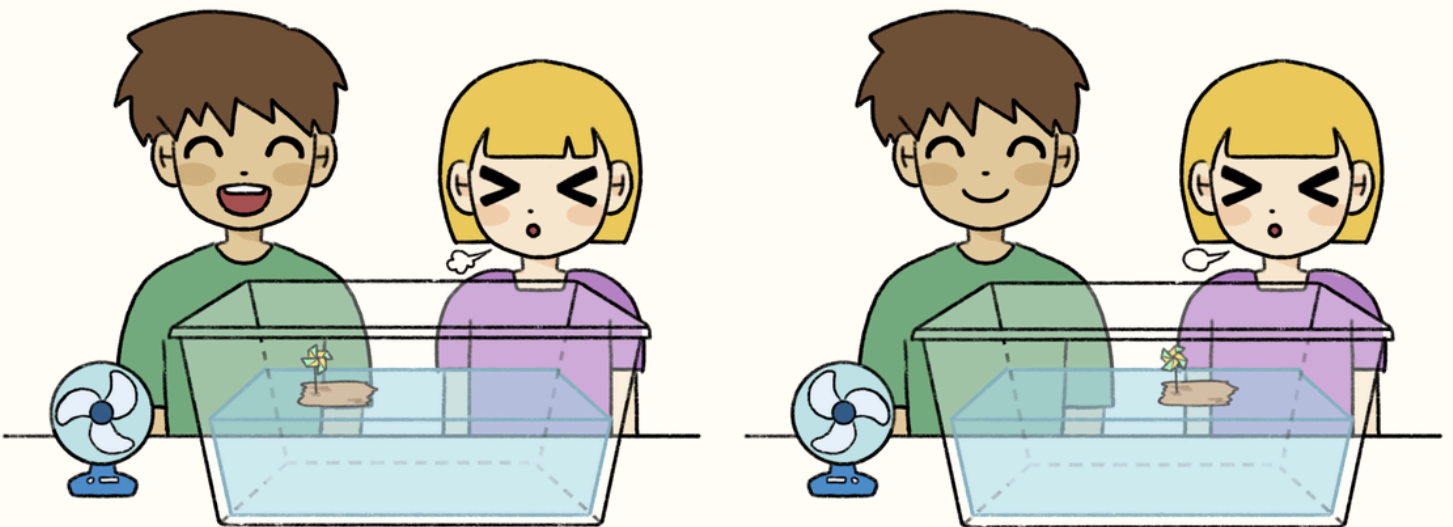
WATER PRESSURE & FLOW LAB

OFFSHORE WIND LAB

PUZZLE 1

SPOT THE DIFFERENCE

Two summer-energy scenes... but 5 things have changed. Circle every difference you can find. The answers will be on the last page.



WATER PRESSURE & FLOW

Does more water mean more pressure? Grab a bottle, poke a hole, and find out.

 **Outdoor · Ages 7–12 · 30 min · Mess level: medium**

WHAT YOU'LL NEED

- 2-liter bottle
- Pushpin
- Large bucket
- Measuring cup
- Permanent Marker
- Stopwatch (your phone works)

MAKE A GUESS FIRST

At which fill level will water shoot out fastest? Write it down before you start.

GROWN-UP PREP

Poke a small hole near the bottom of the bottle with a pushpin. Mark four lines on the outside: $\frac{1}{4}$ full, $\frac{1}{2}$ full, $\frac{3}{4}$ full, and full.

DO THE LAB

- Cover the hole with your finger. Fill the bottle to the top.
- Hold over the bucket, take your finger off, and start the timer.
- After 10 seconds, cover the hole again.
- Pour what's in the bucket into the measuring cup. Write down how much came out.
- Repeat at $\frac{3}{4}$ full, $\frac{1}{2}$ full, and $\frac{1}{4}$ full.
- Look at your four numbers. Which fill level pushed the most water out?

WHY IT WORKS

More water = more weight pushing down = more pressure at the hole. Real dams are built with this in mind.


PUSH IT FURTHER

Try holding the bottle higher off the ground. Does height change anything? What about making the hole a little bigger?



FLOAT THE WIND FARM

Can you build a floating wind turbine that survives waves? Time to find out!

 **Indoor or Outdoor · Ages 7–12 · 45–60 min · Mess level: high**

WHAT YOU'LL NEED

- A pinwheel
- A large bin or tub of water
- A fan
- Building materials: bottles, cups, foam, tape, cardboard, string, coins (whatever you can find around the house)

SKETCH IT FIRST

Before you build, draw your design. What keeps it floating? What keeps it from tipping? What stops it from drifting?

YOUR MISSION

Build a floating platform that holds a pinwheel without tipping or drifting... even when waves hit.

BUILD AND TEST

- Build your floating platform and attach the pinwheel on top.
- Float test: place it in water. Does it stay upright for 10 seconds?
- Wind test: turn on the fan. Does the pinwheel spin?
- Drift test: does the platform stay in place?
- Wave test: tap the side of the tub gently. Does it recover?
- Write down what worked and what didn't.
- Redesign and try again.

WHY IT WORKS

Out at sea, the wind blows faster with no trees, hills, or buildings to slow it down. That's why offshore wind farms generate so much electricity. The engineering challenge you just tackled is the same one real engineers face, just at kitchen-tub scale.

STRETCH IT

Change one thing at a time: more weight at the bottom, wider base, different float material, hurricane force wind and waves. Which change makes the biggest difference?



CLEAR THE AIR

Air filters are one of the hardest-working parts of your home energy system. Find out how they work!

AIR FILTERS IN ACTION LAB

PUZZLE 2

WORD SCRAMBLE

Unscramble each word: they all have something to do with air filtration!

PICLSTARE

RTLIFE

HXBOOSE

FLWOARI

RNEDAD

CAOOC

SDTU

INIEAONLVTT

AIR FILTERS IN ACTION

Blast cocoa powder through a shoebox. See what an air filter actually does.

 Indoor · Ages 7–12 · 40 min · Mess level: high

WHAT YOU'LL NEED

- Shoebox with lid
- Large straw
- 2 tsp cocoa powder
- Filter material: tissue paper, coffee filter, etc.
- White paper (cut into 2 for collection cards)
- Clear packing tape, regular tape, scissors
- Damp paper towel for cleanup

MAKE A GUESS FIRST

Draw what you think your collection card will look like with no filter. Then draw what you think it will look like with a filter.

GROWN-UP PREP

Cut a straw-sized hole in one short end of the box and a larger square hole on the opposite end for the filter outlet. Cut a small flap in the top for adding cocoa. Cover each piece with clear packing tape (sticky side out) to create collection cards.

DO THE LAB

Round 1: No Filter

Add 1 tsp of cocoa through the top flap and close it. Turn your head, breathe in, then blow through the straw 5 times. Hold a collection card in front of the outlet to catch what comes out. Look at your card & take a photo to compare. Wipe out the box with a damp paper towel.

Round 2: With Filter

Tape your filter over the outlet. Make a fresh collection card. Add 1 tsp of cocoa and blow 5 times the same way. Compare your two cards. Which has more cocoa on it?

WHY IT WORKS

Cocoa stands in for the real stuff floating in your air: dust, pollen, pet dander, smoke, etc. Your filter trapped some of it before it reached the card. The same thing happens in your home's heating and cooling systems. A clogged filter makes these systems work harder and use more energy.

STRETCH IT

Try two different filter materials and compare. Which catches more?

FROM FOOD TO FUEL


A bottle, a balloon, and one very hungry microorganism.

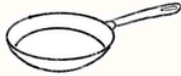

FERMENTATION & BIOFUELS LAB

PUZZLE 3



PICTURE PUZZLE

Find the missing letter in each clue. The six letters spell out one final word.



1. What letter is in  but not in  : _____

2. What letter is in  but not in  : _____

3. What letter is in  but not in  : _____

4. What letter is in  but not in  : _____

5. What letter is in  but not in  : _____

6. What letter is in  but not in  : _____

FINAL WORD: _____



FERMENTATION & BIOFUELS

Yeast is alive. Feed it sugar, keep it warm, and watch what happens.

 **Indoor (kitchen) · Ages 7–12 · 45 min (mostly waiting) · Mess level: low**

WHAT YOU'LL NEED

- 1 small water bottle (16 oz)
- 1 balloon
- 1 packet active dry yeast
- 2 tablespoons sugar
- 1 cup water (~100°F, like a warm bath)
- String and ruler
- Funnel if you have one

MAKE A GUESS FIRST

How big do you think the balloon will get in 30 minutes? Draw a circle on paper showing your prediction.

DO THE LAB

- Pour warm water into the bottle.
- Add sugar and swirl gently to dissolve.
- Add the yeast packet and swirl again.
- Stretch the balloon over the bottle mouth. Make sure the seal is tight.
- Set the bottle somewhere warm and start the timer.
- Every 5 minutes, wrap string around the widest part of the balloon and measure it.

WHY IT WORKS

Yeast eats sugar and releases CO₂ gas; that's what's inflating the balloon. It also makes ethanol at the same time. In a factory, ethanol is what gets purified and blended into gasoline. About 10% of the gasoline sold in North America contains ethanol made from corn.

STRETCH IT

Try the experiment again with corn syrup instead of sugar. Does the balloon grow bigger or smaller?

FEEL THE HEAT

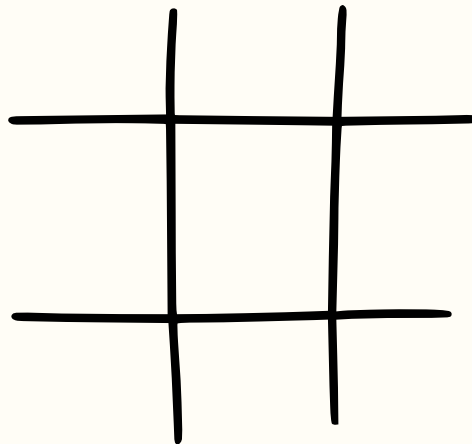
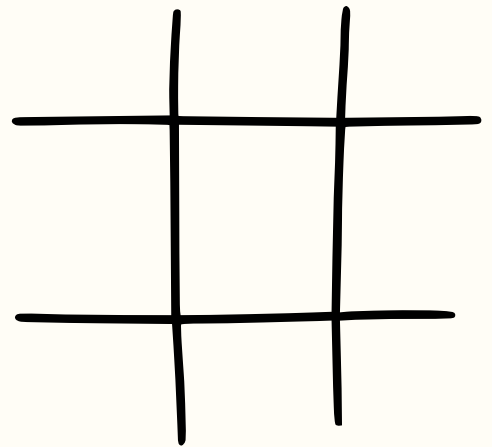
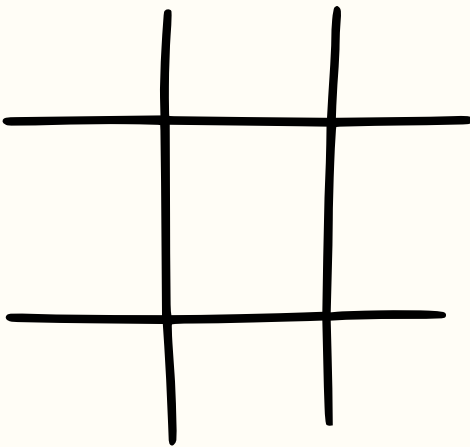
Bury warm water underground and see what the earth does with it.

HEAT TRANSFER LAB

PUZZLE 4


TIC TAC TOE

Challenge a friend or family member to a game. Best out of three wins!



HEAT TRANSFER

Stick your hand in the dirt on a hot day. Cool, right? Now, find out why.

 **Indoor/Outdoor • Ages 7–12 • 30 min • Mess level: medium**

WHAT YOU'LL NEED

- 2 clear containers filled with soil
- Kitchen thermometer
- Warm water (~100°F, like a warm bath)
- Measuring cup
- Turkey baster or spoon
- Timer (your phone works)

MAKE A GUESS FIRST

Which soil will cool the warm water faster: chilled or room temperature? Write it down before you start.

THE NIGHT BEFORE

Fill one container with soil and put it in the fridge. Fill a second with the same amount and leave it out. You'll use both tomorrow.

DO THE LAB

- Slowly drip half a cup of warm water into each container over the same spot.
- Push the thermometer about an inch into the soil where you poured.
- Write down the starting temperature of each container.
- Every 30 seconds for 5 minutes, check the temperature of each container.
- Which container changed temperature the most?

WHY IT WORKS

Underground soil stays at a steady temperature year-round, even when it's blazing hot or freezing above ground. Geothermal heat pumps use this by running fluid through underground pipes to carry heat out of homes in summer and into them in winter. Your chilled soil just showed you exactly how that works.

STRETCH IT

Try a third container left in the sun for an hour. How does warm soil behave differently?



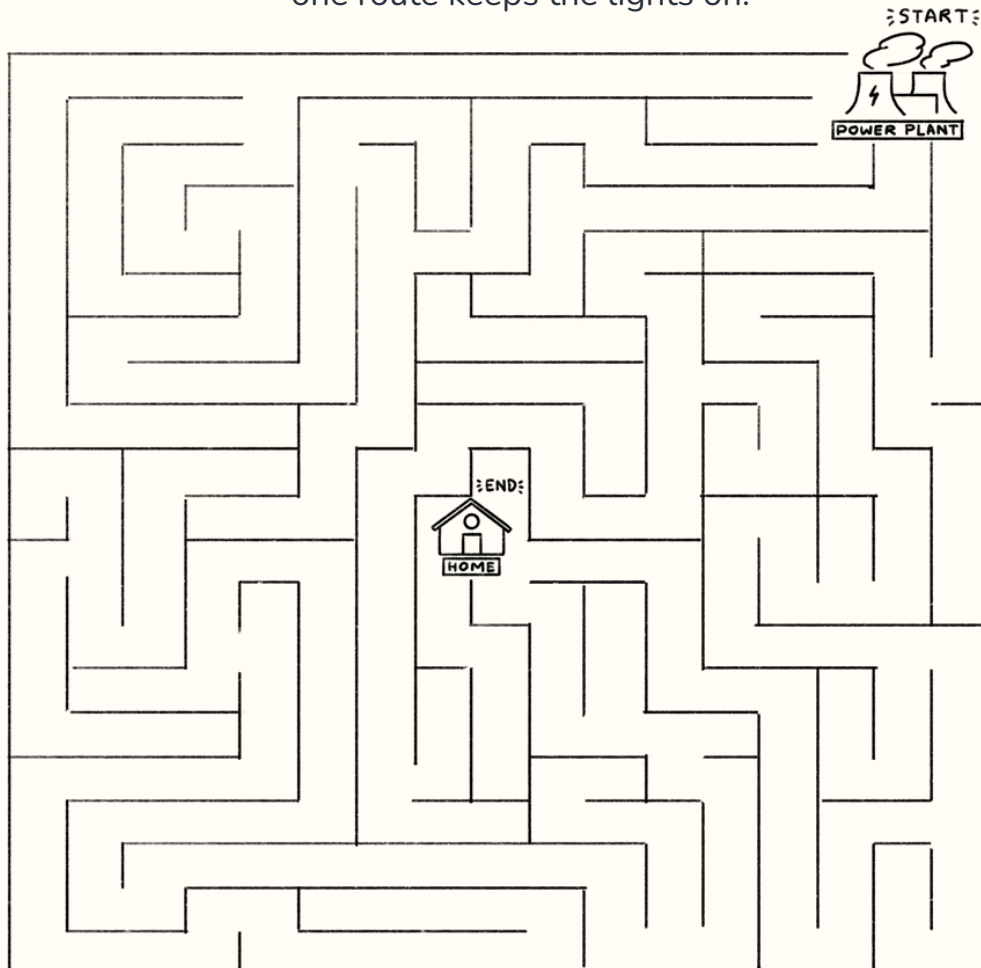
WATT'S GOING ON

Every appliance wastes a little energy.
Today, measure exactly how much.

INVESTIGATING ENERGY EFFICIENCY LAB

POWER-UP THE GRID MAZE


Trace the path from the power plant to the home. Watch out for dead ends... only one route keeps the lights on.



PUZZLE 5

HOW EFFICIENT IS IT?

Every appliance wastes some energy. Today you find out exactly how much.

 **Indoor (kitchen) · Ages 10+ with a grown-up · 30 min · Mess level: low**

WHAT YOU'LL NEED

- Electric kettle
- 1 cup cold water
- Kitchen thermometer
- Kitchen scale
- Stopwatch (your phone works)
- Calculator (your phone works)
- Pen and paper

MAKE A GUESS FIRST

How much of your kettle's electricity actually ends up as heat in the water? All of it? Most of it? Less than half?

SAFETY CAUTION

Have an adult help with the electric kettle.

DO THE LAB

- Weigh 1 cup of cold water using the scale. Write down the weight in grams.
- Take the water's starting temperature and write it down.
- Pour the water into the kettle. Plug it in and immediately start the timer.
- When the kettle switches off, stop the timer. Write down the seconds.
- Carefully check the final water temperature and write it down.
- Find the wattage printed on the kettle. Write it down.

DO THE MATH

Energy IN (Joules) = Wattage x Seconds

Energy OUT (Joules) = Grams of water x 4.186 x Temperature change in C

Efficiency = (Energy OUT / Energy IN) x 100 *(4.186 is the specific heat capacity of water)*

WHAT'S ACTUALLY HAPPENING

No appliance converts energy perfectly. Some always escapes as heat, sound, or light you didn't want. That lost energy isn't gone. It's just not doing the job you needed. The more efficient an appliance, the less it wastes.

STRETCH IT

Try the same calculation with a different appliance. Find the wattage on your microwave, toaster, or phone charger. Which one do you think wastes the most energy?

BRAIN BOOSTERS

Puzzles, doodles, and games to outsmart your family.

CROSSWORD

WORD SEARCH

RIDDLES

COLORING

BINGO

CONVERSATION CARDS

Pick one at dinner. Pick one in the car. No wrong answers.

If you could power your whole house with one kind of energy, which would you pick, and why?

CARD 01/ 09

What's the most surprising thing that runs on electricity in your home?

CARD 02/ 09

Where's the windiest place you've ever been? What did it feel like?

CARD 03/ 09

If you could invent any energy source, what would it run on?

CARD 04/ 09

What's one thing you do every day that uses more energy than you'd expect?

CARD 05/ 09

If we lost power for a week, what's the first thing you'd miss? The first thing you'd love?

CARD 06/ 09

Name three ways your family already saves energy without thinking about it.

CARD 07/ 09

If sunlight had a flavor, what would it taste like in summer?

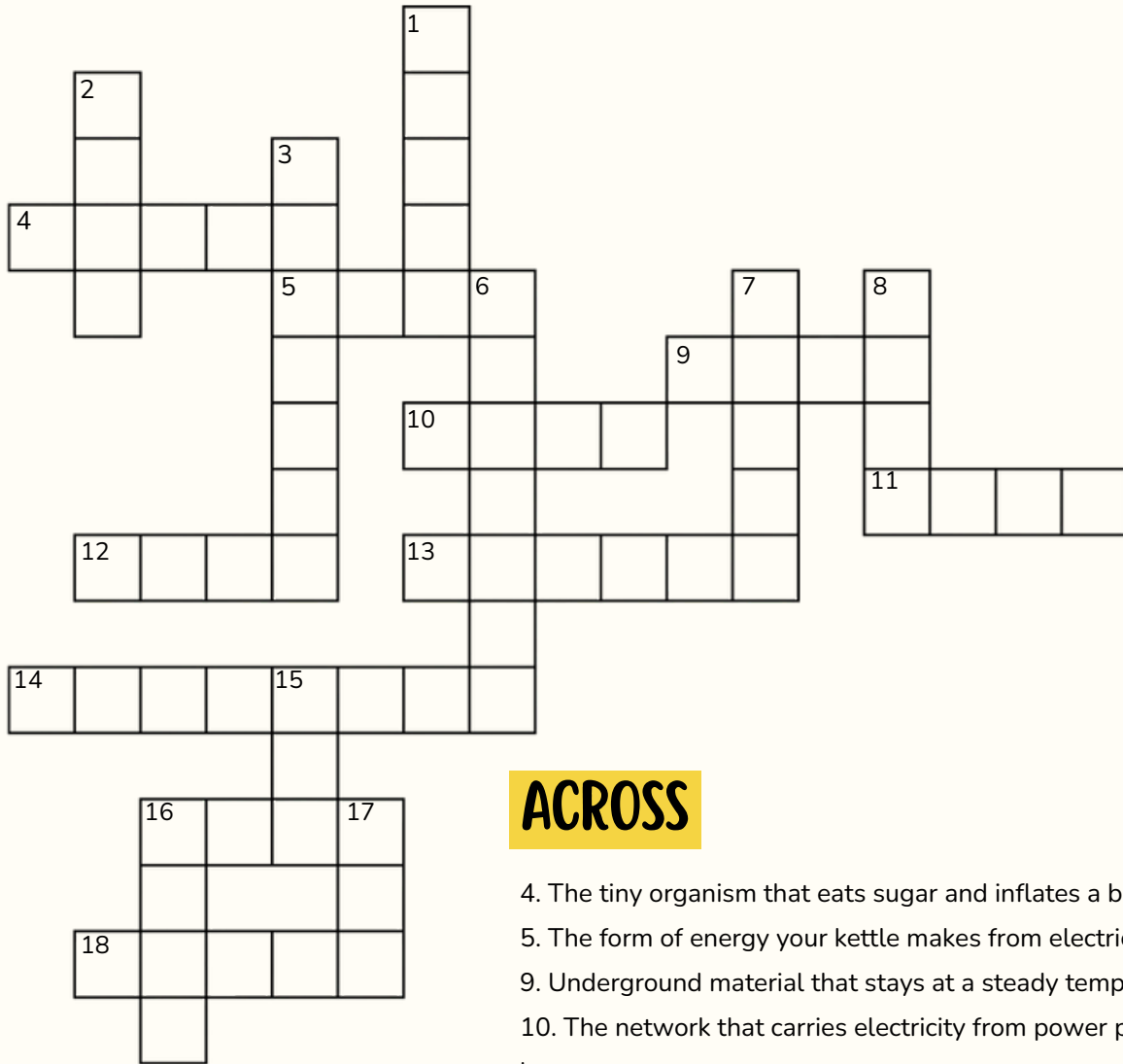
CARD 08/ 09

What energy question do you wish someone could answer for you right now?

CARD 09/ 09



THE ENERGY CROSSWORD



ACROSS

4. The tiny organism that eats sugar and inflates a balloon with gas
5. The form of energy your kettle makes from electricity
9. Underground material that stays at a steady temperature
10. The network that carries electricity from power plants to your home
11. What water does when wind blows across it
12. An energy source formed from ancient plants
13. A material that traps particles and cleans the air
14. The force that pushes water out of a hole at the bottom of a jug
16. Moving air that can spin turbines and make electricity
18. Water heated until it turns to gas

DOWN

1. The powder used in the air filter lab
2. What a car runs on
3. The alcohol made when yeast ferments sugar
6. A machine that turns moving wind into electricity
7. Energy directly from the sun
8. How fast water moves through a pipe or tube
15. The star that gives our planet light and warmth
16. The unit used to measure electrical power
17. A wall built across a river to store water for power



ENERGY WORD SEARCH

Twelve energy words are hidden across, down, and diagonally. Try to find them all!



Word Bank:

- Hydropower
- Biomass
- Battery
- Grid
- Geothermal
- Biofuel
- Current
- Joule
- Offshore
- Nuclear
- Energy
- Solar

RIDDLE ROUND

Read each riddle aloud. Make a guess before checking your answers on page 24.

The deeper you go, the stronger I get. I'm the reason the bottom of a dam works harder than the top. I'm invisible, but I can flatten things. What am I?

You used me before breakfast today. You'll use me to read this sentence. You can move me around but you can never make me disappear. What am I?

I started life as a cornfield. Yeast and I had a really good meal! They ate, and I became the fuel. Now I'm blended into the gas in your tank. What am I?

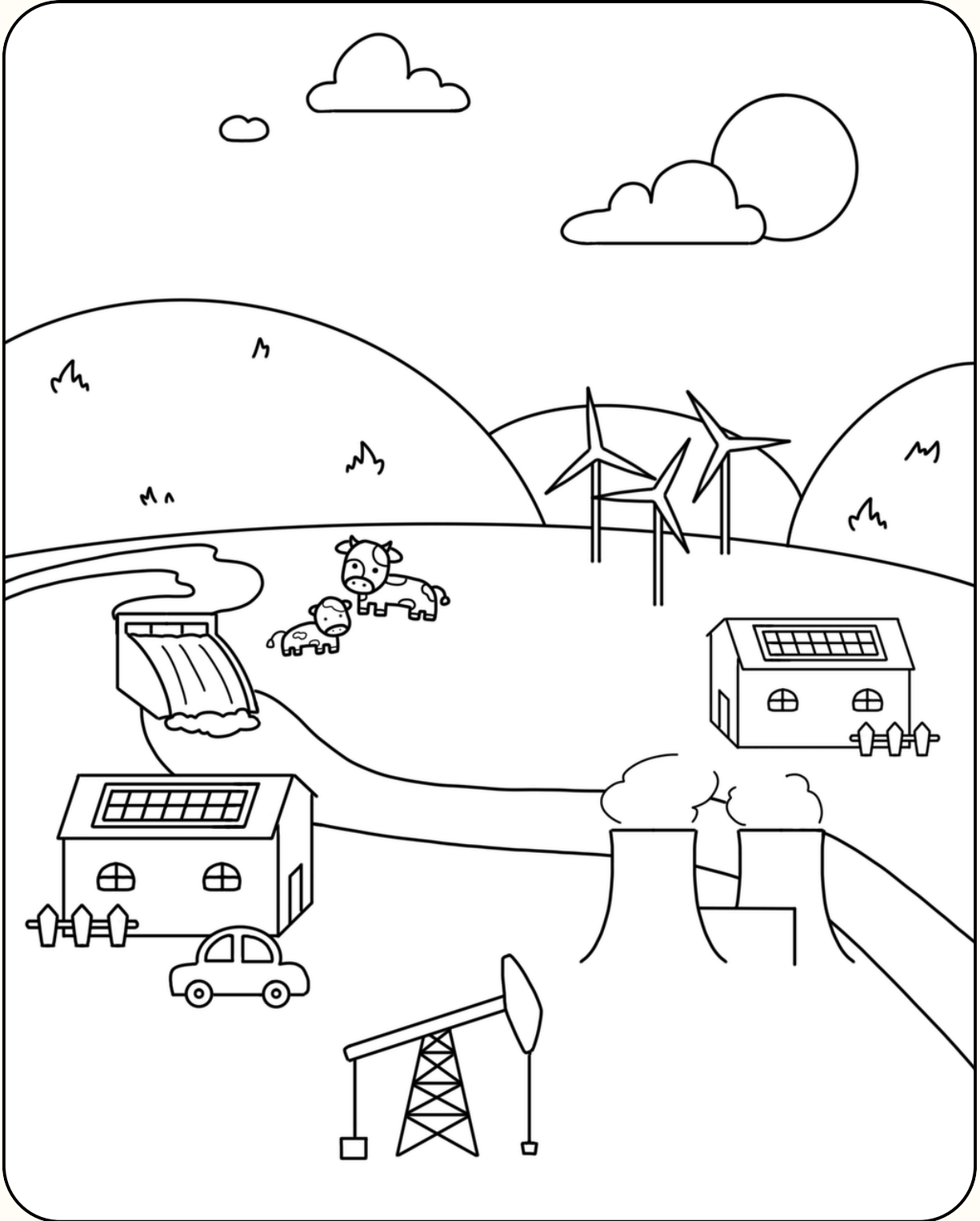
Everyone wants me when I'm full. Nobody wants me when I'm empty. I'm not alive, but I act like it. What am I?

I dance but have no feet. I eat but have no mouth. Blow on me gently and I grow. Blow too hard and I'm gone. What am I?



COLOR THE ENERGY TOWN

Print this page and color it in with markers, crayons, or colored pencils.



SUMMER ENERGY BINGO

Cross off squares as you complete the board.

Five in a row = bingo. Whole card = legendary summer.

PRINT & CROSS OFF!

Spot a solar panel	Find a wind turbine (in real life or in a picture)	Hang clothes on a line instead of using the dryer	Eat a whole meal made with NO stove or oven	Read a chapter of a book using sunlight only
Use a fan instead of A/C for an entire day	Unplug one thing in your house for 24 hours	Catch rainwater in a bucket and use it to water a plant	Stargaze quietly for 10 whole minutes	Race a paper boat down a stream or gutter
Walk or bike somewhere you'd usually drive	Find 3 things in your home with rechargeable batteries	★ FREE	Take a shower in 5 minutes or less	Read your family's power bill. Find the kWh number
Compare two lightbulbs in your home to see which one uses fewer watts	Plant or harvest something you can eat	Open a window instead of turning on the A/C	Time how long your devices last without charging	Count the lightbulbs in one room
Build a shady hideout using only things you find outside	Find the energy-rating sticker on an appliance	Charge something using a solar charger	Watch a sunset all the way down... no screens	Spend one evening with all the lights off after sunset



STAY CURIOUS, FRIEND.

You did it! You poked holes in bottles, blew cocoa powder through a shoebox, and watched a balloon inflate all on its own. You buried warm water underground and did actual math on your kettle. Not bad for a summer.

The science doesn't stop here... it's happening all around you, all the time. Keep asking why. Keep testing things out. Keep making a mess.

See you next summer!

— *The Switch Classroom Team*

PARENTS:

Stay Connected

Sunshine and Science is a summer publication, but Switch Classroom is here year-round. Sign up for our newsletter or explore our full resource library at switchclassroom.org.

Want more labs?

Every lab in this packet has a full version at switchclassroom.org, with data tables, analysis questions, and more. Free to use.

SEND US A PHOTO

If your family tries an activity, we'd love to see it. Tag us on Instagram @switchclassroom. You just might end up on our feed.

BRAIN BOOSTER ANSWER KEY

Puzzle 1 - Spot the Difference: *girl's bangs, gust of air, fan, position of pinwheel boat, boy's smile*

Puzzle 2 - Word Scramble: *particles, filter, shoebox, airflow, dander, cocoa, dust, ventilation*

Puzzle 3 - Picture Puzzle: 1. (bear, crab) E 2. (pan, map) N 3. (free, frog) E 4. (train, paint) R 5. (log, bowl) G
6. (May, mask) Y Final Answer: ENERGY

Puzzle 6 - Energy Crossword: 1. cocoa 2. fuel 3. ethanol 4. yeast 5. heat 6. turbine 7. solar 8. flow 9. soil 10. grid 11. wave 12. coal 13. filter 14. pressure 15. sun 16. wind 17. dam 18. steam

Puzzle 8 - Riddle Round: 1. Pressure 2. Energy 3. Ethanol 4. Battery 5. Flame

