

By Jay Egg-Illustrated by Sarah Cheney

Geothermal Activity Book

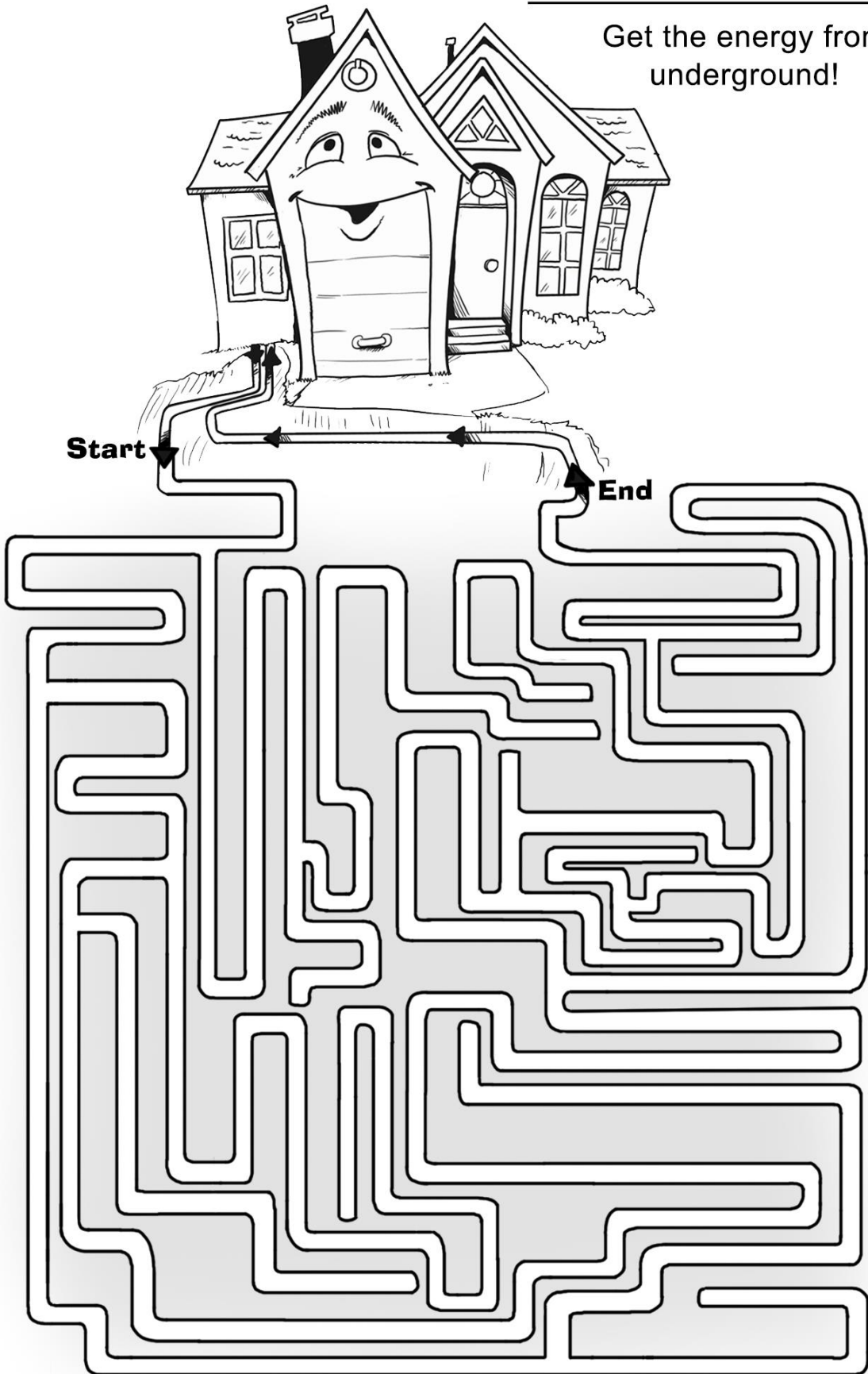
- Crossword
- Science Experiment
- Coloring
- Word Scramble
- Maze
- ...and more!



Geothermal

Geothermal Maze

Get the energy from
underground!



So Why is Geothermal So Efficient?

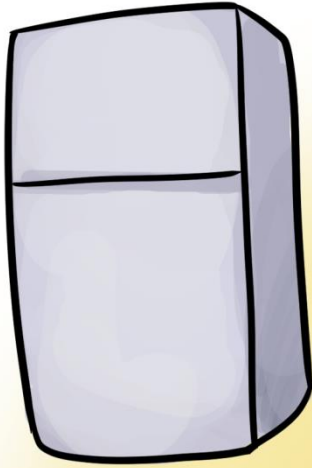
Try This Experiment, and You'll Be a Geothermal Genius!

Let's have some fun with science and see what we can learn about geothermal heating and cooling along the way!

Here's what we'll need...



Geothermal Experiment Supplies



A Freezer (5° F)



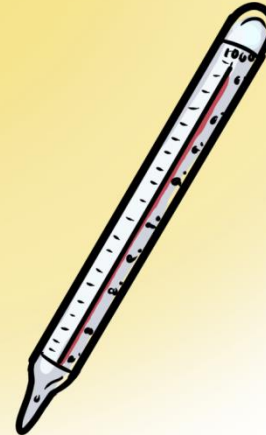
A Stopwatch



**A Bucket of Ice
(32° F)**



2 Bottles of Water



A Thermometer

1. Place a room-temperature water-bottle in the freezer, and another one in the ice-water

2. Set the stop-watch for 10 minutes



Before you guess which bottle of water will end up colder, let's learn a little about heat transfer on the next page...

There are 3 basic ways to transfer heat from one place to another:

RADIATION

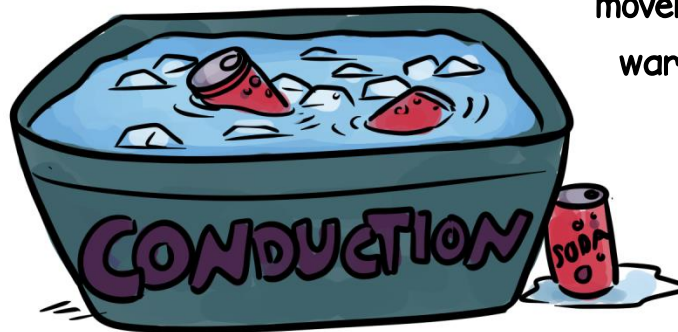


"Radiation" is electromagnetic waves, like the heat from a campfire or from the sun

CONVECTION



"Convection" is the bulk movement of molecules, like the warm air from a blow-dryer



"Conduction" is the transfer of thermal energy between neighboring molecules as a result of a difference in temperature, like cans of soda in a cooler full of ice

Times Up?! - Which bottle of water is cooler?

Let's look at the results of our experiment:

In our lab, the 32F ice-water
resulted in a 41F water -bottle

Write you results here: _ _ _



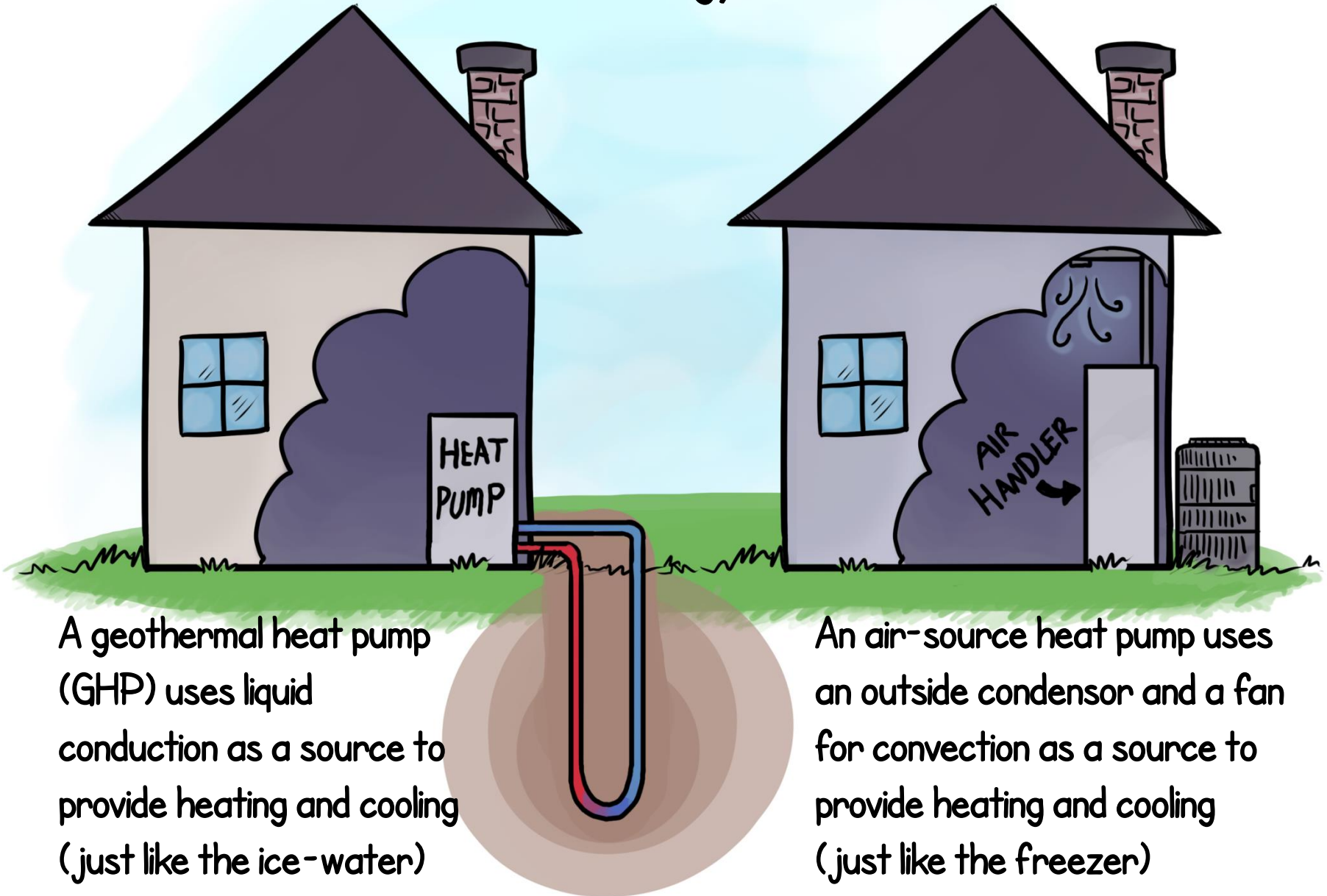
The water-bottle in the 6F
freezer only got down to 66F

Write your results here: _ _ _



Why do you think that the 32F ice-water "cooled" the water-bottle down more quickly than the 6F freezer?
How does this apply to geothermal heating and cooling?

Geothermal is so energy efficient because...



A geothermal heat pump (GHP) uses liquid conduction as a source to provide heating and cooling (just like the ice-water)

An air-source heat pump uses an outside condensor and a fan for convection as a source to provide heating and cooling (just like the freezer)

...and remember; the earth is cooler in the summer and warmer in the winter!



Geothermal Quiz

Please circle the most correct answer to each of the following questions:

1. What is combustion heating?

- a. Burning wood in a fireplace to heat a home
- b. Using a propane domestic water heater for hot showers
- c. Using a natural gas furnace to heat the house
- d. All of the above

2. What is renewable energy?

- a. Energy from an abundant source
- b. Energy that never runs out
- c. Energy from a permanent pipeline or power source
- d. Energy that is clean burning

3. When it's stormy and windy outside, which of the following renewable energy sources work best?

- a. Solar and geothermal
- b. Wind and geothermal
- c. Wind and solar
- d. All of the above

4. When it's sunny and calm outside, which of the following renewable energy sources work best?

- a. Solar and geothermal
- b. Wind and geothermal
- c. Wind and solar
- d. All of the above

5. When it's a still, cold night outside, which of the following renewable energy sources work best?

- a. Solar and geothermal
- b. Wind and geothermal
- c. Wind and solar
- d. Either a or b



Geothermal Quiz

6. Which of the following is the earth MOST similar to?
- a. A wind turbine
 - b. A battery
 - c. A solar collector
 - d. Both b and c
7. Of all the solar energy that shines on our atmosphere, how much is absorbed by the surface?
- a. Less than 10%
 - b. All of it
 - c. 50%
 - d. It depends on if it's cloudy or sunny outside
8. In what way can a building be most like a tree or a plant?
- a. Use all natural materials for construction
 - b. Use solar panels to generate electricity
 - c. Use a GHP for its heating and cooling needs
 - d. Plant trees on the west side of the building
9. In a geothermal heating and cooling system, what do installers put underground to collect the solar energy stored in the earth?
- a. Pipes filled with water to collect the solar energy stored there
 - b. Special electrical wires with temperature sensors
 - c. Thermal storage batteries to collect the solar energy stored there
 - d. A rainwater cistern to hold water for later usage
10. What kind of “pump” is used to bring the solar energy in the earth into a building?
- a. A solar thermal pumping unit
 - b. A geothermal heat pump
 - c. A solar sump pump
 - d. A CO2 pump



Geothermal Quiz

11. How does a GHP cool a building?

- a. By evaporating cool water over the cooling coils
- b. By extracting the heat from the outside air
- c. By pumping the heat in a building back into the earth for later use
- d. By blowing air over the hot surfaces

12. What is a Zero-Net Energy building?

- a. A building that uses no energy
- b. A building that is perfectly insulated
- c. A building that uses a geothermal heat pump
- d. A building that uses the same or less energy that it generates on site

13. Why is a GHP (geothermal heat pump) the best way to help a building attain a goal of Zero Net (No net energy consumption from outside sources)?

- a. Because a GHP uses less energy than any other type of heating and cooling system
- b. Because a GHP works regardless of weather conditions
- c. Because a GHP reduces the amount of solar panels needed
- d. All of the above



Geothermal Word Search

G	M	C	X	S	R	M	W	Q	C	M	Z	I	I	X	T	Y	B
E	E	M	J	N	D	T	N	R	E	N	E	W	A	B	L	E	E
R	N	O	N	T	Z	M	Z	H	N	W	S	N	D	H	O	Q	V
M	U	V	T	V	U	N	Z	U	O	I	L	R	K	H	Z	R	L
B	H	Q	I	H	E	A	T	P	U	M	P	T	F	Z	F	C	N
Y	N	V	S	R	E	Z	H	L	I	F	I	F	G	R	V	M	J
R	T	O	O	V	O	R	A	R	O	W	Z	O	R	G	M	U	F
O	T	H	L	D	Z	N	M	C	Q	F	T	S	O	A	X	O	H
S	G	L	A	K	E	F	M	A	T	E	K	S	U	G	Q	I	H
M	E	I	R	X	R	P	S	E	L	K	C	I	N	C	T	E	G
L	U	E	E	B	O	X	Z	O	N	X	K	L	D	E	L	H	H
W	Y	L	N	K	N	A	U	X	Z	T	W	F	L	P	T	C	R
J	T	F	E	Z	E	L	E	K	R	A	L	U	O	L	A	S	C
O	D	G	R	W	T	I	R	L	A	K	Q	E	O	X	D	Y	R
W	E	R	G	S	J	D	X	Z	B	N	B	L	P	O	W	E	R
M	I	D	Y	W	Z	C	B	E	O	F	P	S	R	T	F	N	D
K	E	N	J	Q	P	I	J	Q	G	R	D	P	K	F	K	I	J
E	I	M	D	L	L	B	I	V	W	T	B	Y	V	U	V	Z	S

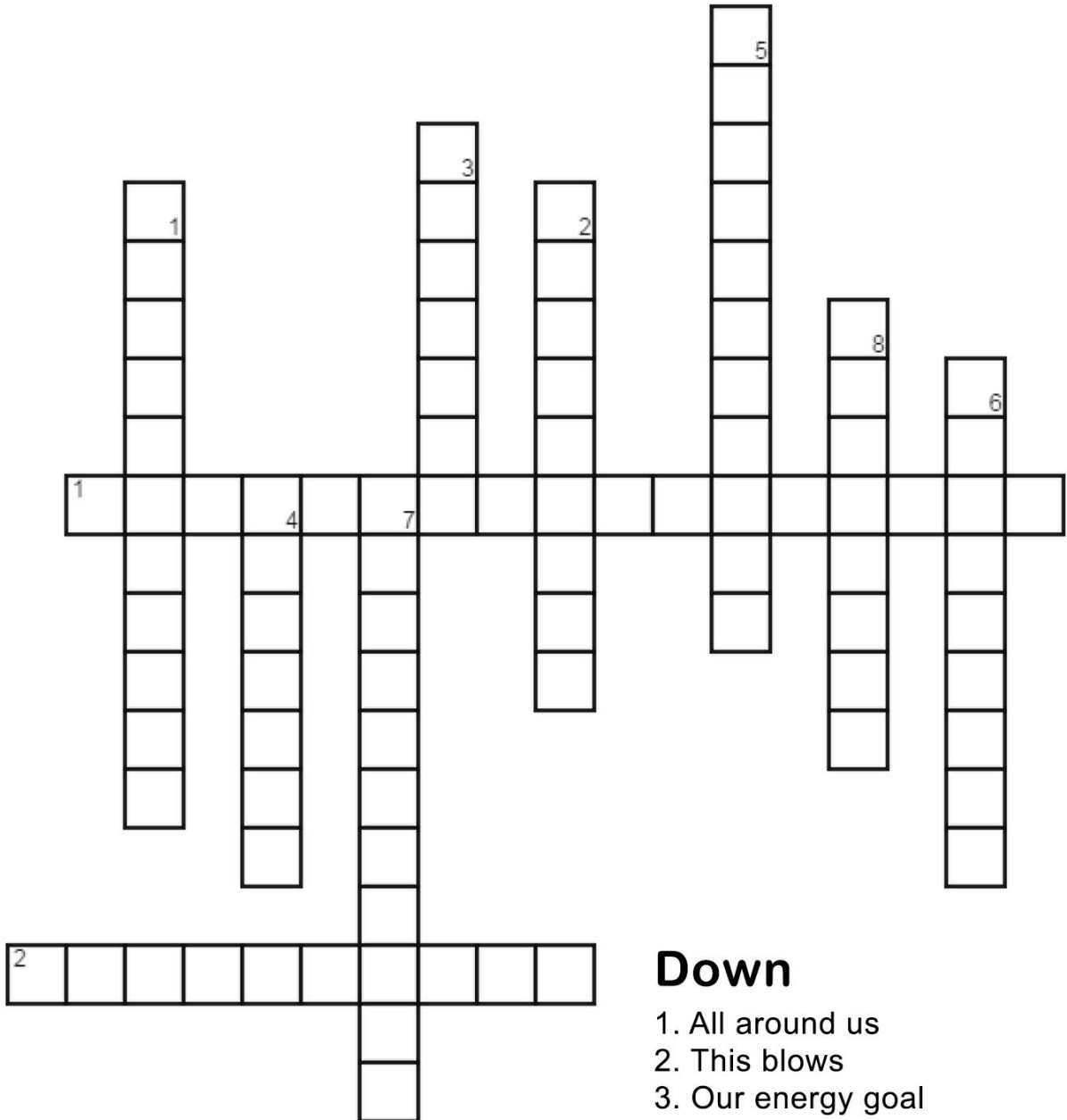
Geothermal
Ground Loop
Heat Pump
Solar Energy

Renewable
Fossil Fuels
Zero Net

Wind
Power
Environment



Geothermal Crosswords



Across

1. Causes CO₂
2. Earth energy

Down

1. All around us
2. This blows
3. Our energy goal
4. Stores Power
5. Source of combustion heat
6. Unlimited availability
7. From the sun
8. Pumps energy from earth



STORM
PROOF

Long, Long
Lasting!

QUIET-
SHWW

NO Fossil
Fuel

Incentives!

OUTDOOR
EQUIPMENT

BEST
ENERGY
EFFICIENCY

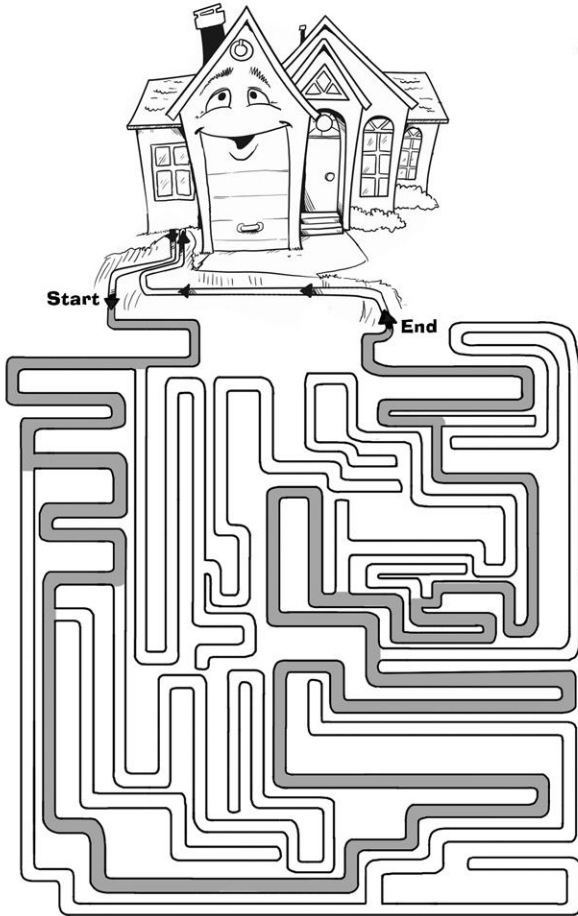
WOW!

Geothermal
Classic & Comfort

GREEN
♻️



Answer Sheet



Crossword Key

Across

1. combustion heating
2. geothermal

Down

1. environment
2. wind power
3. zeronet
4. battery
5. fossil fuels
6. renewable
7. solar energy
8. heat pump

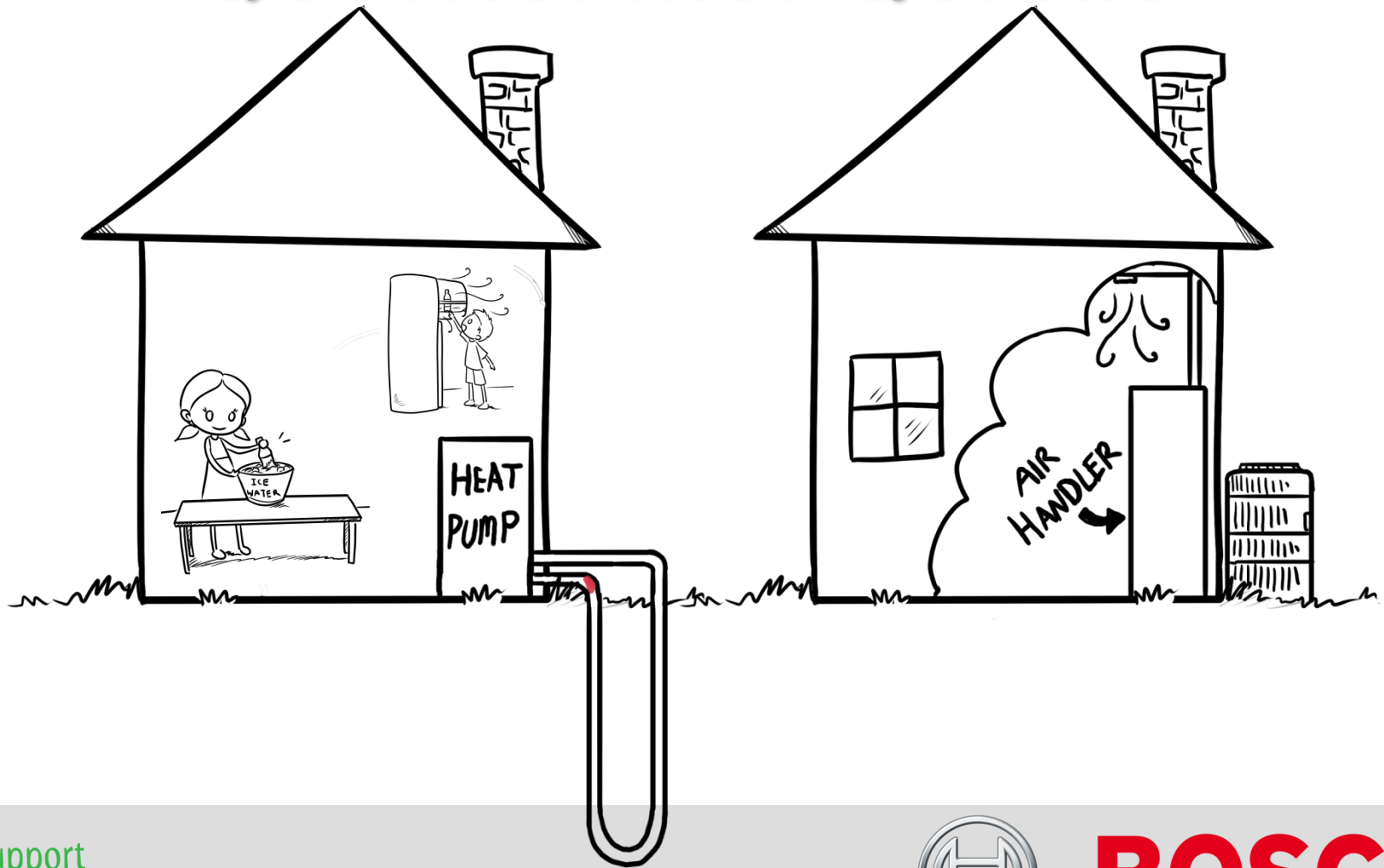


Quiz Answers

1. d
2. b
3. b
4. a
5. d
6. d
7. c
8. c
9. a
10. b
11. c
12. d
13. d

Congratulations! You are now a

Geothermal Genius!



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