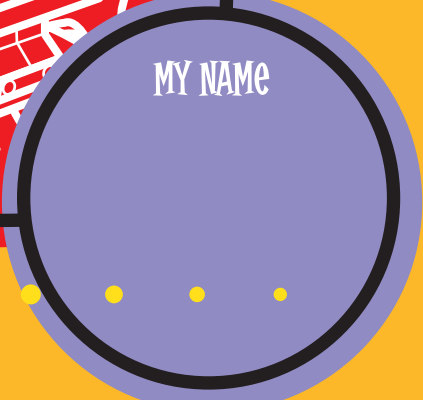




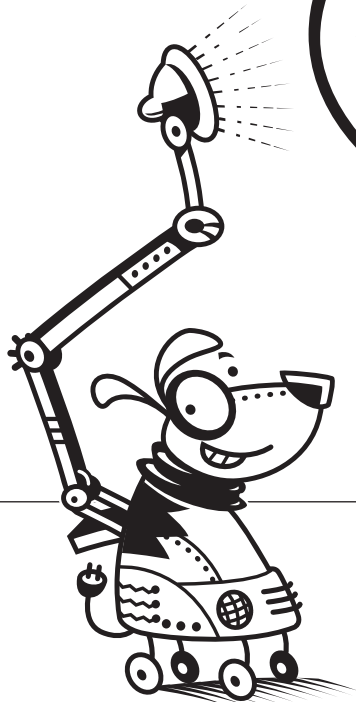
PETROLEUM PLAY



AN ACTIVITY BOOK ABOUT ALBERTA'S OIL AND GAS

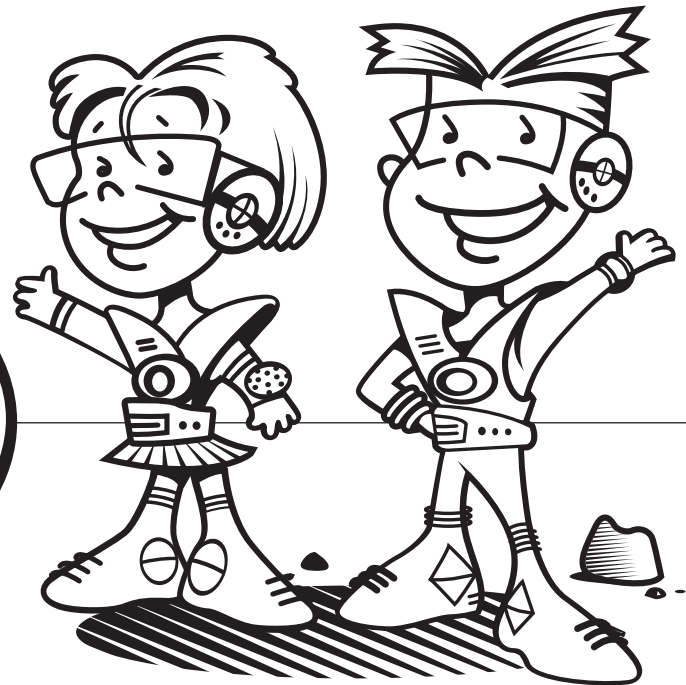
MY ENERBUDDIES

Welcome to Petroleum Play – a place for you to discover and learn about the oil and gas industry in Alberta.



I'm RO-VR, the EnerBot from the ERCB, and I know all there is to know about petroleum! And these are my Enerbuddies, Emmy and Nick. Together we are going to take a journey through time and show you the amazing world of petroleum. Let's play!

The ERCB ensures that the discovery, development, and delivery of Alberta's resources take place in a manner that is fair, responsible, and in the public interest. We regulate oil, natural gas, oil sands, coal, and pipelines.



© Energy Resources Conservation Board, 2008. Design: pfang creative inc. Illustrations: Guy Parsons.

This booklet is brought to you by the Energy Resources Conservation Board (ERCB).

SQUEEZE PLAY

A BIT OF SCIENCE HISTORY

Read each sentence carefully, filling in the blanks with the correct word from the list below. Then fill in the crossword puzzle. The answer key is at the back.

LAYERS

SQUEEZED

TRAPPED

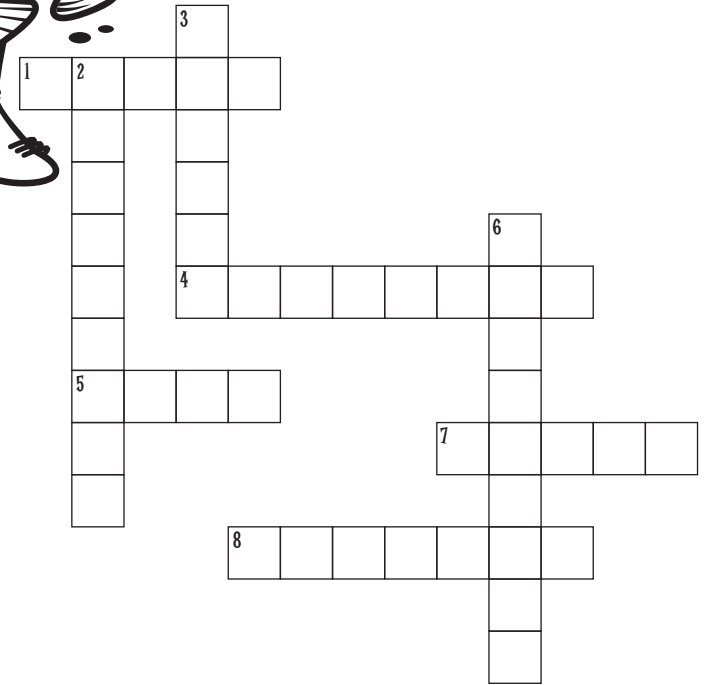
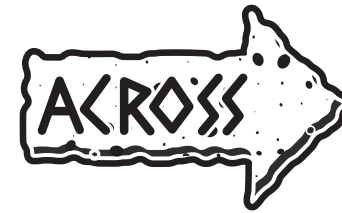
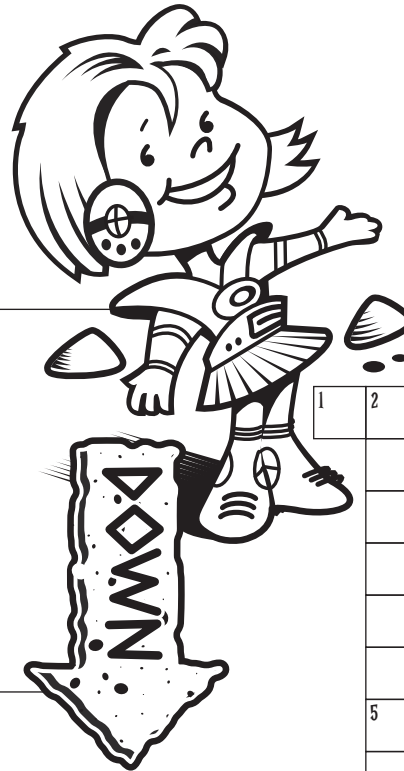
ROCK

PETROLEUM

HOLES

OCEAN

CREATURES



Scientists think that...

- 1 Across Millions of years ago Alberta was covered by an _____.
- 2 Down Many tiny _____ living in the sea died and sank to the bottom.
- 3 Down Mud and sand buried them, forming many _____.
- 4 Across The weight of the earth _____ the layers tightly together.
- 5 Across At last, the mud and sand turned into _____.
- 6 Down Meanwhile, the bodies of the sea creatures slowly became _____ (oil and gas).
- 7 Across Oil and gas often moved into rocks that had tiny _____ in them. These are called porous rocks.
- 8 Across Whenever petroleum reached solid rock, it couldn't move any farther. It was _____.

A SEDIMENTARY SANDWICH

A YUMMY RECIPE USING BASIC GEOLOGY

Step 1: Read through the recipe below and learn about the different layers of earth.
Then colour your own rock layers in Step 2 on the next page.



METHOD

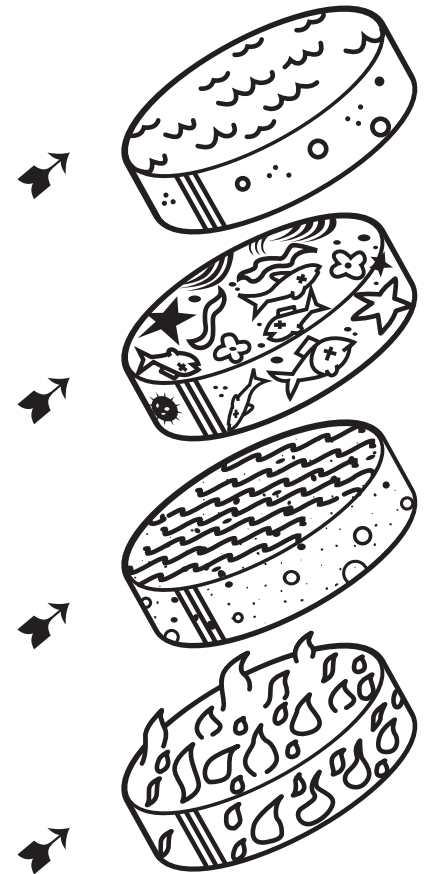
- Cover Alberta with a layer of sediments.
- Top with warm sea.
- Add microscopic (tiny) sea creatures and plant materials (organics). When these die, they will sink to the sea floor.
- Add sediments until you have many layers. They should be several kilometres thick.
- Squeeze and cement the layers with pressure. Turn up the heat underneath them. This will “cook” the once-living matter and change it into oil and natural gas.

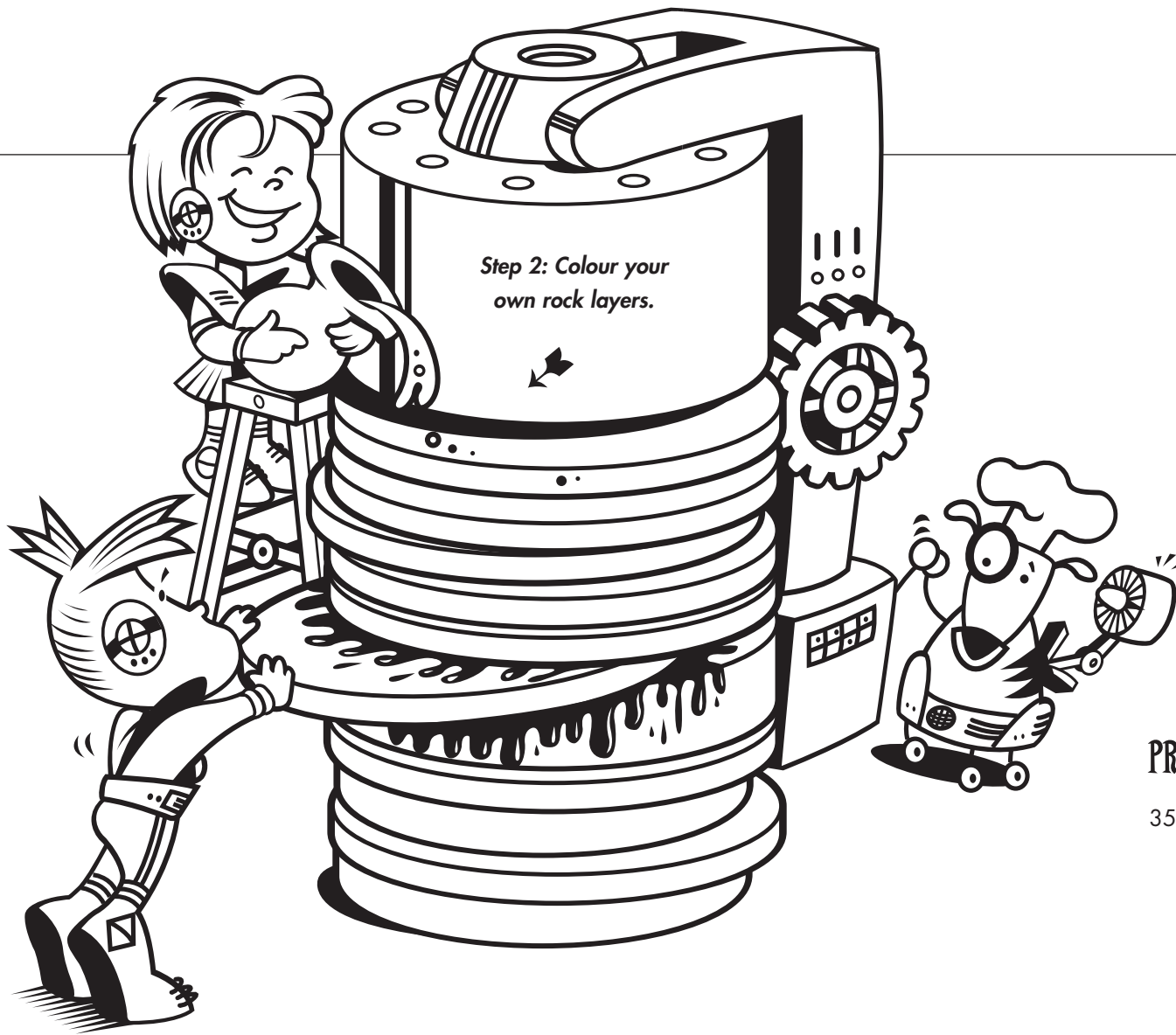
SERVES

Everyone! Petroleum can be used in gasoline for cars, in plastic for football helmets, or to make clothing, perfume, skateboard wheels, and much more. It should be served carefully, because it takes a lot of time to prepare.

INGREDIENTS

- Layers of mud and sand (sediments)
- A lot of water (a warm sea about the size of Alberta will do)
- Blanket of sea animals and plants (organic source rock)
- More mud and sand
- A source of pressure and heat





PREPARATION TIME

350 million years

A LITTLE GEOPHYSICS TALK

DOODLEBUGGING

All the underlined words from the story below are hidden in the puzzle. As you find a word in the puzzle, draw a circle around each letter in that word, as shown by the example. Use the letters that are NOT circled to fill in the mystery sentence at the bottom of the page. Hint: the uncircled letters from the puzzle are in the correct order, reading left to right from the top to the bottom of the puzzle.

Oil and gas are often found deep in the ground in layers of porous rock, with solid rock on top. How do we find such rock?

We can get some clues from seismic exploration, or doodlebugging.

Here's how it works:

A worker called a "jughustler" places geophones, or jugs, on the ground. Jugs pick up sound waves.

A special rig drills shotholes and puts dynamite in them. When the dynamite explodes, it sends out sound waves deep into the earth. They hit layers of rock and bounce back to the jugs, which are connected with wires to a recording truck.

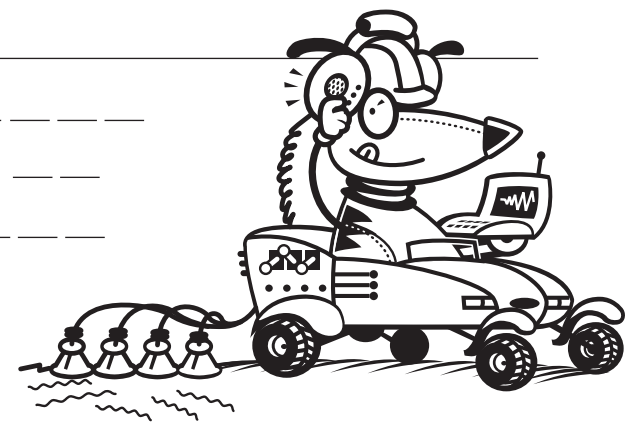
The strength and timing of the sound waves coming back to the jugs give experts a clue about the kinds of rock hidden below the surface.

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

Mystery sentence goes here:



 ----- ! ' -----
 ----- !



LANDMEN AND ENGINEERS

A GAME OF HIDE AND SEEK

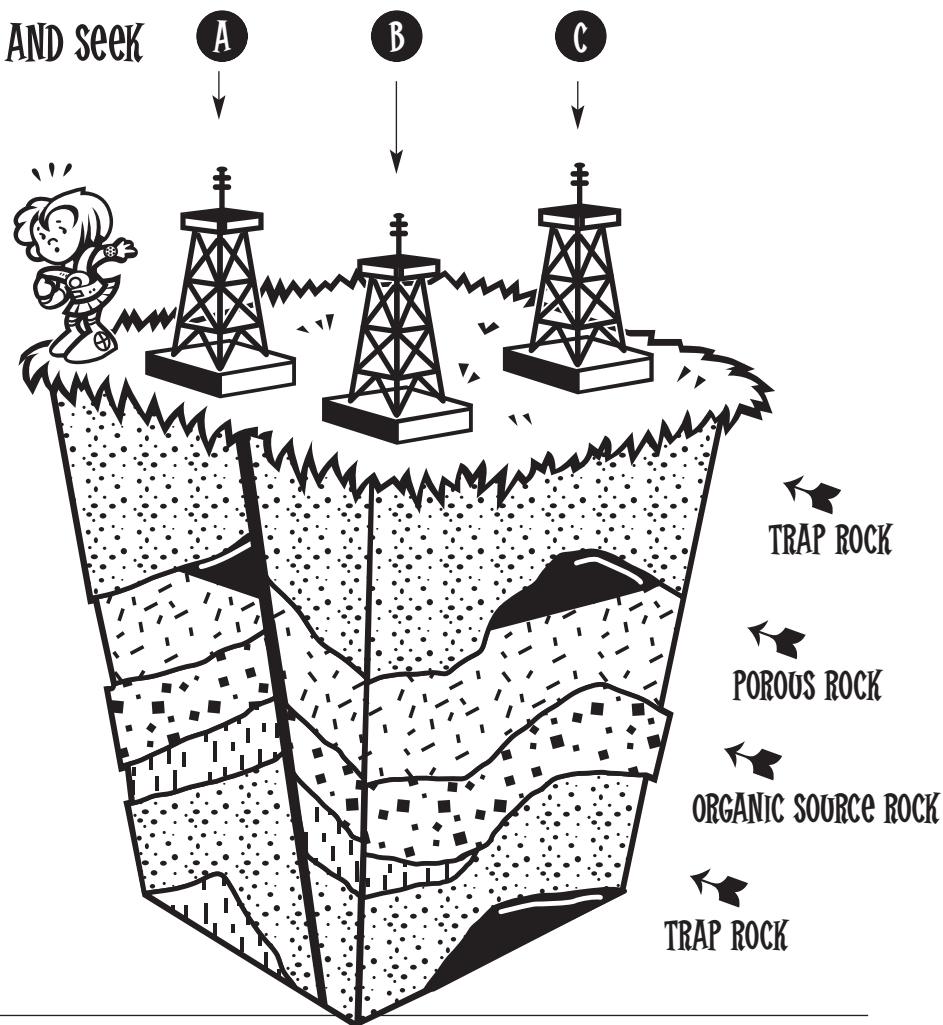
Look at the diagram to the right. Where do you think would be a good place for Emmy to drill? Need some hints? Read on...

Before a company can drill a well, it must first lease the rights to the oil and gas found deep underground. This is called getting a mineral lease, and it is the job of the company. Getting such leases often means competing against other companies that may want to drill in the same place.

Once a mineral lease is obtained, a landman* must speak to the landowner. Then the company must apply to the ERCB for a permit to drill. If the ERCB approves the application, the company may drill. A team of geologists, geophysicists, and engineers will decide where to drill.

- Oil and gas are found trapped in porous rock.
- This porous rock is squished between two layers of non-porous rock. (Remember our Sedimentary Sandwich from page 3?)
- A fault, which is a split or crack, often causes oil to become trapped.

*You don't have to be a man to be a landman!



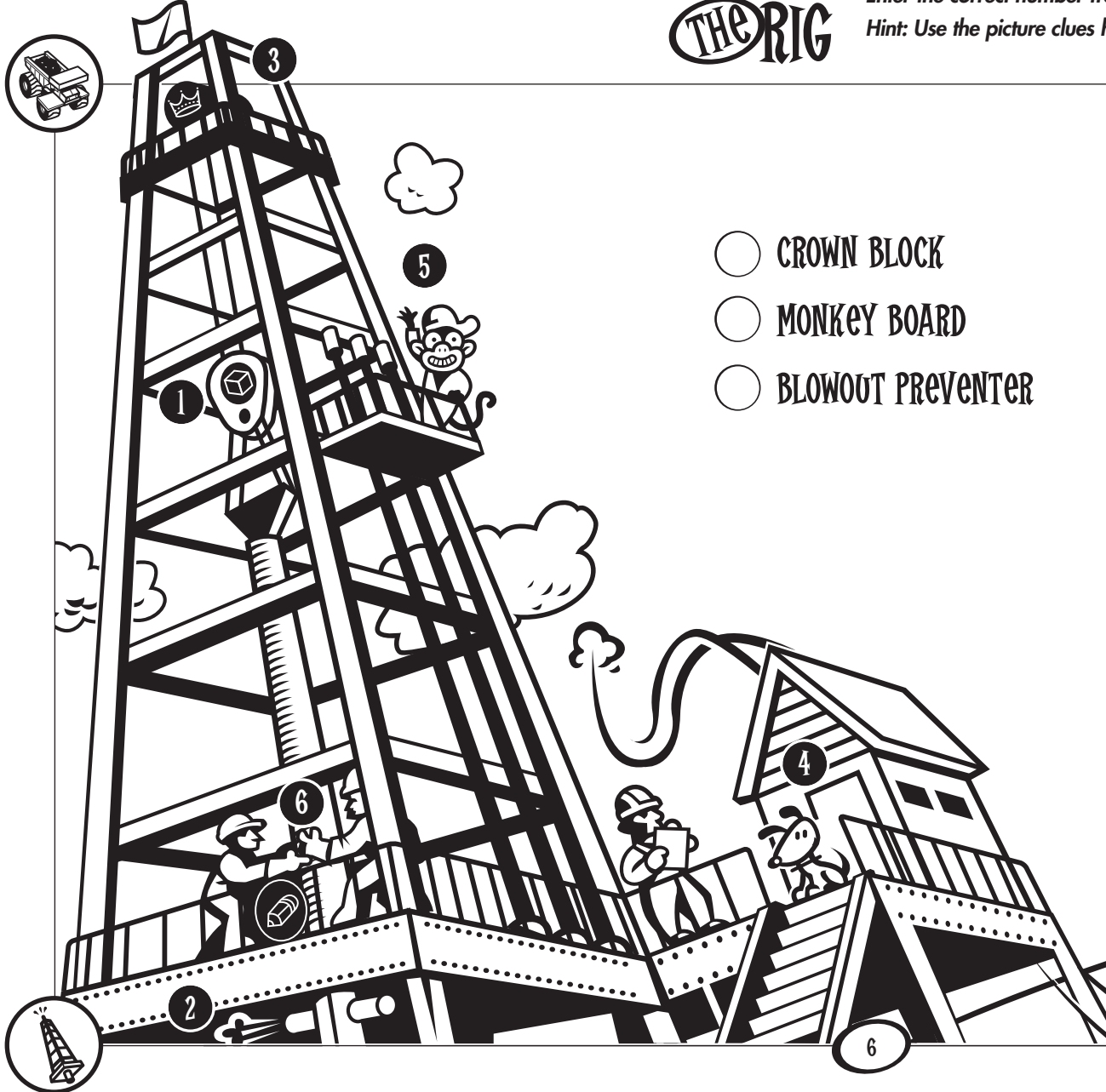
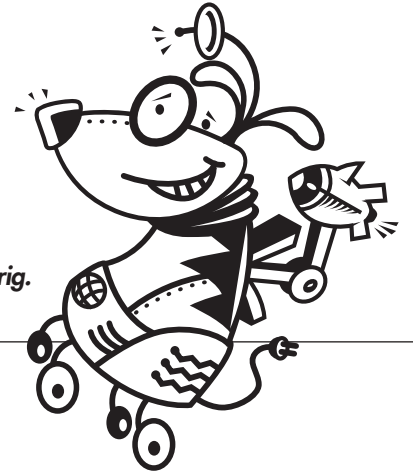
WHO OWNS THE MINERAL RIGHTS? Even though oil is found on your land, you probably don't own the mineral rights. The province of Alberta owns about 80% of the minerals below the surface. The government grants companies the right to drill for these minerals. Minerals include such natural substances as copper, iron, coal, and diamonds, as well as oil, natural gas, and oil sands. The remaining 20% of minerals are owned by individuals and are called "freehold" minerals.

As a landowner, you own the land on top of the ground: the surface. If an oil company finds a huge oil deposit underneath your land, you won't get rich. But the oil company will pay you rent for the inconvenience of working on your land.

DRILLING

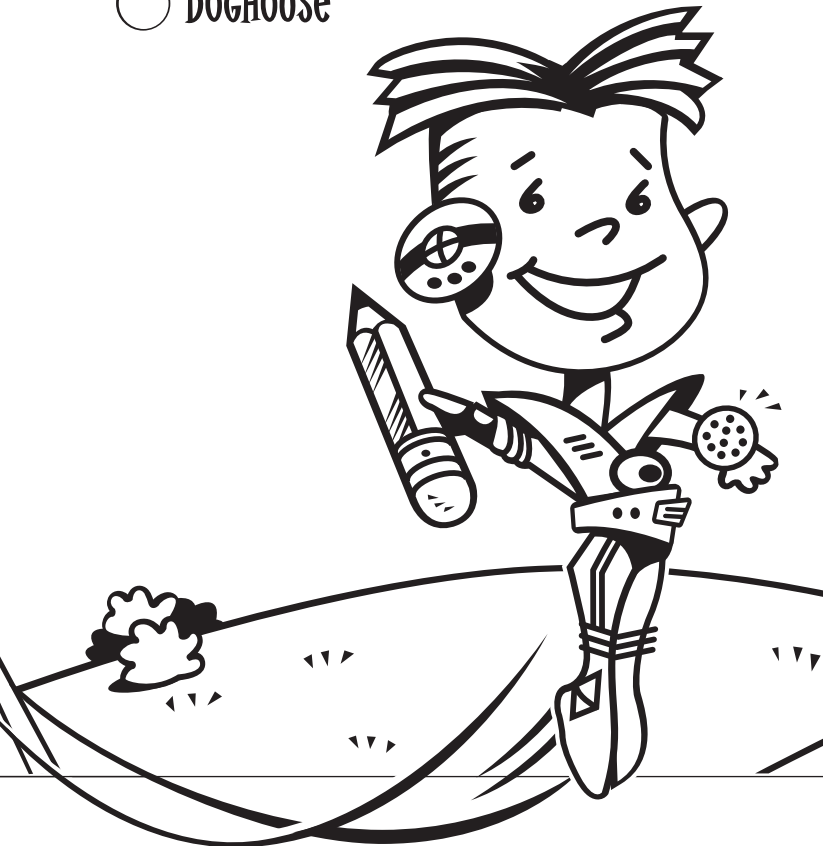
KNOW THE RIG

Match the following with the parts shown on the rig.
Enter the correct number from the picture in each circle.
Hint: Use the picture clues hidden in the drawing of the rig.



- CROWN BLOCK
- MONKEY BOARD
- BLOWOUT PREVENTER

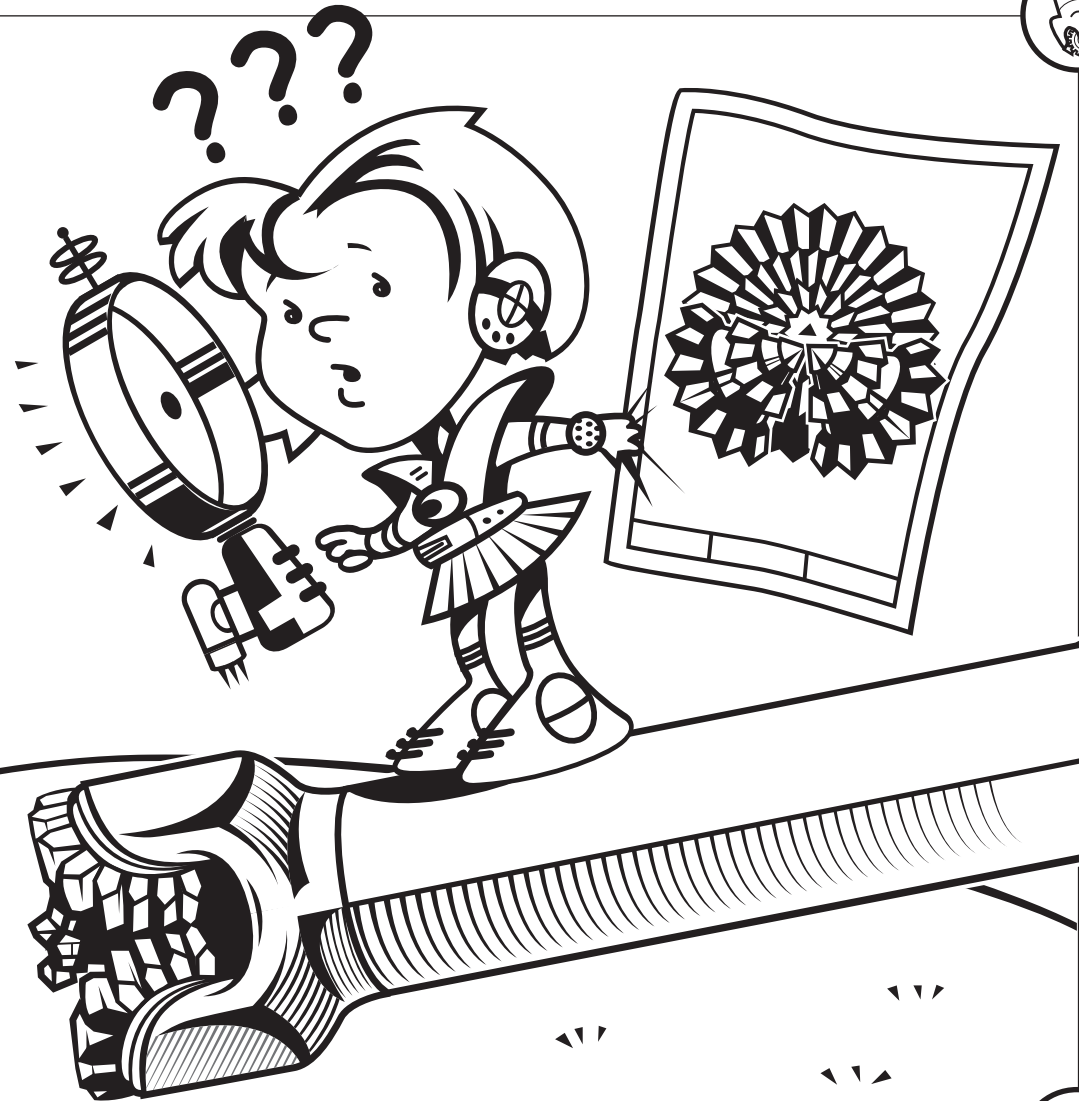
- TRAVELLING BLOCK
- DRAWWORKS
- DOGHOUSE



WHAT IS IT?

Look carefully at the drawing Emmy is holding and the thing she is standing on. Turn the page so that you can look at them from all directions. What does this thing make you think of? Add to it to create something new. Name your creation.

Write a story about this "thing". What does it do? Is it alive? Where does it live? Remember to write yourself into the story.

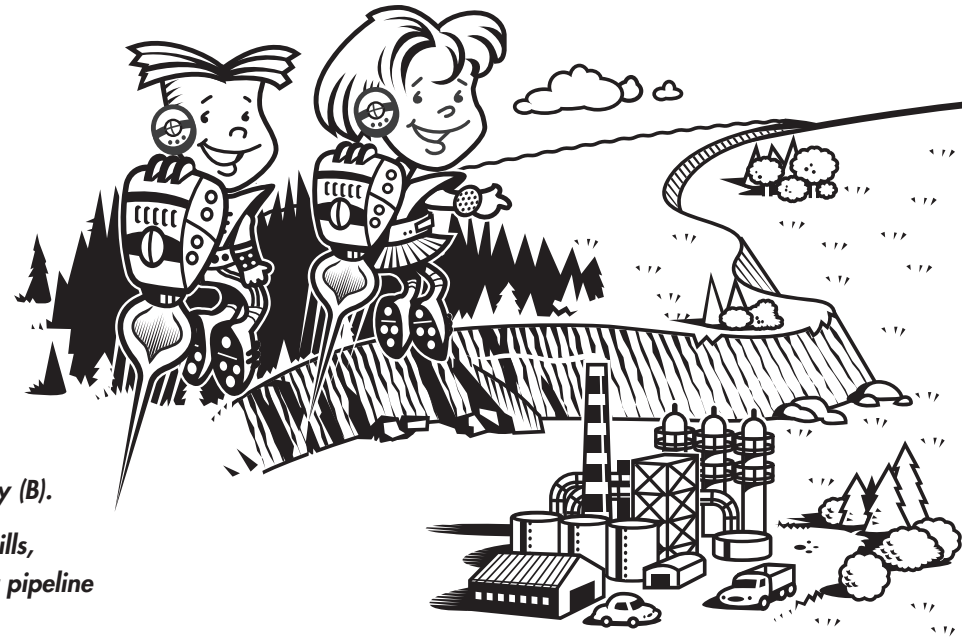


PIPELINES

PLOTTING A PIPELINE'S FUTURE

This is a map of an imaginary place. Pretend that you are an engineer, and draw the most direct route for a pipeline. It should start at the plant (A) and end at the city (B).

Some things to keep in mind: it is expensive to go over hills, cross rivers, and go through swamps. Try not to put your pipeline through farms and recreational areas.



START **A**



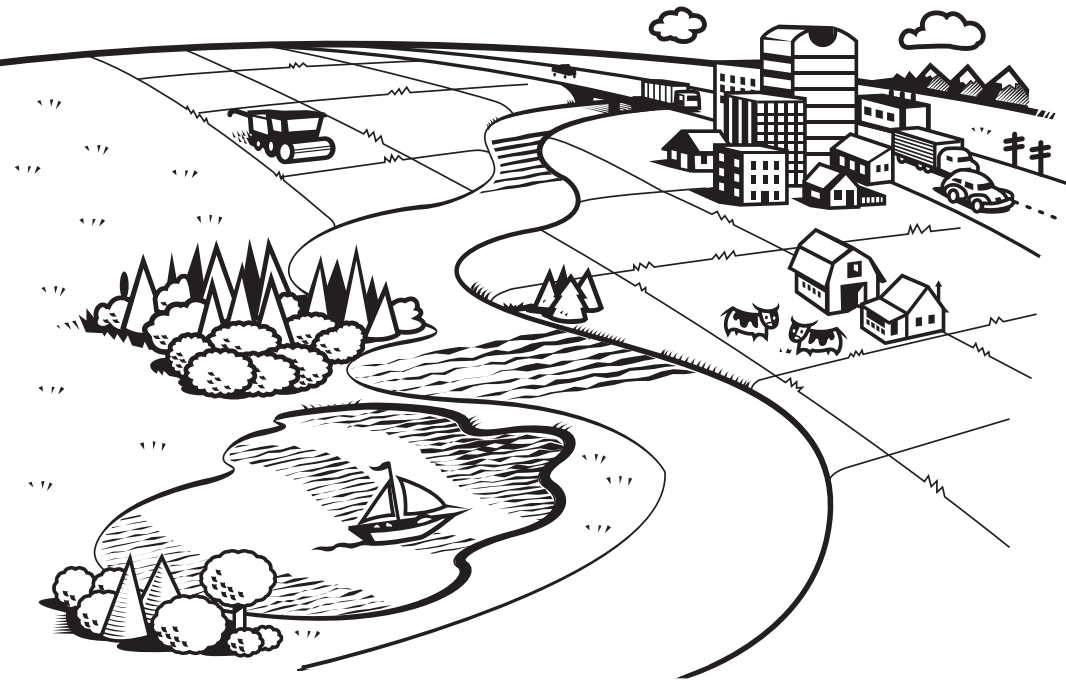
GUESS AND LEARN

GETTING A LINE ON PIPELINES

Read each sentence on the right and identify if it is Fact or Foolishness by circling the correct answer. (If you don't know the answer, it's okay to guess and learn!)

- | | |
|--|---------------------------------------|
| <p>1 The Chinese used bamboo "pipelines" for moving water over 7000 years ago.</p> | <p>FACT FOOLISHNESS</p> |
| <p>2 The first crude oil pipeline was built in Pennsylvania, U.S.A., in 1865. It was soon torn up by angry men who had hauled oil in wagons and were put out of work.</p> | <p>FACT FOOLISHNESS</p> |
| <p>3 Natural gas from the Bow Island gas field in Alberta was first piped to Calgary in 1912. Edmonton didn't have piped natural gas until 1923.</p> | <p>FACT FOOLISHNESS</p> |





B
FINISH



HOW ARE OIL AND GAS TRANSPORTED?

At first, oil was loaded in barrels and carted away from the oilfield in horse-drawn wagons. Today, oil companies can use big oil tankers (trucks) and railway cars to transport oil, but pipelines have become the easiest method. Oil or gas flows through the pipes, using pumps that can send it hundreds or thousands of kilometres. A pipeline costs a lot to build, but once it's built, it's the cheapest method of moving oil and gas.

- 4** The TransMountain oil pipeline crosses Canada's Rocky Mountains, the Coast Range, 56 highways, 24 railways, and 72 rivers and streams.
- 5** The valves and pipes at the top of a well that control the flow of oil and gas into a pipeline are called a Christmas tree.
- 6** It takes about 21 days at the speed of a quick walk for a barrel of oil to travel by pipeline from Edmonton to Toronto.

FACT FOOLISHNESS

FACT FOOLISHNESS

FACT FOOLISHNESS

- 7** Gas can move through a pipeline at about 40 kilometres an hour.
- 8** Canada's oil and gas pipeline system measures more than 250 000 kilometres, a distance more than six times around the earth.
- 9** A "jeeper" is a person who follows the pipe wrapper with a special detector ring to check for holes on the wrapping.
- 10** Most damage to pipelines is caused by dogs digging for bones.

FACT FOOLISHNESS

FACT FOOLISHNESS

FACT FOOLISHNESS

FACT FOOLISHNESS



SOUR GAS

DECODING THE FACTS



WHAT IS SOUR GAS?

Sour gas is natural gas containing hydrogen sulphide (H₂S).

WHAT IS HYDROGEN SULPHIDE?

H₂S is a chemical compound containing hydrogen and sulphur. It catches fire easily, smells like rotten eggs, and can be harmful to humans and animals.

HOW DO WE USE SOUR GAS?

Through a chemical process, H₂S is removed or “cleaned” from natural gas. The natural gas is then used to heat our homes, run our dryers, and fuel our fireplaces. The H₂S is refined into elemental sulphur that is used to make fertilizers, steel products, rubber, and medicine all over the world.

WHY IS SOUR GAS DEVELOPMENT IMPORTANT TO ALBERTA?

Sour gas development has created almost 20 000 jobs in western Canada and is a \$4 billion industry. And natural gas is one of the cleanest-burning fuels, which is good for the environment!

One more question!

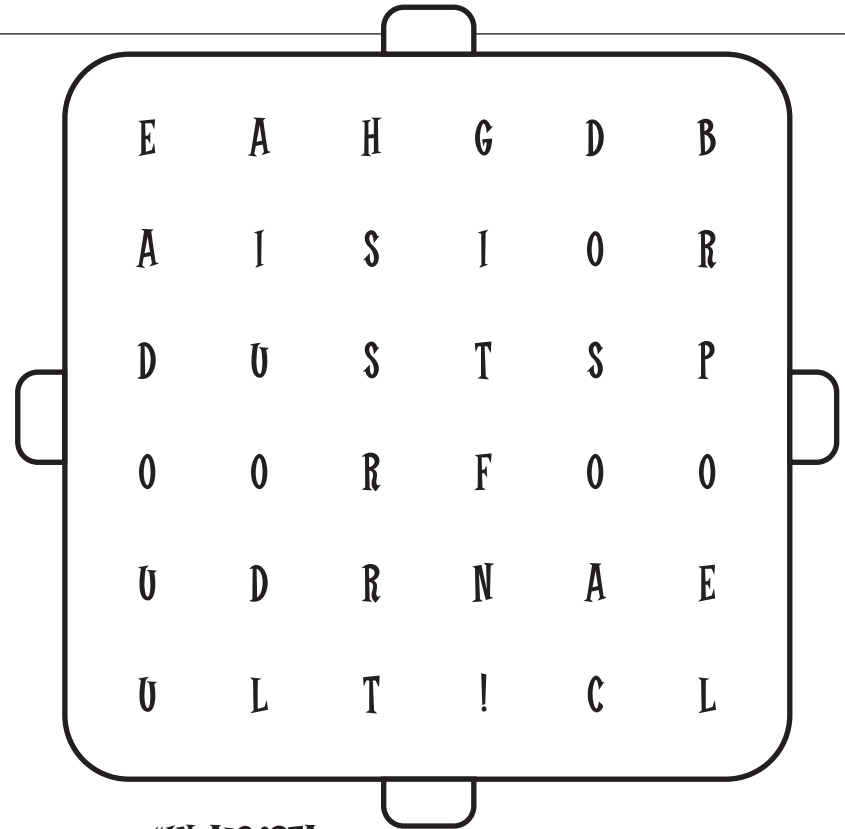
HOW MUCH OF ALBERTA'S GAS IS “SOUR”?

Punch out the Decoder on the back page to figure out the answer.

Hint: Fill the spaces with the letters in the order they appear, from left to right and top to bottom.



To decode, place the Decoder (found at the back of this book) over the rows of letters on the grid below. Make sure the number “1” at the top of the Decoder is at the top of the grid. In the spaces below, write in all of the letters that appear through the holes of the Decoder. Then, flip the Decoder ONE TURN TO THE RIGHT and write down the next set of letters that appears. Continue turning ONE TURN TO THE RIGHT until you have decoded the sentence.



“IN ALBERTA:

_____ / _____ -
_____ / ____ / _____
_____ / _____
_____ / _____ ”

WHAT ABOUT SOUR GAS AND SAFETY?

Sour gas has been developed safely for many years. Even though sour gas can be harmful to humans and animals, the ERCB believes it can continue to be developed safely. We protect people's safety by making sure that companies use safety measures.

Complete the sentences by using the words below.

REGULATES

BLOWOUT PREVENTERS

AUTOMATIC SHUTOFF

GAS EMISSIONS

SPECIAL TRAINING

INSPECTIONS

- 1 Crews working with sour gas receive _____ to recognize any hazards and to deal with emergencies.
- 2 Drilling rigs can use _____ to seal off the well.
- 3 Sour gas wells and plants receive frequent _____.
- 4 Pipelines use _____ valves to reduce the amount of sour gas that can escape in the event of an emergency.
- 5 Air quality is tested for _____.
- 6 The ERCB _____ sour gas drilling, production, pipelines, and processing in Alberta. The ERCB makes sure companies follow all safety procedures.



A FIELD DAY FOR SAFETY

Safety is very important in the oil and gas business. Drilling rigs must be run safely, and the people who work on them must take strict safety precautions.

What do you think some of these safety measures are? List them below.

From all the circles near Nick, identify the safety items that a person working on a drilling rig should have.

Draw a line to where the safety equipment should go.



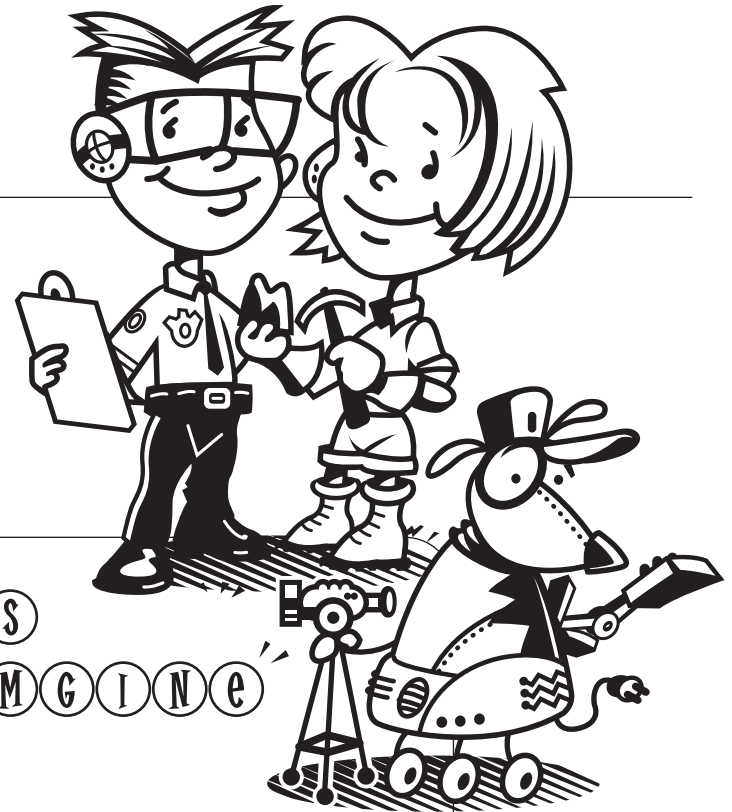
WHO'S WATCHING OUT FOR OUR SAFETY? ERCB inspectors visit drilling rigs and look them over carefully to make sure that they are operating safely. This is one way the ERCB helps to keep Albertans safe.

WHO'S WHO?

WORKING IN THE PETROLEUM INDUSTRY

It takes many people doing many jobs to keep the energy business moving. Below are just a few of the kinds of jobs involved.

Fill in the blanks using each of the circled letters to discover some of the exciting jobs in the petroleum industry.



- 1 Ge _____ T
- 2 Pe _____ e _____ EN _____ er
- 3 DR _____ Le _____
- 4 SA _____ FF _____ er
- 5 TR _____ RI _____ er
- 6 R _____ MAN _____ R
- 7 LA _____ SU _____ YOR

O L O G I S
 T R O L U M G I N E
 I L R
 F E T Y O I C
 U C K D V
 I G A G E
 N D R V E

Hint: Fill the spaces with the letters in the order they appear, from left to right.

FIELD TRIP

UNCOVERING THE JOB OF AN ERCB FIELD INSPECTOR!

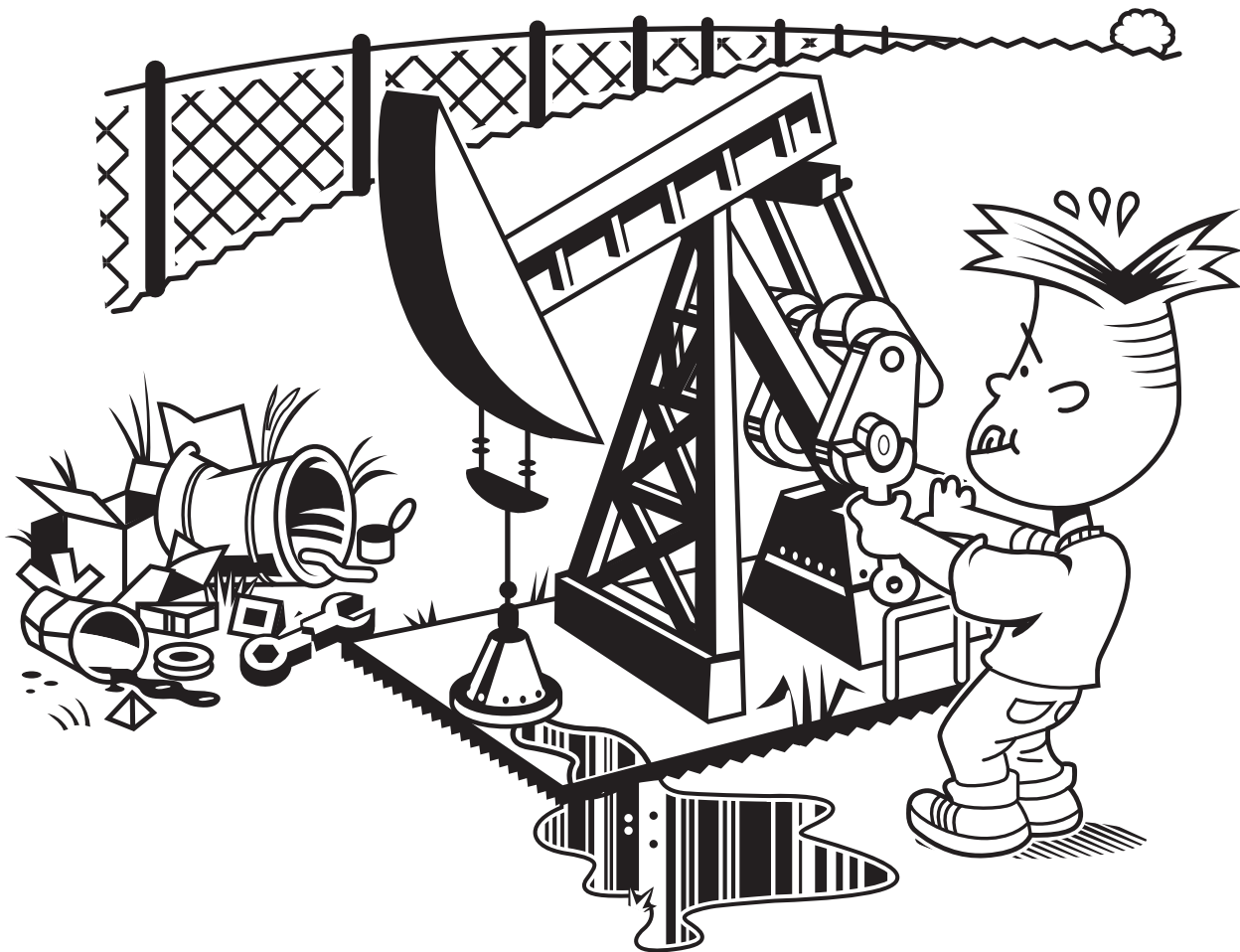
In Alberta, ERCB field inspectors from nine offices around the province make sure that companies are operating safely. One of the most important things they do is handle complaints about energy development and the environment. And they are specially trained to help people understand oil and gas development in their communities.

Look at the drawing to the right. What things do you think a field inspector would notice? Need a few hints? Circle the correct answers to the questions below for clues and to learn more about what a field inspector does!

- 1 ERCB field inspectors**
 - a) handle complaints about energy development
 - b) take care of farm crops
 - c) are professional soccer players
 - d) none of the above
- 2 ERCB field inspectors are located**
 - a) all over Alberta
 - b) only in major cities
 - c) only in small towns
 - d) only where there are farms
- 3 They inspect**
 - a) drilling rigs
 - b) oil and gas facilities
 - c) pipelines
 - d) all of the above
- 4 Field inspectors are trained to**
 - a) inspect wells and pipelines
 - b) enforce safe practices
 - c) answer questions from the public
 - d) all of the above

- 5 When an emergency happens, ERCB field inspectors**
 - a) monitor the cleanup of spills
 - b) ignore it and let the company take care of it
 - c) make sure the area is safe
 - d) a and c
- 6 If you have a question about oil and gas development in your area, you should**
 - a) talk to an ERCB field inspector, who will help you find the answers
 - b) attend community meetings to learn more
 - c) visit the ERCB field centre nearest you
 - d) all of the above
- 7 A company must not**
 - a) display a sign on the site
 - b) keep the site clear of garbage
 - c) use safety equipment
 - d) leak oil and gas into the environment

From what you have just learned, look at the picture below and circle the things you think a field inspector would notice are wrong.



A-MAZE-ING PETROCHEMICALS

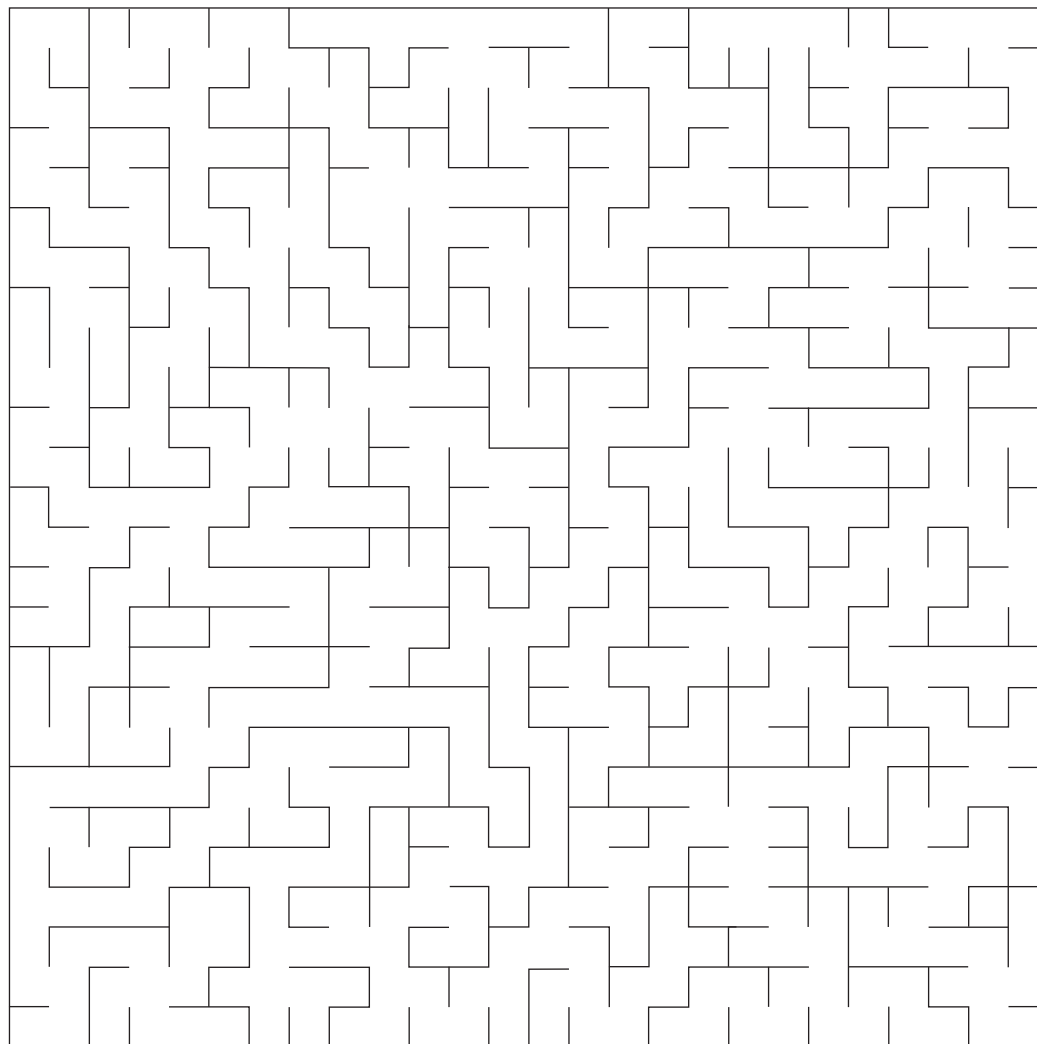
FANTASTIC PLASTICS!

Hard hats, skateboard wheels, computer keys, camera film – what do these have in common? These and many other plastic things are made from oil and gas. They are called petrochemical products.

Changing oil and natural gas into these products is very complicated. The oil and gas must be processed, refined, treated, and reprocessed to form the “building blocks” to make thousands of petrochemical products. Amazing!

Find your way through this petrochemical maze.

Can you find more than one way out?





WHAT AM I?

1. You use me to paint with.
2. I make your roads smooth. Cars like to drive on me.
3. I help plants to grow strong and healthy.
4. People use me instead of money.
5. I come in many sizes and colours. You use me at the grocery store and can put garbage in me too.
6. If the power goes out, I can help you light your way.

Plastic Bag

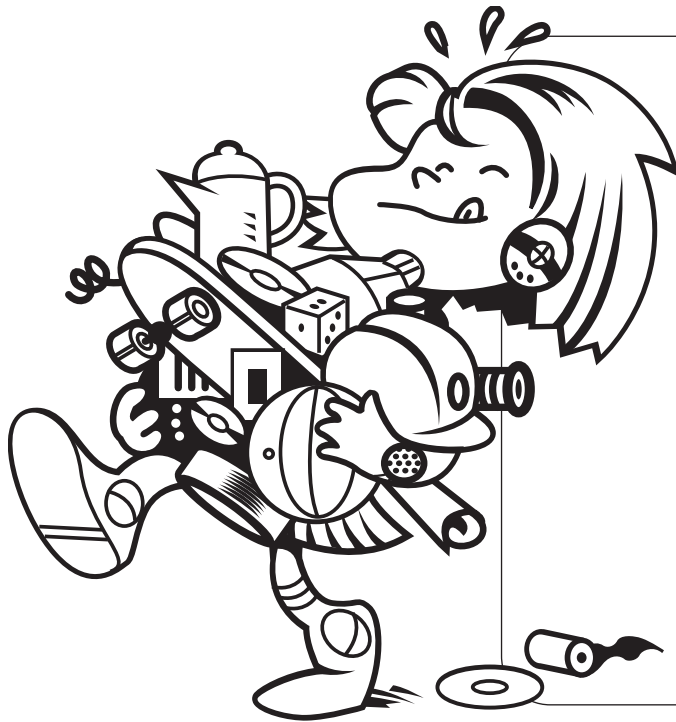
Fertilizer

Brush

Credit Card

Candle or Kerosene

Pavement



Draw another plastic product.

THE CONSERVATION KID

As a kid, you can do plenty to save or conserve energy!
And you can help grown-ups to conserve energy too!

Use the key to help Nick crack the code in the following sentences and find out how you can be a conservation kid. The first sentence is filled in for you as an example.

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

1
 ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒
 P u t o n a s w e a t e r a n d
 ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒
 t u r n d o w n t h e h e a t .

2
 ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒
 _____,
 ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒
 _____.



3
 ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒

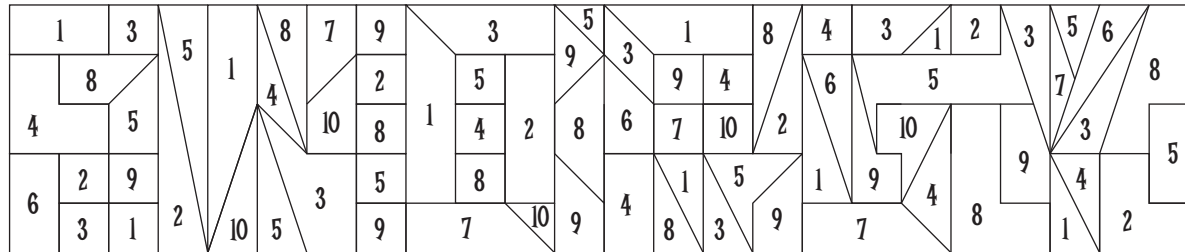
 ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒
 _____.

4
 ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒
 _____,
 ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒ ⌒
 _____.



LOOKING BACK AT WHAT WE'VE LEARNED

To solve the puzzle and find the hidden word below, read the sentences at the bottom of the page. If the sentence is **TRUE**, colour the numbered spaces as directed. Only use one colour. Hint: All the answers are in this booklet.



- 1 If Alberta was covered by an ocean millions of years ago, colour the #1 spaces.
- 2 If jugglers work in bottle factories, colour the #2 spaces.
- 3 If a monkey board is part of a drilling rig, colour the #3 spaces.
- 4 If the Chinese used bamboo pipelines 7000 years ago, colour the #4 spaces.
- 5 If the valves and pipes at the top of a well are called a Christmas carol, colour the #5 spaces.
- 6 If goggles are used for safety on drilling rigs, colour the #6 spaces.
- 7 If you save energy by riding your bike or walking to the store, colour the #7 spaces.
- 8 If the ERCB field inspector's job is to check the number of weeds in a farmer's crop, colour the #8 spaces.
- 9 If wood is a building block for camera film, colour the #9 spaces.
- 10 If sulphur is the end product of sour gas, colour the #10 spaces.

ANSWER KEY

SQUEEZE PLAY: PAGE 1

- | | |
|--------------|--------------|
| 1. Ocean | 5. Rock |
| 2. Creatures | 6. Petroleum |
| 3. Layers | 7. Holes |
| 4. Squeezed | 8. Trapped |

A SEDIMENTARY SANDWICH: PAGE 2

Read to learn about the different earth layers.

A SEDIMENTARY SANDWICH: PAGE 3

Colour your own rock layers.

DOODLEBUGGING: PAGE 4

"Working on a seismic exploration crew is dynamite! It's a real charge!"

LANDMEN AND ENGINEERS: PAGE 5

If you drilled down from rig:

A = 1000 barrels of oil.

B = Sorry, no oil.

C = Wow! 100 000 barrels of oil!

DRILLING: PAGE 6

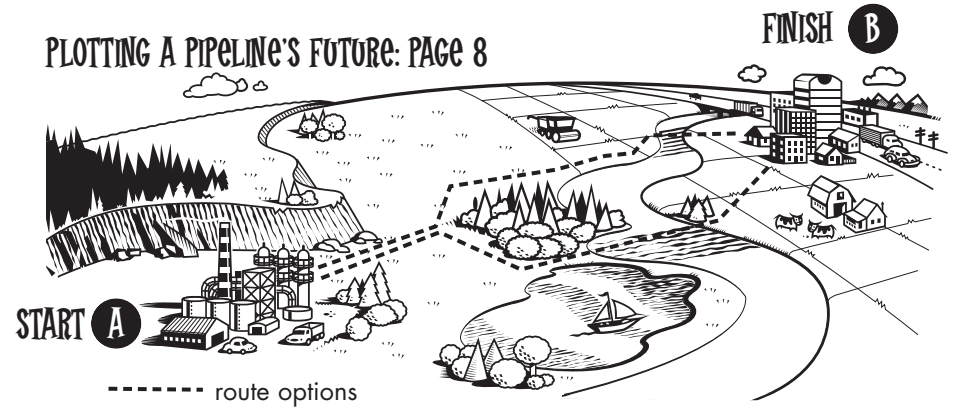
- | | |
|---------------------|--------------------|
| ③ CROWN BLOCK | ① TRAVELLING BLOCK |
| ⑤ MONKEY BOARD | ⑥ DRAW WORKS |
| ② BLOWOUT PREVENTER | ④ DOG HOUSE |

WHAT IS IT?: PAGE 7

It is a picture of a drill bit.



PLOTTING A PIPELINE'S FUTURE: PAGE 8



GUESS AND LEARN: PAGE 8

Questions 1 through 9 are FACT; number 10 is FOOLISHNESS.

SOUR GAS: PAGE 10

"About one-third of all gas produced is sour!"

WHAT ABOUT SOUR GAS AND SAFETY?: PAGE 11

- | | | |
|-----------------------|----------------------|------------------|
| 1. Special Training | 3. Inspections | 5. Gas Emissions |
| 2. Blowout Preventers | 4. Automatic Shutoff | 6. Regulates |

A FIELD DAY FOR SAFETY: PAGE 12



- Hardhat
- Safety boots
- Coveralls
- Breathing mask
- Oxygen bottle
- Flame-resistant clothing
- Goggles
- Training certificates

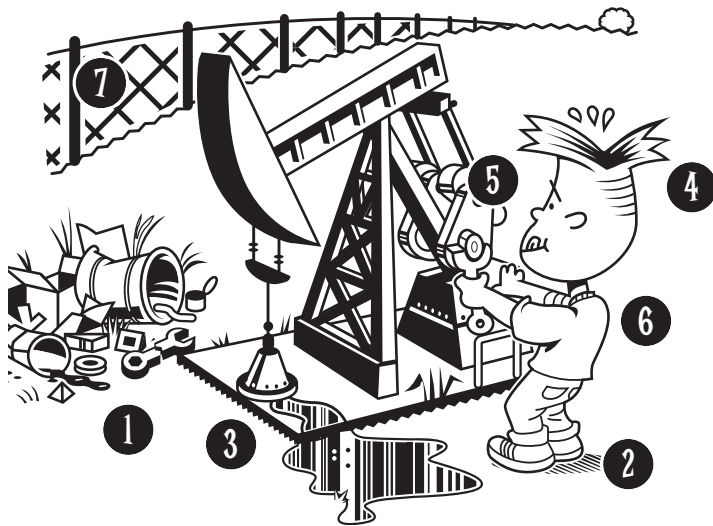
WHO'S WHO: PAGE 13

- | | |
|-----------------------|------------------|
| 1. Geologist | 5. Truck Driver |
| 2. Petroleum Engineer | 6. Rig Manager |
| 3. Driller | 7. Land Surveyor |
| 4. Safety Officer | |

FIELD TRIP: PAGE 14 - Correct answers are

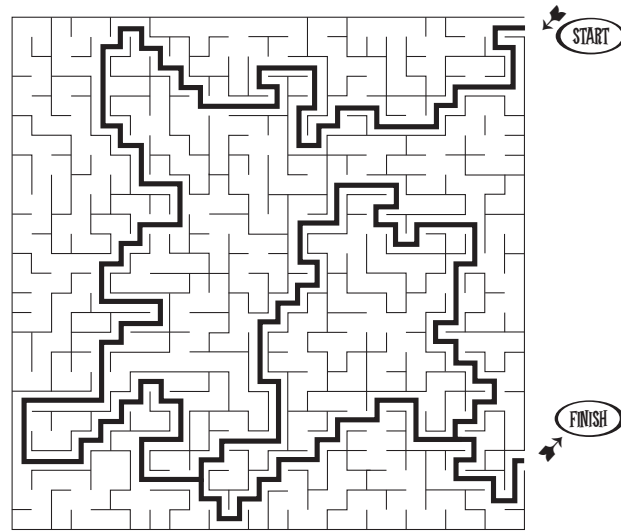
- | | |
|------|------|
| 1. A | 5. D |
| 2. A | 6. D |
| 3. D | 7. D |
| 4. D | |

FIELD TRIP: PAGE 15



- | | |
|--------------------|----------------------|
| 1. Trash | 5. No Safety Goggles |
| 2. No Safety Boots | 6. No Coveralls |
| 3. Oil Leak | 7. No Sign |
| 4. No Hardhat | |

A-MAZE-ING PETROCHEMICALS: PAGE 16



WHAT AM I? QUIZ: PAGE 17

- | | | | |
|---|---|---|--------------------|
| 1. You use me to paint with. | ← | → | Plastic Bag |
| 2. I make your roads smooth. Cars like to drive on me. | ← | → | Fertilizer |
| 3. I help plants to grow strong and healthy. | ← | → | Brush |
| 4. People use me instead of money. | ← | → | Credit Card |
| 5. I come in many sizes and colours. You use me at the grocery store and can put garbage in me too. | ← | → | Candle or Kerosene |
| 6. If the power goes out, I can help you light your way. | ← | → | Pavement |

THE CONSERVATION KID: PAGE 18

- "On short trips, ride your bike or walk."
- "Take the bus instead of asking for a ride."
- "Learn to windsurf, not to waterski!"

IF TRUE, DO!: PAGE 19



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