



Coal-Related Activities for Elementary Students



A M E R I C A N C O A L F O U N D A T I O N

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Note to teachers:

We hope you and your class will enjoy these activities as you learn about coal and electricity.

Please let us know how these activities work in your classrooms or if you have suggestions to improve them. We are always looking for new coal-related activities, so if you have one you would like to share, please contact us so it can be included in future editions of this publication.

The American Coal Foundation



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Coal Formation Activity

OBJECTIVE:

The student will simulate, observe, and explain the conditions under which coal is formed.

CONCEPTS:

- Coal is called a fossil fuel because it was formed from the remains of vegetation that grew as long as 400 million years ago.
- Coal formation is a continuing process.

SKILL REINFORCEMENT:

Critical thinking
Cooperative learning

GRADE LEVEL:

1-8

TIME NEEDED:

Two class periods over four weeks

MATERIALS:

- aquarium (for an individual version you can use a clear plastic shoe storage box or a 2 liter soda bottle with the top cut off)
- fine to medium grain sand
- fern fronds (leaves)
- twigs
- plant leaves
- screen or sifter
- fine silt or mud

PROCEDURE:

1. Pour water into your container to a depth of four to six inches.
2. Spread about two inches of sand on the bottom.
3. Drop small leaves, sticks and pieces of fern on sand. Let it stand for about two weeks. Write down what you observe as change in color and decomposition occur.
4. Gently sift fine silt or mud on top of the plant layer to the depth of two inches.
5. Wait two weeks and drain any water if there is any left. Let it sit and dry for another week or two. Now you not only have simulated coal where the plants were, if you break it gently in layers you might have a simulated fossil imprint from your plant leaves.

NOTE: If you line your container with plastic wrap before you begin, you can lift the whole formation out when it is dry.

TIP: This is a smelly activity. If you have an area where you can put this out of the way and observe it occasionally, you will like it better!

ACTIVITY DEVELOPED BY:

Kathleen Berry, Pennsylvania Teacher

Identifying and Comparing Different Types of Coal

OBJECTIVE:

Students will identify and compare the four different types of coal.

CONCEPT:

- There are four major types of coal.

SKILL REINFORCEMENT:

Critical thinking
Comparison and contrast
Cooperative learning

GRADE LEVEL:

4-8

TIME NEEDED:

One class period or less

MATERIALS:

- American Coal Foundation written materials and coal sample kit
- labels for student's backs (anthracite, bituminous, lignite and peat)

PROCEDURE:

1. Have students affix a "coal type" label to the back of each student.
2. By asking yes or no questions of their neighbors, each student must determine what type of coal they are (Example questions: "Am I used primarily in home heating energy?" or "Am I considered 'hard' coal?").
3. Assign a corner of the room for each type of coal. When the student thinks he/she knows what type they are, they can go to the appropriate corner.
4. Provide assistance to those who appear to be having trouble.
5. Review types of coal based on this exercise.

ACTIVITY DEVELOPED BY:

American Coal Foundation

Coal Flowers

OBJECTIVE:

Students will grow crystals on coal and explain the relationship between temperature and crystal development.

CONCEPT:

- Temperature affects crystal formation.

SKILL REINFORCEMENT:

Critical thinking Cooperative learning

GRADE LEVEL:

1-8

TIME NEEDED:

Two classroom periods

MATERIALS:

- glass bowl, shallow
- coal
- glue
- twigs or toothpicks
- paper towels
- salt
- laundry bluing
- water
- string/small pieces of cloth
- ammonia
- food coloring
- bowl, small paper cups
- thermometers
- worksheet

PROCEDURE:

1. In a shallow glass bowl place several small lumps of coal.
 2. Interwork twigs, toothpicks, paper or cloth with coal. You may select all or some of the items. You may need to use glue to hold the twigs and/or toothpicks to the coal.
 3. In a separate bowl or paper cup mix:
 - 6 tablespoons salt
 - 6 tablespoons laundry bluing (TIP: If your grocery or hardware store does not carry laundry bluing, check with local a pharmacist. Many women's magazines have ads for bluing and it may be purchased over the Internet at www.mrsstewart.com.)
 - 6 tablespoons water
 - 1 tablespoon ammonia
 4. Pour the mixture over the coal mound.
 5. Sprinkle dots of food coloring randomly over the mound.
 6. Crystals will begin to form within several hours.
 7. Have students fill out and turn in worksheet and answer question how "coal flowers" grow and why?
- NOTE: In colder weather, the crystals grow slower and colors are not as vivid due to slower evaporation time.

DISCUSSION:

This activity has an interesting background. Families and wives of coal miners in the late 1800s and early 1900s had little money to decorate or to buy toys so they used things they had around the house to create these. Coal flowers were entertaining and children liked to watch them grow because changes took place in a relatively short period of time. The original "coal flowers" were made without using food coloring. Many people thought the flowers looked like snow and used them to decorate at Christmas. Note that coal plays no chemical role in the creation of the crystals and is no more critical than the toothpicks used.

ACTIVITY DEVELOPED BY:

American Coal Foundation and Women In Mining Education Foundation

Coal Flower Worksheet

Name: _____ Date: _____

List items placed in bowl along with coal: _____

Time experiment started: _____ Time experiment ended: _____

Air temperature: _____ Coal flower bowl temperature: _____

Where did crystals first appear?

Which items did the crystal appear on?

Which items did the crystals completely cover?

What colors were most vivid?

What other items might be used in this experiment?

What effect do you think surrounding temperatures had on the crystal growing? Why?

Why was this a natural activity for mining families in the late 1800s and early 1900s?

NOTE: Check crystals about every two hours to note observations.

Students in a Coal Mine or Power Plant

Your students will have a much clearer understanding of the importance of coal if you can take them to observe the processes involved in mining coal and then follow the coal to an electrical power plant to observe the generation of electricity.

OBJECTIVE:

Students will list the steps or processes in converting coal to electricity.

CONCEPTS:

- Coal is mined above or below ground.
- Coal is an important fuel source in electric generation.

SKILLS REINFORCEMENT:

Critical thinking
Cooperative learning
Observation
Comparison and contrast
Predicting and map skills

GRADE LEVELS:

4-8

TIME NEEDED:

One half to one day

MATERIALS:

- notebooks and pencils
- list of mines and power plants in your area (Call local Chamber of Commerce or local utility for information.)

PROCEDURE:

1. Contact the manager of operations for your local mine or power plant to arrange for field trips. Explain how important it is for the children to see the mine and power plant to better understand and appreciate their size and the volume of resources they consume in order to produce the electricity that we have grown to assume will always be there when we need it. Remember to follow your school system's procedures for field trips.
2. Prior to the field trip, have your students begin keeping a journal of their experience.
3. Ask them to describe in their journal what they think they will see on their tour.
4. Have them draw diagrams and illustrations to show how they think the coal is mined and how coal is used to generate electricity.
5. Ask them to estimate how much coal they think the mine produces or the power plant burns daily.
6. Also ask students to notice the landscape along the route to the mine or power plant. For instance, did they notice railroad tracks? Was there a waterway nearby? Was the site located next to a metropolitan area or in the country? Would this make a difference? Did they observe reclamation? What effect does the location of the mine or power plant have on the economy of the immediate area?

Students in a Coal Mine or Power Plant

(Continued)

7. After returning from the field trip, ask students to write in their journals again, answering the same questions asked on the previous page. Have them compare their pre-trip predictions with what they learned on the trip.
8. Flip the lights in your classroom off and on a few times. Ask the students to draw a map which traces the energy used in the classroom lights back to the coal which was burned to generate the electricity.
9. Ask them to draw in the details they remember about the conversions of energy along the way: ancient plants storing the sun's energy as plant material, coal formation, coal mining, coal burning to create steam to run generators, generators making electricity, the transmission lines, feeder stations along the way, the switch and the light bulbs in the classroom.

ACTIVITY DEVELOPED BY:

Samantha Glover, Wyoming Teacher

Cookie Mining

OBJECTIVE:

Students will demonstrate economics skills in a simulated mining activity.

CONCEPT:

- Coal mining is a capital-intensive industry.

SKILL REINFORCEMENT:

Critical thinking
Math-number manipulation
Cooperative learning
Evaluation of multiple factors
Negotiation and compromise

GRADE LEVEL:

3-12

TIME NEEDED:

One or two class periods

MATERIALS:

- play money
- worksheet
- grid paper
- pencils
- three different types of chocolate chip cookies
- flat toothpicks
- round toothpicks
- paper clips

PROCEDURE:

1. Each student starts with \$19 of play money.
2. Each student receives a Cookie Mining worksheet and a sheet of grid paper.
3. Each student must buy their own "mining property," which is a cookie. Only one "mining property" per player. Cookies are for sale:
 - Mother's Chocolate Chip — \$3
 - Chips Ahoy — \$5
 - Chips Deluxe — \$7
4. After the cookie is purchased, the student places the cookie on the grid paper and, using a pencil, traces the outline of the cookie. The student must then count each square that falls inside the circle. Count partial squares as a full square.
5. Each student must buy their own "mining equipment." More than one piece of equipment may be purchased. Equipment may not be shared between students. Mining equipment for sale is:
 - Flat toothpick — \$2
 - Round toothpick — \$4
 - Paper clips — \$6
6. Mining costs are \$1 per minute.
7. The sale of one chocolate chip mined from a cookie results in a \$2 profit. (Broken chocolate chips can be combined to make one whole chip).

Cookie Mining

(Continued)

8. After the cookie has been “mined,” the cookie should be placed back into the circled area on the grid paper (reclamation). This can only be accomplished using the mining tools — no fingers or hands allowed. Reclamation costs are \$1 for each square covered outside original outline.

RULES:

1. No student may use their fingers to hold the cookie. The only things that can touch the cookie are the mining tools and the paper on which the cookie is sitting.
2. Students should be allowed a maximum of five minutes to mine their cookie. Students who finish mining before the five minutes are used up should only credit the actual time spent mining.
3. A student can purchase as many mining tools as desired and the tools can be of different types.
4. If the mining tools break, they are no longer usable and a new tool must be purchased.
5. The students who make money by the end of the game win (because they realized a mining profit).
6. All students win at the end of the game because they get to eat the remains of their cookie!

REVIEW:

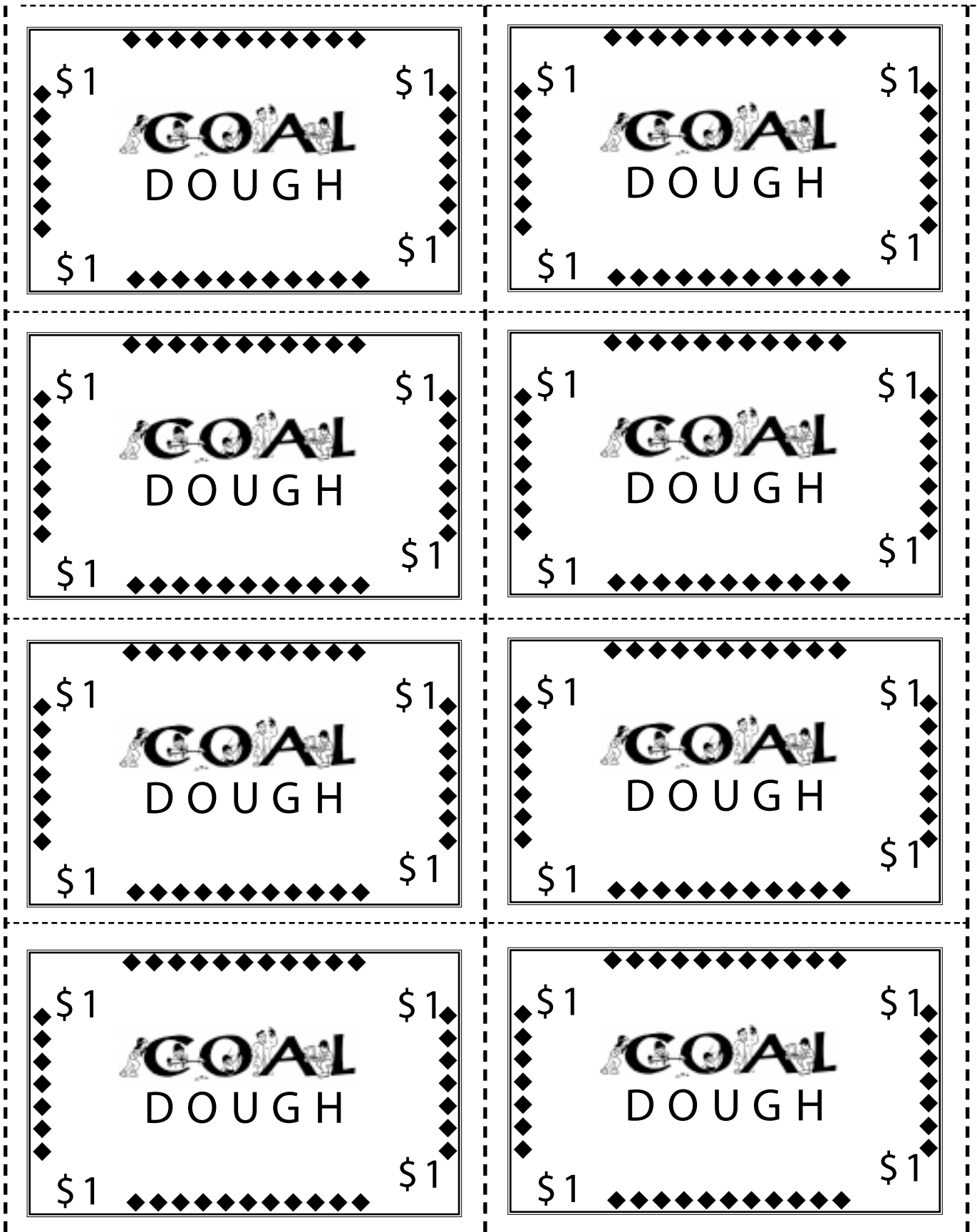
The game provided each student an opportunity to make the most profit that he/she could make with the resources provided. Students were forced to make decisions to determine which properties to buy and which piece or pieces of mining equipment should be purchased.

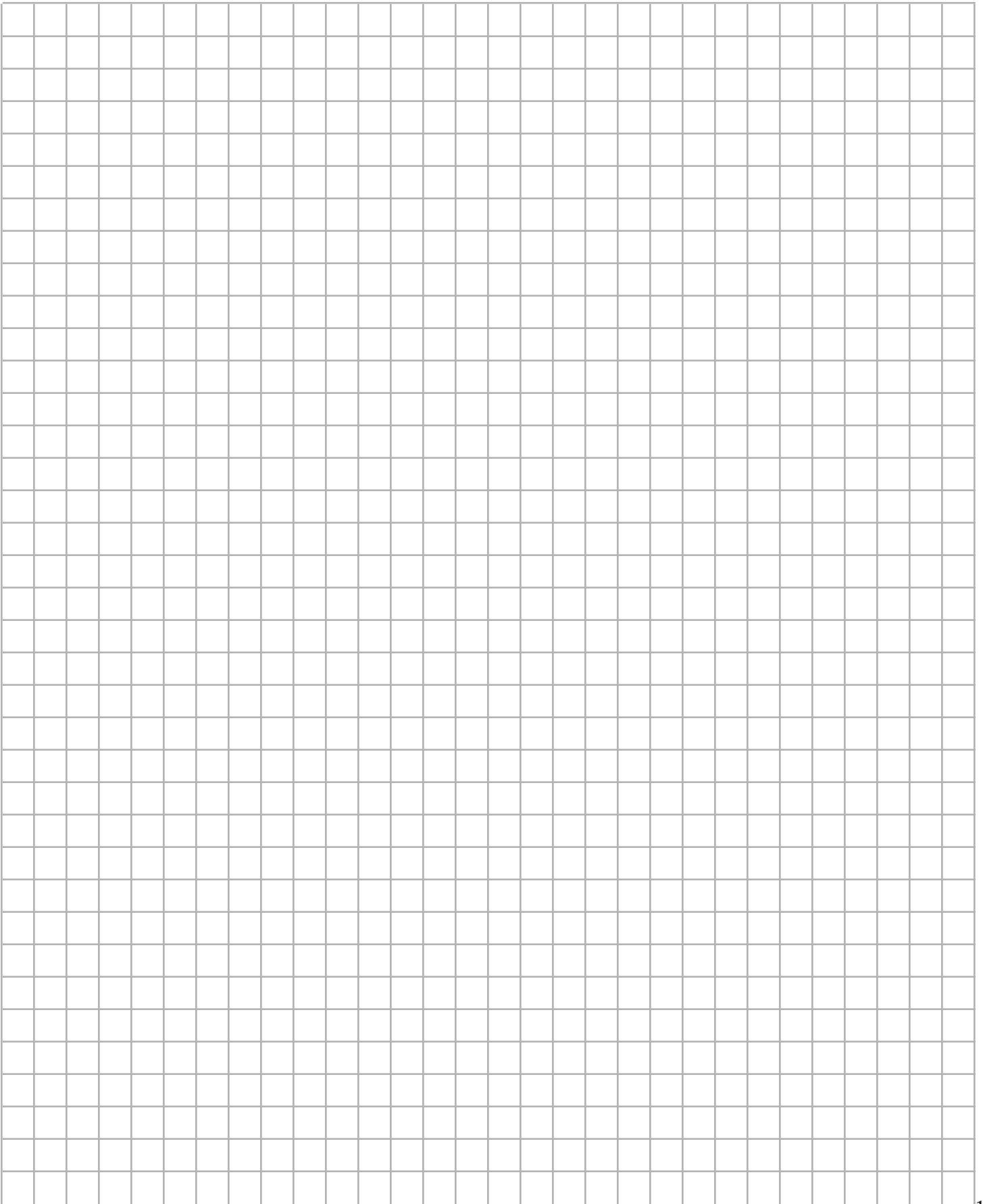
Each student should have learned a simplified flow of an operating mine. Also, each student should have learned something about the difficulty of reclamation, especially in returning the cookie back to the exact size that it was before “mining” began.

ACTIVITY DEVELOPED BY:

Women In Mining Education Foundation

Coal Dough





When the Lights Go Out!

OBJECTIVE:

Students will identify coal as the primary fuel used to generate electricity.

CONCEPTS:

- Coal is used to generate over one-half of the United States' electricity.
- Demand for electricity continues to increase with the increased use of microelectronics and power electronics equipment.
- There are trade-offs in using one energy source over another.

SKILL REINFORCEMENT:

Critical thinking
Comparison and contrast
Evaluation of multiple factors
Presentation and persuasion

GRADE LEVEL:

3-8

TIME NEEDED:

Two class periods

MATERIALS:

- worksheets
- pencils

PROCEDURE:

1. After discussing coal's use in the generation of electricity, have students complete "When the Lights Go Out" worksheet.
2. Have students share what they wrote and summarize.
3. Assign "My Two Hours Without Electricity" worksheet.
4. Review worksheet with class the next day. Ask students if their earlier written predictions came true and how they felt about being without electricity for only a fraction of a day. Ask students how they might better conserve electricity.

ACTIVITY CREATED BY:

Beverly S. McNamara, Arizona Teacher

When the Lights Go Out! Worksheet

Name: _____ Date: _____

Our way of life has become increasingly dependent on electricity. It seems that the electric meter on the side of the house is constantly spinning. Electricity is a source of energy. If you use electricity, you are using coal because coal generates over one-half of the electricity consumed in America each day, far more than any other energy source. We have appliances and machines that change electrical energy into other forms of energy, and then they do work for us.

But what would it be like if the power was turned off and there was no electricity? Would our lifestyle be just like the lifestyles of about a hundred years ago? Would you be able to survive?

Write a paragraph explaining what would happen to life in your home if the electricity was turned off. List what changes would have to be made. Tell what innovations you could come up with that would replace the electricity entering your home from your power company.

My Two Hours Without Electricity Worksheet

Name: _____ Date: _____

Time period I went without using electricity: _____

During this time I did not use the following that I normally would have if I had electricity:

- | | | | |
|--------------------|-------------|------------------------------------|--------------------------|
| radio/stereo | computer | microwave | oven/stove (electric) |
| hairdryer | dishwasher | washing machine | clothes dryer (electric) |
| lights/lamps | video games | TV/VCR | can opener |
| garage door opener | toaster | coffee maker | refrigerator |
| freezer | alarm clock | shower (electric hot water heater) | |

Instead I.....(Explain what you did during your two hour period without electricity)

This made me feel.....(How did you feel about going without electricity?)

I now realize that electricity.....(What do you think about electricity now? Is it more important to you or less? Why?)

To conserve electricity at home I can.....(What things can you do at home to avoid "wasting" electricity?)

Controlling Our Rate of Consumption

OBJECTIVE:

The student will demonstrate the relationship between limited resources and the rate at which they are consumed.

CONCEPTS:

- Natural resources, including fossil fuels such as coal, oil and natural gas, are called non-renewables because they are limited in supply.
- There are energy conservation decisions and measures we must make on a daily basis.

SKILL REINFORCEMENT:

Critical thinking
Math-number manipulation
Cooperative learning
Comparison and contrast
Evaluation of multiple factors
Presentation and persuasion

GRADE LEVEL:

4-6

TIME NEEDED:

One or two class periods

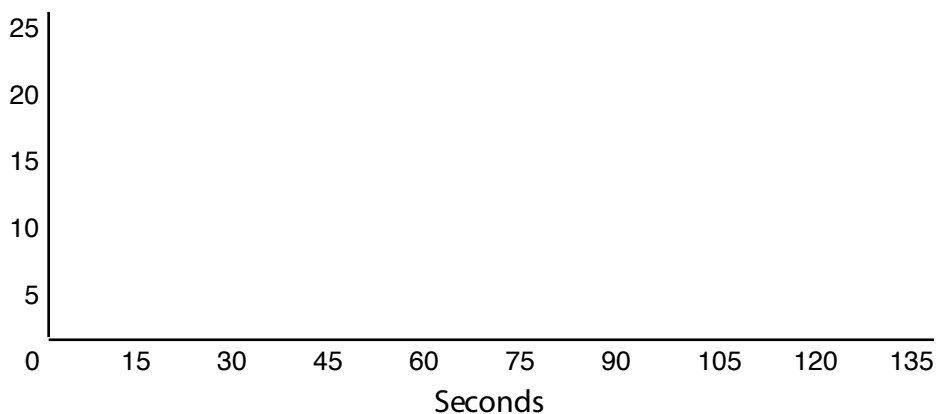
MATERIALS:

- cookies (two per student)
- chalkboard or easel for graphing

PROCEDURE:

1. Give each student a cookie. When the signal is given, the students will begin eating the cookies. Each student must raise a hand and keep it raised when he or she is finished. Count the hands raised every 15 seconds until all the cookies are eaten. At the last count, all hands should be raised.
2. Create the graph below indicating how many students finished eating every 15 seconds.

Students Finished
Eating Cookies



Controlling Our Rate of Consumption

(Continued)

3. Explain to the class that one cookie equals one coal deposit. Analyze the graph with the students. How many different coal deposits were consumed after each 15 second interval? 30 seconds? 45 seconds? etc.
4. Distribute the second cookie. This time the pupils can only take a bite when you say "Take a bite." Do this every 15 seconds. The system is the same: the pupils raise their hands when finished and you tally the number of hands raised until all students have eaten their cookies.
5. Construct a second graph. This graph usually indicates that coal resources last longer. Analyze the data. How long did it take for all resources to be eliminated?
6. Compare graph #1 (unlimited consumption) with graph #2 (limited consumption).

How do they differ? How are they the same? Can we help control how rapidly we use our resources, such as coal, oil and natural gas? How?

What can each student do to control their energy consumption at home and in the school?

ACTIVITY DEVELOPED BY:

Indiana teachers through workshops sponsored by the Indiana Council for Economic Education and Public Service of Indiana

The Geologist's Dilemma

OBJECTIVE:

Students will explain the relationship between supply and demand and its impact on energy resources.

CONCEPTS:

- There are renewable and non-renewable energy sources.
- These energy sources have costs and benefits associated with them.
- Demand for energy sources is shaped by supply and cost.

SKILL REINFORCEMENT:

Critical thinking
Math-number manipulation
Cooperative learning
Evaluation of multiple factors

GRADE LEVEL:

4-12

TIME NEEDED:

One or two class periods

MATERIALS:

- chalkboard or graph paper for recording
- glass jar
- five different colors of beads or types of beans
- rice in same quantity as beads

About 31 percent of the beads should be black (or black beans), 27 percent white (or navy beans), 19 percent blue (or kidney beans), 13 percent green (or rice) and 10 percent red (or lentils).[1] Since the beads represent our energy sources, which are unknown to all, do not attempt to count all the beads or beans. NOTE: Any resources not found the first time are waiting to be recovered the next time the game is played.

[1] Percentages from EIA Total U.S. Energy Production figures, 1996.

PROCEDURE:

1. Throw the beads high into the air, letting them scatter over the room. Divide the class into five exploration companies. Each of the companies will search for one of our energy resources represented by one color bead.

Company #1:	black bead/black bean = coal
Company #2	blue bead/kidney bean = oil
Company #3	white bead/navy bean = natural gas
Company #4	red bead/lentil = nuclear
Company #5	green bead/rice = solar/other

NOTE: Do not interfere or comment if any company starts to collect all colors.

2. Allow the exploration companies to search for one minute. Each company counts its resources. Keep the resources in separate piles. Record the totals for each group for each round on the chalkboard or on graph paper. (See graph.)

The Geologist's Dilemma

(Continued)

		<u>TRIAL</u>		
		1	2	3
SOURCE	Coal			
	Oil			
	Natural Gas			
	Nuclear			
	Solar/Other			

3. Start a second search for one minute. Each company must search for resources still missing. Record totals.
4. Do the same for a third one-minute round.
5. Discuss the following questions:
 - a. Which energy sources were easier to collect? Why? Which were the most difficult? Why?
 - b. What makes them easy or difficult to find? Is it the availability of the beads or is it the skill of the searchers?
 - c. Looking at the piles of energy from each of the different rounds, which is greater? Why? Which round is the smallest? Why?
 - d. Did anyone collect more than one energy resource? Is it realistic to collect more than one?
 - e. As energy resources become more scarce and demand continues to increase, what should happen to the price or cost of energy resources?

ACTIVITY DEVELOPED BY:

Mary Rose Cameron, Alabama Teacher

ETV — Energy TV

OBJECTIVE:

Students will rewrite the lyrics of existing songs using the different energy terms as the focus of their work.

CONCEPTS:

- There are different energy sources and each makes an important contribution to our lives and to our nation.
- We are dependent on energy from the moment we get up until we go to sleep at night.

SKILL REINFORCEMENT:

Critical thinking
Cooperative learning
Presentation and persuasion

GRADE LEVEL:

K-6

TIME NEEDED:

One or two class periods

MATERIALS:

- resource books/materials on different energy sources
- supplies for drawing pictures
- costumes/props (if desired)

PROCEDURE:

1. Place students in groups representing coal, oil, natural gas and nuclear energy. Have each team create a name for their musical group (i.e., "The Atoms" for nuclear power, "The Rays" for solar power).
2. Using a tune from a popular song, have students make up a song about their particular energy source. Begin by making the statement, "Let's see if we have real talent here today." Encourage creativity.
Example: Using Gene Chandler's hit "Duke of Earl," from the '60's "Duke, Duke, Duke, Duke of Oil, or Nuke, Nuke, Nuke, Nuke of Earl." Of course your songs will be more creative and contemporary.
3. Allow student groups a certain time period to come up with something (15 minutes). Next ask them to draw pictures and to create costumes and props (15 minutes).
4. Each group performs its song.
5. After each performance ask the students to identify the puns or word plays used in the titles or songs. Also, ask students what they learned about the different energy sources as a result of this activity.

ACTIVITY DEVELOPED BY

American Coal Foundation

Documentary on Coal

OBJECTIVE:

Students will gather, organize and present information about coal and its uses in an oral presentation.

CONCEPTS:

- Coal is formed from the remains of vegetation that grew as long as 400 million years ago.
- There are two major types of coal mining – surface mining and underground (deep) mining.
- Coal is used to generate electricity, for industry, for making steel and for export.
- The coal industry, with the federal and state governments, have worked to achieve a steady decline in combustion pollutant levels, improved water management practices and increased land reclamation efforts.
- Coal is one of the world's most abundant, efficient and affordable fuels.

SKILLS REINFORCEMENT:

Critical thinking
Math-number manipulation
Cooperative learning
Comparison and contrast
Evaluation of multiple factors
Presentation and persuasion

GRADE LEVEL:

4–8

TIME NEEDED:

Two to three class periods for preparation; one to two class periods for presentation.

MATERIALS:

- resources containing information about coal and electricity
- pictures or other visual aids
- supplies to make charts, graphs, etc.

PROCEDURE:

1. Assign students to one of the following groups:
 - coal formation
 - coal mining
 - environmental issues of coal mining
 - creating energy from coal
 - benefits from coal energy
2. Students will conduct their own research on the topic assigned. Encourage the use of the Internet if available (see the American Coal Foundation's website at www.acf-coal.org and related links). Students should prepare a presentation that includes visuals as well as written information. Graphs, charts, and tables are possible visuals that would enhance the presentation. Clarify your expectations and grading scale. Example: In order to get an A, the group must have at least two illustrations, a one-page narrative, etc.
3. Assign a specific time limit for the presentation. Evaluate groups according to their research and presentation.

ACTIVITY DEVELOPED BY:

Mary Rose Cameron, Alabama Teacher

Finding Coal Products in Your Home

OBJECTIVE:

Students will identify items in their homes that come from coal.

CONCEPTS:

- Coal is used for industrial and manufacturing purposes and household materials.
- Fly ash, bottom ash and boiler slag are formed when coal is burned and each is used to make certain end-products.

SKILL REINFORCEMENT:

Critical thinking
Cooperative learning
Presentation and persuasion
Math-number manipulation

GRADE LEVEL:

5-12

TIME NEEDED:

One or two class periods

MATERIALS:

- | | | |
|---------------------------|-------------------|--------------------|
| • abrasives | • insulation | • plastic |
| • baking powder | • linoleum (some) | • poster board |
| • batteries | • mothballs | • rubberbands |
| • chalk | • paint | • shingles (some) |
| • concrete (small pieces) | • paper clips | • sugar substitute |
| • fertilizer | • perfumes | • trays |
| • golf balls | • pens | |

NOTE: Teachers may use other items.

DISCUSSION:

Coal is a national resource whose use affects everyone. Coal is America's most readily available, least expensive, and most abundant major fossil fuel resource. Over half of our nation's electricity is generated by burning coal. Coal is also used directly by industries and manufacturing plants. When coal is burned it produces coal ash. Fly ash, bottom ash, and boiler slag are the primary forms. Fly ash can be used as a partial replacement for cement in concrete; as a low cost filler in golf balls, tennis rackets, screwdriver handles, plastics, bowling balls and linoleum. Bottom ash is often used in concrete blocks and as a base in road construction. Boiler slag is used in roofing shingles and as a blasting abrasive.

PROCEDURE:

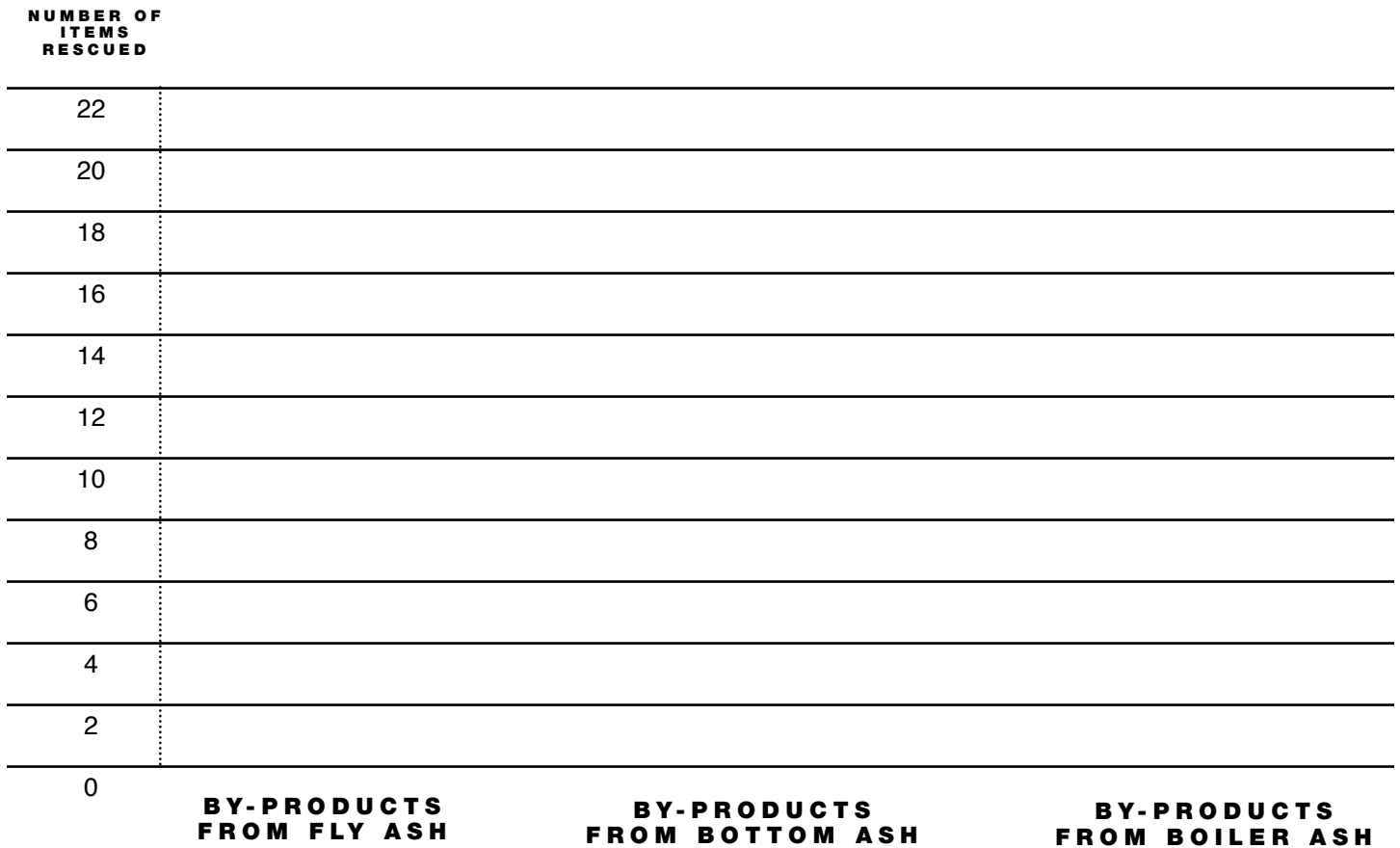
1. Divide students into groups.
2. Give each group poster board and markers.
3. Students are to view the items laid out before them and are to decide as a group which items are made from coal by-products.

Finding Coal Products in Your Home

(Continued)

4. Students are to divide their poster board into three columns and label the first - Items made with fly ash, second — Items made with bottom ash and third - Items made of boiler slag.
5. Students are to arrange the items on the poster board under the column of the group's choice (students may also glue or paste their items on to the poster board).
6. Each group is to explain its selection rationale with class members.
7. Students are to create a graph to depict coal by-product use. See sample graph.

SAMPLE COAL-BY-PRODUCTS GRAPH



ACTIVITY CREATED BY:

Beverly S. McNamara, Arizona Teacher

Coal Scrambles

OBJECTIVE:

Students will review, identify and use terms associated with coal.

CONCEPTS:

- Coal is an important fuel source in electric generation.
- Coal is used to produce a wide variety of products essential to our daily life.

SKILL REINFORCEMENT:

Critical thinking
Math-number manipulation
Cooperative learning

GRADE LEVEL:

4-8

TIME NEEDED:

One classroom period or less

MATERIALS:

- balloons (three each of three different colors)
- word scramble sheets (make nine copies)
- answers to word scrambles (#1 through #3)
- pencils
- pin
- play money

PROCEDURES:

1. Fold and roll each word scramble (one through three) into nine balloons, using one color for each of three teams.
2. Divide class into three teams.
3. Tell the class that each puzzle consists of four coal-related words jumbled up. Some of the squares are numbered. When the words are unscrambled, the letters of the numbered squares are used to fill in the blanks of the clue sentence, completing the word scramble.
4. Each team must blow up its balloon for word scramble #1, tie it, and then pop it on a pin taped to a table or a board. When the balloon pops, releasing the puzzle, the team retrieves it and attempts to solve it.
5. When the first word scramble is solved, the team must repeat the steps in #4 and solve word scrambles #2 and #3 in a similar fashion.
6. Set an appropriate time limit on this activity and award "Coal Dough" for each correct answer. The team with the most "Coal Dough" wins.
7. Review any puzzles that were most frequently missed.

ACTIVITY CREATED BY:

Kathryn McCoy, Tennessee Teacher

Word Scrambles

Word Scramble #1

L R A G D I N E

R O O V E N C Y

N L L L G A O W

N I T N O R N E S M I O U U C

Use the eight numbered letters above to answer this clue.

Our end product is often

Word Scramble #2

L L O G I I T H

K C O E

M I E S H A C C L

S A G S E

Use the five numbered letters above to answer this clue.

From ancient **to our lives**

Word Scramble #3

K	I	N	G	P	E	A	B	W	O	D	R
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
H	G	Y	S	U	U	O	C	R	P		
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
O	O	O	O	D	F	C	R	L			
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S	A	G	S	E	E	E	E	E	E	E	E
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Use the six numbered letters above to answer this clue.

Here is how we coal

Answer Key for Word Scrambles

ANSWERS TO WORD SCRAMBLE #1

- Drag Line
- Conveyor
- Long Wall
- Continuous Miner
- Computers

Our end product is often ELECTRICITY.

ANSWERS TO WORD SCRAMBLE #2

- Light Oil
- Coke
- Chemicals
- Gases

From ancient TIMES to our lives.

ANSWERS TO WORD SCRAMBLE #3

- Baking Powder
- Cough Syrup
- Food Color
- Preservatives

Here is how we INGEST coal.

Coal Dough



Coal Bingo

OBJECTIVE:

The student will use coal facts to complete a problem-solving activity.

CONCEPTS:

- Coal has played an important role in the world's history.
- Coal has four major uses.
- There are four major types of coal.

SKILL REINFORCEMENT:

Critical thinking
Cooperative learning

GRADE LEVEL:

4-8

TIME NEEDED:

One class period

MATERIALS:

- worksheet
- pencils

PROCEDURES:

1. Students are to write the answers to the questions on the bottom of their coal bingo sheets. Next, students are to write the answer in the block with the letter that matches the letter of the question.
2. Instruct students that they are to move about the room and find others who can name the required item and write the name of that person in the appropriate square on the Coal Bingo worksheet.
3. Allow no more than 10 minutes for students to fill as many squares as possible.
4. The teacher becomes the Bingo Caller by asking for a student to name the person in, for example, "square J." If that person can answer correctly, then that person's name can be X'ed wherever it is used on any sheet.
5. Continue calling at random in this manner until someone has four X's in a row to win the game.

NOTE: An answer sheet is attached to verify answers.

This activity can also be used as a pre-lesson activity to assess what knowledge your students already have about coal. You may also want to use the attached K-W-L chart (which you can put on your blackboard or an easel). Have students write about what they know about coal in the first column (without using any resources) and what they want to know about coal in the second column. You may have students share what they know, as well as their questions. Resource materials can then be used to find answers to their questions and to verify what they thought they knew. After your coal unit is completed, have students fill in the third column about what they learned about coal.

ACTIVITY DEVELOPED BY:

Kathryn McCoy, Tennessee Teacher

Coal Bingo Worksheet

Name: _____ Date: _____

A. Name of the geologic age when coal was formed.

B. What is a dragline?

C. Tell how Native Americans used coal.

D. Name the energy source that produced coal.

E. Name three coal safety devices.

F. Name the main air pollutant element from coal.

G. Which southeastern state produces the most coal?

H. Name a region of the United States with no coal resources.

I. What is coke used for?

J. Name the process of cleaning up after mining, restoring the land to its premining condition.

K. Name a country to which we sell coal.

L. Define fossil fuel.

M. Name the four chief types of coal.

N. What is the main element in coal?

O. Name the state with the largest demonstrated coal reserves in the nation.

P. Where is a continuous miner used?

<p>A</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>B</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>C</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>D</p> <p>_____</p> <p>name</p> <p>_____</p>
<p>E</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>F</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>G</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>H</p> <p>_____</p> <p>name</p> <p>_____</p>
<p>I</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>J</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>K</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>L</p> <p>_____</p> <p>name</p> <p>_____</p>
<p>M</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>N</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>O</p> <p>_____</p> <p>name</p> <p>_____</p>	<p>P</p> <p>_____</p> <p>name</p> <p>_____</p>

Answers to Coal Bingo

- A. Carboniferous
- B. Powerful machine used in surface mining
- C. To bake pottery
- D. Sunshine (solar)
- E. Hard hat, steel-toed shoes, self-rescuer, battery powered light
- F. Sulfur
- G. Alabama
- H. New England
- I. Smelting iron to steel
- J. Reclamation
- K. Canada, Japan, Brazil, Netherlands
- L. Product of ancient plants and animals
- M. Anthracite, bituminous, sub-bituminous, lignite
- N. Carbon
- O. Montana
- P. In underground or deep shaft mines

Coal K-W-L Chart

Name: _____ Date: _____

What I know about coal	What I want to know about coal	What I learned about coal

The Coal Bowl

OBJECTIVE:

Students will review facts about coal use and its importance in the United States.

CONCEPTS:

- Coal is used to produce electricity, to provide heat for industrial and retail manufacturing processes, in iron and steel production and for export.
- Coal is present in 38 states, and is widely distributed and used across the United States.
- The four major types of coal are: lignite, sub-bituminous, bituminous and anthracite.

SKILL REINFORCEMENT:

Critical thinking
Math-number manipulation
Cooperative learning

GRADE LEVEL:

4-8

TIME NEEDED:

One class period or less

MATERIALS:

- worksheet
- list of categories
- teacher answer sheet
- play money

PROCEDURE:

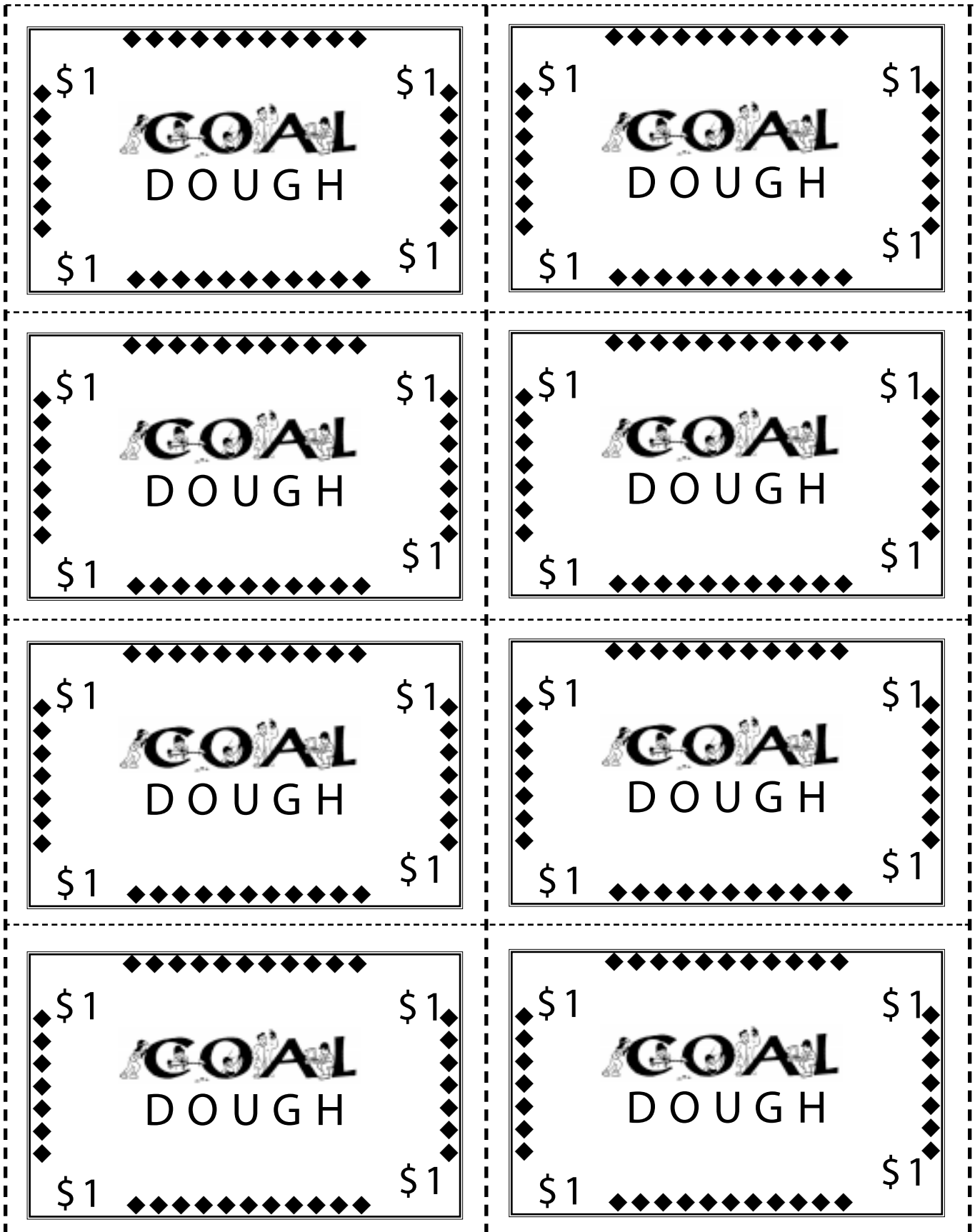
After students have studied about coal, they can take this Coal Bowl.

1. Place class into teams.
2. Put The Coal Bowl Categories on the blackboard or an easel for class viewing.
3. Students, using acquired knowledge and resource aids, complete the Coal Bowl Worksheet. Place an appropriate time limit on this (about 15 minutes).
4. Teacher calls out a Coal Bowl Category and asks the first team to raise its hand to answer. The team is rewarded with one "Coal Dough" for each correct answer in that category. Call on another team as necessary to finish correct answers.
5. Repeat until quiz is completed. The team with the most "Coal Dough" is the winner.
6. Review categories that seemed to stump most students.

ACTIVITY DEVELOPED BY:

Kathryn McCoy, Tennessee Teacher

Coal Dough



The Coal Bowl Worksheet

Name: _____ Date: _____

Fill in the answers to the following coal-related questions.

What are the four major uses of coal?

What are the five top states with the largest proven coal reserves?

What are the top five coal-producing states?

What are the top five means of coal transportation?

What are the top five products from coal?

What are the top five coal-using states?

What are the top five countries the United States exports coal to?

What are the five major types of mining machinery?

What are the three types of tools or techniques used in coal exploration?

What are the four major types of coal?

The Coal Bowl Categories

Four major uses of coal

Top five states with proven coal reserves

Top five coal-producing states

Top five means of coal transportation

Top five products from coal

Top five coal-using states

Top five countries to which the United States exports coal

Five major types of mining machinery

Three major types of tools/techniques used in coal exploration

Four major types of coal

THE COAL BOWL ANSWERS

Four major uses of coal

electricity, heat for industrial and retail manufacturing processes, iron and steel production, export

Top five states with proven reserves

Montana, Illinois, Wyoming, West Virginia, Kentucky

Top five coal-producing states

Wyoming, West Virginia, Kentucky, Pennsylvania, Texas

Top five means of coal transportation

railroad, barge, conveyor systems, truck, slurry pipeline

Top five products from coal

coke, gas, tar, light oils, chemicals

Top five coal using states

Texas, Indiana, Ohio, Illinois, Pennsylvania

Top five countries to which the United States exports coal

Canada, Japan, Brazil, Netherlands, Italy

Five major types of mining machinery

draglines, continuous miner, longwall mining machine, front-end loaders, bulldozers

Three major types of tools/techniques used in coal exploration

core sampling, surveying and mapping, computer-aided design

Four major types of coal

lignite, sub-bituminous, bituminous, anthracite

Know Your Coal Time Line

OBJECTIVE:

Students will create a time line while identifying the highlights of coal history in the United States.

CONCEPTS:

- Coal use in the United States has continued through time.
- Coal has played an important role in U.S. history.
- Coal is an important fuel source for electricity generation.

SKILL REINFORCEMENT:

Critical thinking

GRADE LEVEL:

3-6

TIME NEEDED:

one class period

MATERIALS:

- Coal Highlights Time Line and worksheet
- pencils/markers/crayons
- glue
- paper

PROCEDURE:

1. Students are asked to review the Coal Highlights Time Line.
2. Students are to follow the instructions on the worksheet:
 - a. Put the 15 historical events/eras relating to coal use and development in chronological order by correctly numbering them in the square of the upper left of each block.
 - b. Cut the fifteen rectangles out and glue them on to another sheet in the correct chronological order.
 - c. Draw a picture to illustrate each coal event.

ACTIVITY DEVELOPED BY:

Kathryn McCoy, Tennessee Teacher

Timeline of Coal in the United States



- 1000 A.D. ● Hopi Indians, living in what is now Arizona, use coal to bake pottery made from clay.
- 1673-74 ● Louis Jolliet and Father Jacques Marquette discover “charbon de terra” (coal) at a point on the Illinois River during their expedition on the Mississippi River.
- 1701 ● Coal is found by Huguenot settlers at Manakin on the James River, near what is now Richmond, Virginia.
- 1748 ● The first recorded commercial U.S. coal production from mines in the Manakin area.
- 1762 ● Coal is used to manufacture, shot, shell, and other war material during Revolutionary War.
- 1816 ● Baltimore, Maryland becomes the first city to light streets with gas made from coal.
- 1830 ● The first commercially practical American-built locomotive, the Tom Thumb, is manufactured. Early locomotives that burned wood were quickly modified to use coal almost entirely.
- 1839 ● The steam shovel is invented and eventually becomes instrumental in mechanizing surface coal mining.
- 1848 ● The first coal miners' union is formed in Schuylkill County, PA.
- 1866 ● Surface mining, then called “strip” mining, begins near Danville, Illinois. Horse-drawn plows and scrapers are used to remove overburden so the coal can be dug and hauled away in wheelbarrows and carts.
- 1875 ● Coke replaces charcoal as the chief fuel for iron blast furnaces.
- 1890 ● The United Mine Workers of America is formed.

Timeline of Coal in the United States



- 1896 ● Steel timbering is used for the first time at the shaft mine of the Spring Valley Coal Co., where 400 feet of openings are timbered with 15-inch beams.
- 1901 ● General Electric Co. builds the first alternating current power plant at Ehrenfeld, Pennsylvania, for Webster Coal and Coke Co., to eliminate inherent difficulties in long-distance direct-connect transmission.
- 1912 ● The first self-contained breathing apparatus for mine rescue operations is used.
- 1930 ● Molded, protective helmets for miners are introduced.
- 1937 ● The shuttle car is invented.
- 1961 ● Coal becomes the major fuel used by electric utilities to generate electricity.
- 1973-74 ● Oil embargo by the Organization of Petroleum Exporting Companies (OPEC) focuses attention on the energy crisis and results in increased demand for U.S. coal.
- 1977 ● Surface Mining Control and Reclamation Act (SMCRA) passed.
- 1986 ● Clean Coal Technology Act passed.
- 1990 ● U.S. coal production tops 1 billion tons in a single year for the first time.
- 1995 ● The National Coal Association and the American Mining Congress merge into the National Mining Association, representing coal- and minerals-producing companies.
- 1996 ● Energy Policy Act goes into effect, opening electric utility markets for competition between fuel providers.
- 2002 ● Coal mining companies reclaimed 2 millionth acre of mined land.
- 2005 ● Congress passes and President signs into law the Energy Policy Act of 2005 that promotes increased use of coal through clean coal technologies.

Coal Time Line Worksheet

Name: _____ Date: _____

Put the following fifteen historical events/eras related to coal use and development in chronological order by numbering them in the square in the upper left of each block. Cut your sheet into fifteen rectangles and arrange these in chronological order by gluing them to another piece of paper. Draw a picture to illustrate each coal event.

- Steam shovel invented which mechanized surface mining
- Steel replaces wood in Colorado mine, making shaft mining safer
- Energy Policy Act goes into effect, opening electric utility markets
- Oil embargo by OPEC results in increased demand for U.S. coal
- General Electric builds first alternating current power plant
- Joliet and Marquette discover coal on the Illinois River
- Coal becomes leading fuel for electric generation
- U.S. coal production tops 1 billion tons in a single year
- Huguenot settlers discover coal near present-day Richmond, VA
- Coke replaces charcoal as fuel for blast furnaces
- First recorded commercial coal production in Virginia
- First commercial American-built coal-powered locomotive
- Baltimore, MD becomes first city to light streets with coal gas
- "Surface" mining begins in Illinois with horse-drawn plows and scrapers
- Hopi Indians bake pottery by burning coal

Notes