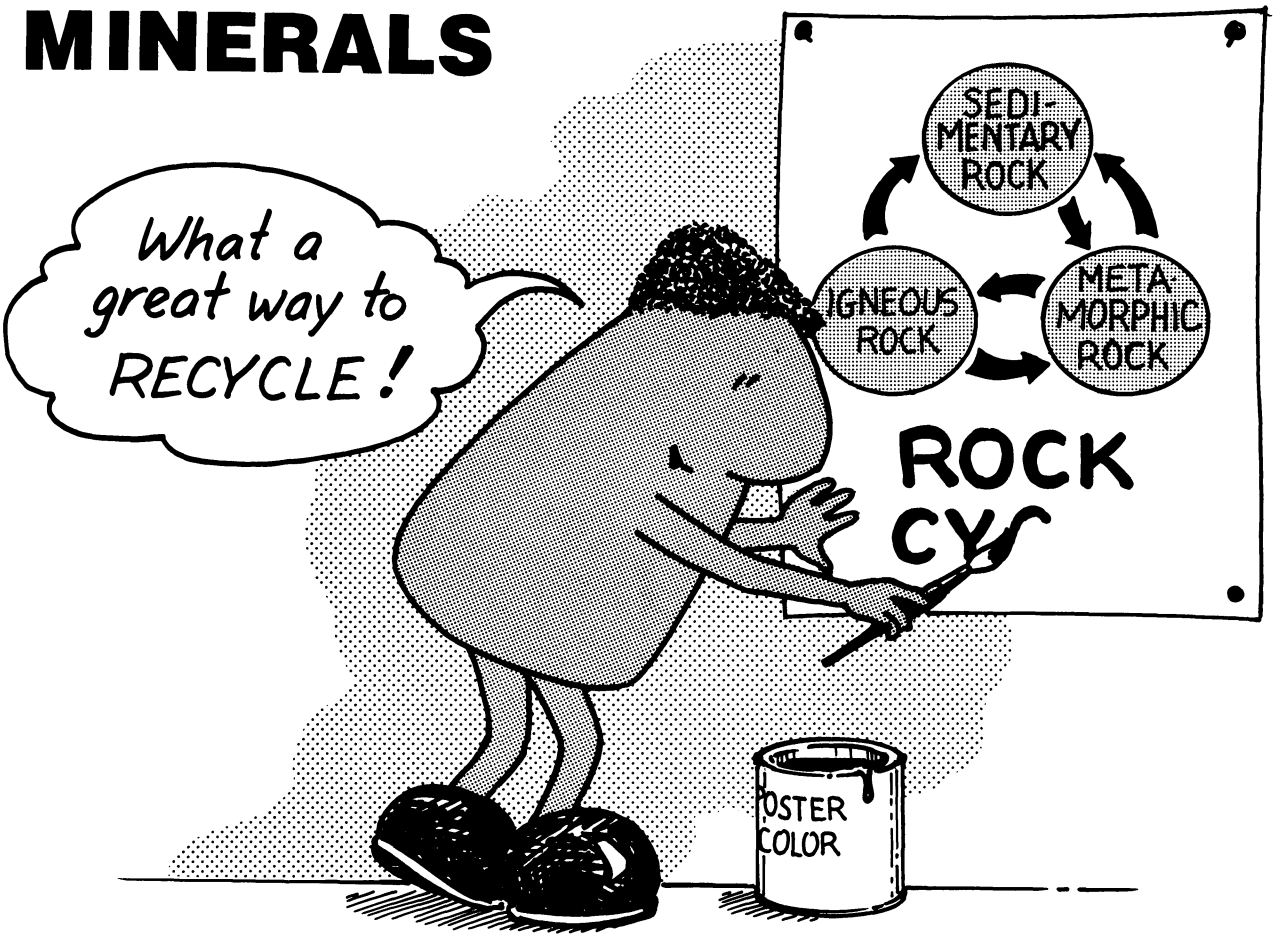
ROCKS AND MINERALS



TASK CARD SERIES

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TOPS LEARNING SYSTEMS

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REPRODUCIBLE STUDENT TASK CARDS

Gathering Materials

Listed below is everything you'll need to teach this module. You already have many of these items. The rest are available from your supermarket, drugstore and hardware store. Laboratory supplies may be ordered through a science supply catalog. Hobby stores also carry basic science equipment.

Keep this classification key in mind as you review what's needed:

special in-a-box materials:	general on-the-shelf materials:
Italic type suggests that these materials are unusual. Keep these specialty items in a separate box. After you finish teaching this module, label the box for storage and put it away, ready to use again the next time you teach this module.	Normal type suggests that these materials are common. Keep these basics on shelves or in drawers that are readily accessible to your students. The next TOPS module you teach will likely utilize many of these same materials.
(substituted materials):	*optional materials:
A parentheses following any item suggests a ready substitute. These alternatives may work just as well as the original, perhaps better. Don't be afraid to improvise, to make do with what you have.	An asterisk sets these items apart. They are nice to have, but you can easily live without them. They are probably not worth the an extra trip, unless you are gathering other materials as well.

Everything is listed in order of first use. Start gathering at the top of this list and work down. Ask students to bring recycled items from home. The teaching notes may occasionally suggest additional student activity under the heading "Extensions." Materials for these optional experiments are listed neither here nor in the teaching notes. Read the extension itself to find out what new materials, if any, are required.

Needed quantities depend on how many students you have, how you organize them into activity groups, and how you teach. Decide which of these 3 estimates best applies to you, then adjust quantities up or down as necessary:

Q_1 / Q_2 / Q_3

- **Single Student:** Enough for 1 student to do all the experiments.
- **Individualized Approach:** Enough for 30 students informally working in 10 lab groups, all self-paced.
- **Traditional Approach:** Enough for 30 students, organized into 10 lab groups, all doing the same lesson.

KEY: *special in-a-box materials* (substituted materials) general on-the-shelf materials *optional materials

Q_1 / Q_2 / Q_3	
10/300/300	sheets of lined notebook paper
1/15/15	rulers (straight edges)
.1/1/1	*quart of coarse brown sand with flecks of mica*
1/8/10	*spoons
1/8/10	pie tins
1/30/30	hand lenses
1/1/1	box of granulated sugar
1/10/10	microscope slides
1/10/10	a candle with drip catcher and matches (Bunsen burners)
2/20/20	*pieces (each) of granite and basalt, about golf ball size*
3/10/12	glass jars
1/10/10	eyedroppers
1/1/1	package of table salt
1/15/30	pennies
2/15/20	paper clips
1/10/10	*common bricks*
2/20/20	pieces of chalk
1/1/1	roll of masking tape
2/10/20	test tubes
1/10/10	dropper bottles with 5% hydrochloric acid
1/10/10	margarine lids (panes of glass)
1/3/10	*sea shells (egg shells)*
1/2/5	needle-nose pliers
1/30/30	a large coffee can or equivalent
1/30/30	safety goggles (twice this many plastic produce bags)
1/1/1	a place where students can search for rocks
1/1/1	**a commercial collection of common rocks*
1/5/10	scissors
1/30/30	egg cartons
.5/2/5	cups of oil-based clay —1 cup = 1/2 lb
1/10/10	gram balances
3/30/30	paper towels
1/10/10	100 ml graduated cylinders
1/1/1	box of pepper
1/10/10	small beakers or jars
1/10/10	*hand calculators
5/15/50	glass marbles
1/4/10	*empty film canisters with snap on lids*
1/1/5	large wash tubs (buckets)
1/1/1	a freezer (freezing weather)
.5 /5/5	*cups Epsom salts*
1/3/10	stirring rods
1/2/10	dictionaries

Sequencing Task Cards

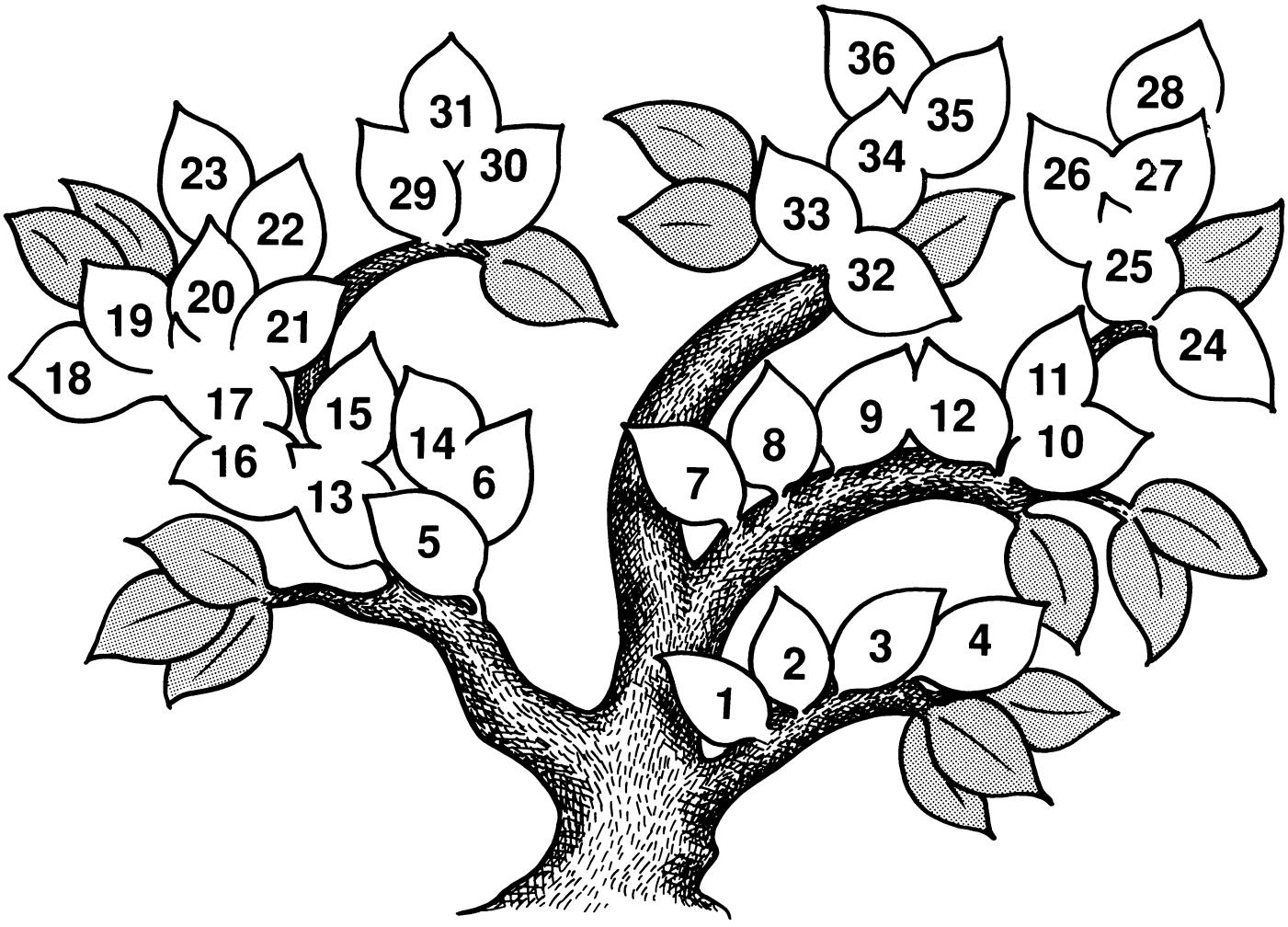
This logic tree shows how all the task cards in this module tie together. In general, students begin at the trunk of the tree and work up through the related branches. As the diagram suggests, the way to upper level activities leads up from lower level activities.

At the teacher's discretion, certain activities can be omitted or sequences changed to meet specific class needs. The only activities that must be completed in sequence are indicated by leaves that open *vertically* into the ones above them. In these cases the lower activity is a prerequisite to the upper.

When possible, students should complete the task cards in the same sequence as numbered. If time is short, however, or certain students need to catch up, you can use the logic tree to identify concept-related *horizontal* activities. Some of these might be omitted since they serve only to reinforce learned concepts rather than introduce new ones.

On the other hand, if students complete all the activities at a certain horizontal concept level, then experience difficulty at the next higher level, you might go back down the logic tree to have students repeat specific key activities for greater reinforcement.

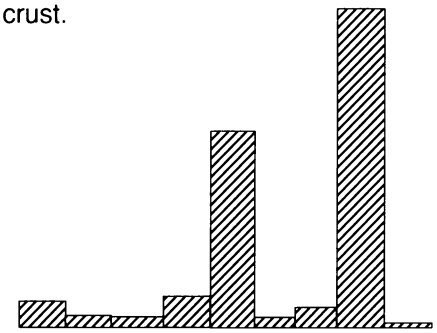
For whatever reason, when you wish to make sequence changes, you'll find this logic tree a valuable reference. Parentheses in the upper right corner of each task card allow you total flexibility. They are left blank so you can pencil in sequence numbers of your own choosing.



Review / Test Questions

task 1

This bar graph shows the relative abundance of elements in the earth's crust.



	Fe	Na	Mg	Al	Si	K	Ca	O	other
%:	5.6	2.4	2.3	8.2	28.2	2.0	4.2	46.4	0.7

List the first 8 elements by name. Start with the most common element at the top of your list and work down in order of abundance.

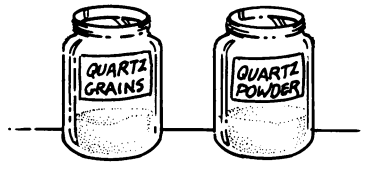
task 2

Write "feldspar", "mica" or "quartz" after each descriptive word that applies. A word may have 1, 2 or 3 minerals written after it.

translucent:
shiny:
opaque: cleaves:
fractures:
found in sand:
flat:
chunky:
streaks across brick:
scratches brick:

task 3

Transparent quartz grains are gathered from sand. Half are poured into a jar labeled "quartz grains." The other half are smashed with a hammer and poured into a jar labeled "quartz powder."

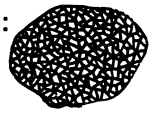


Describe how the crystals in each jar look. Explain why you think so.

task 4

One of these rocks is volcanic and one is plutonic. Explain how you know which is which.

A: 

B: 

task 5

Place minerals X, Y, and Z on a scale of hardness:

X scratches **Y** and **Z**
Y streaks across **Z**

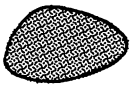
task 6

Which is harder, the lead in your pencil or the paper you write on? Explain.

task 7

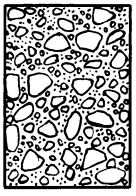
You find 2 rocks that both broke off the same parent slab of granite. Rock (A) is rough and jagged. Rock (B) is round and smooth. Propose a theory that explains these differences.

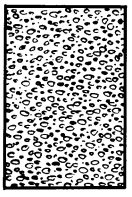
A: 

B: 

task 8

One of these core samples was taken in the mountains, the other in a broad river valley. Which sample most likely came from where?

A: 

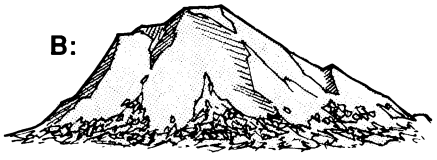
B: 

task 9

Explain how clastic sedimentary rock forms. Give an example.

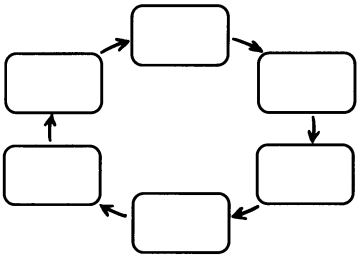
task 10

A: 

B: 

Which mountain is more likely made from limestone? from granite? Explain.

task 11



Each phrase below describes a step in the calcium carbonate cycle. Write a letter in each box so the phrases are arranged in the correct order.

A. absorbed by marine animals
B. uplifted to limestone mountains
C. washed into the sea
D. buried deeply, layer upon layer
E. shelled remains deposited on sea bed
F. chemical erosion by rain

task 12

Compare the cement that holds sandstone together with the cement that binds limestone. How can you identify each?

task 13

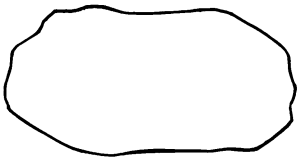
Why is it helpful to break rocks open when you study them? What safety precaution should you observe?

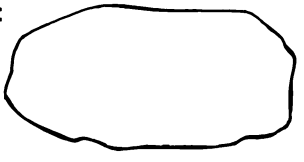
task 14

Streak testing a rock may be more complicated than streak testing a mineral. Why is this so?

task 15

Draw a massive texture on rock A; a foliated texture on rock B. Explain the difference.

A: 

B: 

Review / Test Questions (continued)

task 16-21

Write the name of each rock in the correct egg-cup category below:

chalk, gabbro, ore bearing, pumice, serpentinite, gneiss, shale, flint, gypsum, sandstone, quartzite, andesite.

1 CLASTIC SEDIMENTARY coarse grained	**7** PLUTONIC IGNEOUS coarse crystals
2 CLASTIC SEDIMENTARY fine grained	**8** VOLCANIC IGNEOUS fine crystals
3 CLASTIC SEDIMENTARY poorly sorted	**9** VOLCANIC IGNEOUS pyroclastic
4 CHEMICAL SEDIMENTARY carbonate	**10** MASSIVE METAMORPHIC
5 CHEMICAL SEDIMENTARY silica	**11** FOLIATED METAMORPHIC
6 CHEMICAL SEDIMENTARY other	**12** OTHER METAMORPHIC

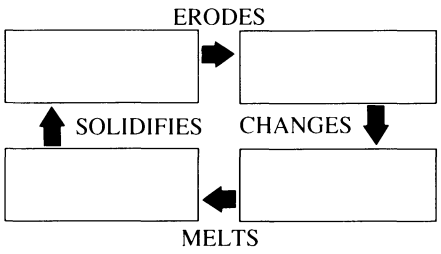
task 18-21

Name each rock. Then write a word or phrase to describe how it forms:

A. A dark-colored, fine grained rock with gas holes
B. A light-colored rock with coarse interlocking flecks of quartz, feldspar and mica
C. A hard, black rock with a glassy texture
D. A soft, black rock made from carbon
E. A soft rock containing sea shells
F. A smooth, banded, translucent rock that is very hard
G. A rock that bubbles in dilute HCl and has coarse interlocking crystals
H. A light-colored rock foliated with thin layers of mica
I. A clastic rock with small, well-sorted clasts
J. A clastic rock with poorly-sorted clasts

task 22

A. Fill each box in this rock cycle with the correct rock type: metamorphic rock, sedimentary rock, molten magma or igneous rock.



B. Which steps of this cycle can move in both directions? Explain.

task 23

Name the...
A. 2 most common igneous rocks.
B. 3 most common sedimentary rocks.
C. 3 most common metamorphic rocks.

task 24

You are given 2 different rocks. Tell how you would use a gram balance to find which rock is most permeable to water.

task 25

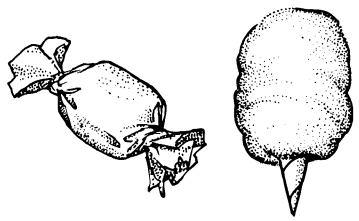
A nugget of pure gold raises the water in a graduated cylinder from 50 ml to 57 ml. It has a mass of 135.1g.
A. Find the volume of this nugget. Show your math.
B. Find the density of gold. Show your math.

task 26

Answer the previous question first, before you try this one.
A. 10 ml of liquid mercury has a mass of 136 g. Find the density of mercury.
B. Liquid mercury is poured over gold-bearing granite that has been thoroughly crushed. Explain how this separates out the gold.

task 27

Taffy is much denser than cotton candy, yet they are both made from melted sugar. Explain why these 2 forms of sugar have different densities.



task 28

Ice has a density of .92 g/ml. What is its specific gravity?

task 29

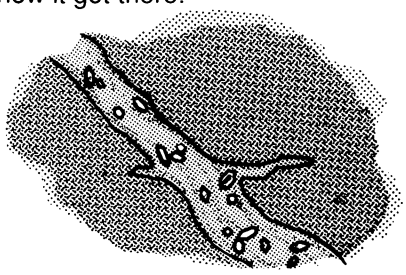
A jar is completely filled with water and sealed with a screw-on lid.
A. Predict what happens to this jar if you leave it in a freezer overnight.
B. How does this experiment model mechanical erosion in nature?

task 30

Salt crystals can be made by dissolving table salt in hot water, then evaporating away the water. List 2 things you can do to grow the largest crystals possible.

task 31

You discover a rich vein of pegmatite running through granite rock. Explain how it got there.



task 32

On an archaeological dig, you unearth a log that has been turned to stone. How did this happen?

task 33

How is a stalactite similar to an icicle? How is it different?

task 34

Silica ions (+4) and oxygen ions (-2) combine into basic building blocks called tetrahedra. Describe a single tetrahedron in words and pictures. Compute its net charge.

task 35

Silica tetrahedra combine to form both flat sheets and 3-dimensional frameworks. Which way do these tetrahedra join in mica? in quartz? Explain your reasoning.

task 36

Most rock forming minerals contain silica tetrahedra. List several that contain NO silica tetrahedra.

Task Objective (TO) appreciate that the earth's crust is made almost entirely from 8 basic elements. To graph these elements on a bar graph.

EIGHT BASIC ELEMENTS ○ Rocks and Minerals ( )

1. Most rocks and minerals are made from just 8 common elements. These are listed in bold in the periodic table below.

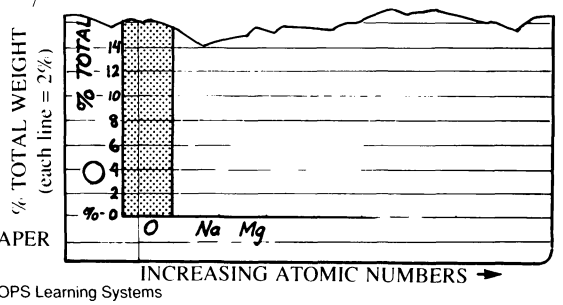
2. Spell out the names of these 8 elements.

PERIODIC TABLE OF THE ELEMENTS

ATOMIC MASS NUMBER — PERCENT TOTAL WEIGHT

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O 46.4%	9 F	10 Ne
11 **Na** 2.4%	12 **Mg** 2.3%											13 **Al** 8.2%	14 **Si** 28.2%	15 P	16 S	17 Cl	18 Ar
19 **K** 2.0%	20 **Ca** 4.2%	21 Sc		25 Mn	26 **Fe** 5.6%	27 Co		30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr			

3. The percent (by weight) of each element is written under its symbol. Make a bar graph to show the relative abundance of each element. Add a 9th bar to represent all other elements.

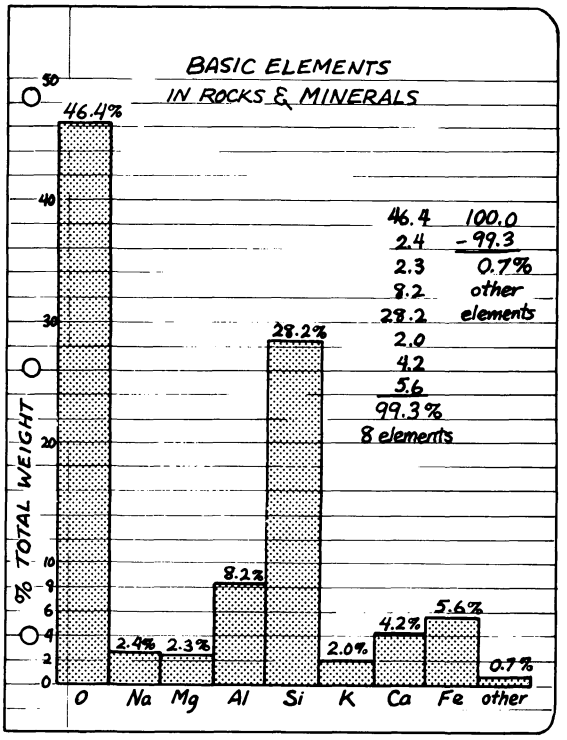


USE LINED PAPER

Answers / Notes

2. *Students may need to consult a physics or chemistry text to correctly list all the names. Or they can look up abbreviations in the back of a dictionary.*

oxygen	silicon
sodium	potassium
magnesium	calcium
aluminum	iron



3. *These elements are graphed in order of atomic mass numbers. This ordering (from left to right and from top to bottom) is natural to anyone that reads. Other orderings are OK too.*

Scale is always an important consideration when graphing. We have chosen 1 line = 2%. Other scales are equally possible. Students who use a scale of 1 line = 1% must tape 2 pieces of notebook paper together to accomodate the long oxygen bar. A scale of 1 line = 5%, by contrast, fits on less than a half sheet of paper.

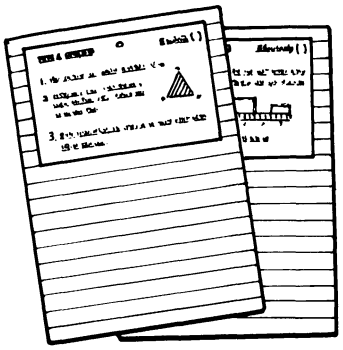
Your students will probably ask you a whole host of questions: What order? What scale? How wide should the bar be? Allow them this grand opportunity for creative problem solving. Just smile and say, "you decide."

Materials

- ☐ Lined notebook paper.
- ☐ A ruler or straight edge.

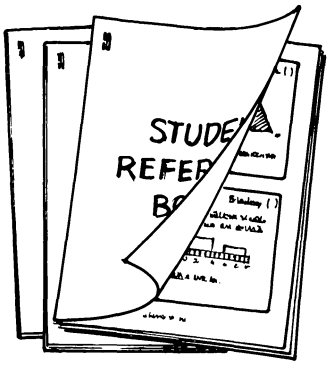
Task Cards Options

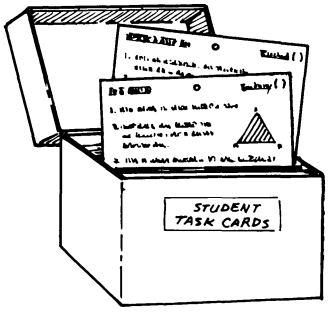
Here are 3 management options to consider before you photocopy:



1. Consumable Worksheets: Copy 1 complete set of task card pages. Cut out each card and fix it to a separate sheet of boldly lined paper. Duplicate a class set of each worksheet master you have made, 1 per student. Direct students to follow the task card instructions at the top of each page, then respond to questions in the lined space underneath.

2. Nonconsumable Reference Booklets: Copy and collate the 2-up task card pages in sequence. Make perhaps half as many sets as the students who will use them. Staple each set in the upper left corner, both front and back to prevent the outside pages from working loose. Tell students that these task card booklets are for reference only. They should use them as they would any textbook, responding to questions on their own papers, returning them unmarked and in good shape at the end of the module.





3. Nonconsumable Task Cards: Copy several sets of task card pages. Laminate them, if you wish, for extra durability, then cut out each card to display in your room. You might pin cards to bulletin boards; or punch out the holes and hang them from wall hooks (you can fashion hooks from paper clips and tape these to the wall); or fix cards to cereal boxes with paper fasteners, 4 to a box; or keep cards on designated reference tables. The important thing is to provide enough task card reference points about your classroom to avoid a jam of too many students at any one location. Two or 3 task card sets should accommodate everyone, since different students will use different cards at different times.

EIGHT BASIC ELEMENTS ○ Rocks and Minerals ( )

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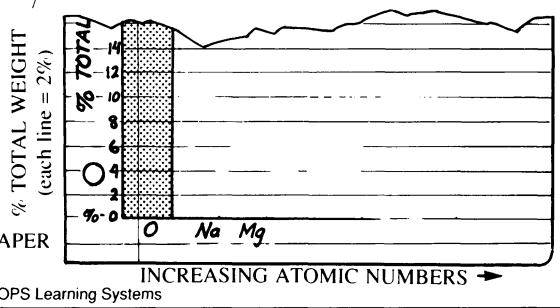
11 **Na** 2.4%	12 **Mg** 2.3%											13 **Al** 8.2%	14 **Si** 28.2%	15 P	16 S	17 Cl	18 Ar
19 **K** 2.0%	20 **Ca** 4.2%	21 Sc		25 Mn	26 **Fe** 5.6%	27 Co		30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr			

3. The percent (by weight) of each element is written under its symbol. Make a bar graph to show the relative abundance of each element. Add a 9th bar to represent all other elements.



USE LINED PAPER

TINY TREASURES ○ Rocks and Minerals ( )

1. Put about a spoonful of sand into a pie tin. Use a hand lens to inspect the tiny grains. Pick out different shapes, lusters and colors with the moistened tip of your pencil.

2. Copy this mineral table. For each box, find the correct grain sample, describe it, then tape it in.

CHUNKY TRANSLUCENT Quartz	description: *crystal clear* specimen: ( )		
CHUNKY OPAQUE Quartz or Feldspar			
FLAT SHINY Mica			

3. Minerals *cleave* (break evenly) to form flat, smooth surfaces. Describe sand grains you see that have cleaved.

4. Minerals *fracture* (break unevenly) to form irregular, rough surfaces. Describe sand grains you see that have fractured.