

# Keying Out Cars (and other vehicles)

## Lesson at a glance:

Students will begin to understand classification and dichotomous keys by sorting a variety of transportation vehicles.

## Skills:

Observing, Comparing, Matching, Sorting

## Grades:

3-5



## Materials:

- ❑ Small toy vehicles (e.g. cars, trucks, motorcycles, trains, etc.) or magazine pictures of vehicles (Eight per team)
- ❑ Pencils
- ❑ Paper (blank and with lines)
- ❑ Ruler
- ❑ Chalk and blackboard or markers and whiteboard

## Background:

*Dichotomous keys* are tools used by scientists to identify specific names of natural objects, such as trees, ferns, wildflowers or insects. “Dichotomous” means “divided into two parts,” so there are always two choices in each step of the identification process. For example, if you wanted to classify writing utensils, you might begin by sorting them into “those with an outside surface that is round” and “those with an outside surface that is not round.” You would then select another characteristic to subdivide each of the two groups into two smaller groups. You might choose to separate the two groups into smaller groupings based on whether “the outside surface was made of plastic” or whether the outside surface was made up of some other material other than plastic.” You would continue to subdivide your groups in this way until you had made a specific identification for each object.

## Activity:

### Part 1:

1. Explain to your students that scientists use similarities and differences of objects to help identify them. Explain what a dichotomous key is and have the students help you create a dichotomous key for the following objects:



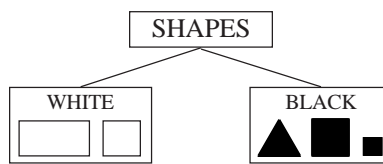
Note: Make each side of the large black square 2” in length and each side of the small black square 1” in length.

2. Tell the class that the first step in developing a dichotomous key is to choose one characteristic to separate the objects into two smaller groups. Ask the class:

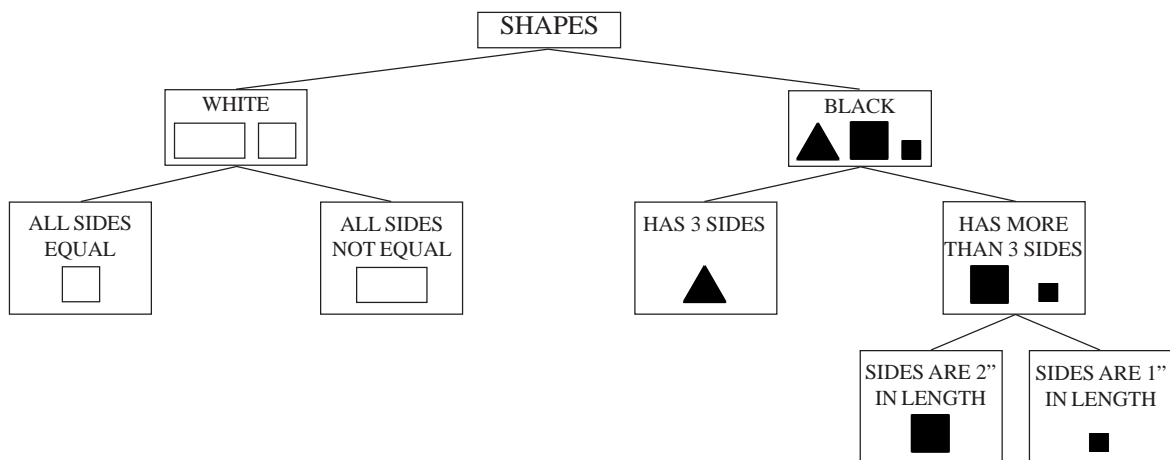


Can you think of a characteristic we can use to separate these shapes into two groups? (Some possible choices might be color, number of sides, whether the sides are all equal, etc.) Have the students choose the characteristic you use in each step of the identification process.

- On a blackboard or a white board, use a flow chart like the one below to record how the groups are divided and to help your students visualize the process. Begin at the center top with a box labeled SHAPES. Then separate this group into two based on the first characteristic the class has chosen. There is no one right answer, so you can use any attribute your students choose as long as it successfully separates the shapes into two groups. For illustration purposes, let's assume the class chooses whether the shapes are white or black as their first characteristic. You would depict the two choices as follows on your flow chart:



- Now have the students focus on the "white shapes" group and pick a second characteristic to separate this group into two smaller groups. Let's assume the class chooses "all sides are equal in length" or "all sides are not equal in length" as the two choices into which they next want to divide the group. This identifies both shapes since the white square and the white rectangle are the only shapes in their respective groups.
- Add the new information to the chart. Now have the children return to the "black shapes" group and pick another characteristic to subdivide this group into two smaller groups. Again depict the two choices on your flow chart and continue the process until each shape ends up in a group by itself. When you are through, your flow chart should look like this:



- Now show the students how to depict this in the traditional dichotomous key format. Explain that each step should be numbered successively, and that the two choices in each step should be represented by "a" and "b." Show them how

to direct the user of the key to another pair of choices by using “go to.”

- 1a. The shape is white.....Go to 2
- 1b. The shape is black.....Go to 3
  
- 2a. The sides of the shape are all equal in length.....White Square
- 2b. The sides of the shape are not all equal in length.....White Rectangle
  
- 3a. The shape has 3 sides.....Black Triangle
- 3b. The shape has more than 3 sides.....Go to 4
  
- 4a. The sides of the shape are 2 inches in length.....Large Black Square
- 4b. The sides of the shape are 1 inch in length.....Small Black Square

7. Leave the flow chart and the dichotomous key on the board for the students to refer to when completing Part 2.

**Part 2:**

1. Divide the class up into three teams and give each team 8 small toy vehicles (cars, trucks, buses, motorcycles, bicycles, trains, etc.) or 8 pictures of vehicles cut out of magazines. Make sure no team has two vehicles/pictures in their set that are exactly the same. (You can ask your students to bring in their Hot Wheels or Matchbox toys from home if you like.)
2. Tell each team its task is to develop a dichotomous key that they can use to identify each vehicle. Have each team independently come up with the characteristics it uses to separate the vehicles into successively smaller groupings. Remind the students that in each step they have to provide two choices.
3. Have each student construct a flow chart as his/her team completes each step in the identification process. Refer the students to the flow chart on the board. Make sure they understand that they do not need to draw any pictures in the boxes. Explain that you included the shapes in the boxes in the flow chart on the board just to help them better understand what was going on.
4. When the students have completed their flow charts, have them write out their dichotomous keys on lined paper. Refer them to the sample key that is on the board if they have difficulty remembering how this should be done.
5. When they are through, have the students in each team explain to the rest of the class what characteristics they used to key out their set of cars and what their two choices were in each step.

**Assessment:**

1. Can the students sort the vehicles/pictures into logical groupings and explain why they did so?
2. Do the keys the students made allow you to successfully key out the vehicles?



**Extensions:**

1. Have each team give its set of vehicles/pictures and the key it developed to another team to use. Have each team then use the key it was given to identify the new set of vehicles/pictures.
2. Take a “field trip” to your school’s parking lot and have the students look for ways to sort the vehicles they see there.

