NATIONAL MUSEUM OF THE UNITED STATES AIR FORCE™

Dichotomous Keys and Aircraft Classification

Students will learn about dichotomous keys and its components by classifying different aircraft and organizing them into specific categories.

LESSON PLAN

Learning Objectives:

The students will:
- Learn the definition of a dichotomous key
- Classify objects into groups
- Make a dichotomous key

Purpose:

Students will design their own dichotomous key for the eight airplanes given. After students have designed their keys, they will exchange papers and check each other's keys for accuracy. Students will learn about dichotomous keys and how they function scientifically. Students will learn about aircraft properties and the classifications that separate them from one another. They will look at images to classify aircraft and establish a dichotomous key that leads people to finding that specific aircraft.

Introduction:

To classify means to group objects by their similarities and/or their differences. A dichotomous key, usually related to living things, is used to classify things by dividing a group into two by characteristics. First, the group is divided into two parts. Next, each of those parts are divided again. This process continues until the groups are single objects. Dichotomous keys are very helpful in studying how to classify objects with numerous characteristics. The key is then used to identify individual objects. The individual objects that will be monitored in this dichotomous key are airplane parts and the distinctions that set them apart. All forms of an airframe are unique in their own right. Fighter jets have a smaller airframe and use turbo jets as their main source of energy, while cargo and bomber airplanes use larger engines to carry heavy payloads or equipment. Airplanes range in their shapes and size so having a dichotomous keys allows for a more streamline method of finding the difference among various airframes.

Grade Level: 6

Ohio Learning Standards/Science (2018)
Expectation of Learning
Cognitive Demands for Science

Demonstrating Science Knowledge
Interpreting & Communicating Science Concepts

Materials Required:
- Pencil
- Paper
- Handout of the different aircraft to be classified
- Diagram for dichotomous key

Procedure:

A. Warm-up

1. Discuss the different types of aircraft. An aircraft is given a two-part symbol consisting of a letter and a number. There are several types of aircraft, and 3 types are used for this activity. These are:

   B (Bomber): carry bombs, torpedoes or missiles
   C (Cargo): carry cargo or passengers
   F (Fighter): designed to intercept and destroy other aircraft or missiles

2. The number tells the model of the aircraft. For example:

   F-16: a fighter plane with the model number of 16
   F-16C: a newer version of the original F-16

3. Have students review what the symbols stand for.

4. Review dichotomous key example before activity (page 7).

B. Activity

1. Have students study the pictures of the aircraft.

2. Direct them to divide the aircraft into 2 large groups (bomber or not a bomber). Write the characteristic of one group on the top line of the diagram and the characteristic of the other group on the bottom line. Refer to Figure 1. Often, the second characteristic is "no" of the first characteristic.

3. Divide the top group into 2 more groups. Write the characteristics on the lines. See Figure 1.

4. Divide the class into 2 more groups and write the characteristic of the groups on the lines. Do the same for the other group.

5. Then tell students to start with the bottom group and follow the above procedure for the remaining aircraft.

Assessment/Evaluation:

Students may exchange papers and see if they can follow each other's dichotomous keys.

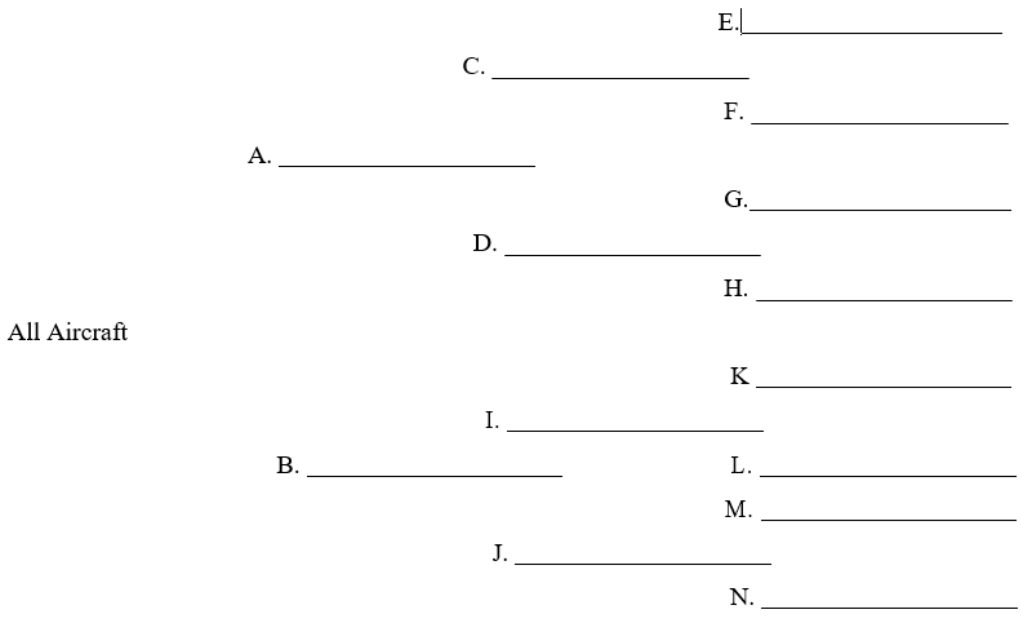
Extensions:

The information from the dichotomous key can be put into column form to use as a key to check answers. Figure 1 is also attached for the assignment.

A.	_____	_____
B.	_____	_____
C.	_____	_____
D.	_____	_____
E.	_____	_____
F.	_____	_____
G.	_____	_____
H.	_____	_____
I.	_____	_____
J.	_____	_____
K.	_____	_____
L.	_____	_____
M.	_____	_____
N.	_____	_____

In the left column, write the characteristics used to divide each group. In the right column, write "Go to" clues. These clues will tell someone using the key where to go to search for the names of the aircraft.

Figure 1:



Resources/References:

National Museum of the United States Air Force (NMUSAF):

https://www.nationalmuseum.af.mil/

https://www.nationalmuseum.af.mil/Visit/

Bomber, cargo, and fighter aircraft:
https://www.britannica.com/technology/military-aircraft/Bombers
https://www.sciencedirect.com/topics/engineering/cargo-aircraft
https://www.britannica.com/technology/fighter-aircraft

Differences between aircraft:
https://www.britannica.com/technology/military-aircraft

Answers

Figure 1:

All Aircraft

A. Bombers

B. Non-Bombers

C. Tube/Traditional Shaped

D. Delta Shaped

E. Engine Underneath, B-1

F. Engine on Wings, B-52

G. Gas Engine Powered, B-2

H. Electric Engine Powered, B-21

I. Fighter Aircraft

J. Cargo Aircraft

K Narrow Triangular Wings, F-16

L. Wide Triangular Wings, F-22

M. Propeller Engines, C-130

N. Turbo Engines, C-17

Answers

A.	Bombers	Go to C,D
B.	Non-bombers	Go to I, J
C.	Tube/Traditional shaped	Go to E,F
D.	Delta Shaped	Go to G,H
E.	Engine Underneath	B-1
F.	Engine on Wings	B-52
G.	Gas Engine Powered	B-2
H.	Electric Engine Powered	B-21
I.	Fighter Aircraft	Go to K,L
J.	Non-Fighter Aircraft	Go to M,N
K.	Narrow Triangular Wings	F-16
L.	Wide Triangular Wings	F-22
M.	Propeller Engines	C-130
N.	Turbo Engines	C-17

EXAMPLE OF DICHOTOMOUS KEY

Aircraft	Bombers	4 propellers on front of wings	rectangular tail, B-24
			no rectangular tail, B-29
		No propellers on front of wings	6 props on back of wing, B-36
			Delta wing shape, B-58
	Not bombers	Fighter aircraft	Swept wing, F-86
			"W" shape wing, F-117
		Cargo aircraft	4 propellers, C-124
			2 propellers, C-46

Example of Answer for Extension

A. Bombers	Go to C, D
B. Not Bombers	Go to I, J
C. 4 propellers on front of wings	Go to E, F
D. No propellers on front of wings	Go to G, H
E. Rectangular tail	B-24
F. No rectangular tail	B-29
G. 6 propellers on back of wing	B-36
H. Delta wing shape	B-58
I. Fighter aircraft	Go to K, L
J. Not fighter aircraft	Go to M, N
K. Swept wing	F-86
L. "W" shaped wing	F-117
M. 4 propellers	C-124
N. 2 propellers	C-46

DICHOTOMOUS KEYS AND AIRCRAFT CLASSIFICATION

Bombers, Fighters, & Cargo Planes

All photos can be seen on:
https://www.nationalmuseum.af.mil/Visit/
Except: B-21:
https://www.military.com/daily-news/2016/09/19/air-force-unveils-name-of-future-b21-bomber-as-tk.html

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B-1

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B-52

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B-2

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B-21 (ELECTRIC POWERED BOMBER)

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F-16

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F-22

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C-130

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C-17

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