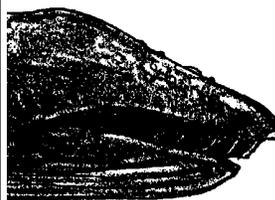


Big As Life

Key Concepts

1. Whales are the largest animals that have ever lived on the earth.
2. Coordinates on a grid enable us to locate precise points on the grid.
3. Images can be enlarged to scale with the aid of an overlay grid.

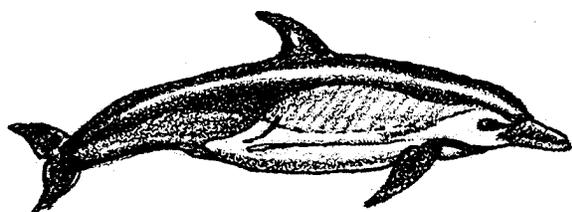


Background

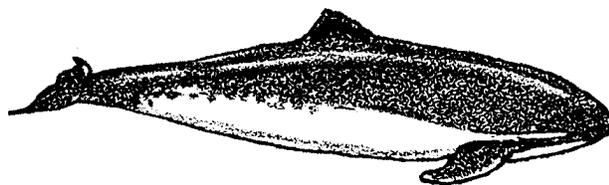
Whales and dolphins have always caught the fancy of humans because of their size, beauty, and playfulness. They have been valuable to humans for centuries as a source of food and oil. The scientific name of the order, Cetacea which includes the whales and dolphins, comes from “cetus”, the early Greek and Latin word for whale. Cetaceans have poor senses of smell and of taste, but a good sense of vision and an excellent sense of hearing. Whales and dolphins are apparently very intelligent mammals that make a variety of sounds, both for “talking” with one another and, in some cases, for use as a sort of sonar to locate food and avoid underwater objects. Cetaceans breathe through nostrils (blowholes) on top of the head.

Cetaceans usually give birth to only one offspring each year. The young are large at birth, usually one-fourth to one-third or more the length of the mother. For example, an 80-foot blue whale may give birth to a baby that is 25 feet long and weighs 2 tons or more. The young grow quickly, doubling their length within the first year. The cetaceans are divided into two groups:

- a. toothed whales** - dolphins, porpoises, beaked whales, orca whales, sperm whales and pygmy sperm whales;

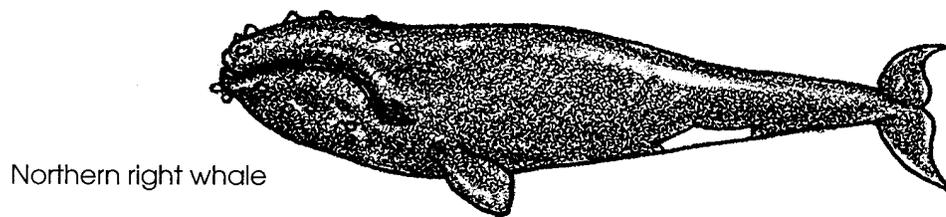


Common dolphin

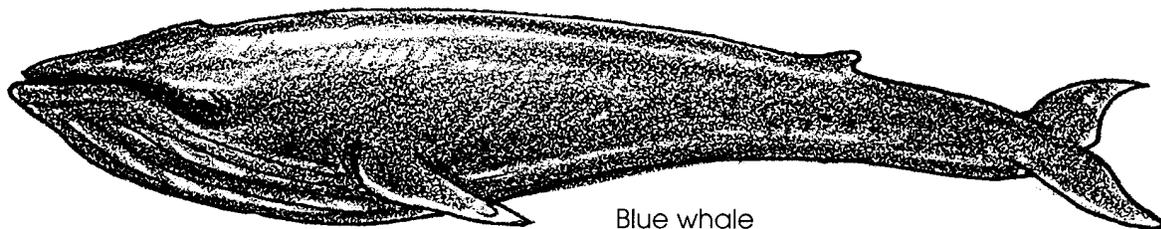


Harbor porpoise

b. baleen whales - blue whales, right whales, humpback whales, fin whales, and California gray whales.



Northern right whale



Blue whale

Toothed whales feed mostly on fishes, squids, octopuses, and occasionally on large mammals. Baleen whales have no teeth; instead, sheets of a fringed, fingernail-like material, called whalebone or baleen, hang from their upper jaws. Most baleen whales feed on plankton, strained through the baleen, and also on small fishes and shrimp. Gray whales use their baleen to filter shrimp, clams and other animals from sediments of the sea floor.

Whales are the largest animals known. In fact, the blue whale, reaching a length of 100 feet and a weight of more than 100 tons, is the largest animal that has ever lived. Larger than the largest dinosaur, whales can grow so large because their body weight is supported by the water and, in the case of baleen whales, because of the abundance of the planktonic organisms on which they feed. Not all whales are large, however. Some, like the pygmy sperm whale, reach a length of only 13 feet.

Whale hunting by native cultures goes back many centuries before the appearance of western people. Non-native whaling, the commercial fishing of whales for food and by-products, has also been carried on for many centuries. Whaling began off the east coast of North America almost coincidentally with the first settlements. By 1640, there was a well established shore whale fishing on the east coast. By the 1800's whalers from New Bedford and Nantucket, Massachusetts were plying the waters of the west coast in search of the whale. At that time, the main products taken were oil and spermaceti (a wax-like substance) used in lamps and for making candles; and whalebone, used in women's garments. Today whale oil is used in the manufacture of soap, cosmetics, shortening, lubricants, and many other products. The meat and

rest of the body are used for human or animal food and for fertilizer. Ambergris, a rare, soft, grayish material found in the digestive tract, is the most valuable product from whales, and is used in the finest perfumes.

Human toll on whales has been so heavy that some species, including the blue whale, now are regarded as endangered. Whaling ended in the United States in 1971 when a law was passed protecting eight species of whales. International regulations have been set and, although enforcement has not been completely effective, many large whale populations are beginning to increase. As an encouraging sign, the California gray whale population has increased to a point that it qualified for removal from the endangered species list. Controversy continues to surround marine mammal harvesting.

Materials

Part 1: Sizing it Up

For each student

- 45 foot tape measure or length of string

Part 2: How Big?

For the class

- 100 foot tape measure or a substitute (you might use a 100 foot length of string or a 50 foot tape measure laid out twice, etc.)
- 4-6 stakes or traffic cones

Part 3: Life Size

For each student

- 1 gridded whale pattern
- chalk or lime dispensers for drawing the enlargement

For the class

- 1 overhead transparency of the gridded whale pattern
- 1 ball of string
- permanent marker for students assisting with grid
- duct tape

Teaching Hints

“Big As Life” introduces students to the California gray whale, the marine mammal which forms the unifying thread for this curriculum. Beginning with the next activity, “A Whale Is Born”, a story line focusing on gray whale migration integrates a variety of lessons on behavior and adaptations of marine mammals, the environments in which they live, and some issues facing people who observe them.

Most of us have never seen a great whale in the wild. Although there can be no substitute for this thrilling experience, the three activities in “Big As Life” do provide students with a tactile experience of the true scale of these majestic animals. Comprehending the size of the California Gray whale requires real experiences; estimating, measuring, and reproducing whales to scale help students grasp the concept of “whale size”.

In Part 1 “How Big?” and Part 2 “Sizing it Up”, students compare the length of an adult California gray whale to real objects, such as classroom furniture, building features, and even themselves.

In Part 3 “Life Size”, the class enlarges a drawing of a whale to life-size on a playing field, gymnasium or parking lot. They use a grids and coordinates to expand a small pattern to the whale’s full dimensions. The use of coordinates will appear again in later lessons as students develop some of the skills of ocean navigation.

“VOYAGE OF THE MIMI” - Episode 2: Setting Sail correlates well with this lesson. Expedition 2: Whale Watch can also be used with this lesson.

Part 1: Sizing it Up

Comparing length of a gray whale to classroom objects

Materials

For each student

- 45 foot tape measure or length of string
- “Sizing it Up” data sheet (optional)

Procedure

1. A fully grown gray whale can reach 45 feet in length. Ask students to estimate how many students it would take, with arms outstretched, fingertip to fingertip to extend 45 feet. Then try it!

2. Next pick some other objects to compare. For example, students might find out many desks side by side would it take to equal 45 feet. Ask students to first predict how many desks it would take, and then, using a 45 foot piece of string, devise a way to find out how many it would actually take. Now, let students work in pairs or small groups to compare the length of a gray whale to different classroom or playground objects. You may choose to have students record their findings on a copy of the included “Sizing it Up” data sheet.
3. Ask groups of students to find objects in the school or on the school grounds that are approximately the same length as the maximum length of the gray whale. They might find a wall or hallway of that length, or a strip of concrete on the school grounds.

Part 2: How Big?

Predicting a whale’s length

Materials

For the class

- 100 foot tape measure or a substitute (you might use a 100 foot length of string or a 50 foot tape measure laid out twice, etc.)
- 4-6 stakes or traffic cones

Procedure

1. Remind students that the largest living whale, the blue whale, is approximately 100 feet in length. What does this distance look like? In this activity they will find out! Take students to an open area such as a playing field or gymnasium. Indicate the location of the imaginary blue whale’s nose and point out the direction of its tail. Have students predict the whale’s length by walking to where they think its tail flukes would end.
2. When everyone has made a prediction, have students stand on their predicted spot while you and an assistant measure a 100 foot length using a tape measure or some other improvised tool. A stake in the ground or a traffic cone can preserve this distance for future reference.

3. This activity can be repeated using other whales. For your reference, here are full grown lengths of some different cetaceans:

Baleen Whales

Bowhead	65 feet
Right Whale	55 feet
Blue Whale	100 feet
California Gray Whale	45 feet
Humpback	55 feet
Fin whale	85 feet
Minke Whale	30 feet

Toothed Whales

Sperm Whale	60 feet
Orca Whale	32 feet
Bottlenose	32 feet
Porpoises	10 feet
Narwhal	25 feet (15 feet excluding tusk)
Beluga	15 feet

Part 3: Life Size

Making a life-size whale on the school grounds

Materials

For each student

- 1 gridded whale pattern
- chalk or lime dispensers for drawing the enlargement

For the class

- 1 overhead transparency of the gridded whale pattern
- 1 ball of string
- permanent marker for students assisting with grid
- duct tape

Preparation and Planning

Select a 40 ft. x 60 ft. area where your class can work relatively undisturbed. A life-size whale can be drawn on concrete with chalk, on a wood floor with masking tape, or on a grassy surface with a lime dispenser. Your choice of surface will necessarily dictate the medium in which you work. This project is likely to take your students more than one 50 minute class period. If you do not have an extended period in which to carry out the activity, you will

need to make arrangements for how the partially completed work can be preserved. Alternatively, you might allow more than one class to work on the project until it is completed.

Some teachers prefer to have smaller groups of students work separately to enlarge several whales.

The enlargement process requires a grid of string or chalk which students will use for reference in expanding a small image to full life-size. Although a string grid may be more work to prepare initially, it has the advantage of being easily removable when the work of art is finished so that you can appreciate the whale image without interfering lines.

Have your students help you prepare by cutting, measuring and marking string for the grid. You will need three 45+ foot long strings and ten 15+ foot long strings marked at 5 foot intervals, with about a foot left at each end for attachment to the surface by tape or stake.

Procedure

Classroom Preparation with Students

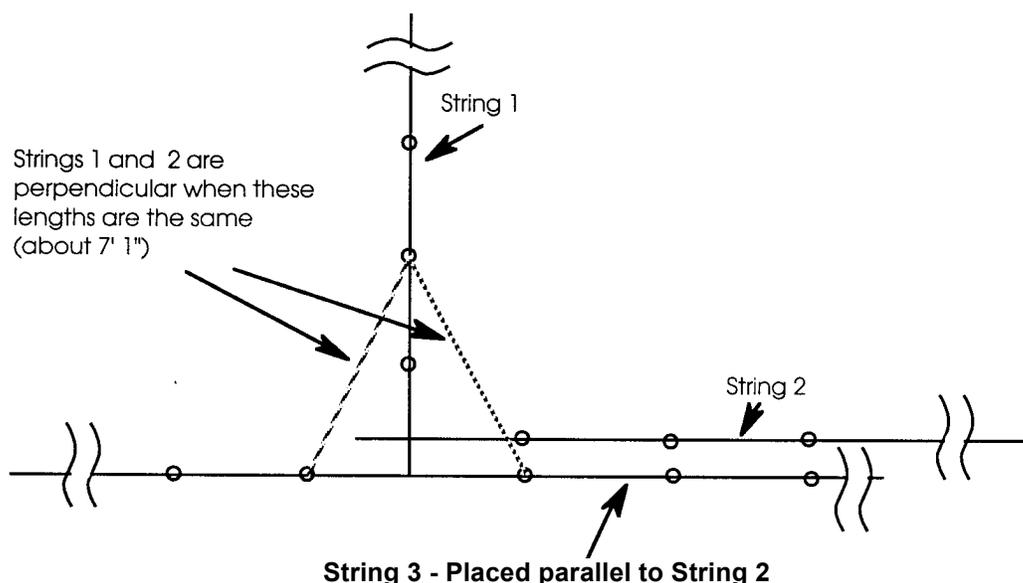
1. Introduce the purpose of this activity and hand out gridded whale patterns. Explain that to expand the image to life-size, each square on the pattern will be enlarged to a five foot square. Ask students how long the gray whale will be once it has been enlarged. (They should be able to multiply the number of squares which make up its length, 9, by 5 feet to determine its true length, a little under 45 feet as it does not extend entirely to grid margins.)
2. Demonstrate how to use the coordinate letters on the side of the page and numerals across the top to locate and name any square on their grids.
3. Have students label each square in the diagram with its coordinates. This will help them locate the place they are working when they move to the large grid. You might mention that they will be using grids and coordinates to identify locations in later activities in this unit.
4. Using a yard stick, draw 2 adjoining squares on the board, each 5' x 5'. This will be the actual size of the squares but for demonstration you could draw them a little smaller (especially if your board is only 4' tall!).
5. Model how to go about enlarging two adjoining squares, such as C3 and C4, parts of the gray whale's jaw and flipper. Before actually drawing in the features, call attention to all places where a line crosses the edge of one of the squares. Mark those places lightly. Then continue those lines into the

interior of the squares so they divide the spaces in the same proportion as they do in the smaller pattern. Explain that the entire whale picture can be enlarged by following this procedure carefully.

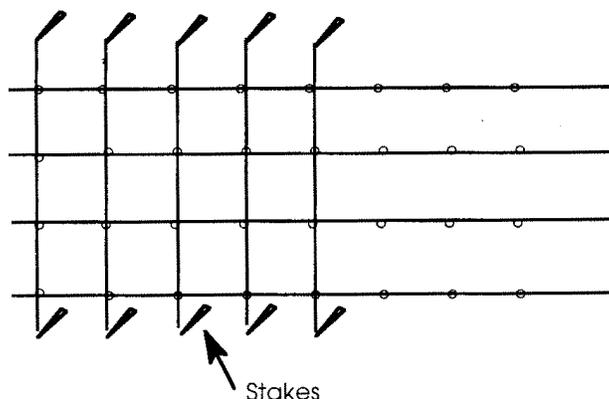
6. Assign squares to students or areas of the whale to groups of students. Suggest that they coordinate with those students or groups who are enlarging adjoining squares as they expand their sections, making sure their common lines match up.
7. Before you go outside, be sure everyone has a job to do and that they all understand the process and their job. Let students manage the laying of the grid and enlarging the drawing by themselves as much as possible, with minimal direction from the teacher. Encourage them to use thinking skills to solve problems themselves.

Setting Up The Grid Outside

1. Have students lay out the grid by establishing two perpendicular edges of the grid. Let students explore techniques to assure that the two strings are perpendicular. If they have difficulty, you may choose to use the following approach.



2. Add all parallel string lines first in one direction and then the other. If strings don't cross at the marked intervals make the needed adjustments until they do. Then, secure the ends of the strings with duct tape or stakes.



3. Tape 3"x5" cards to the edges of the grid to label coordinate numerals and letters in the same manner as they are labeled on the small grid.

Drawing the Whale

1. Give each student the material she will use for drawing and have each find the location of her section of the drawing. This will be a little like navigating on the ocean by the latitude and longitude coordinates! As they begin enlarging the squares from the pattern onto the enlarged grid, remind them to coordinate their portion of the drawing with students working in adjoining squares.
2. Finally, remove the string grid and enjoy your reproduction of a life-sized California gray whale. Be sure to have the entire class sit inside the whale's outline for a class photo or to read whale stories or sing songs about whales.

Key Words

coordinates - intervals along a pair of perpendicular axes which define the location of a point

grid - a system of perpendicular lines at regular intervals

latitude - imaginary lines around the earth parallel to the equator which represent the angular distance from the equator.

longitude - imaginary lines around the earth perpendicular to the equator which represent the angular distance from one prime meridian and other points east or west of it

parallel - oriented in the same direction

perpendicular - meeting at right angles

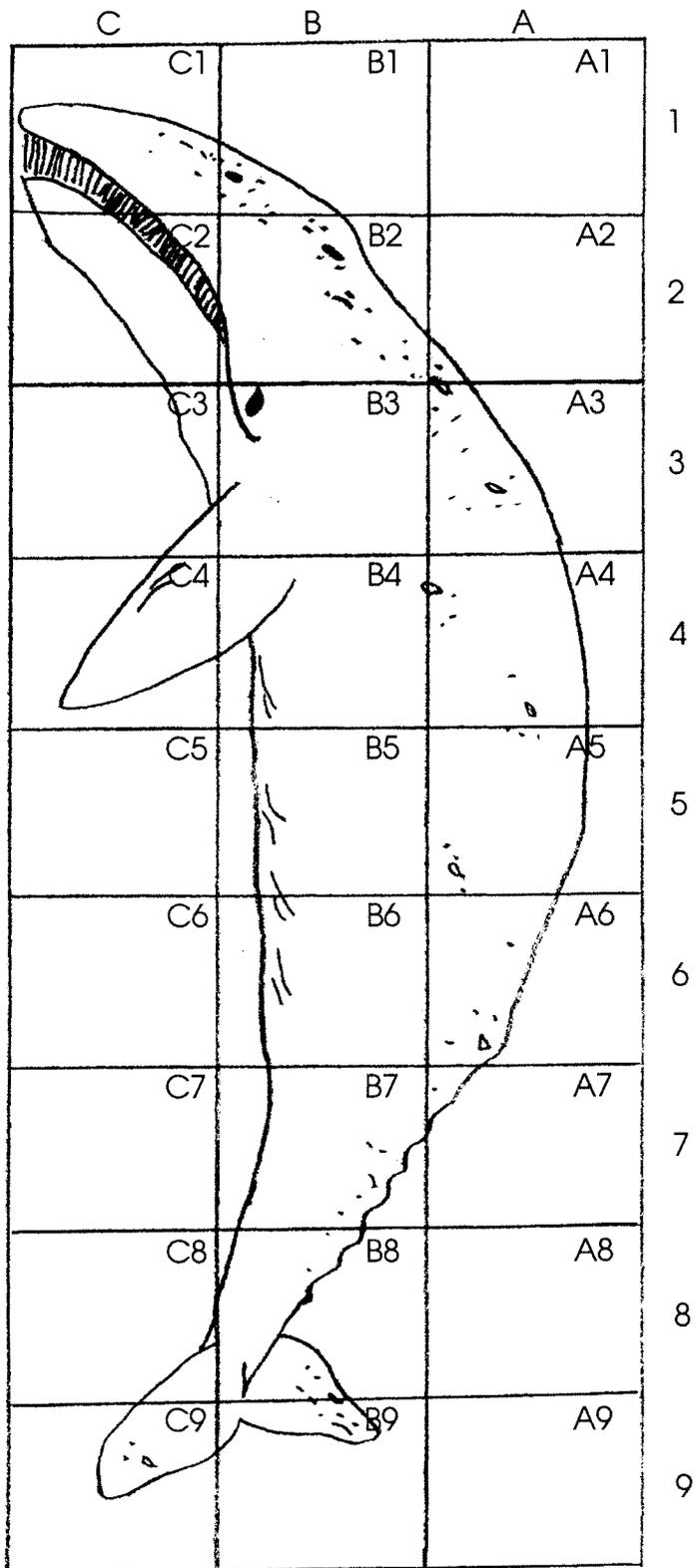
Extensions

1. If you live near a sandy beach, this project can spin off into some 3-dimensional life-sized whale sand sculptures.
2. If you live where it snows, try enlarging the whales in snow and make a snow sculpture. Mist the sculpture with water and allow to freeze. More details can be carved into it after the surface hardens.

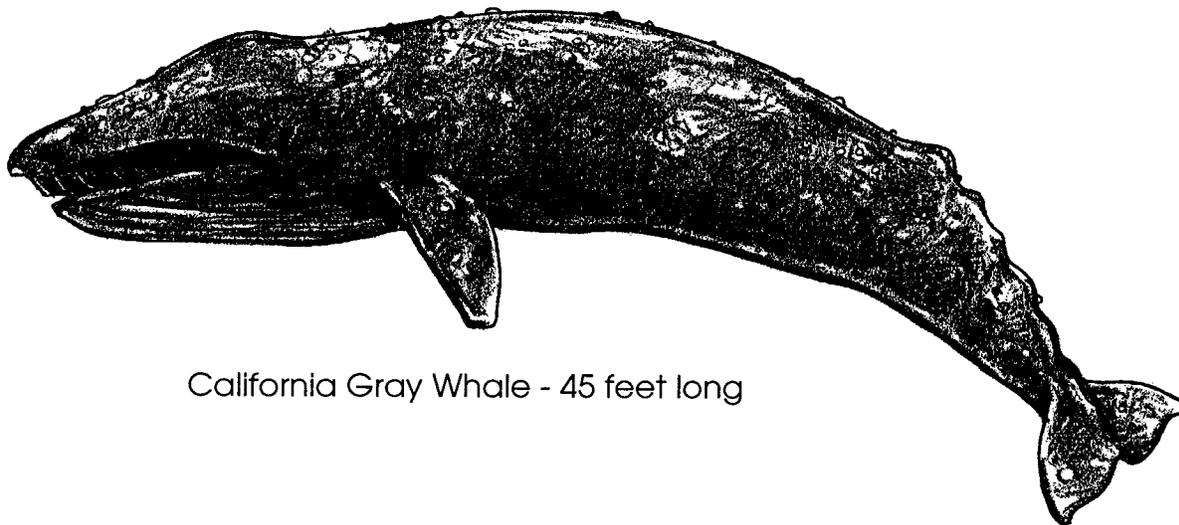
Answer Key

Part 1: Sizing it Up

1. Answers will vary depending on students' estimates.
2. If you try step 2 as a whole class, all answers will be the same. If not, members of each group that worked together will have the same answer.
3. Answers depend upon the experimental results.
4. Possible reasons for variations in whale's lengths include:
 - age
 - genetic makeup
 - food resources/nutrition
 - injury.
5. through 10. Answers will vary depending on objects students chose for comparison. Members of a group may have different estimates for length of objects but lengths of measured results should be the same. In discussing this section you might wish to make a chart on butcher paper to list how various objects compare in length to the gray whale. Keep the chart on display in your classroom.



Big As Life



California Gray Whale - 45 feet long

Sizing It Up

Just how big are these whales? Here's one way to find out. Compare the length of one to real objects you see everyday, including your classmates. Record your results on your record sheet.

Here's what you'll need:

- a 45 foot length of string. This is the maximum size for a California gray whale.

Here's what to do:

Use the string to measure objects that equal the size of the whale. Start with yourself and your classmates.

1. Estimate how many students can stand along the length with their arms outstretched and fingertips touching.

Estimate _____

2. Try it. Stand along the 45 foot length of the gray whale as described in number 1, above.

Results _____ students

3. Was your estimate more than or less than the results? (Please circle the correct answer.)

-
4. Scientists measure the length of real whales. They use the lengths to calculate the average length. They also look for the longest length. This longest length is called the **maximum** length. You are using the maximum length of the California gray whale for these activities.

In the ocean, few of the animals actually measure the maximum length. Give two possible reasons for differences in whale lengths.

- a.
- b.

5. Now, use the 45 foot string as your unit of measurement. Look for objects that are about the same length as a gray whale. Find five and record your estimates of their length below. Then measure them and record their actual lengths.

(Having trouble getting started? Try these. How many desks side by side would it take to equal 45 feet? Can you find a wall or hallway the same length? Which classroom door is 45 feet from your classroom door?)

- I.
 - a. Object _____
 - b. Estimate how many it will take to equal the whale
Estimate _____
 - c. Measured result _____

- II.
 - a. Object _____
 - b. Estimate how many it will take to equal the whale
Estimate _____
 - c. Measured result _____

- III.
 - a. Object _____
 - b. Estimate how many it will take to equal the whale
Estimate _____
 - c. Measured result _____

IV. a. Object _____

b. Estimate how many it will take to equal the whale

Estimate _____

c. Measured result _____

V. a. Object _____

b. Estimate how many it will take to equal the whale

Estimate _____

c. Measured result _____