Welcome to Treasure!

Using this Guide

This education guide is designed to be used by teachers, parents, museum staff, students, group leaders, and pirates. Many of the activities in this guide lend themselves to being used with students of a variety of ages. You will need to judge which activities are best suited to your group. This guide was developed to accompany the Treasure! museum exhibit. You may wish to use the materials before or after your visit. We recommend that you do some of each. You are welcome to make classroom sets of this guide but it is not to be otherwise redistributed or copied.

Contents

The Exhibit ............................................................... 3
What is Treasure? ..................................................... 4
What do you Treasure? ............................................. 5
Challenge 1–Deduction ............................................. 6
Secret Codes ............................................................ 7
Morse Code ............................................................. 9
Navigating ............................................................... 10
Getting Directions .................................................. 11
Challenge 2–Navigation ........................................... 12
Letterboxing: Old-Time Treasure Hunt .................... 13
Coordinates ........................................................... 14
Degrees ................................................................. 16
Arcs & Degrees ...................................................... 17
Latitude & Longitude ............................................. 18
Geocaching ......................................................... 19
A Treasure Game: Sunken Ship ............................... 23
About the *Treasure!* Exhibit

"There is something in a treasure that fastens upon a man's mind...He will never forget it..."

- Nostromo
  (from *Nostromo* by Joseph Conrad)

Treasure is a word that stirs the imagination of everyone of every age. An educational and entertaining exhibit for museums and science/technology centers, *Treasure!* explores the history of treasures and treasure hunting, the technology employed in hunting treasure, as well as the people and personalities that hunt for treasure—including you!

What is treasure? Who hunts for treasure? Why do they hunt treasure? How do people hunt for treasure? What do you treasure? Explore these questions and take part in your own treasure hunt when you visit *Treasure!*

*Treasure!* has several thematic areas and hands-on activities that allow you to try tools of treasure hunting and investigate treasures. Special exhibit features include actual artifacts from shipwrecks and other treasure sites. Visitors are invited to go on a treasure hunt in the exhibit to solve the mystery of the special treasure chest.

**Your Visit**

If you are coming to the exhibit with a group, be sure to check with the host museum for their group admission policies and procedures. Many of the components of the exhibit are hands-on but there are also objects just for viewing. Children are encouraged to remind their adults to treat all museum exhibits with care so that everyone may enjoy them. Children should follow this advice, too.

You may find that you have questions or ideas after visiting the exhibit. Be sure to talk with your friends on the way home about the exhibit. What did you learn? What do you wonder? In addition to this guide, the exhibit’s website has resources to help you extend the experience and do some treasure hunting of your own.
What is Treasure?

Treasure is a “concentration of riches” that has been newly discovered or re-discovered. When you think of treasure, what comes to mind?

For many, it’s an image of pirates digging or burying the ill-gotten booty. Indeed, the European discovery of the gold and silver in the New World launched a campaign of pillage and plunder that lasted for three hundred years. As avaricious as the Spanish were in reducing their huge national debt by shipping tons of treasure to Europe, others lurked on the side to profit from the illegal capture of Spanish treasure-laden galleons.

Today the hunt for the treasure that was extracted by slave labor and destined for Spain continues. Divers along the coast of Florida and throughout the Caribbean find riches every year that keep them searching for the “mother lode.” Mel Fisher found the wreck of the Nuestra Señora de Atocha in 1985. This ship, lost in 1622, yielded hundreds of millions of dollars of treasure. Other divers, like Frogfoot Weller, continue to earn their livings by diving on sites where ships or entire fleets of ships sunk hundreds of years ago.

But treasure can mean many different things to different people. Imagine wandering through your grandparent’s attic or basement. Boxes of magical stuff await you at every turn. Peering behind one pile or opening a box reveals magazines, photos, and objects from an earlier era. If this isn’t treasure hunting, what is?

Although gold, silver, and jewels come to our minds when we hear “treasure,” they aren’t what we value most. Even the most hardened treasure divers relish the chase as much as the find and are lost after finding what they sought for years.

What do you treasure most? Memories? Photographs? Time spent with others?

We invite you to come enjoy the exhibit and think of your own personal treasures.
What do you Treasure?

Try this: Think of five things that really are important to you, so important that you would not give them up for anything. Write those here:

________________________________________
________________________________________
________________________________________
________________________________________
________________________________________

Now think about a treasure you would like to find. Describe it here:

________________________________________
________________________________________
________________________________________
________________________________________
________________________________________

What is different about your first list and the treasure you described next? Have someone else do the same activity and compare your lists. Are they similar? Different? Why?

Consider this: Gold is one of the most treasured materials in the world. Many cultures have valued it for centuries. But gold does not make useful food, clothing, or shelter. It’s not even very good as a tool in most cases. So why is gold so expensive and cherished? Make some guesses and then do some research to learn more. Look for the display of gold in the Treasure! exhibit, too.
Have your students try this deduction challenge!

Challenge your students to guess what is inside a “treasure chest”.

How do you know something? You can look at a pile of gold and say, “Yes, that’s gold!” But, what if your vision were blocked? Let’s say the gold is in a box that you can’t open until you know what the contents are. Let’s say that there are several boxes and you get to open only one. Which one do you open?

How can you figure out what’s on the inside? Student teams create a series of tests to determine the contents of each box (empty cereal box that’s taped shut with one of the items below). They have to figure out what non-destructive test to use to determine what each unseen object is. At the end of the session, each team gets to make their predictions for all the boxes and gets to open one of the boxes.

Suggestions for treasure to put in chests:

- Sliced onion
- 2 hard boiled eggs
- 5 nails
- Craft sticks
- Coins
- A book
- Sand in a bag
- A cut flower
- Cereal
- A hammer
- Ball bearings or small balls
- Rubber bands
- Pencils

If the objects in the boxes are familiar to you—specifically, they have properties that you recognize—then you may deduce what is in the chest based on these properties. What if two objects have similar properties? Can you tell if a chest contains peas rather than rice?
Can you read the sentence above? If it looks like gobbledy-gook to you, that’s because it is in code. A code, or encryption, is a way to change ordinary words into text that is difficult to read. The only way to read it is to decode (or decrypt) the message. Why might people hiding treasure use secret messages and codes?

ROT-13 is one such code. ROT-13 is short for “rotate 13”. To use this code, you replace the first half of the alphabet with the second half of the alphabet. It looks like this:

```
A B C D E F G H I J K L M
N O P Q R S T U V W X Y Z
```

Using ROT-13, “A” becomes “N” and vice versa. Notice how the letters PBQR become CODE. Now use this to decode the message at the top of the page. It takes a few minutes, but it’s not too hard, is it?

```
A B C D E F G H I J K L M
N O P Q R S T U V W X Y Z
```

Using a code like ROT-13 is a great way to provide useful information without giving it away too easily. Geocachers often include “spoilers” or hints on the web page that provide specific information about the location of a geocache. But ROT-13 isn’t the only type of code. Let’s take a look at a few more.

Not all codes use letters. Another simple code replaces the letters of the alphabet with the numbers 1 through 26. In the following example, “A” is “1”, “B” is “2” and so forth:

```
```
Codes are useful if you and the person to whom you send the message both know the code. You can make sure that other people have a hard time deciphering your code by using one that you create. What might be some other codes you could create? There are several different rotation codes you could make. Instead of rotating the alphabet by 13 you could pick a different amount. Here is a ROT-4 code:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
E F G H I J K L M N O P Q R S T U V W X Y Z A B C D

You can see that any rotation other than 13 requires using the entire alphabet. The top row represents the “actual” message and the bottom row is the code. So the code letter “E” represents an “A” and a code letter “A” represents a “W”. This type of code takes a little longer to learn, so it is a little more secure than ROT-13.

But what if you wanted to make a code that was very difficult to decrypt? One way is to generate a random alphabet combination. Have a look at this example:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
P L O I K M N J U Y H B T G V C F R X E D Z Q S W A

Why is this code so much harder to decrypt than the others? In the rotation codes, figuring out one letter will lead you to the remaining 25. But with a random code, one must decipher each individual letter, one at a time.

Make up your own rotation code. If you were going to invent a special type of code of your own, how would you do it? Can a friend decipher it? Try it out!
An Important Code

In the early 1800’s, Samuel Morse became interested in improving communications throughout the nation. He studied the early telegraph machines and discovered that they were designed in such a way that they required 26 pairs of wires. One pair of wires for each letter of the alphabet. Morse knew that if he was going to realize his dream of providing virtually instant communication across our country, that having to run this many wires was going to be cost prohibitive.

He therefore set about to find a way to get the entire English language to travel down a single pair of wires. To accomplish this, he redesigned the telegraph machine so that it had a single rather then multiple electromagnets. He then devised a code that would allow the encoding and transmission of all the alphabet and the ten digits over a single pair of wires.

Ironically, the code Morse developed was not the one comprised of dots and dashes that is often attributed to him. What you now know as Morse Code was really developed by his assistant, Alfred Vail.

The alphabet

```
-.A  -.B  -..C  .-D  E  -.F  --.G
...H  .I  ---J  -.K  -..L  --M  -.N
--.O  --.P  --.Q  -.R  ...S  -T  ..-U
...V  --W  ...X  --.Y  --.Z
```

Numbers

```
.-----  1
-.----  2
....--  3
.....-  4
......  5
.....  6
.--..  7
-----.  8
-----  9
-----  0
```

Punctuation marks

```
.-.-.-  Point (.)
--.--.  Comma (,)
..--..  Question-mark (?)
```
Finding Your Way—and Finding Treasure

Finding our way from one place to another is called navigating. People have been doing this for a long, long time. In order to navigate, we first have to know our present position and where we want to go. Sometimes we just want to go from our house to the store. With a little practice, this becomes quite easy. We can remember our way.

In order to travel great distances or to go places where we have never been, we have to use some other method of navigation. It will take more than just our memory. Ancient people often relied on the stars overhead (including our sun) to navigate. In fact, this kind of navigation is still useful today. But it is not very easy to do and it isn’t very precise.

How do you find your way? With a map and compass? Directions? A GPS receiver? There are many tools for navigating. Treasure hunters often need to navigate well. Why do you think this is so?

Sometimes treasure hunters have an idea where a treasure is buried. In order to get to that location, they need to navigate. Other times, people find a treasure or something valuable—like a vein of gold in the ground—and need to be able to find it again. What do you think would be good ways to find your way back to a particular place?
How do I get there?

Have your friends ever given you directions? How did they do it? Read the following and think about different ways of finding where you want to go.

I asked my friend, Alice, how to get to the museum. She thought for a second and gave me directions.

“First,” she said, “Go to McDonald’s at the end of my street, turn left there, and go til you see Dunkin Donuts. Turn right at Dunkin, and go about ¼ mile until you see the Burger King. It’s just beyond that.”

Still not entirely sure, I asked Dave. Dave gave me entirely different directions: “Go north about half a mile. You’ll see the big hill off to the right, turn left there. Travel a mile or two, and turn right just past the hospital. Keep straight and you can’t miss it.

Sam had overheard my conversation with Dave and he insisted on providing me more detail. “Yes, that’s right. You go down 3rd Avenue until you get to Peach Street. Turn left on Peach. You pass Apple, Pear, and Grape Streets and finally come to Orange Street. Turn right there. Pass through streets named for Presidents until you get to Reagan. It’s in the next block.”

As Sam was finishing up, Sally walked by. Seeing some distress on my face with the various directions I was receiving, she pulled out her GPS. “Here, take this,” she said. “I programmed it for the museum. It will guide you there with its voice synthesizer.”

As I was getting in my car I realized I didn’t know how to turn the GPS on, let alone use it. So, I started looking for fast food restaurants.
Have your students try this navigation challenge!

Challenge your students to write instructions for traveling from your school to any nearby location. They can work in teams of two or three. When each team has finished, have them trade instructions with another team and ask each team to see if the instructions would guide them there.

Writing instructions to guide people is a difficult task. What do you use as markers and how do you relate visual clues? Read the narrative above to the class and then ask them to come up with as many different ways they could provide directions to someone trying to go from your school to your selected location.

They could use landmarks, street names, distances, and time? What else can they come up? What different types of landmarks can they think of? Fast food restaurants, malls, public buildings, big houses?

Challenge them to think how they navigate on their way to school. Do they find their way only by remembering the sights and turns? How does their navigational brain work?

If they were in a huge open field or in the middle of the ocean, how would they navigate? They may throw out some buzzwords, but do they know how to use the stars, moon, or sun? Even if you don’t have time to teach them the basics of the earth’s rotation (and apparent rotation of celestial bodies), get them thinking by asking questions.

During your visit to the museum, see if you can schedule a planetarium show or ask for a short presentation on astronomy and navigation.
An Old-Time Treasure Hunt

Letterboxing is a treasure hunting game that began in England in the mid-1800s. Even today, most letterboxes are hidden there. Originally, letterboxes were simply containers that were hidden containing a letter or a postcard. Today, a letterbox is a weatherproof container that holds a log book and a rubber stamp.

People find the letterboxes using clues—which sometimes require a compass. Upon finding the letterbox, the finder will mark the logbook with her personal stamp. Then she will mark her own logbook with the stamp that is in the letterbox. The box is hidden back where it was, awaiting the next visitor.

In England, the clues to finding letterboxes are published in a catalog. In North America, most letterboxers post their clues on the letterboxing.org web site. Sometimes, letterboxing clues are simply passed from one person to another.

You may hide your own letterbox and give clues for finding it to your friends. Have an adult help you choose a good location. It might be in your yard or in a neighborhood park. You might buy a rubber stamp or make one yourself.

Here is an example of how you might write a clue:

Begin at the largest oak tree in the yard. Take five big steps toward the morning sun. Turn right and walk fifteen steps to a short bush. Now turn left and go eleven big steps until you find a really big rock. Look under the rock!
As a treasure hunter, you’ll need to be familiar with coordinates. For our purposes, coordinates are sets of numbers that locate points on Earth. Coordinates can be used to find points in a variety of settings. A single coordinate needs a partner to become useful information.

Coordinates are used in several ways. Look at the grid below and its coordinate system. Move your finger across the bottom until you reach “4”. Then move up to line number “2”. The diagonal lines intersect at coordinates (4,2). Graphs use coordinates.

The point at which coordinates \textbf{intersect} is useful information! (coordinates A,B)

Coordinates are used in several ways. Look at the grid below and its coordinate system. Move your finger across the bottom until you reach “4”. Then move up to line number “2”. The diagonal lines intersect at coordinates (4,2). Graphs use coordinates.

The two diagonal lines on this graph intersect at coordinates 4,2.

Now consider a street address as a set of coordinates. There are many buildings with the number 1234 and many buildings on West Washington Street. But the address 1234 West Washington Street refers to only one building. That’s using coordinates!

There is a fun coordinates game called “Sunken Ship” on page 24 in this guide.
Look at the illustration at left. It was made by connecting the following coordinates. Note that the number going across (called “X”) comes first in each pair and the number going up or down (called “Y”) is last.

(3,8)
(5,9)
(7,8)
(5,2)
(2,7)
(3,8)

Coordinates can also use negative numbers (numbers less than zero). Negative coordinates move points to the left of the Y axis or below the X axis. Study the illustration below and the coordinates that go with it.
What is a degree?

The word **degree** is used to describe the amount by which something changes. We commonly use degrees to describe temperature. These degrees are set on a standard scale, like Fahrenheit or Celsius. That is, each degree has the same value. Degrees are also used in measuring angles. These are not the same type of degrees used to measure temperature, but they also have a specific value. For instance, a circle is described as having 360 degrees. If you ‘do a three-sixty’ on a skateboard, you have turned completely around. Similarly, a ‘one-eighty’ is 180 degrees or half of a circle.

Look at the following angles, demonstrating a variety of degrees. Note that degrees are written with a number followed by the ° symbol.

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At 3:00, the hands on a clock form a 90° angle and a 270° angle. What angles are formed when the clock shows 7:00?
Parts of a Circle

Now look at the following angles and notice how they sweep out an arc or part of a circle. In the following section, we will look at how degrees are used to measure distance and time on a sphere—our own planet, Earth.

When this golfer follows through on his swing, he has moved his club in a 360° arc.
Measuring the Globe

The lines of **latitude** run East-West around the globe. They are spaced equally apart and are called **parallels**. Parallels of latitude measure degrees and distance, North-South.

The parallel of latitude that divides the Northern and Southern **hemispheres** is called the **Equator**. It is at zero degrees.

The lines of **longitude** run North-South around the globe and are called **meridians**. They meet at the poles and are farthest apart at the Equator. They measure degrees and time, East-West. The meridian that divides the Eastern and the Western hemispheres is called the **Prime Meridian**. It is at zero degrees. Opposite it on the globe is the **International Date Line**. It is at 180° degrees and also divides the hemispheres.

Together, the lines of latitude and longitude create coordinates by which we are able to pinpoint specific locations on our planet. This is the basis of most mapping systems, including the **Global Positioning System** or GPS.

Why are the lines of latitude parallel to one another while the lines of longitude converge? What would happen if you switched them? How do we use the two sets of lines differently?
The Global Treasure Hunt

Geocaching in an exciting hobby! It is a modern treasure hunt with hundreds of thousands of participants around the world. Geocaching is essentially a game—a game in which everyone wins. Once you get started, you’ll be spending time outdoors searching for clues and making great finds.

What can I learn?

The learning possibilities involved in geocaching are endless. You’ll employ the understanding of latitude, longitude, and other basic geography tools. You’ll learn more about the area in which you live, including places you haven’t been before, local history, and more. You will use technology that is fun and useful. Geocaching will exercise your mind and body. If you are between the ages of 4 and 124, you’re certain to learn through geocaching.

What is a geocache?

The word geocache (je´ o kash) comes from two words. The first is the prefix geo, meaning "Earth", as in geography. The second is cache which is a safe place for hiding or storing something. It can also be the thing which is hidden. For example, the batch of nuts that a squirrel hides for winter is her cache. Your computer keeps Internet files in a cache.

So a geocache is something that is hidden somewhere on Earth! It is a new word created for the hobby geocaching. People gather up a few little odds and ends and put them in a watertight container. Then they hide it outdoors somewhere, record the coordinates using their GPS receiver, and post the coordinates on the Web.

What is a GPS receiver?

The initials GPS stand for "Global Positioning System". The GPS uses a series of 24 satellites that orbit Earth and GPS receivers which you can carry. When you stand outdoors with your receiver turned on, it will receive radio signals from several of the satellites which are flying about 11,000 miles overhead. By receiving signals from these satellites, the GPS receiver is able to calculate your location on the planet using longitude and latitude coordinates. Coordinates look like this: N 47° 41.026’ W 122° 11.038’. The receiver is often referred to as a “GPS unit” or “GPS device”.

Geocaching
What's the story behind "geocaching"?

Geocaching started in the year 2000 in Oregon. Jeremy Irish and Mike Teague were instrumental in bringing the hobby to life, via the Web. Jeremy is the founder and operator of geocaching.com, which is the clearing house for most of the geocaching community.

Where are the geocaches?

Geocaches are hidden all over. Later, when you go to the geocaching.com web site, you'll be able to find geocaches in your area. There are thousands of them all over the world! They are usually hidden on public land or on private land with the permission of the land owner. The geocaches are hidden well enough that people who aren't looking for them generally don't happen to find them. Some geocaches are easier to get to than others.

Who put the geocache there?

Geocaches are hidden by other geocachers. They get the container and the first few items to put inside. They choose the hiding place and record the coordinates, which are then posted on the geocaching.com web site. Hiding a geocache usually means that you have to check on it once in awhile to make sure it is still there and intact. After you have tried geocaching, you and your family may want to make one yourselves!

What is in a geocache?

A geocache can have all sorts of things in it. Generally, there are small items of little value. When you go geocaching, you take items to trade with the geocache. For example, you might find a geocache that has a CD, a toy car, trading cards, and other stuff. You might choose to take the car and leave a kazoo. The general rule is, if you take an item, you leave an item. Geocaches also have a logbook where you record the date and your name (or code name—most geocachers have a code name just for fun). Some geocaches even have a camera so that you can snap a picture of yourself. Never take the camera.

Where do I get a GPS receiver?

Getting a GPS receiver is simple and relatively inexpensive. You can get a nice one for under $120. You can find them at many sporting goods stores. Another easy way to get one is to order it on the Web. Popular brands of hand-held models are Garmin and Magellan. Have a look at the geocachingkids.com web site to find one.

How do I get started?

You'll need three things to start: an adult, an Internet connection, and a GPS receiver. You'll use the Internet to get the coordinates for a local geocache. Visit geocaching.com to see if there is a geocache near you!
A water-tight container is very important. Choose one that has a lid with a snug fit.

A logbook is a must, even if you don’t include anything else. A small, spiral-bound memo pad is a good choice. Keep this in a zipper-lock baggie.

The geocache note is also important. You may copy this from the following page.

You may wish to include a disposable camera. If you do, include a note asking visitors to snap a picture of themselves and to leave the camera. You’ll need to check on your camera and process the photos when it is full.

A pencil for signing the logbook. Pens are okay, but may dry up or become difficult to use in cold weather. A small pencil sharpener can also be included.

Toys and souvenirs! These are for “take an item, leave an item”. Keychains, postcards, and small toys are good choices. Never leave food!
Congratulations, you've found it! Intentionally or not!

What is this hidden container sitting here for? What the heck is this thing doing here with all these things in it?

It is part of a worldwide game dedicated to GPS (Global Positioning System) users, called Geocaching. The game basically involves a GPS user hiding "treasure" (this container and its contents), and publishing the exact coordinates so other GPS users can come on a "treasure hunt" to find it. The only rules are: if you take something from the cache, you must leave something for the cache, and you must write about your visit in the logbook. Hopefully, the person that hid this container found a good spot that is not easily found by uninterested parties. Sometimes, a good spot turns out to be a bad spot, though.

**IF YOU FOUND THIS CONTAINER BY ACCIDENT:**

Great! You are welcome to join us! We ask only that you:

- Please do not move or vandalize the container. The real treasure is just finding the container and sharing your thoughts with everyone else who finds it.
- If you wish, go ahead and take something. But please also leave something of your own for others to find, and write it in the logbook.
- If possible, let us know that you found it, by visiting the web site listed below.

Geocaching is open to everyone with a GPS and a sense of adventure. There are similar sites all over the world. The organization has its home on the Internet. Visit our website if you want to learn more, or have any comments:

http://www.geocaching.com

If you're a young person, have a look at http://www.geocachingkids.com.

If this container needs to be removed for any reason, please let us know. We apologize, and will be happy to move it.

The name of this geocache is:

__________________________________________________________

Sunken Ship Instructions

• Each player draws three ships in his or her fleet: A ship, two squares long; a ship, three squares long; a ship, four squares long. Make sure the opponent does not see where you place your ships.

• Starting with the youngest player, each player tries to sink the opponents ships by guessing—one set of coordinates at a time—the location of each ship.

• Call out the coordinates and the opponent will respond “miss” or “hit” or “sunk”. Each player gets one guess per turn. Record your guesses on your Guess Sheet. Record your opponent’s guesses on your Fleet Sheet.

• Winner is the first player to sink all three of the opponents ships.

If there are numbered streets in your community (like 12th Street), notice how the addresses correspond. For example, houses on streets running perpendicular to 12th Street may have addresses like 1203 in the block adjacent to 12th Street.

Fleet Sheet

In this example, “B,2” is a miss. “F,7” is a hit. The ship is sunk.