Name: _____

edHelper

The Flat Sphere



It sits on the counter by the window peering out into the world. It comes to life when the names of countries, explorers, and oceans are thrown around the room. It's your trusty classroom globe! Students throughout the years have seen a globe or two by their classroom windows. We take this colorful sphere for granted. However, have you ever wondered how scientists produce such an accurate model of our planet?

Cartographers are the earth scientists responsible for producing globes and maps of Earth. For centuries, scientists have made models and pictures of our planet. Today's cartographers use different methods for collecting information about the Earth's surface. Technology in the form of satellites and airplane computers has allowed scientists to collect images of Earth from space and high altitudes. This is done through **remote sensing.** By using remote sensing, scientists can take images of the Earth's surface from high above and analyze those images. In addition to remote sensing, cartographers also conduct **field surveys.** Field surveys allow scientists to measure specific areas on Earth that need to be mapped. They walk or drive through these areas, collecting measurements and plotting those measurements on maps. Surveyors then use these measurements to make measurement estimates for areas between the surveyed points. Once all of the information is collected, cartographers produce globes and maps of our planet.

Speaking of globes, can you imagine how hard it would be if that was the only representation of our planet we could use? It would be very hard to store globes in our cars as we travel. Well, cartographers have found ways to transfer the images from a globe to a flat map. Scientists accomplish this goal by using **map projections.** Imagine having a transparent globe with a flashlight inside. It would be very easy to wrap the globe with paper and trace its images onto the paper. As you may have guessed, it is not that simple. Cartographers use mathematical formulas to make map projections. Three basic map projections are used- **cylindrical, conic,** and **azimuthal.** A fourth projection, **interrupted,** is not used as often as the previous three. Each map projection has its advantages and disadvantages.

Cylindrical, or **Mercator** projections, have meridians that are straight and equally-spaced parallels. Mercator projections have a grid-like appearance which makes this type of map useful for navigation. Since meridians meet at the poles on globes, the distances and sizes of land masses are distorted at the poles on maps with Mercator projections. Sizes and distances at the equator, however, are accurate.

If you were to place a sheet of paper on our lighted globe so that it touched only one point of the sphere, you would produce a map with an azimuthal projection. Azimuthal projection maps have distorted shapes, areas, and distances as you move farther away from the contact point. The contact point is usually one of the poles; however, it may be at other points on the globe. If the point is at one of the poles, the Earth looks as if it is cut into even pie slices. If the point is any point other than the poles, the Earth looks like a stretched-out sphere. On this projection

there is not equal spacing between the parallels. This unequal spacing causes distortion in direction and distance. In spite of the distortion, navigators use this type of map because great circles appear as straight lines. If a straight line was drawn between any two points on an azimuthal projection map, you would actually have a great circle route.

On maps with conic projections, there is little distortion of shapes and areas along the contact point parallel. If you were to place a cone-shaped paper on the globe with its point lined up with the globe's pole, the cone would touch the globe along one parallel of latitude. The distances along the meridians and parallels are correct on this type of map. Cartographers can also combine conic projections of different neighboring areas on the globe. The cone would touch the globe at different latitudes. The result - a continuous map called a **polyconic projection** map. This map's small areas are almost the same relative size and shape as those areas on the globe. The final projection, interrupted projection, is produced by one of the other three projections. The map has the appearance of flattened orange peel slices. This projection is rarely used.

Even though cartographers have found methods for limiting distortion on two-dimensional maps, there is not any one projection that is a completely accurate model of Earth.

The Flat Sphere

Questions

_____ 1. Cartographers use _____ and _____ to map areas of the Earth.

A. remote sensing and field surveys
B. field surveys and expeditions
C. field surveys and historical models
D. remote sensing and excavation

2. What are the disadvantages of using map projections?

_____

_____

3. If I wanted to study equatorial regions, which map projection do you think I should use? Why?

_____

_____

4. Describe the four types of map projections.

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5. If you were an airline pilot, which map projection would you use? Why?

_____

_____

6. Why do you think maps with interrupted projections are rarely used in the classroom?

_____

_____

_____ 7. When a straight line is drawn between any two points on an azimuthal projection map, it produces a _____.

A. great circle route
B. fault line
C. contour line
D. parallel

8. Why are globes more useful for studying larger areas than maps?

_____

_____

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How many of these can you write about? Think! Write! Check all the ones you answered.

- ☐ You are an azimuthal projection map. Write a monologue that explains to the other map projections why you are valuable. Be creative!
- ☐ Humans have used maps for thousands of years. When did the first map appear on Earth? Use the internet and other research tools to find out about the history of maps. Design a time line that describes the origin of important maps throughout history and the people responsible for designing the maps.

Don't stop writing. Use a blank piece of paper to continue.