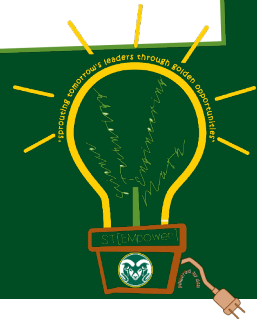




SCIENCE, TECHNOLOGY,
ENGINEERING, AND MATH
COLORADO STATE UNIVERSITY
EXTENSION

ST[EMpower]



OCEANS & CLIMATE

VOLUME 8, ISSUE 3, MARCH 2019

THIS MONTH

- Water World pg. 2
- Exploding Balloons pg. 5
- Oceans Moderate Climate pg. 6

POWER WORDS

- **jargon:** special words used by a particular profession, difficult for others to understand
- **reservoir:** a supply or source of something (in this case, solar radiation in the form of heat)
- **sink:** receives heat (the ocean)
- **source:** supplier of heat or energy (the sun)

CAREERS

- This month's Careers activity is on page 10. It highlights 3 amazing websites for kids exploring careers.

Water and Energy

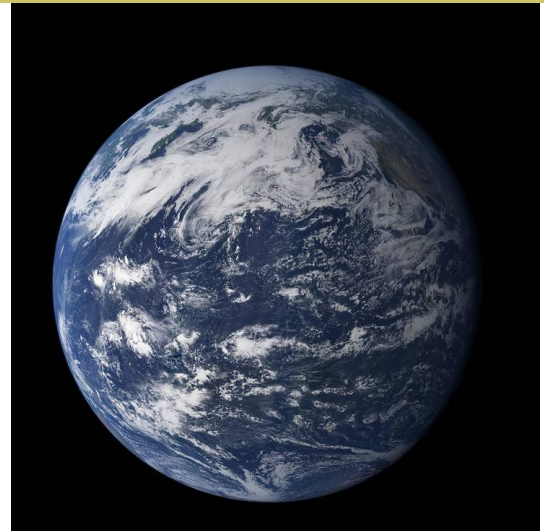
Water covers approximately 75% of the surface of the Earth. Water is found in clouds, in rocks and soil, and the organisms that call Earth home. Water is the one common factor for all life as we know it. When we look for life on other worlds, the first step is to look for water.

Water also moderates our climate. It is an enormous reservoir of energy. It absorbs tremendous amounts of solar energy during the day, and releases that energy throughout the night.

The reason that our oceans are a sink and source for heat is that water has a high heat capacity. That means that it takes a lot of energy to raise the temperature of water.

In science jargon, water has to absorb 4,184 Joules of heat for the temperature of one kilogram of water to increase 1°C. That is the same amount of energy it takes you to walk the dog every 5 seconds.

The ocean is $\sim 1.3 \times 10^{12}$ cubic kg. You would have to walk your dog over 13 quadrillion years to use the same energy it takes to change the ocean's temperatures by 1°C!



What is 13 quadrillion?

13,000,000,000,000,000!

I bet you would wear out a lot of shoes and leashes!

The activities in this newsletter explore the ocean's capacity to store energy. It also will experiment on the impact on organisms when the ocean's temperature rises.

You may need to purchase or order:

- inflatable globe

All the other items are easily available at local stores.



COLORADO STATE UNIVERSITY
EXTENSION

Colorado state university extension 4-H programs
are available to all without discrimination



Is Earth really mostly water? Is only 25-30% of the surface of our planet land? You can check this out for yourself.

Confounding Bias: distorted results due to another variable. In the case of the inflatable globe, the nozzle used to inflate the globe weights it differently at that spot.

Record your hypothesis. on the Water World Data Analysis Sheet (pg. 4). The hypothesis is a statement of what you think your results will be. This is your best guess.

Your results will probably not be exact, but close. We analyze results with statistics to evaluate if our results fall within a 5% margin. If the results are within that range, we can support our hypothesis. We can never prove a hypothesis, but we can reject it or support it.

Directions:

- Record your hypothesis.
- Find at least one other person. or as many people as you like.
- Give each person the Tally Sheet and a pencil.
- Toss the inflatable globe to a partner.
- When each person catches the globe, record on the Tally Sheet if the right index finger touches ocean or Antarctica **OR** if the right index finger touches land.
- Continue tossing the globe 100 times.
- Add each tally mark to get a total.
- The analysis is very simple, because you have 100 data points. Each total represents the percentage of times your right index finger touched

water and the percentage of times it touched land. This will give you a rough estimate of the percentage of water/land on the globe. For a margin of error, add 5 and subtract 5 from your results (e.g. if you touched water 30 times, use the range of 25-35% to account for your margin of error.)

- Do your results support your hypothesis? If not, you reject your hypothesis.
- Repeat the experiment 2 more times. Are your results similar?
- As you catch the globe, notice if the heavier end with the nozzle is pulled more by gravity. This may skew your results.



POWER WORDS

- **bias:** error in results
- **confound:** mix up, fail to discern differences between, increase the confusion of
- **datum** (pl. data): a piece of information
- **hypothesis:** a proposed explanation made on the basis of limited evidence as a starting point for further investigation
- **skew:** distort especially from a true value or symmetrical form

MATERIALS:

- 1 inflatable globe
- 1 partner or more
- 1 Water World Data Sheet (pg 3) for each person
- 1 pencil for each person
- 1 Water World Data Analysis Sheet (pg. 4)
- Mathematical compass
- 1 blue color pencil
- 1 green color pencil
- 1 ruler



What is your hypothesis:

Pie chart graphs are perfect when your data can be converted to percentages. You collected data in 3 trials that easily converted to a percentage because you had a total of 100. For our graph, though, we want to use all the data.

Water Trial 1 _____	Land Trial 1 _____	Margin for Error (± 5)
Water Trial 2 _____	Land Trial 2 _____	Water FINAL _____ - 5 = _____
Water Trial 3 _____	Land Trial 3 _____	Water FINAL _____ + 5 = _____
Total _____	Total _____	Land FINAL _____ - 5 = _____
FINAL: Divide by 3 _____ %	Divide by 3 _____ %	Land FINAL _____ + 5 = _____

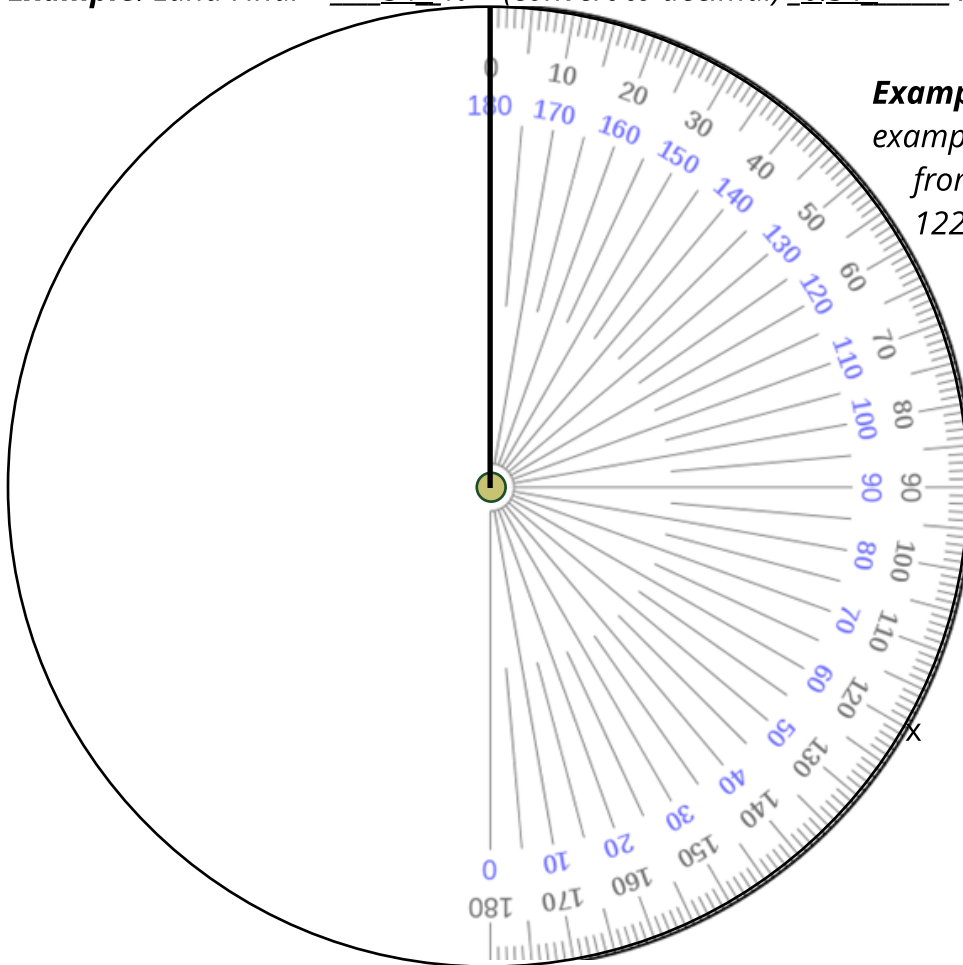
- use these percentages for graph below.

You need to figure the percentage of the pie. A circle is 360°. Start with the smaller percentage. How much of the circle is that percentage? You can easily convert a percentage to a decimal. For example, 50% = 0.50 or 22% = .22. To find the percentage of the circle, multiply the answer by 360°

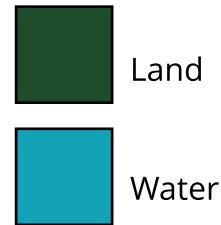
Water Final _____ % = (convert to decimal) 0. _____ x 360° = _____ °

Land Final _____ % = (convert to decimal) 0. _____ x 360° = _____ °

Example: Land Final 34 % = (convert to decimal) 0,34 x 360° = 122.4° (at the "x").



Example: To make a pie chart graph with the example data, use the ruler, and draw a line from the center gold dot to 122°. Color 0° to 122° pie of the circle with Green (for Land). Color the other part of the circle blue (for Water).



Water is an amazing molecule. It is so common on Earth, we take it for granted. Water is unique.

- Water is polar. The water molecule diagram has a "-" by the oxygen atom and "+" by the two hydrogen atoms. The strong negative charge on the oxygen atom attracts the weak positive charge on the hydrogen atoms.
- Water has the second highest specific heat capacity of all molecules (ammonia has the highest). It absorbs energy without quickly raising its temperature.
- Water exists in three states of matter (solid, liquid, and gas) on Earth.
- When water freezes, it is lighter than when it is a liquid. This is very unusual. Usually solids are heavier than liquids.
- Water is a universal solvent. Many solutes dissolve in water. For example, salt dissolves easily in water.
- Water is sticky - both to itself (cohesion) and to other items (adhesion).

In fact, it is the only thing necessary for life on our planet. Every organism (known) is dependent on water for life. While it is theoretically plausible for life to exist on a world without water, we have no proof that it has ever happened. Scientists look for water first to determine if there could possibly be life.

This is a quick demonstration on the high specific heat capacity of water.

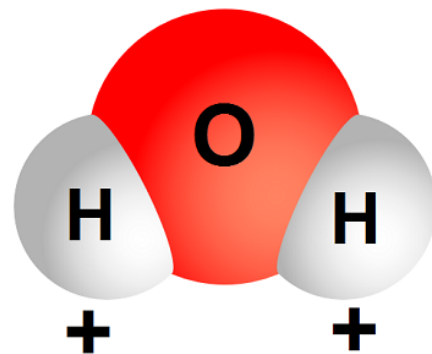
Because you will be using an open flame, ask your parent or guardian to do this demonstration with you.

Directions:

- Blow up the first balloon, and tie the nozzle in a knot.
- Add water to the second balloon, and blow into it while the balloon is pointed down (so water won't leak). Tie the nozzle into a knot.
- Add about 2" water in a cup.
- Put on your goggles. Be sure to tie back if you have long hair, and roll up your sleeves.
- Strike the match, striking away, and light the candle. Drop the match in the cup with water.
- With the tongs, grasp the nozzle on the balloon without the water. Hold the balloon in the candle flame. What happens?
- Grasp the nozzle on the water balloon with the tongs, and hold it in the candle flame. What happens?
- Why do you have two different results? Why did one balloon pop and the other did not?
- Do your results change if you have twice as much water in the balloon? Do your results change if you only add 1 teaspoon of water in the balloon?

POWER WORDS

- **sink:** receives heat (the ocean)
- **source:** supplier of heat or energy (the sun)
- **theory:** explanation for why things work or how things happen supported by strong evidence



MATERIALS:

- safety glasses
- 2 party balloons (or more)
- water
- candle
- matches
- cup
- tongs
- parent or guardian



The water balloon did not pop because the water absorbed the energy from the flame, not the latex balloon. In the same way, the ocean absorbs solar energy during daylight hours (sink), and releases that energy during the night (source). This helps to moderate the temperatures worldwide, but especially along coastal regions.

You will collect the average January and July high/low temperatures for several locations throughout the world. You will plot the average temperature swings between day and night and plot it on the maps.

Directions:

- Examine your globe. What do you notice about:
 - Northern versus the Southern Hemisphere
 - Pacific, Atlantic, Indian, Arctic, and Southern Oceans
- Apply everything you know to develop a hypothesis about the coastal and inland temperatures in the Southern and Northern Hemispheres.
- Measure two rectangles 8½ x 11" (the size of the paper maps you print) on the corrugated cardboard. You could also trace a piece of copy paper.
- With sharp scissors or a box cutter (parent supervision), cut out the 2 pieces of cardboard.
- Glue one map to each piece of cardboard with the glue stick.
- **Note that this activity uses Fahrenheit scale.**
- Use computer Internet to collect the data for high and low temperatures in January and in July for each city listed in the data table (page 9).

- *Example Dinosaur, CO:* Use a search engine and type in "Dinosaur, Colorado high low temperatures by month." This accesses several websites to find these data. Record January and July high and low temperatures in the table (example for Dinosaur, CO below in the green box).
- Calculate each row in the data table (a different location):
 - January: subtract Jan High from Jan Low; record in Difference
 - July: subtract July High from July Low; record in Difference
 - Add Jan Difference and July Difference.
 - Divide by 2 (orange box)
- Each push pin color represents a different temperature range (see legend on the right). The world map has white dots and US map has black dots to help you find the locations. Find the correct push pin color to represent the average temperature swing, and push it into that spot. Note on the US map, the red dot indicating that Dinosaur temp swing is 33°F (between 31 and 40°F).

POWER WORDS

- **hemisphere:** a half of the Earth as divided into northern and southern halves by the equator
- **moderate:** make or become less extreme

Science means knowledge. Even when we reject our hypothesis, it is still good science if we learn.



- Examine your maps. Do these data support your hypothesis? Why or why not?

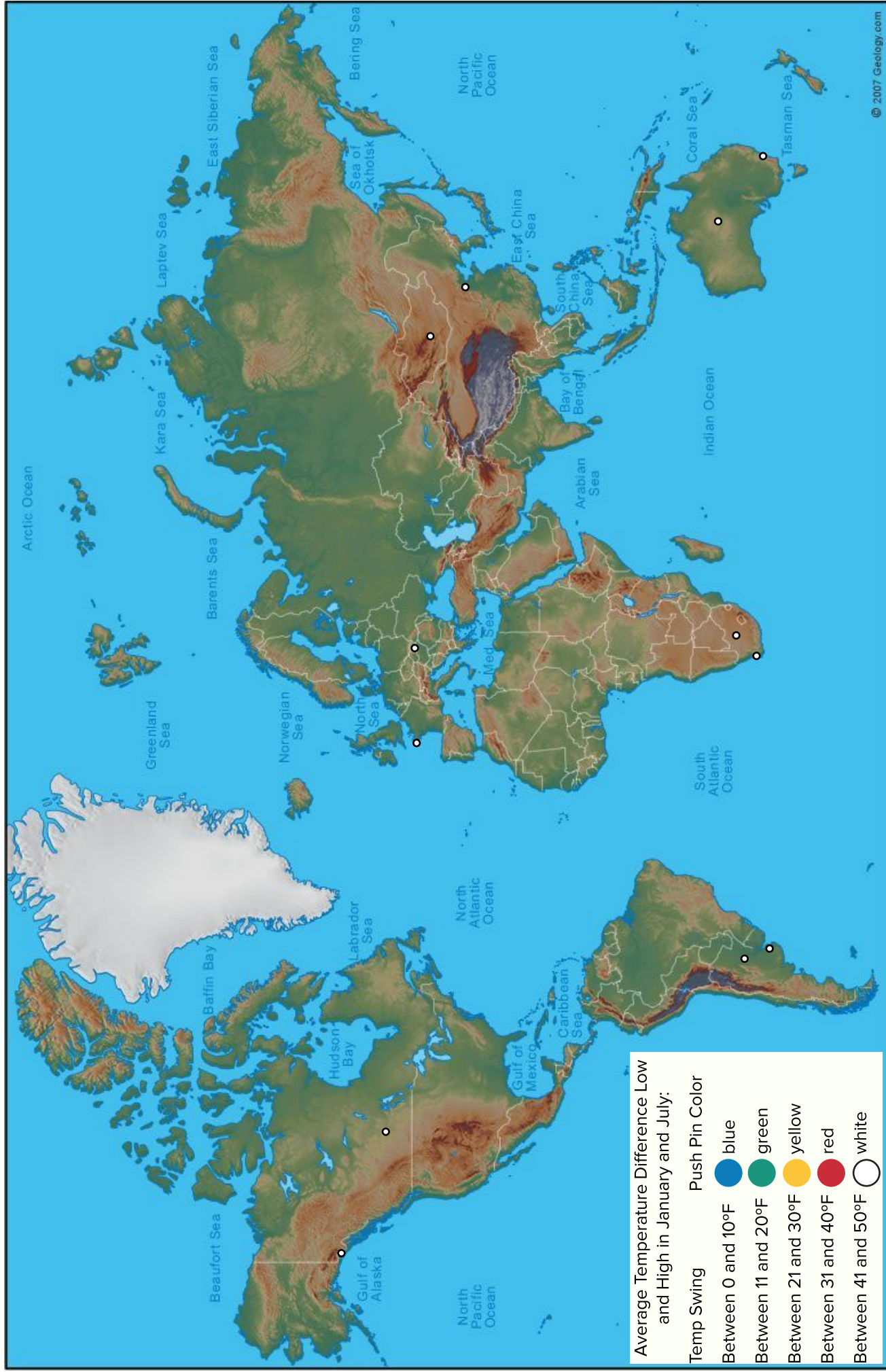
Temperature Swings:
 0 and 10°F ●
 11 and 20°F ●
 21 and 30°F ●
 31 and 40°F ●
 41 and 50°F ○

Location	Jan High	Jan Low	Difference	July High	July Low	Difference	Total Difference	Divide by 2
Dinosaur, Colorado	33°F	11°F	22°F	91°F	57°F	44°F	66°F	33°F

MATERIALS:

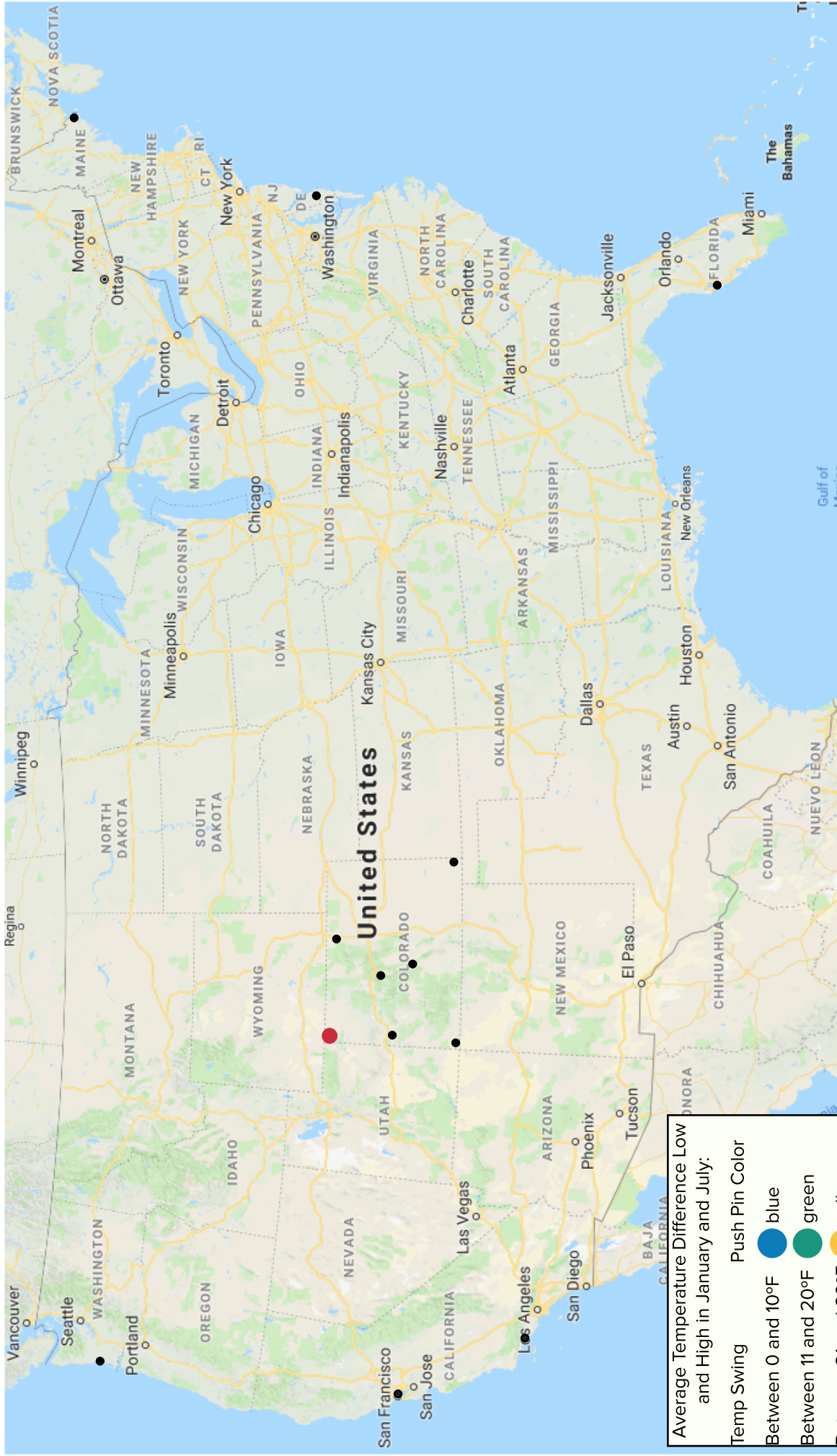
- print pages 7 - 9 (maps and data sheet)
- inflatable globe
- glue stick
- recycled corrugated cardboard
- sharp scissors or box cutter
- ruler
- pencil
- variety of different color push pins
- computer with Internet access





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- | | | | |
|--|---|--|---|
| Southern Hemisphere Coastal | Southern Hemisphere Inland | Northern Hemisphere Coastal | Northern Hemisphere Inland |
| <ul style="list-style-type: none"> • Sidney, Australia, 33.9° S • La Plata, Argentina 34.9° S • Cape Town, South Africa 34.0° S | <ul style="list-style-type: none"> • Alice Springs, Australia 23.7° S • Cordoba, Argentina 31.4° S • Kimberley, South Africa 28.7° S | <ul style="list-style-type: none"> • Shanghai, China 31.2° N • Brest, France 48.4° N • Prince Rupert BC, Canada 54.3° N | <ul style="list-style-type: none"> • Lanzhou, China 36.1° N • Vienna, Austria 48.2° N • Prince Albert SK, Canada 53.2° N |



- West of Continental Divide Coastal**
- Oxnard, CA 34.2° N
 - San Francisco, CA 37.8° N
 - Grayland, WA 46.8° N

- West of Continental Divide Inland**
- Grand Junction, CO 39.1° N
 - Towaoc, CO 37.2° N
 - Breckenridge, CO ° 39.5N

- East of Continental Divide Coastal**
- Tampa, FL 28.0° N
 - Chevy Chase, MD 39.0° N
 - Lubec, Maine 44.9° N

- East of Continental Divide Inland**
- Fort Collins, CO 40.6° N
 - Poncha Springs, CO 38.5° N
 - Campo, CO 37.1° N

Careers

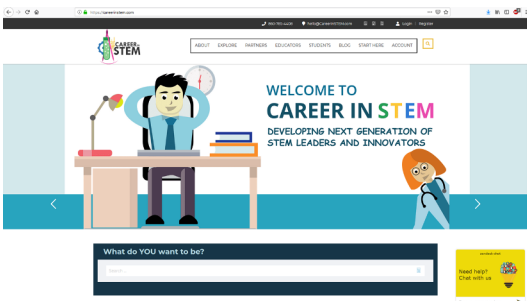
While researching Mind Maps for last month's career section, I ran across three amazing websites on exploring careers for youth. Hang onto those mind maps one more month, and we will continue organizing all your information in April's issue.

Virginia Career VIEW is that state's Career Information Delivery System for all students in grades K-8. They have put together a great website that is interesting, with an interest survey, games, and contests.

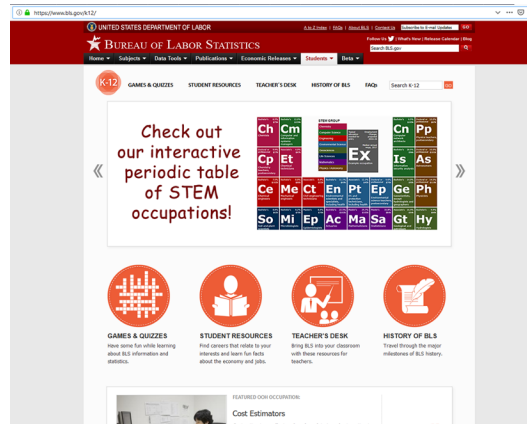
The website will direct you to explore in two areas, the Grades K-5 or Grades 6-8. Click, and there is a great selection of activities and surveys to explore.



The second website, Careers in STEM, was developed by a classroom teacher frustrated that there was so little information about STEM careers on-line. There are plenty of free resources for you to explore, including videos of people talking about their jobs to viewing lists of careers by interest. Check it out!



US Bureau of Labor also has a "kid-friendly" website on careers.



One of the really nice features is each career is linked to the Occupational Outlook Handbook. with links to:

- What They Do
- Work Environment
- How to Become One
- Pay
- Job Outlook
- State and Area Data
- Similar Occupations
- More Information



POWER WORDS

- **bureau:** an office or department for transacting p
- **occupation:** a job or profession



High School Science Teacher - high job satisfaction

These websites have great information, and interesting ways of presenting it.

Your career will be amazing, engaging, and perfect for you, if you spend the time. What is even better, even the journey towards your career can be fun!

Career Exploration Websites:

Virginia Career VIEW

Vital Information for Education and Work

<https://vacareerview.org/>

<https://vacareerview.org/68/check-it/who-r-u/>

Careers in STEM

<https://careerinstem.com/>

US Bureau of Labor

<https://www.bls.gov/k12/>



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Citations:

Background Information

- <https://oceanexplorer.noaa.gov/facts/climate.html>
- <https://climatekids.nasa.gov/ocean/>
- <https://water.usgs.gov/edu/heat-capacity.html>; <https://hypertextbook.com/facts/1998/AvijeetDut.shtml>
- <https://www.medibank.com.au/livebetter/be-magazine/exercise/kilojoules-burned-in-exercise-calculator/>
- <https://www.livescience.com/6470-ocean-depth-volume-revealed.html>;

Career Information

- Vital Information for Education and Work: <https://vacareerview.org/> and <https://vacareerview.org/68/check-it/who-r-u/>
- Careers in STEM: <https://careerinstem.com/>
- US Bureau of Labor: <https://www.bls.gov/k12/>

Images

- South Pacific Earth: https://www.nasa.gov/multimedia/imagegallery/image_feature_1925.html
- inflatable globe: https://cdn.shopify.com/s/files/1/2927/2664/products/inflatable-globe-animals-objet-dart-english-12-847629_1024x1024.jpg?v=1533248230
- protractor: <https://medium.com/@a.ruzaik/protractor-101-3ea022fb6050>
- water balloon and candle: <https://i.ytimg.com/vi/qeDZQ9-gsjY/hqdefault.jpg>
- water molecule: <https://s3.amazonaws.com/user-content.enotes.com/e9051bff4b4e7a03460d69f59ac430160eb764f6.png>
- push pins: <https://www.supplychimp.com/go/abilityone-7510012073978-color-push-pins-plas1.html>
- world map: <https://geology.com/world/world-map.shtml>
- US map: <https://www.google.com/maps/place/United+States>
- High School Science Teacher: https://journalistsresource.org/wp-content/uploads/2016/03/Science-teacher-helps-students-ed.gov_.jpg