Incorporating

Into the Earth Science Curriculum

The UNIVERSITY of VERMONT

NSF

VERMONT

Project based learning

-satellite/remote sensing

-ozone

-plate tectonics

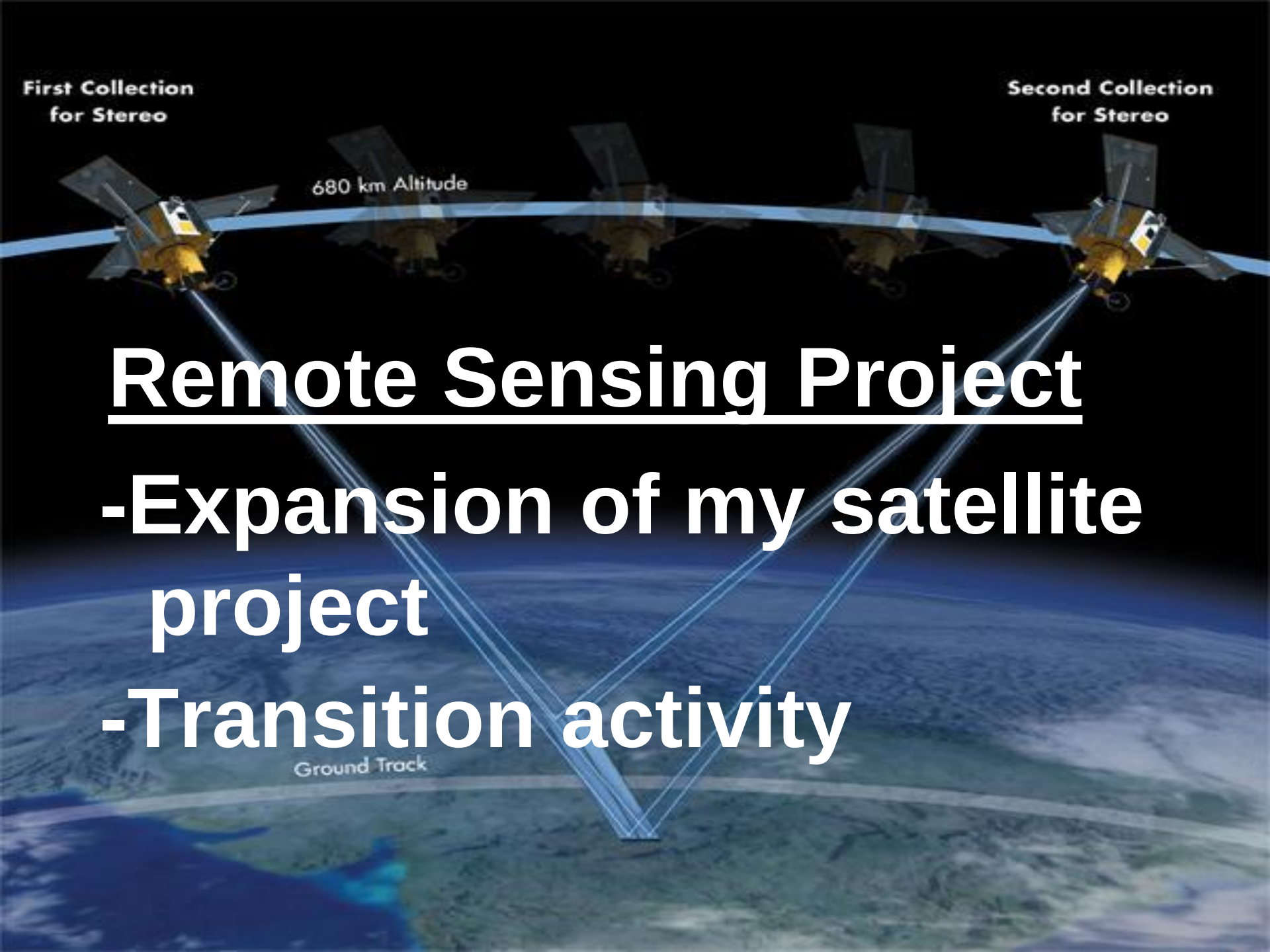
Core Concepts

- density

- EMS

- convection

Resources



Remote Sensing Project

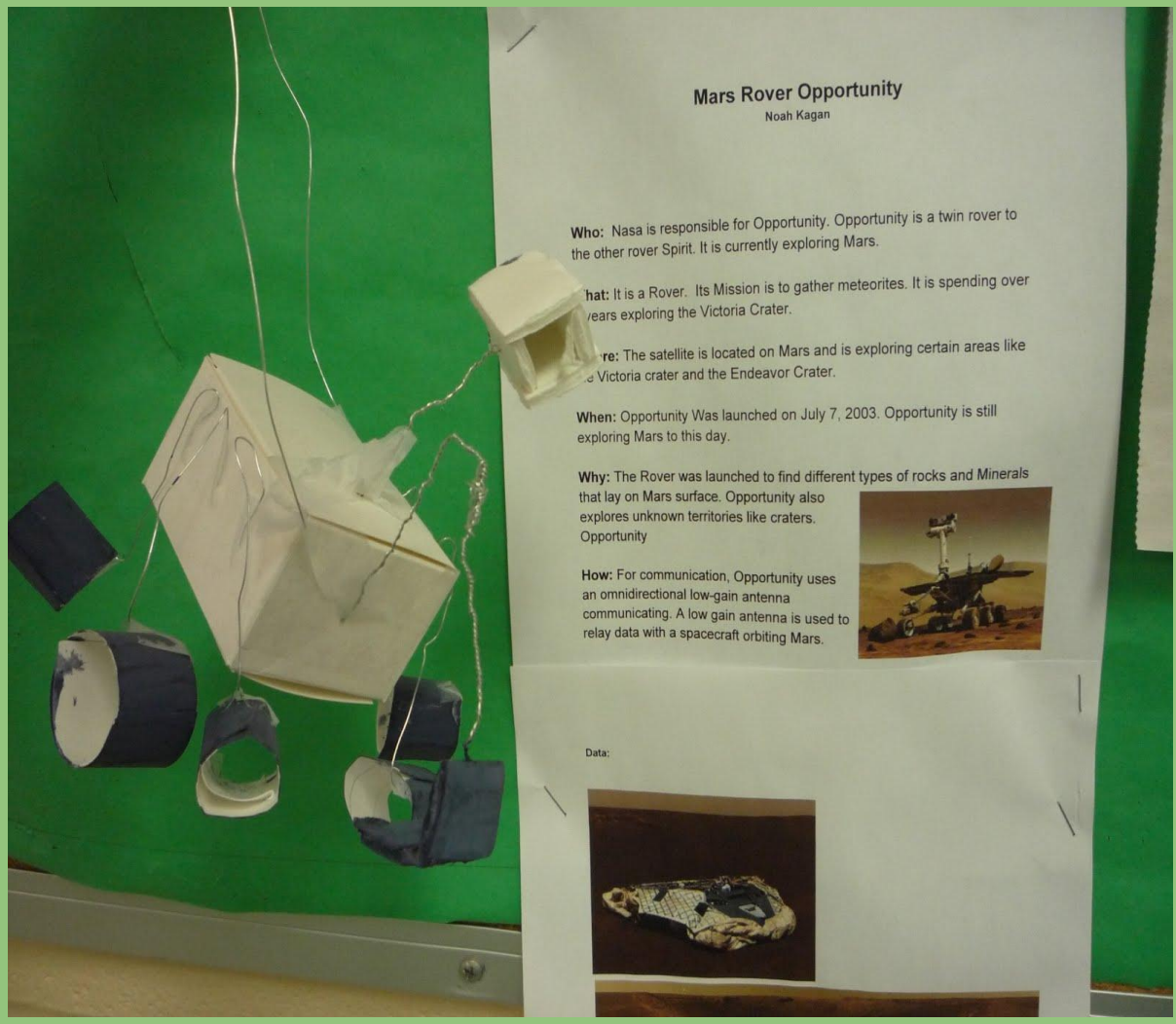
-Expansion of my satellite project

-Transition activity

Requirements:

Word document "poster"

Model of remote sensing instrument



NEEMO 16

WHAT- NASA's Extreme Environment Mission Operations, this expedition involves a crew of astronauts and scientists spending between two to three weeks in the Aquarius Reef Base.

WHO- NOAA (National Oceanic and Atmospheric Administration.), NASA (National Aeronautics and Space Administration.) and NMS (National Marine Sanctuary) are responsible for this expedition. Dr. Steve Gittings provides support for geological, chemical and biological research.

WHERE- 60 feet below the surface of Florida's keys National Marine sanctuary.NEEMO is the world's only undersea laboratory.

WHEN- The crew left June 11th and they will stay underwater for about two to three weeks at a time.

WHY- The objective is to focus on asteroid mission scenarios. The

NEEMO studies under water animals and water temperature.

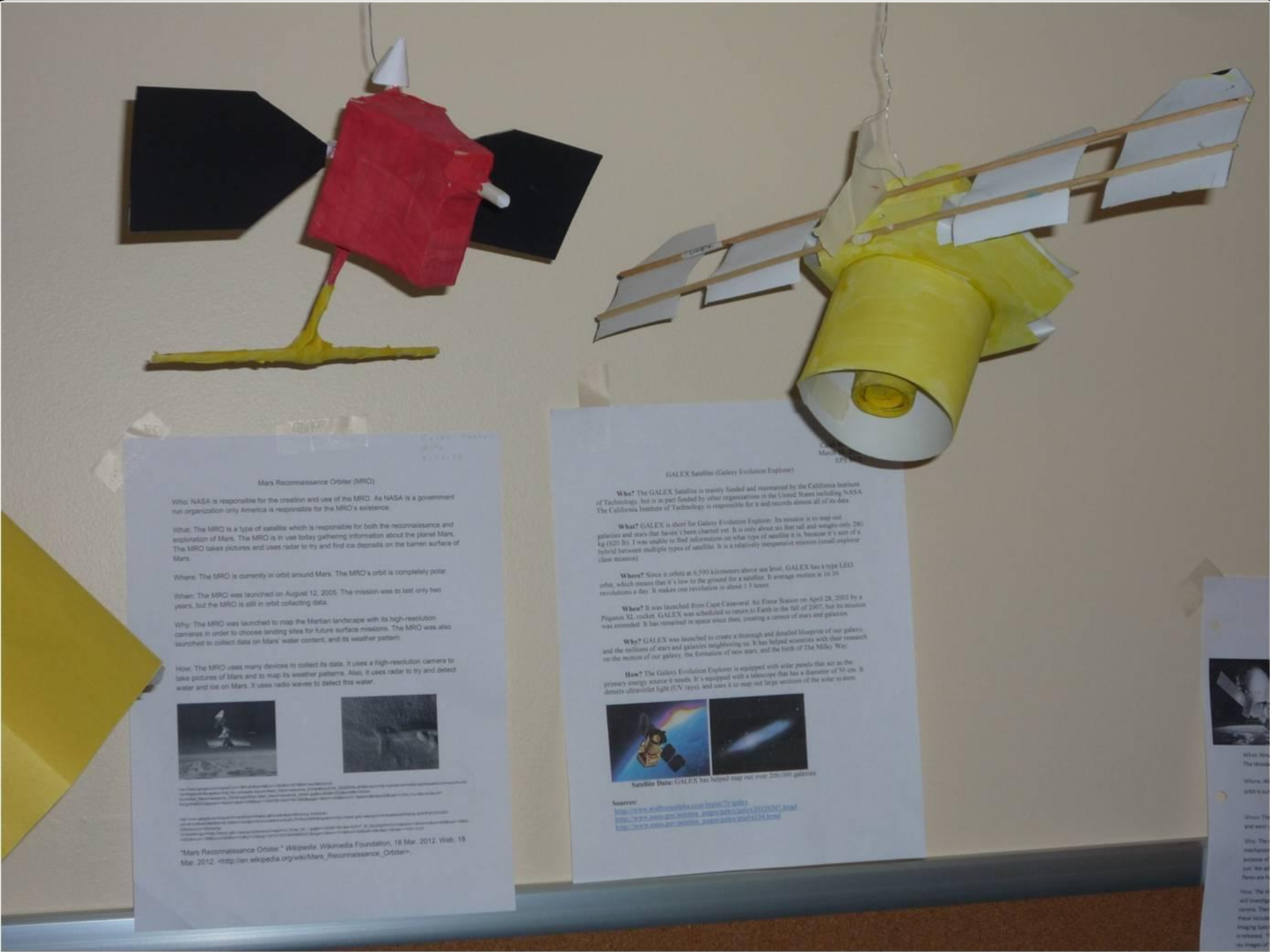
HOW- NEEMO missions are performed in the isolation, constrained habitat and crew quarters. Harsh environment and reduced gravity challenge aquanauts to perform mission operations. The NEEMO uses visible light and solar panels.

Citations-

http://sanctuaries.noaa.gov/science/neemo/welcome.html

http://www.nasa.gov/pdf/585011main_TS-2012-06-619-JSC_NEEMO_16_508.pdf
Lyndon B. Johnson Space Center
Houston, Texas 77058

http://www.nasa.gov/mission_pages/NEEMO/index.html



Mars Reconnaissance Orbiter (MRO)

Who: NASA is responsible for the creation and use of the MRO. As NASA is a government run organization only America is responsible for this MRO's existence.

What: The MRO is a type of satellite which is responsible for both the reconnaissance and exploration of Mars. The MRO is in use today gathering information about the planet Mars. The MRO takes pictures and uses radar to try and find ice deposits on the barren surface of Mars.

Where: The MRO is currently in orbit around Mars. The MRO's orbit is completely polar.

When: The MRO was launched on August 12, 2005. The mission was to last only two years, but the MRO is still in orbit collecting data.

Why: The MRO was launched to map the Martian landscape with its high-resolution cameras in order to choose landing sites for future surface missions. The MRO was also launched to collect data on Mars' water content, and its weather pattern.

How: The MRO uses many devices to collect its data. It uses a high-resolution camera to take pictures of Mars and to map its weather patterns. Also, it uses radar to try and detect water and ice on Mars. It uses radio waves to detect this water.

"Mars Reconnaissance Orbiter." *Wikipedia*. Wikimedia Foundation, 18 Mar. 2012. Web. 18 Mar. 2012. <http://en.wikipedia.org/wiki/Mars_Reconnaissance_Orbiter>.

GALEX Satellite (Galaxy Evolution Explorer)

Who? The GALEX Satellite is mainly funded and maintained by the California Institute of Technology, but is in part funded by other organizations in the United States including NASA. The California Institute of Technology is responsible for it and records almost all of its data.

What? GALEX is short for Galaxy Evolution Explorer. Its mission is to map out galaxies and stars that haven't been charted yet. It is only about six feet tall and weighs only 280 kg (620 lb). I was unable to find information on what type of satellite it is, because it's sort of a hybrid between multiple types of satellite. It is a relatively inexpensive mission (small explorer class mission).

Where? Since it orbits at 6,590 kilometers above sea level, GALEX has a type LEO orbit, which means that it's low to the ground for a satellite. It average motion is 16.36 revolutions a day. It makes one revolution in about 1.5 hours.

When? It was launched from Cape Canaveral Air Force Station on April 28, 2003 by a Pegasus XL rocket. GALEX was scheduled to return to Earth in the fall of 2007, but its mission was extended. It has remained in space since then, creating a census of stars and galaxies.

Why? GALEX was launched to create a thorough and detailed blueprint of our galaxy, and the millions of stars and galaxies neighboring us. It has helped scientists with their research on the motion of our galaxy, the formation of new stars, and the birth of The Milky Way.

How? The Galaxy Evolution Explorer is equipped with solar panels that act as the primary energy source it needs. It's equipped with a telescope that has a diameter of 50 cm. It detects ultraviolet light (UV rays), and uses it to map out large sections of the solar system.

Satellite Data: GALEX has helped map out over 200,000 galaxies.

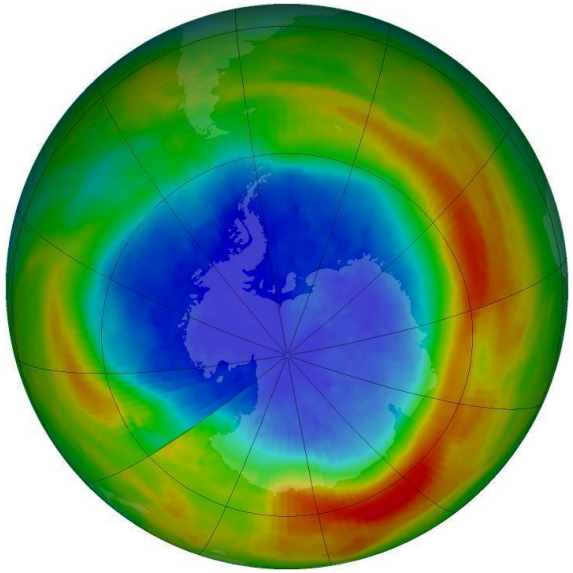
Sources:

http://www.wolframalpha.com/input/?i=galex

http://www.nasa.gov/mission_pages/galex/galex20120207.html

http://www.nasa.gov/mission_pages/galex/galex4334.html

Ozone Project



Learn more about ozone

Design a unique question to research

- spend time on this step
- most groups need assistance
- keep working until question is specific

to simplify research

Ozone Research Questions

Student generated topics

-How does the ozone hole affect the arctic food web?

-Is there a connection between bad ozone and global warming?

-What is the cost of smog related health issues?

-What is bad ozone doing to plants?

-Is the thinning ozone layer increasing mutations?

-Is there a link between smog and asthma?

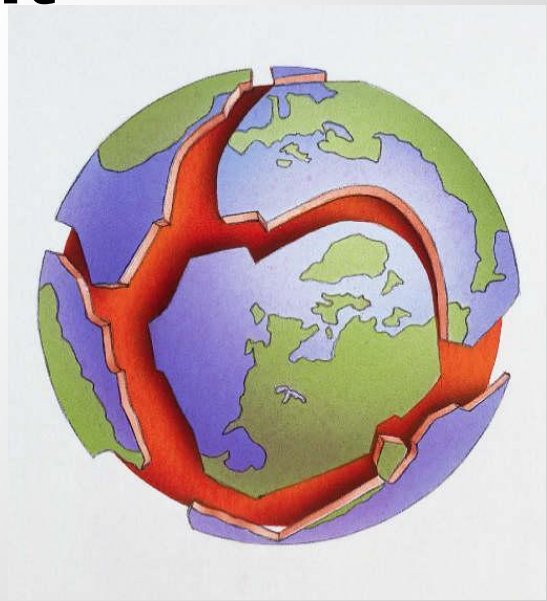
-Can the ozone hole be repaired?

Examples of Ozone Project

Plate Tectonics Lab

Extension of class lab

Students ask a question and design an experiment to answer it



Earthquake lab videos

earth quake lab video #1

earth quake video #2

slow motion video

Core Concepts revisited throughout the school year

Examples:

Density

Convection

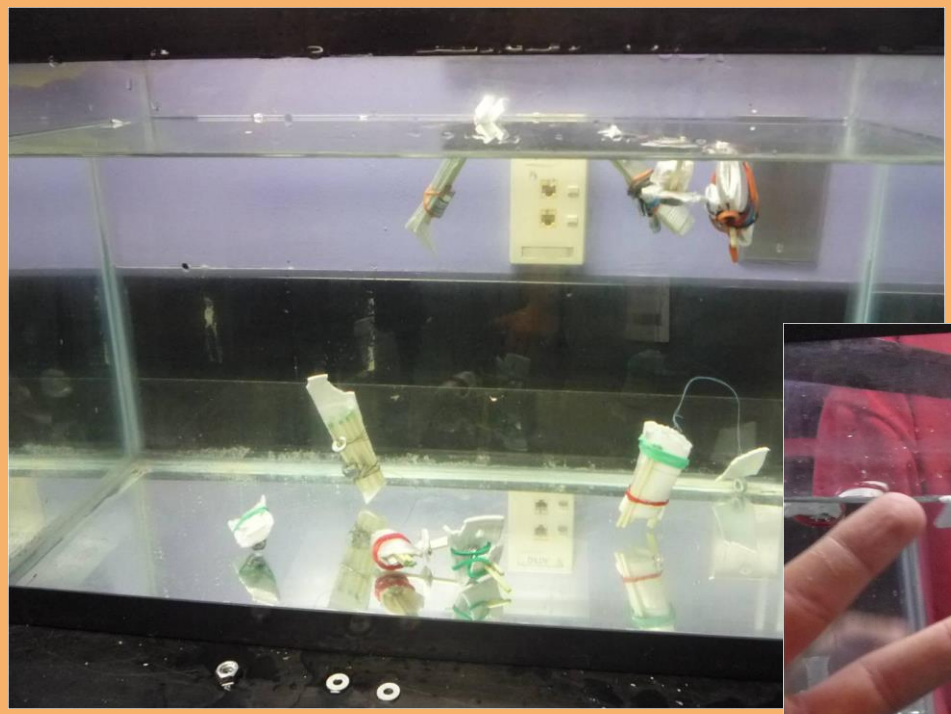
Electromagnetic Spectrum

Density

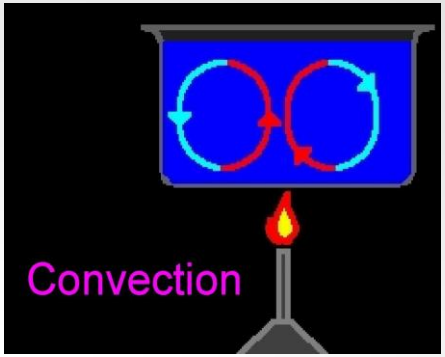
Begin year with review and lab activities, then revisit

- ocean exploration, water temps, salinity, ROV currents, thermohaline circulation
- construct a neutrally bouyant object
- convection
- air masses and fronts
- cloud formation

Designing a neutrally bouyant object

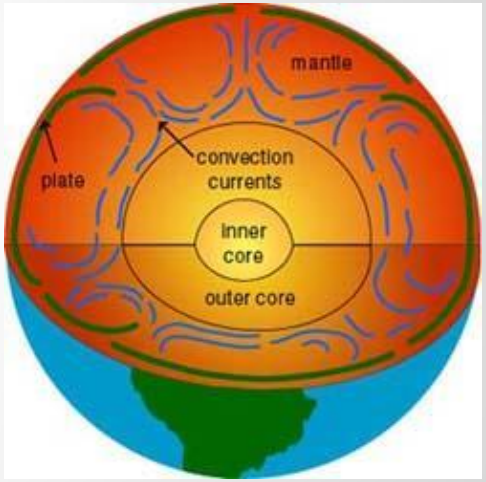


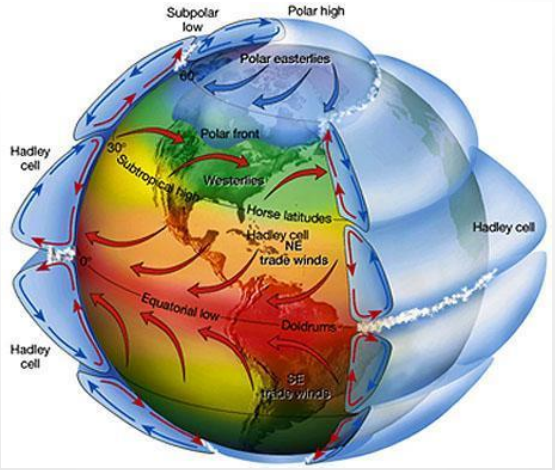
Convection

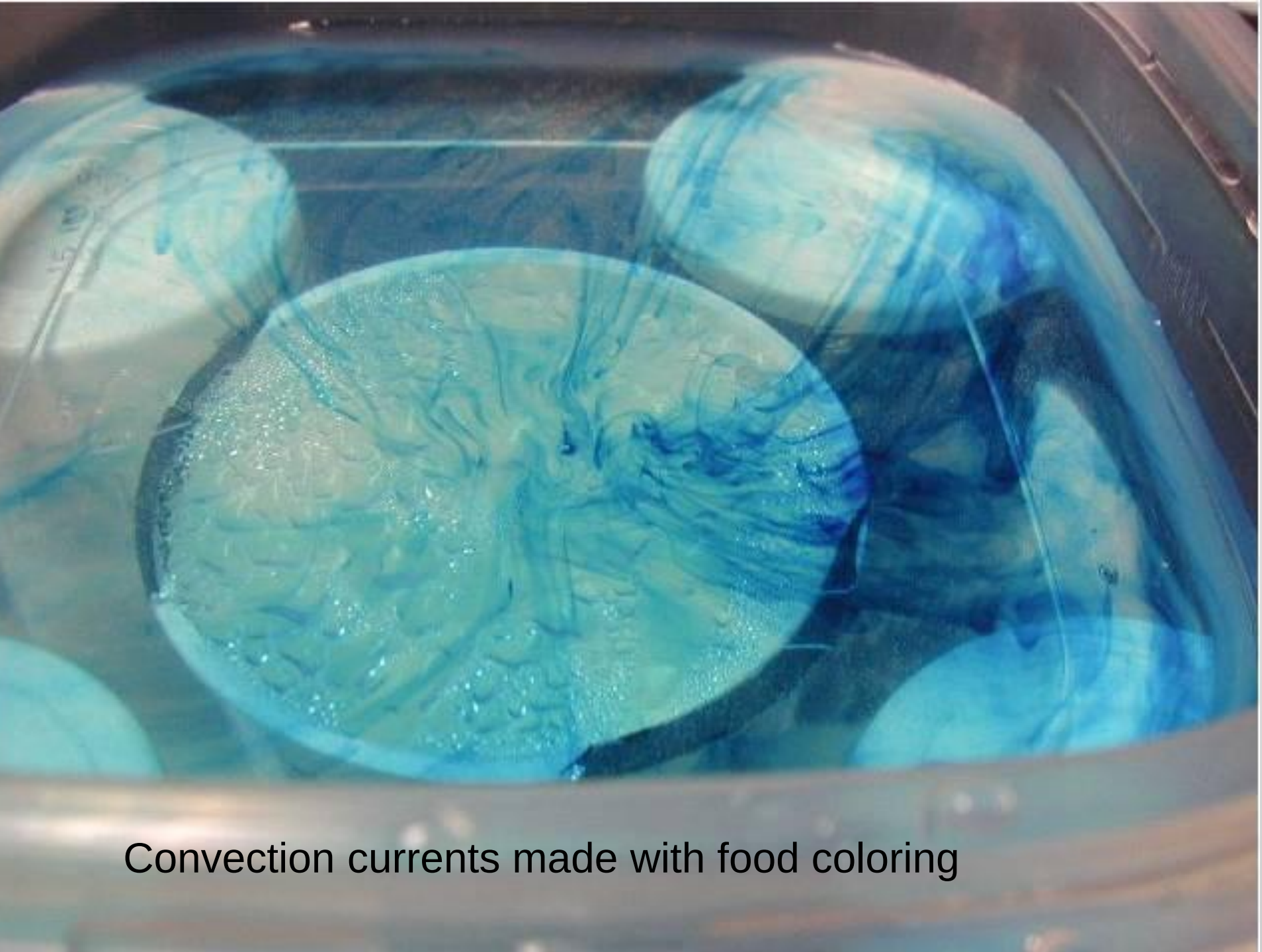


introduced after density, then revisited

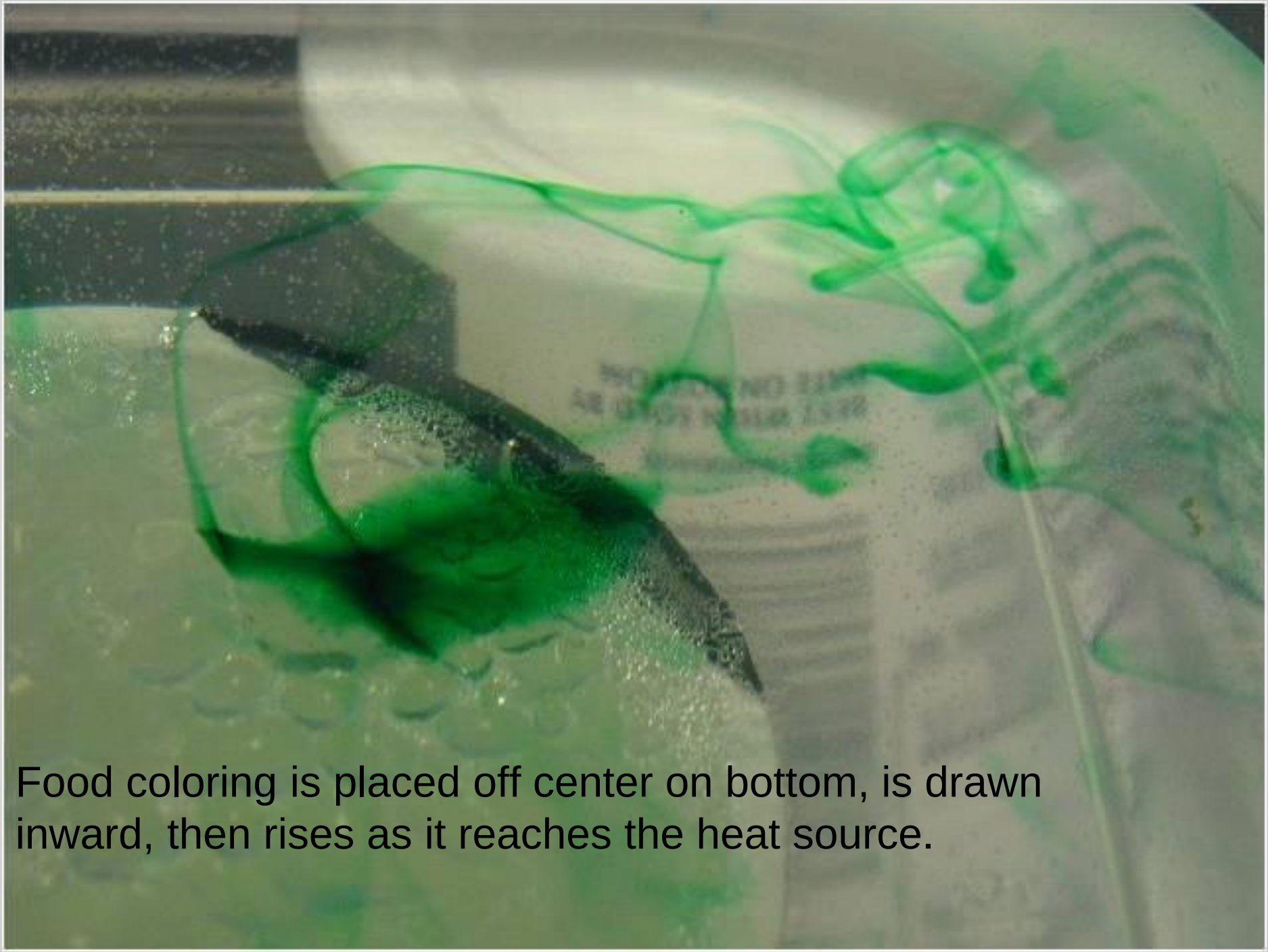
- convection currents within mantle of earth, plate tectonics
- convection currents within sun
- transfer of energy via convection in atmosphere, cloud formation, winds







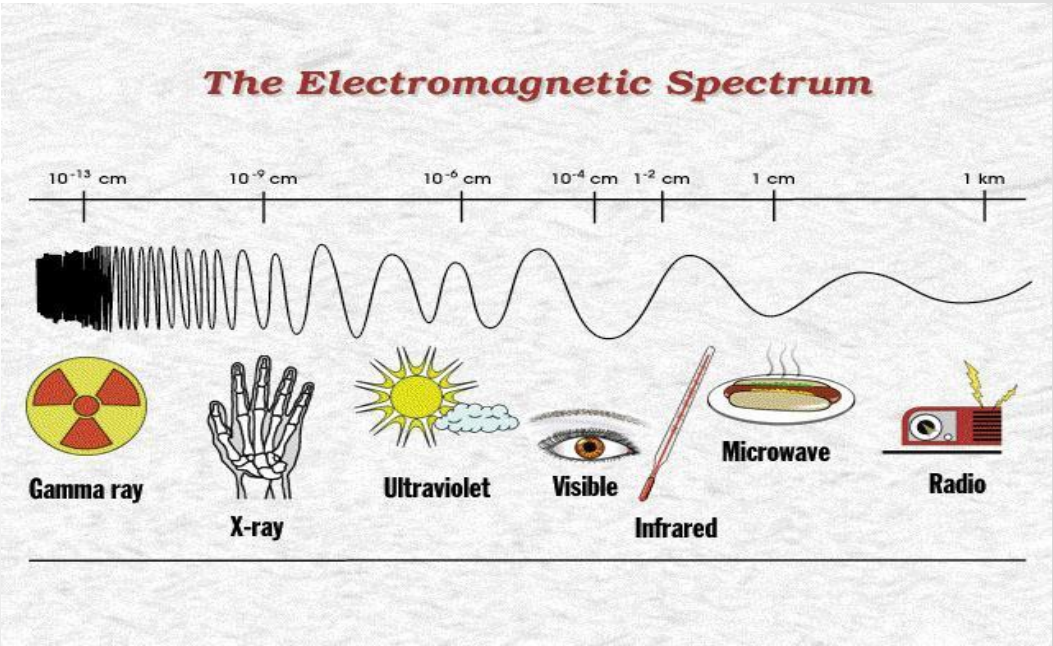
Convection currents made with food coloring



Food coloring is placed off center on bottom, is drawn inward, then rises as it reaches the heat source.

Electromagnetic Spectrum

- remote sensing
- astronomy, telescopes
- atmosphere, ozone, earth's energy budget



Resources

My Nasa Data

SWAC

NOAA

NASA

Windows to the Universe