

6.17: Earth and Impacts (Exercises)

For Further Exploration

Articles

Earth

Collins, W., et al. "The Physical Science behind Climate Change." *Scientific American* (August 2007): 64. Why scientists are now confident that human activities are changing our planet's climate.

Glatzmaier, G., & Olson, P. "Probing the Geodynamo." *Scientific American* (April 2005): 50. Experiments and modeling that tell us about the source and reversals of Earth's magnetic field.

Gurnis, M. "Sculpting the Earth from Inside Out." *Scientific American* (March 2001): 40. On motions that lift and lower the continents.

Hartmann, W. "Piecing Together Earth's Early History." *Astronomy* (June 1989): 24.

Jewitt, D., & Young, E. "Oceans from the Skies." *Scientific American* (March 2015): 36. How did Earth get its water after its initial hot period?

Impacts

Boslaugh, M. "In Search of Death-Plunge Asteroids." *Astronomy* (July 2015): 28. On existing and proposed programs to search for earth-crossing asteroids.

Brusatte, S. "What Killed the Dinosaurs?" *Scientific American* (December 2015): 54. The asteroid hit Earth at an already vulnerable time.

Chyba, C. "Death from the Sky: Tunguska." *Astronomy* (December 1993): 38. Excellent review article.

Durda, D. "The Chelyabinsk Super-Meteor." *Sky & Telescope* (June 2013): 24. A nice summary with photos and eyewitness reporting.

Gasperini, L., et al. "The Tunguska Mystery." *Scientific American* (June 2008): 80. A more detailed exploration of the site of the 1908 impact over Siberia.

Kring, D. "Blast from the Past." *Astronomy* (August 2006): 46. Six-page introduction to Arizona's meteor crater.

Websites

Earth

Astronaut Photography of Earth from Space: earth.jsc.nasa.gov/. A site with many images and good information.

Exploration of the Earth's Magnetosphere: <http://phy6.org/Education/Intro.html>. An educational website by Dr. Daniel Stern.

NASA Goddard: Earth from Space: Fifteen Amazing Things in 15 Years: <https://www.nasa.gov/content/goddard...gs-in-15-years>. Images and videos that reveal things about our planet and its atmosphere.

U.S. Geological Survey: Earthquake Information Center: <http://earthquake.usgs.gov/learn/>

Views of the Solar System: <http://www.solarviews.com/eng/earth.htm>. Overview of Earth.

Impacts

B612 Foundation : <https://b612foundation.org/>. Set up by several astronauts for research and education about the asteroid threat to Earth and to build a telescope in space to search for dangerous asteroids.

Lunar and Planetary Institute: Introduction to Terrestrial Impact Craters: <http://www.lpi.usra.edu/publications...esets/craters/>. Includes images.

Meteor Crater Tourist Site: <http://meteorcrater.com/>.

NASA/Jet Propulsion Lab Near Earth Object Program: <http://neo.jpl.nasa.gov/neo/>.

What Are Near-Earth-Objects: <http://spaceguardcentre.com/what-are-neos/>. From the British Spaceguard Centre.

Videos

Earth

All Alone in the Night: <http://apod.nasa.gov/apod/ap120305.html>. Flying over Earth at night (2:30).

Earth Globes Movies (including Earth at night): astro.uchicago.edu/cosmos/projects/earth/.

PBS NOVA Videos about Earth: <http://www.pbs.org/wgbh/nova/earth/>. Programs and information about planet Earth. Click full episodes on the menu at left to be taken to a nice array of videos.

U. S. National Weather Service: <http://earth.nullschool.net>. Real Time Globe of Earth showing wind patterns which can be zoomed and moved to your preferred view.

Impacts

Chelyabinsk Meteor: Can We Survive a Bigger Impact?: <https://www.youtube.com/watch?v=Y-e6xyUZLLs> . Talk by Dr. David Morrison (1:34:48).

Large Asteroid Impact Simulation: <https://www.youtube.com/watch?v=bU1QPtOZQZU>. Large asteroid impact simulation from the Discovery Channel (4:45).

Meteor Hits Russia February 15, 2013: <https://www.youtube.com/watch?v=dpmXyJrs7iU>. Archive of eyewitness footage (10:11).

Sentinel Mission: Finding an Asteroid Headed for Earth: https://www.youtube.com/watch?v=efz8c3ijD_A. Public lecture by astronaut Ed Lu (1:08:57).

Review Questions

1. What is the thickest interior layer of Earth? The thinnest?
2. What are Earth's core and mantle made of? Explain how we know.
3. Explain briefly how the following phenomena happen on Earth, relating your answers to the theory of plate tectonics:
 1. earthquakes
 2. continental drift
 3. mountain building
 4. volcanic eruptions
 5. creation of the Hawaiian island chain
4. What is the source of Earth's magnetic field?
5. Why is the shape of the magnetosphere not spherical like the shape of Earth?
6. Although he did not present a mechanism, what were the key points of Alfred Wegener's proposal for the concept of continental drift?
7. List the possible interactions between Earth's crustal plates that can occur at their boundaries.
8. List, in order of decreasing altitude, the principle layers of Earth's atmosphere.
9. In which atmospheric layer are almost all water-based clouds formed?
10. What is, by far, the most abundant component of Earth's atmosphere?
11. Describe three ways in which the presence of life has affected the composition of Earth's atmosphere.
12. Briefly describe the greenhouse effect.
13. How do impacts by comets and asteroids influence Earth's geology, its atmosphere, and the evolution of life?
14. Why are there so many impact craters on our neighbor world, the Moon, and so few on Earth?

Thought Questions

1. If you wanted to live where the chances of a destructive earthquake were small, would you pick a location near a fault zone, near a mid ocean ridge, near a subduction zone, or on a volcanic island such as Hawaii? What are the relative risks of earthquakes at each of these locations?
2. Which type of object would likely cause more damage if it struck near an urban area: a small metallic object or a large stony/icy one?
3. If all life were destroyed on Earth by a large impact, would new life eventually form to take its place? Explain how conditions would have to change for life to start again on our planet.
4. Why is a decrease in Earth's ozone harmful to life?

5. Why are we concerned about the increases in CO₂ and other gases that cause the greenhouse effect in Earth's atmosphere? What steps can we take in the future to reduce the levels of CO₂ in our atmosphere? What factors stand in the way of taking the steps you suggest? (You may include technological, economic, and political factors in your answer.)
6. Do you think scientists should make plans to defend Earth from future asteroid impacts? Is it right to intervene in the same evolutionary process that made the development of mammals (including us) possible after the big impact 65 million years ago?

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