Earth Science: Grade 1, Semester 2

Energy Force and Power

Big Idea: Gravitational, rotational, thermal, nuclear and electromagnetic forces drive the processes that shape the earth and ecosystems provide energy resources for human consumption. The Earth system processes and dynamics are controlled and powered by different soures and mechanisms: the sun's energy, geothermal energy, Earth's magnetic and gravitational forces. Several energy transformation processes control the Earth's interior and exterior dynamics (plate techtonics, volcanism, earthquakes).

ES.1.08 - Students will analyze and identify common ore minerals that are used as a resource for modern industries. (Week 01 - Week 02)

Essential Questions: What is the relationship between ore minerals an Egyptian history?

Skills:

▸A. Identify and discriminate among common Fe-ores (magnetite, hematite, pyrite), common Cu-ores (chalcopyrite, malachite, native Cu), Pb-ores (sphalerite, galena), and precious metals (native Au and native Ag) as well as other important Egyptian ore minerals.

▸B. Interpret geologic processes from textural evidence in ore deposit hand samples or outcrops.

▸C. Identify and use different tools to measure physical properties of minerals.

▸ D. Using microscopic scale features to interpret and classify different types of ore minerals.

▸ E. Use different geologic maps that show occurrences of ore minerals in Egypt.

Concepts:

▸A) Different earth materials and ore minerals have different chemical, physical and engineering properties making them suitable for different economic industries.

▸B) Common ore minerals include both relatively oxidized (some oxides, hydroxides, carbonates) and relatively reduced (some oxides, sulfides) compounds of metals as well as native elements.

▸C) Ore minerals must become concentrated by some geologic process to produce an economic mineral deposit. Igneous, sedimentary, and metamorphic processes can all produce ore deposits.

▸D) Modern electronics technologies require new materials, such as rare earth elements, that must also be extracted from earth materials, creating new ores and new industries.

Evidence:

Successfully identify and differentiate common ore minerals in hand samples.

Successfully connect different types of metals and their ores to different uses (e.g. Cu for piping in construction and for wires in electronics and consumer goods, Fe in automobiles, construction, appliances, etc)

Know and describe important historical and modern ore deposits in Egypt.

Know and describe important global sources of commonly used metal ores (e.g Cu from Chile and western US, rare earth elements from China, etc.)

Texts & References: Week 1: ▸

Student Activity: Cell phone minerals:
http://www.mineralseducationcoalition.org/sites/default/files/uploads/cell_phone_activity_0.pdf and
http://www.mineralseducationcoalition.org/pdfs/Cell-Phone.pdf

▸

Student Activity: Grade 1 Laboratory Manual: Ore Deposits in Egypt – look at ore samples and describe

▸

Student Activity: Chapter 7, Section 6, Part A, B, C, p. 790-793

Week 2: ▸

Student Activity: Chapter 7, Section 7, Investigate, p. 803-804

Capstone Connection: Application of knowledge and understanding the different earth materials and ore applies to possible alternative engergy designs and materials to use

Grand Challenge Connections: Address the exponential population growth and prepare for the impact,Increase opportunities for Egyptians to stay and work in Egypt,Increase efficient use of our land through improved use of arid areas,Increase industrial base for Egypt

Topic: Metallic ore deposits

ES.1.09 - Students will understand the different resources used by different countries to meet their energy needs. (Week 03 - Week 04)

Essential Questions: What are energy resources?

Skills:

▸A) Use the statistical studies to analyze the data for different energy resources in Egypt and calculate the future needs as a function of the exponential growth of population.

▸ B) Compare the use of energy resources for electricity generation in Egypt to those used in other countries using different statistical charts and visualization figures.

▸ C) Students will conduct an analysis of the socioeconomic and environmental impacts of the Aswan High Dam and explore the potential of tidal generation.

▸ D) Arrange the energy resources according to different factors (current and future availability, current and future need, cost of production…., etc).

Concepts:

A. Electrical energy and transportation fuels come from a variety of natural resources.

Evidence:

Describe different energy resources available in Egypt

Texts & References: Week 3: ▸

Student Activity: Chapter 7, Section 1, Investigate, Part A, p. 726-727

▸

Teacher synthesis: Relationship of population and technology to energy consumption. Engage students in discussing Egypt energy needs for next 50 years.

Week 4: ▸

Student Activity: Chapter 7, Section 1, Investigate, Part B, p. 728

Capstone Connection: This relates directly to the Capstone which is about designing alternative energy systems.

Grand Challenge Connections: Address the exponential population growth and prepare for the impact,Improve the use of alternative energies to reduce our reliance on extracted fuel sources,Increase industrial base for Egypt

Topic: Energy resources (electricity)

ES.1.10 - Students will evaluate potential renewable energy sources in Egypt to replace dependence upon fossil fuels. (Week 05 - Week 06)

Essential Questions: What resources could be developed in Egypt to provide more sources of energy?

Skills:

▸A. Investigate the use of solar energy by constructing a solar water heater and determining its maximum energy output.

▸ B. Investigate the use of wind energy by constructing an anemometer to measure wind speeds and calculating how much power can be generated by wind.

Concepts:

▸A) Electrical energy and transportation fuels come from a variety of natural resources.

▸ B) Directly capturing the sun's energy through solar panels or wind energy through turbines, is a renewable way to provide heat, hot water, and electricity.

▸ C) Electrical energy could be generated by hydroelectric - from dams or by tidal movement of water.

Evidence:

The efficiency of the solar water heater

The precision of measurement of the anemometer and calculations of wind generated power

Texts & References: Week 5: ▸

Student Activity: Chapter 7, Section 5, Investigate, Part A, p. 778-779

▸

Teacher synthesis note: The book uses BTUs, a non-metric measure, skip all of the Btu calculations and just calculate kW-hr/m2/day without converting

Week 6: ▸

Student Activity: Chapter 7, Section 5, Investigate, Part B, p. 780-781

▸

Teacher synthesis: Discuss relationship of wind power to turbine diameter, p781.

Capstone Connection: This relates directly to the Capstone which is about designing alternative energy systems.

Grand Challenge Connections: Address the exponential population growth and prepare for the impact,Improve the use of alternative energies to reduce our reliance on extracted fuel sources,Increase industrial base for Egypt

Topic: solar, wind, alternative energies

ES.1.11 - Students will be able to recognize the processes by which fossil fuels (coal) are extracted and processed for human use. (Week 07 - Week 08)

Essential Questions: How does nature store energy?

Skills:

▸A) Examine coal samples to understand the physical properties of different types of coal.

▸ B) Read and interpret different maps that show the distribution of coal in Egypt.

▸ C) Use data on trends of different fossil fuels production and consumption to extrapolate into the future.

Concepts:

▸A) Coal is a source of trapped energy from the sun, accessible by mining, with extensive reserves.

▸ B) Reserves of coal are limited and are distributed in unequal ways, geographically.

▸C) Impact of the use of coal on the environment

Evidence:

Understanding and Applying questions

Texts & References: Week 5: ▸

Student Activity: Chapter 7, Section 2, Investigate, Part A and B, p. 736-737.

Week 6:
Student Activity: Chapter 7, Section 2, Investigate, Part C and D, p. 736-737. (need a map of Egyptian coal fields)
Capstone Connection: Apply knowledge and information to alternative energy Capstone Challenge
Grand Challenge Connections: Increase industrial base for Egypt
Topic: fossil fuels, mining, coal

ES.1.12 - Students will be able to recognize the processes by which fossil fuels (petroleum and natural gas) are extracted and processed for human use. (Week 09 - Week 10)

Essential Questions: How does nature store energy?
Skills:

- A) Examine Petroleum samples to understand the chemical and physical properties of different types of Petroleum.
- B) Read and interpret different maps that show the distribution of fossil fuels (Petroleum and Natural gas) in Egypt.
- C) Design investigations to explore porosity and permeability of rock bodies and to consider how these factors affect the volume and rate of production in oil and gas fields.
- D) Use data on trends in different fossil fuels production and consumption to extrapolate into the future.
- E) Explore new methods to decrease significantly our dependence on the use of fossil fuels.

Concepts:

- A) Petroleum and natural gas are fluid resources that accumulate in natural reservoirs and can be extracted by drilling.
- B) Reserves of petroleum and natural gas are limited and are distributed in unequal ways, geographically.

Evidence:
Understanding and Applying questions
Texts & References: Week 9:
Student Activity: Chapter 7, Section 3, Investigate, Part A and B, p. 749-750. It is important to conduct this as an open inquiry into porosity, allowing students to exercise their own experimental design skills

Teacher synthesis: include source rock
Important – if B is not finished, save bottles with water and oil still inside and cover them with plastic wrap or aluminum foil to prevent evaporation

Week 10:
Student Activity: Chapter 7, Section 3, Investigate, Part B and C, p. 736-737.

Teacher synthesis: Make sure students understand that oil and gas are finite resources
Add recent data e.g. http://www.tradingeconomics.com/united-states/crude-oil-production
Capstone Connection: Apply knowledge and information to alternative energy Capstone Challenge
Grand Challenge Connections: Improve the use of alternative energies to reduce our reliance on extracted fuel sources,Increase industrial base for Egypt
Applications: BI.1.13,
Topic: petroleum, natural gas, fossil fuels, fuel extraction

ES.1.13 - Students will be able to evaluate environmental impacts of fossil fuel resource use and suggest innovative alternatives. (Week 11 - Week 12)

Essential Questions: What is pollution?

Skills:

- A) Examine maps that show the acidity of rainfall across Egypt, and correlate the pattern of rainwater pH to the distribution of fossil fuel producing and consuming regions.
- B) Examine the effect of the acidity of water on different rock units.
- C) Explore new methods to decrease significantly the environmental impact as a result of using the fossil fuel.

Concepts:

A. Burning fossil fuels to extract energy has a number of environmental effects one of which is acid rain

Evidence:

Analysis questions

Texts & References: Week 11:

Student Activity: Chapter 7, Section 4, Investigate, Part A, p. 764-765. Student discussion and map interpretation

Teacher Demonstration – acid on crushed limestone and crushed granite.

Teacher synthesis: Make sure that students understand the interaction of smokestack emissions (nitrous oxide, sulfur dioxide, carbon dioxide) and water droplets to produce acid rain.

Week 12:

Student Activity: Chapter 7, Section 3, Investigate, Part B, p. 765-767 – graph interpretation, discussion, and analysis questions.

Teacher synthesis: What are the oil spill threats to Egypt?

Capstone Connection: Apply knowledge and information to alternative energy Capstone Challenge

Grand Challenge Connections: Reduce pollution fouling our air water and grounds

Topic: fossil fuels, pollution, acid rain

Geology

Grade 10

Semester 2