Energy

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Understanding Energy

- Distinguish between endothermic and exothermic reactions by constructing potential energy diagrams and explain the differences between the two using chemical terms (e.g. activation energy)
- Recognize when energy is absorbed or given off depending on the bonds formed and bonds broken
- Compare and contrast the concepts of temperature and heat in macroscopic and microscopic terms
- Demonstrate understanding that thermal energy is a form of energy and temperature is a measure of average kinetic energy of a group of particles
- Investigate and compare existing and developing technologies that utilize renewable and alternative energy resources
- Explain the relationships between potential energy, distance between approaching atoms, bond length, and bond energy using graphical representations
- Create more complex electrical circuits using solid state components and circuit boards

Conservation of Energy and Energy Transfer

- Identify myths of different types of energy and how people think they affect ecosystems
- Create a model of photosynthesis demonstrating the net flow of matter and energy into a cell. Use the model to explain energy transfer from light energy into stored chemical energy in the product
- Research and gain an understanding of third law of dynamics-thermodynamics and create an interactive exhibit to explain your findings
- Draw and interpret heating and cooling curves and phase diagrams
- Analyze the energy changes involved in calorimetry by using the law of conservation of energy quantitatively (use of $q = mc\Delta T$) and qualitatively
- Analyze energy changes to explain and defend the law of conservation of energy
- Construct an explanation for how atmospheric flow, geographic features, and ocean currents affect the climate of a region through heat transfer
- Apply scientific principles to design a method to analyze and interpret the impact of humans and other organisms on the hydrologic cycle

Relationship Between Energy and Forces and Fields

- Design and conduct investigations depicting the relationship between magnetism and electricity in electromagnets, generators, and electrical motors, emphasizing the factors that increase or diminish the electric current and the magnetic field strength
- Use Coulomb's law and patterns of valence electron configurations to explain trends in ionization energies and reactivity of pure elements

Energy in Chemical Processes and Everyday Life

- Interpret data to explain that earth's mineral, fossil fuel, and groundwater resources are unevenly distributed as a result of geologic processes (Ex: China and Lithium)
- Graphically represent the composition of the atmosphere as a mixture of gases and discuss the potential for atmospheric change
- Engage in a scientific argument through graphing and translating data regarding human activity and climate
- Draw, identify, and contrast graphical representations of chemical bonds (ionic, covalent, and metallic) based on chemical formulas. Construct and communicate explanations to show that atoms combine by transferring or sharing electrons
- Research how AI may play a role in the future of energy

Influence of Engineering, Technology, and Science on Society and the Natural World

- Investigate if we can recycle solar panels. What is the life span of a solar panel and what do we do with the solar panels after their life span?
- Research pyrotechnics and use concepts in thermodynamics, stoichiometry, oxidation reduction, and kinetics to design and create a low intensity sparkler
- Conduct a school or community energy assessment and develop a service-learning plan to save energy
- Explore the role electronics play within the health care industry and the impact they have in keeping humans healthy