Honeycutt Science ™

Physical Science Topic 36

Overview

Topics **36** & **37** provide students an opportunity to further pursue an area of interest. Select from one of these broad areas:

- Chemistry
- Motion
- Energy
- Electromagnetism

Instructions

There are four ways students may choose to pursue their interest:

- class demonstration — *Individual or small group*
- research paper — *Individual only*
- class lesson — *Individual or small group*
- science model — *Individual or small group*

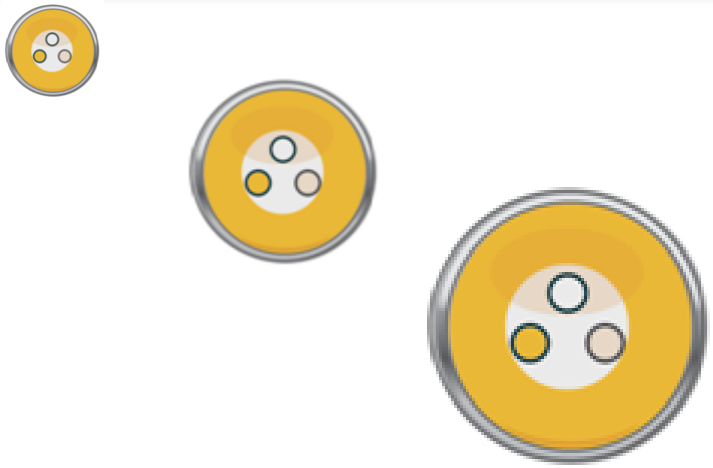
1. Select one of four ways to accomplish this assignment.
2. Select a different way to do the next assignment.
3. Choose an “Area of Interest” with a specific aspect to investigate
4. Remain productively busy on your work throughout the allotted time.
5. Complete your work by the deadline stated by the instructor.
6. Appropriately challenge yourself during this assignment.
7. Include an emphasis on quality and completeness of work.

Chemistry

Atomic Properties and the Periodic Table

The periodic table can be used to identify atomic behaviors/properties and predict the outcome of chemical reactions.

1. Elements are placed on the Periodic Table according to repeating patterns of physical and chemical properties, as well as reactivity patterns. (15)
2. Atomic size decreases going across a period of the table due to increasing nuclear charge. Atomic size increases down a group of elements due to addition of energy levels. (15)
3. All matter is conserved, just broken apart and rearranged to form new molecules/substances. (17)
4. A chemical bond is an attractive force not a physical thing at all. (17)
5. The electron cloud is a "cloud" because of the motion of the electron in orbit around the nucleus, and mostly made up of empty space. (16)
6. Periods on the periodic table are based on the energy levels an atom has. (15)
7. The atomic number of an atom indicates the number of protons an atom has which determines what element and therefore the chemical properties it possesses. (16)
8. Changing the number of electrons an atom has will change its reactivity with atoms around it. (19)



Atomic Properties and the Periodic Table

Properties of Chemical Reactions and Conservation of Energy

Properties of Chemical Reactions and Conservation of Energy

Chemical reactions always start and end with the same amount of atoms, though they will be arranged differently. Furthermore; how fast the reaction occurs, and if energy is stored or released is all determined by the collisions of the molecules that make up the chemical reaction. The number of collisions of molecules during a chemical reaction can be influenced by temperature as well as the amount of particles present during a reaction.

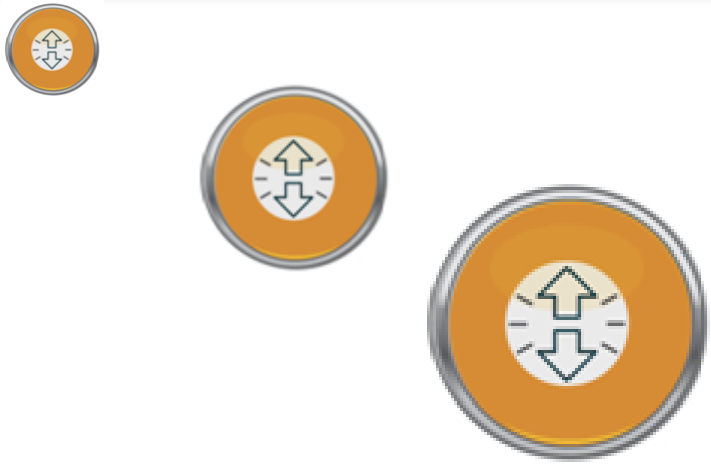
1. Although the substance changes forms, the atoms are still there. In a closed system you will see no change in mass. (17)
2. A chemical reaction will only happen if a collision occurs, however more requirements, such as orientation and available kinetic energy, must also be met. (17)
3. All matter is conserved, just broken apart and rearranged to form new molecules/substances. (17)

Motion

Acceleration and Things That Cause Acceleration

Applying a force to an object will cause acceleration. The size of this acceleration is determined by the mass of the object and the size of force applied. An applied force will cause a change in the types of energy in the system, therefore the energy found in waves and the interaction of waves and their environment will cause accelerations.

1. If a force acts on an object in the same direction as the direction of its motion, the object's speed will continue to increase while the force is acting. (22)
2. Energy can be transferred from one system to another (or from a system to its environment) in different ways: by conduction, mechanically, electrically, or by radiation (electromagnetic waves). (24)
3. Energy can be transferred within a system. Regardless of what happens within a system, the total amount of energy in the system remains the same unless energy is added to or released from the system. (25)
4. Energy can be transformed (converted) within a system. (25)



Momentum

Momentum is determined by the speed of an object and the direction it is traveling (velocity) of an object and the object's mass. This momentum is conserved as long as there are no new objects added to the system. If a new object is added then the momentum will change in order to maintain a balance in the overall system. Devices can be designed and tested, that will use this balance of forces to minimize the effects of a change in momentum on an object.

1. Momentum is a vector quantity. (23)
2. Momentum is mass in motion, whereas forces are pushes or pulls applied to an object or mass. (23)
3. Momentum is conserved in a collision. (23)

Acceleration and Things That Cause Acceleration

Momentum

Energy

Defining and Calculating Energy

The energy of a system depends on the motion of the system, as well as the interactions that occur within the system. Energy is always changing from one kind to another, but the total energy of the system is always the same. Energy can take many forms such as motion, sound, light, and heat. The amount of energy available is mathematically calculable, and determines what the system is capable of doing.

1. Energy can be transformed (converted) within a system. (25)
2. Energy can be transferred from one system to another (or from a system to its environment) in different ways: by conduction, mechanically, electrically, or by radiation (electromagnetic waves). (25)
3. Regardless of what happens within a system, the total amount of energy in the system remains the same unless energy is added to or released from the system. (25)
4. Motion energy (kinetic energy) is associated with the speed and the mass of an object. (22)

Defining and Calculating Energy

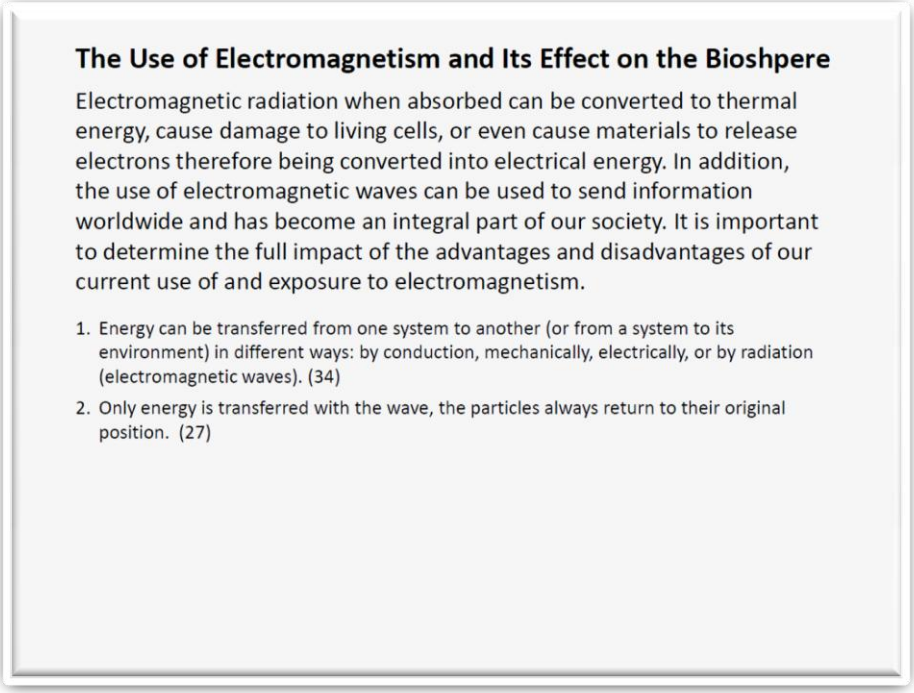
The use of energy, Its Conservation, and Equilibrium

The Use of Energy, Its Conservation, and Equilibrium

Energy can be seen in multiple ways and be used to accomplish goals by building machines that capture and use that energy. These machines will transfer one type of energy to another form until a balance between the amounts of the different forms of energy is reached. Show this by building a machine to accomplish a task.

1. Thermal energy of an object is associated with the disordered motions of its atoms or molecules and the number and types of atoms or molecules of which the object is made. (26)
2. Energy can be transformed (converted) within a system. (34)
3. Energy can be transferred from one system to another (or from a system to its environment) in different ways: by conduction, mechanically, electrically, or by radiation (electromagnetic waves). (34)

Electromagnetism



The Use of Electromagnetism and its Effect on the Biosphere

21st Century Skills

Teams

Technology

Collaboration

Demonstrate the 21st Century 4Cs

- Critical Thinking
- Creativity
- Collaboration
- Communication

Critical Thinking *(General Definition)*

Rational … being based on, or agreeable to reason.

Skeptical … generally, a questioning attitude or doubt towards one or more items of knowledge or belief.

Unbiased. … proportionate weight in favor of - or against - an idea or thing. Open-minded, free from prejudice, and fair.

Critical Thinking *(per AACU)*

Explanation of issues. Issue/problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.

Evidence. Information is taken from source(s) with enough interpretation/evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.

Influence of context and assumptions. Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.

Student's position (perspective, thesis/hypothesis). Specific position (perspective, thesis/hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/hypothesis).

Conclusions and related outcomes (implications and consequences). Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.

Rhodes, T. (2010). *Assessing outcomes and improving achievement: Tips and tools for using rubrics.* Washington, DC: Association of American Colleges and Universities.

Association of American Colleges and Universities (AAC&U). (2009). *Inquiry and analysis VALUE rubric*. Retrieved from https://www.aacu.org/value/rubrics/inquiry-analysis