03 Conservation of Matter and Energy

Content Area: **Science**
Course(s): **Chemistry H**
Time Period: **Semester 2**
Length: **10 weeks**
Status: **Published**

Standards

SCI.HS.PS1.B	Chemical Reactions
SCI.HS.PS3.B	Conservation of Energy and Energy Transfer
SCI.HS.ESS3.C	Human Impacts on Earth Systems
SCI.HS.ETS1.B	Developing Possible Solutions
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.
SCI.HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
	Using Mathematics and Computational Thinking
	Energy and Matter
	Stability and Change
	Constructing Explanations and Designing Solutions

Enduring Understandings

1. Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in total binding energy (i.e., the sum of all bond energies in the set of molecules) that are matched by changes in kinetic energy.

2. In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present.

3. The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.

4. Chemical processes and properties of materials underlie many important biological and geophysical phenomena.

5. Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.

6. The availability of energy limits what can occur in any system. Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). Any object or system that can degrade with no added energy is unstable. Eventually it will do so, but if the energy releases throughout the transition are small, the process duration can be very long (e.g., long-lived radioactive isotopes).

7. The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. Scientists and engineers can make major contributions—for example, by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.

8. When the source of an environmental problem is understood and international agreement can be reached, human activities can be regulated to mitigate global impacts (e.g., acid rain and the ozone hole near Antarctica).

9. Complicated problems may need to be broken down into simpler components in order to develop and test solutions.

10. When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. Testing should lead to improvements in the design through an iterative procedure.

11. Both physical models and computers can be used in various ways to aid in the engineering design process. Physical models, or prototypes, are helpful in testing product ideas or the properties of different materials. Computers are useful for a variety of purposes, such as in representing a design in 3-D through CAD software; in troubleshooting to identify and describe a design problem; in running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs.

Essential Questions

1. What is meant by conservation of energy?
2. How is energy transferred between objects or systems?
3. How is the change in the amount of energy determined?
4. How does the flow of energy into or out of matter change its behavior?
5. How does the physical arrangement of matter depend upon the properties of particles within matter?
6. How do humans change the planet?
7. What is the process for developing potential design solutions?

Knowledge and Skills

Knowledge:

1. Students will know the fact that atoms are conserved, together with knowledge of the chemical properties of the element involved, can be used to describe, and predict chemical reactions. (DCI

PS1.B Chemical Reactions)

2. Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (DCI PS3.B Conservation of Energy and Energy Transfer)

3. Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.(DCI PS3.B Conservation of Energy and Energy Transfer)

4. The availability of energy limits what can occur in any system. (DCI PS3.B Conservation of Energy and Energy Transfer)

5. Uncontrolled systems always evolve toward more stable states— that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). (DCI PS3.B Conservation of Energy and Energy Transfer)

6. Students will know that scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (DCI ESS3.C Human Impacts on Earth Systems)

7. Students will know that when evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (DCI ETS1.B Developing Possible Solutions)

Skills:

1. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

2. Evaluate or refine a technological solution that reduces impacts of human activity on natural systems.

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing