

Name _____



**Day
1**

Weekly Question

How do fireworks work?

KABOOM! No Fourth of July celebration in America would be complete without flashes of fireworks rocketing skyward and bursting into a shower of colors. Invented by the Chinese a thousand years ago, fireworks were first used in ceremonies to frighten away evil spirits. They are now used to celebrate special occasions around the world.

The dazzling display of color, light, and sound produced by fireworks is a **manifestation** of an incredible amount of energy. Specifically, it is the end result of a series of energy transformations. When fireworks explode, chemical energy is transformed into thermal energy, mechanical energy, radiant energy, and sound energy.

Vocabulary

manifestation
MAN-ih-fess-TAY-shun
the visible or noticeable expression of something



Washington, D.C.



Sydney, Australia



Guiyang, China

A. Write true or false.

1. Fireworks were invented on July 4, 1776. _____
2. Color, light, and sound are manifestations of different forms of energy. _____
3. Fireworks explode when sound is transformed into chemical energy. _____

B. List the five forms of energy involved in a fireworks explosion.

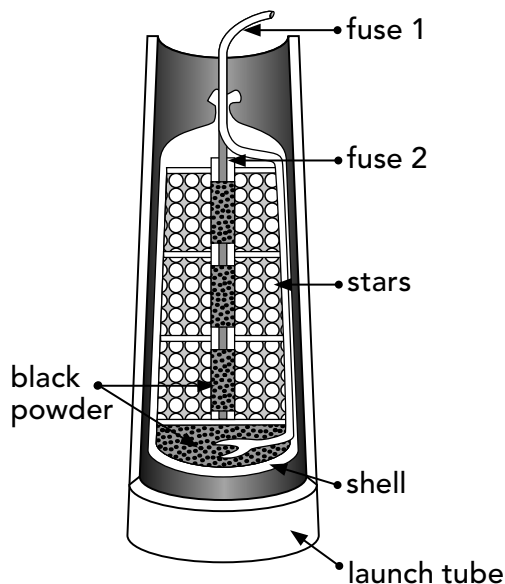
1. _____
2. _____
3. _____
4. _____
5. _____



Day 2 *Weekly Question*
How do fireworks work?

Most fireworks are made up of a shell that contains two fuses and pellets of chemicals, which is loaded into a **cylindrical** launch tube. The most important ingredient in the shell is black powder, a **mixture** of potassium nitrate, carbon, and sulfur. When one of the fuses is lit and comes into contact with the mixture, the powder burns. The chemical energy of the black powder is converted to thermal energy, and great quantities of gas and heat are generated.

The gas then becomes trapped within the launch tube and expands, causing pressure to build. Ultimately, the pressure becomes too intense and the gas explodes, causing thermal energy to be converted to mechanical energy that propels the firework into the sky. There, more black powder and the second fuse produce another explosion, which spews out the remaining contents of the shell.



Vocabulary

cylindrical

suh-LIN-drih-kul
tube-shaped

mixture

MIKS-chur
a blend of different substances that are not chemically bound together

A. Answer the questions.

1. What is inside the cylindrical launch tube of a firework?

2. What is the most important ingredient in fireworks?

3. What becomes trapped in the launch tube?

B. Write the correct forms of energy to show the order in which energy is transformed when the black powder is ignited.

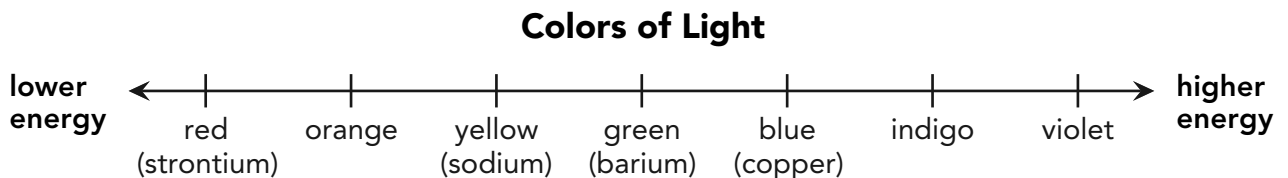
chemical energy → _____ → _____

**Day
3****Weekly Question****How do fireworks work?**

The chemical pellets that produce the sparks of light and color in a firework are called *stars*. Metallic elements within the stars each emit a specific color of light as they burn, due to differences in their atomic structures. When a metallic element burns, its atoms absorb thermal energy, which temporarily moves the atoms' outer electrons up to a higher energy level. The electrons then return to their original energy level, releasing radiant energy as light in the process.

The amount of radiant energy emitted, which is unique to each element, determines the color of the light. Light is the only visible form of radiant energy on the **electromagnetic spectrum**. The colors of light include red, orange, yellow, green, blue, indigo, and violet. Energy increases from red to violet along the spectrum.

- A.** The diagram below shows the colors of light. Four metallic elements are given in parentheses under the colors they emit. Use the diagram and information in the passage to answer the questions.



- Which metallic elements would you mix to create an orange firework?

- Which metals would you mix to create a purple firework?

- Which element, sodium or copper, releases a higher level of energy when it burns? _____

- B.** Explain why different metals emit different colors of light.

**Vocabulary****electromagnetic spectrum**

ee-LEK-troh-mag-NEH-tik SPEK-trum
the complete range of radiant energy types, including microwaves, x-rays, and light



**Day
4**

Weekly Question

How do fireworks work?

Firework stars produce not only light and color, but also heat and sound. In addition to metals, stars contain carbon and potassium perchlorate (per-KLOR-ayt). When the stars are ignited, the chemicals react with each other. The bonds between their atoms break apart, and the atoms rearrange to form new chemicals. Chemical energy in the stars is released as radiant energy in the form of colored light, as thermal energy in the form of heat, and as sound energy in the form of a **shock wave**.

Although it travels in waves like light, sound is not a form of radiant energy. Lightwaves are radiation that can move through empty space, whereas sound waves are vibrations that travel only through the molecules of matter—usually air. So sound energy is actually a form of mechanical energy. Just like an ocean wave, it is the sound wave that travels, not the molecules of matter. The molecules merely vibrate in place, stimulating the molecules next to them.

So the next time you hear the thunderous boom of fireworks exploding into a spectacular burst of lights and colors, remember that you are witnessing firsthand the transformation of energy.



Vocabulary

shock wave

SHAHK wayv
a pulse of high pressure traveling through matter and caused by an explosion or an object moving faster than sound

A. Write what is produced by each form of energy in a fireworks explosion.

Radiant energy: _____ **Sound energy:** _____

Thermal energy: _____

B. Describe two differences between a lightwave and a sound wave.
