

How are New Products Invented?

Student quiz—*Answer key*

1. You followed the engineering design process to invent a new slime. The engineering design process is a series of steps that engineers follow to come up with a solution to a problem. From the list below, which step is NOT included in the engineering design process.
 - a. Background research or learning how other people solved the problem
 - b. Identifying the requirements, including specifying what should be made and what the limitations are
 - c. Identifying the independent, dependent, and control variables
 - d. Iterating, or trying again when a result is not satisfactory

2. The lesson states that chemists are often involved in the deliberate search for new materials. What reason does the lesson give to explain this?
 - a. Chemists are often involved in inventing new materials because chemists love experiments that surprise them, e.g., experiments that yield explosions or dramatic color changes
 - b. Chemists are often involved in inventing new materials because chemists use their knowledge of how various materials combine or separate to propose new chemical reactions to form new materials
 - c. Chemists are often involved in inventing new materials because chemists like to randomly put new substances together and watch what happens
 - d. Chemists are often involved in inventing new materials because they tend to be distracted and make mistakes that lead to accidental inventions

3. Which of the following is NOT an example of a chemical reaction?
 - a. Mixing water with glue and baking soda
 - b. Mixing baking soda and vinegar to create a vigorously bubbling solution
 - c. Creating slime by mixing water, glue, baking soda, and contact lens solution
 - d. The slow rusting of your bike when you leave it out in the rain

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4. Elias and his friend Gael mix ingredients to make cake batter. They pour the batter into a bake pan and put the cake in the oven to bake. While baking, they notice the cake rises, gradually becomes firmer, and finally gets a nice golden color. They also notice a delicious odor filling the kitchen. Elias claims a chemical reaction takes place when baking the cake. Gael claims there is no chemical reaction happening. Who is correct, and what evidence can you use to support this claim?

Elias is correct. He can use the fact that the properties of the mixture change during the baking process as evidence for the claim that a chemical reaction takes place. The batter is liquid while the cake is solid. Some students might mention that the cake rises because bubbles or a gas is released. This is also evidencing that supports a chemical reaction occurs. The color change and the odor they detect are further evidence of a chemical reaction.

5. There are two ways that new materials can be invented: accidental discovery and deliberate experimentation. Explain what they are and what scientist do in each method.

Example answer:

Accidental discovery.

An accidental discovery is an unintentional or surprising discovery made by careful observations and thinking about new possibilities when confronted with unexpected results.

Deliberate experimentation

A discovery made by deliberate experimentation is the result of carefully designed experiments that are conducted with the goal of inventing a new material with specific properties.