Exothermic Reactions

Many chemical changes result in a very obvious energy change. **Fireworks**, using **glow sticks** and **burning fuels** are common examples of **exothermic** reactions.



FIREWORKS



GLOW STICKS



BURNING FUELS

Energy changes occur in all chemical reactions. In some reactions there is a very clear energy change, with the transfer of energy by **heat**, **light** and sometimes **sound** to the surroundings. These are **exothermic reactions**. Exothermic means "to give out heat". Exothermic reactions can be recognized because the temperature of the products is higher than the **temperature** of the reactants. The bigger the temperature rise, the more exothermic the reaction.

Some examples of exothermic reactions are:

1. adding strong bases or reactive metals to strong acids, causing the temperature to increase dramatically. https://www.youtube.com/watch?v=0vi2aq76EqQ
2. the reaction between iron wool and oxygen; a type of hand-warmer makes use of the heat produce by this. https://www.youtube.com/watch?v=TsnLmgWXw-E
3. Adding calcium oxide (quick lime) to a bath of cold water, producing such an exothermic reaction that the cold water boils after about ten minutes. https://www.youtube.com/watch?v=iDhl1jHncDc
4. The **thermit reaction**, in which aluminum powder reacts with iron oxide using a magnesium fuse; aluminum is more reactive than iron, displacing it to produce iron metal. The reaction is highly exothermic, and the heat produced melts the iron. https://www.youtube.com/watch?v=1N50IjDB5Sk

Why are some reactions exothermic?

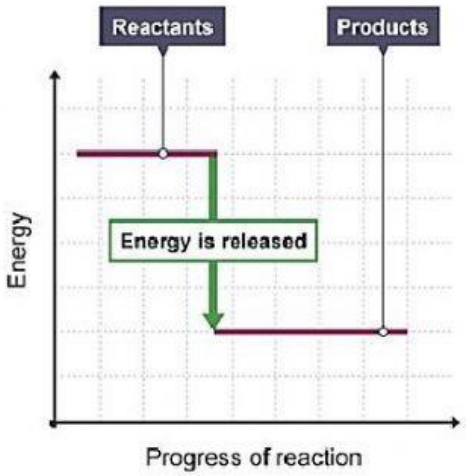
Chemical reactions use starting materials called **REACTANTS** which are turned into changed materials called **PRODUCTS**. During all chemical changes, the reactant particles undergo **collisions**. During a collision, energy is absorbed from the surroundings to break bonds between the reactant particles. Once all the bonds have broken down, the reactant atoms are now free to form bonds with other reactant atoms and make new products. During the formation of new bonds, energy is transferred to the surroundings, usually in the form of heat.

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If the energy transferred to the surroundings during the **bond-making** process is higher than the energy absorbed during the **bond-breaking** process, the reaction is exothermic.

Energy diagrams for exothermic reactions

The figure below shows how the energy of the reactants and products change during an extra thermic reaction.



As you can see, the products are always at a lower energy compared to the reactants. The difference in energy has been transferred to the surroundings. Remember the **law of conservation of energy** that says that "the total energy must always be the same before and after a reaction".

Energy of reactants – Energy of products = Energy Transferred

Question Set 1

1. Write three things mentioned in the passage that are examples of exothermic reactions.

G_____ S_____, F_____ and B_____ F_____

2. During chemical reactions, energy changes can be observed when the following are transferred to the surroundings.

   H_____, S_____ or L_____

3. Exothermic means "to _____".

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4. In an exothermic reaction, the T_____ of the P_____ is H_____ than that of the initial reactants.

5. Starting materials in a reaction are called R_____.

6. The ending materials in a reaction are called P_____.

7. During reactions, particles are always undergoing C_____ with one another and will break old B_____ and form new ones.

8. When new B_____ and formed, H_____ is given out.

9. Draw a line connecting the reactants of the examples of the exothermic reactions given above.

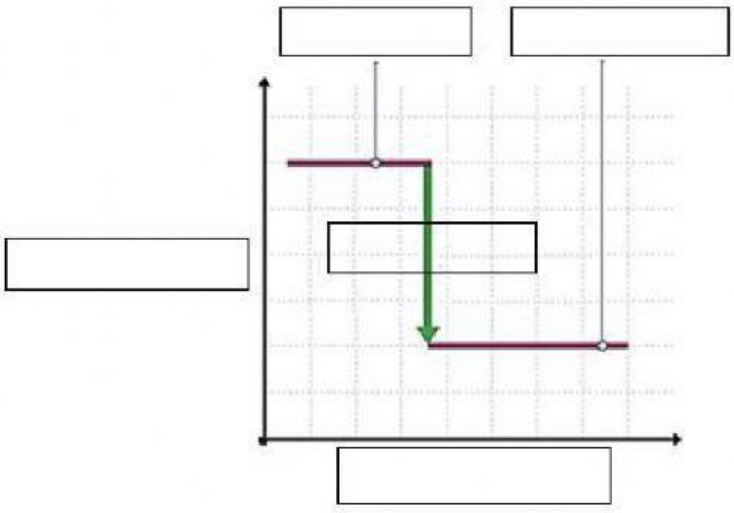
REACTANT 1
• Aluminum powder
• Iron wool
• Strong acid
• Calcium oxide

REACTANT 2
• Reactive metal
• Cold water
• Iron oxide
• Oxygen

10. Write word for word, as in the passage, the law of conservation of energy

"_____".

11. Drag the labels into the correct slots below to label the diagram showing an exothermic reaction.



Energy

Energy is released

Products

Progress of reaction

Reactants

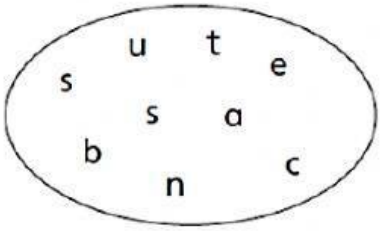
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Question Set 2

1 Use the letters to work out the missing word.

A chemical reaction happens when chemicals combine to form a new

_ _ _ _ _ _ _ _ _ _.



2 There are three things that tell us that a chemical reaction has taken place.

a We could see a change of _____ .

b We could see that a _____ is given off.

c We could see that there is an energy _____ .

change	colour	gas

3 Draw lines to match each word with its description.

a What means that you cannot turn the reaction back?	chemical
b What is a change that can be changed back (reversed)?	irreversible
c What is a reaction that cannot be changed back?	physical

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