Learning Guide for Lecture 4A - Fire
Chem 1010

Introduction

What happens when a candle burns?

What can you observe?

What is being used up?

What is being generated?

What are candles made of?

What about the wick?

What is the flame?

How hot is a candle flame?

Uses and Dangers of Fire

What was fire used for anciently?

What kinds of materials were commonly burned?

How was fire used during the industrial revolution?

What kinds of things were powered by steam engines?

What were they used for?

What's the downside of steam engines?

What do we now use instead of steam engines?

What kinds of things are powered by them?

Even though fire can be a wonderful tool, it can also be very destructive.
What are some examples?

How Materials Burn

When we say that something burns, what does that mean?

Consider the following examples:

coal: $C + O_2 \rightarrow CO_2$

butane: $2\ C_4H_{10} + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O$

acetylene: $2\ C_2H_2 + 5\ O_2 \rightarrow 4\ CO_2 + 2\ H_2O$

methanol: $2\ CH_3OH + 3\ O_2 \rightarrow 2\ CO_2 + 4\ H_2O$

glucose: $C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$

What do these have in common?

If not enough heat or oxygen is present, organic materials may not burn completely.

$2\ C + O_2 \rightarrow 2\ CO$

$2\ C_4H_{10} + O_2 \rightarrow 8\ C + 10\ H_2O$

Can non-organic materials burn?

hydrogen:

sulfur:

magnesium:

iron:

The Energy of Fire

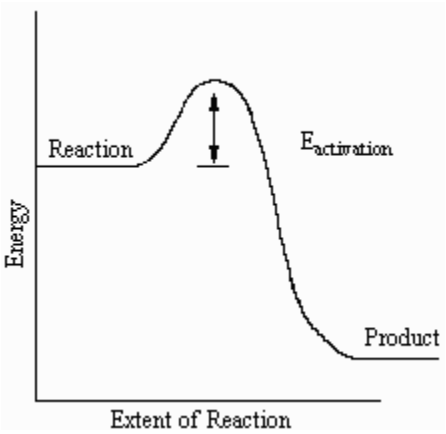
We learned that in nuclear reactions, the energy comes from small amounts of mass that are converted to energy.

So where does the energy of fire come from?

The energy released during any chemical reaction comes from:

If the bonds at the beginning have _____ energy than the bonds at the end, the reaction _____ energy.

Why doesn't everything combustible burst into flame?



Combustion reactions release a lot of energy, so once one molecule reacts, it creates enough energy for more to react.

Putting Fires Out

What three things are needed for a fire to keep burning?

1 –

2 –

3 –

What do you need to do to put out a fire?

Why does a match burn out?

Why does putting water on a campfire put it out?

Why will a CO_2 fire extinguisher work?

Why does blowing on the coals in a campfire make it burn more, but blowing on a candle makes it burn out?

Fires are categorized into four types according to what is burning and the kind of materials that can be used to put it out.

Type A:

Type B:

Type C:

Type D:

Why is it dangerous to use water on a type B, C, or D fire?

Type B –

Type C –

Type D –

Things that don't burn:

1 –

Why?

2 –

Why?

3 –

Why?

Fire-suppression systems often contain gaseous organic compounds with halogens replacing the hydrogens or noble gases.

Children's fire-proof pajamas are made from polymers with halogens attached to the carbon chain, but lately some questions have arisen about their chemical safety.