

OXIDATION: DOES IRON BURN?

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INTRODUCTION

I devised this demonstration to show that oxygen is involved with the process of oxidation. Burning is one aspect of oxidation, but many people do not associate rusting of metals with oxidation.

MATERIALS NEEDED

Cast iron frying pan, 6 or 8 inch diameter
Large iron nail
Steel wool (rinse with acetone to remove any oil coating and allow to dry thoroughly.)
Powdered iron or fine iron filings (The powdered iron can be placed in a small plastic wash bottle) Note: avoid iron dust-type powders they may be too flammable for this demonstration.
Tongs, crucible tongs or equivalent
Burner (preferred) or candle

SAFETY PRECAUTIONS

Wear safety goggles

Perform this demonstration over a heat proof surface. Burning steel wool and powdered iron can ignite nearby flammable materials.

DISPOSAL

Once cool, all spent materials can be disposed of in the trash.

PROCEDURE

Light a burner. Pick up a cast iron frying pan or other large piece of iron and hold it in the flame. Ask the audience "Does iron burn?" You may field a few responses from the audience, but avoid discussion and explanations. If there are no responses, just go on to the next step.

Pick up a large iron nail. Using tongs, hold it in the burner flame. Ask the audience "Does iron burn?" Again, you may field a few responses from the audience, but avoid discussion and explanations. If there are no responses, just go on to the next step.

Pick up a piece of steel wool. Using tongs, hold it in the burner flame. Ask the audience "Does iron burn?" Again, you may field a few responses from the audience, you may summarize their responses, but avoid discussion and explanations. Go on to the next step.

Pick up the wash bottle containing iron filings or powder or just take a small spoonful of the iron. Either squeeze the bottle to send a "spray" of iron powder into the burner flame,

or gently sprinkle the iron powder into the flame. Ask the audience “Does iron burn?” Field a few responses from the audience, but this time, try to get the audience to summarize what they observed through this series of demonstrations.

EXPLANATION

Iron does burn, but not like paper or wood. Generally, iron burns very slowly in a process we call oxidation or rusting. By varying the size of the iron particles from large to powder we can show the effects of particle size and surface area in oxidation. The reaction is:



Some of the higher oxide, Fe_2O_3 may be formed in the reaction.

Fe_3O_4 , the red rust that is observed on iron surfaces exposed to the weather is a mixture of FeO and Fe_2O_3 .

UTILIZATION AND VARIATIONS

This demonstration can be used to demonstrate reaction kinetics.