***Neither fire nor electricity , how do we heat food then?***

# *Heat food without fire*


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# *Introduction:*

***This research in chemistry explains the practical visualisation of exothermic reaction.***
***It also demonstrates important topics such as electron transfer,local cell formation and passivation.***

# *Background Information:*

***With increase in urbanization and technological aspects, the clock seems to run really quick for many. Henceforth, food preparations are in search of better emergency alternatives.***
***Readymade self heating meal packs were primarily used for military use. Such heater meals can be used during natural catastrophes and circumstances when conventional cooking seems infeasible.***

# *Objective of research:*

***The main motive of this research is to reveal the exothermic reactions that drive the working of heater-meal packs. It also aims at comparing the heating efficiency of two elements, calcium oxide and magnesium.***

# *Principle:*

***Heater-meal packs relies on the reaction of elements with  water to produce heat.***

***Mg(s) + 2 H2O(l) ------->***

***$Mg^2$(aq) +  $H^2$(g) +  2OH-(aq)***

***In this reaction magnesium is made less reactive due to oxidation (Mg(OH)2).This leads to passivation process and hence will prevent further reaction. Iron is added to magnesium in a heater meal to form a local cell (Small scale corrosion due to contact of 2 reactively different metals)which accelerates the exothermic reaction. Electrons will pass from magnesium to iron (iron being less reactive) and then into water, Iron mediates the combination of magnesium cations and hydroxide anions  preventing passivation therby increasing reactivity. Sodium. Chloride is added to water to equilibrate the charges of magnesium and hydroxide ions.***

***CaO+H2O ------> Ca(OH)2 + Heat***

***This is an ideal exothermic reaction where slaked lime releases heat on reaction with water.***

***Here the mass of the reactants is an independent variable and the heat generated is the dependent variable.***

# *Hypothesis:*

***Exothermic reaction generate heat,Is it possible to apply this in cooking?***

***Neither fire nor Electricity then how do we heat food?***

***Is Magnesium better than Calcium oxide to heat food?***

***How do military officers in cold places heat food?***

# *Experiment 1*

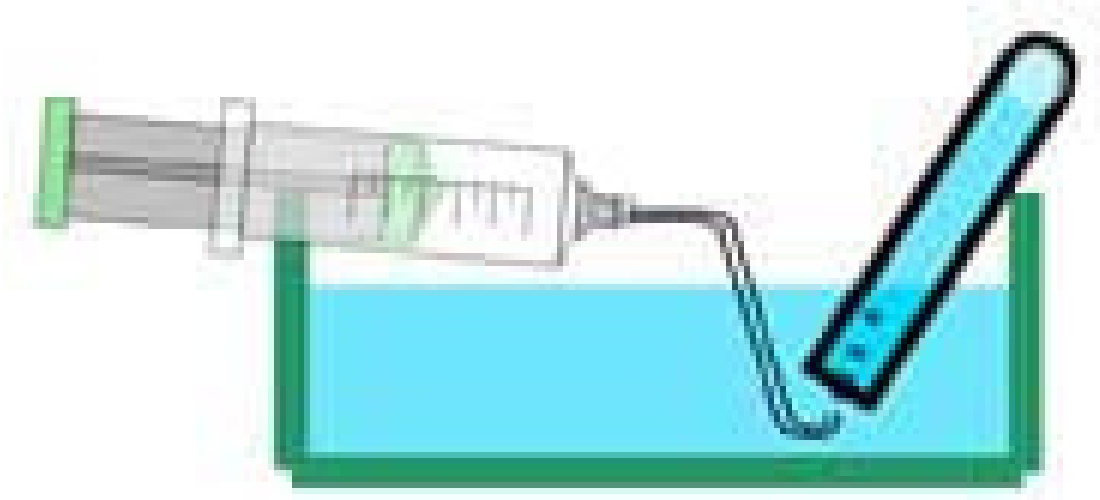
## *Materials Required:*

- ***A small amount of magnesium and iron powder.***
- ***Cold (unheated) saturated sodium chloride solution (salt water)***
- ***phenolphthalein solution***
- ***A heat resistant glass***
- ***A laboratory thermometer***
- ***Food items to observe heating (Coffee, Meatballs, Bread)***

## *Procedure:*

- ***Stuff the metal powder into a 50ml syringe and release the excess air***
- ***Connect a 20ml syringe containing salt water to the former syringe using a three way stopcock***
- ***Allow the two materials flow together by turning the stopcock, in a closed system***
- ***Gas gets collected in one of the syringes***
- ***Release the salt water into a beaker***
- ***close the valve of the stopcock, to retain the gas in the syringe and fix a tube to the valve***

- ***Release the gas into a testtube through the plastic tube within a bowl of water as depicted in the daigram***



- ***Perform the oxyhydrogen test to confirm the release of hydrogen gas***

  - ***TESTING WITH FOOD STUFFS***
  - Place the mixture of magnesium and water in a beaker
  - Place the food stuffs to be heated inside another small beaker
  - place the smaller beaker within the latter
  - Close the setup using an aluminium foil

# *Experiment 2*

## *Materials Required:*

- ***A small amount of Calcium Oxide***
- ***Cold (unheated) Water***
- ***A heat resistant glass***
- ***A laboratory thermometer***
- ***Food items to observe heating (Coffee, Meatballs, Bread)***

## *Procedure:*

- ***Take a small amount of Calcium oxide  in a test tube.***
- ***Add 20 ml of water into the test tube***
- ***Heat released can be observed***

- ***TESTING WITH FOOD STUFFS***
- Place the mixture of calcium oxide and water in a beaker
- Place the food stuffs to be heated inside another small beaker
- place the smaller beaker within the latter
- Close the setup using an aluminium foil

# Observation:

## Tabulation 1:

$$CaO+H2O---->Ca(OH)2 + Heat$$

**Mass of CaO=** **Mass of Water=**

| Food Items | Temperate before performing the experiment (°C) | Temperate after performing the experiment (°C) |
|---|---|---|
| Coffee | | |
| Meatballs | | |
| Bread | | |

## Tabulation 2:

$$Mg+2H2O---->Mg^{2}+H^{2}+2OH-$$

**Mass of Mg=** **Mass of Water=**

| Food Items | Temperate before performing the experiment (°C) | Temperate after performing the experiment (°C) |
|---|---|---|
| Coffee | | |
| Meatballs | | |
| Bread | | |

## *Risk and Safety:*

*->Wear safety goggles. The reaction creates highly flammable gas*

*->The remaining liquids can be disposed into the sink*

*->As both the experiments are exothermic reactions wear safety gloves when you perform it*

## *Bibliography:*


*-> https://www.scienceinschool.org*

*->https://en.m.wikipedia.org/wiki/Self-heating_food_packaging*

*->https://www.sciencebuddies.org*