

## 7.5 MREs and Handwarmers

**Subjects:** Thermodynamics, exothermic reactions

**Demonstration:** MREs and commercial handwarmers are displayed and activated to illustrate exothermic chemical processes and commercial uses.

**Materials:**

MRE (Meal Ready to Eat) heater and bags  
Water for MRE (from tap)  
Handwarmers

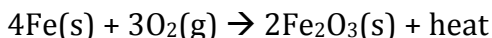
**Procedure:**

1. Display the items to the class.
2. Activate according to the package directions.
3. Pass the hand warmers around the class.

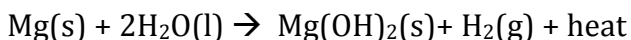
**Discussion:**

The oxidation of metals produces heat. The faster the oxidation, the more heat is produced in a smaller amount of time. Rusting is an oxidation process and produces heat but since it happens over a long period of time, the heat generated is unnoticeable. Rusting goes faster in the presence of water, and especially salt water.

Chemical hand warmers produce heat from the oxidation of iron to iron oxide in the presence of water with sodium chloride as a catalyst.



MREs also use the oxidation of a metal to generate heat. However magnesium is used in place of iron, because the reaction is faster and produces higher temperatures. Within minutes the water inside the MRE will boil. This packet of boiling water is used to heat the meal. In addition to magnesium, sodium chloride and a little iron metal is also used as a catalyst for the reaction. The reaction is as follows:



**Safety:** Use caution with the hot MREs as they could cause burns

**Disposal:** Dispose of use materials in an appropriate waste container.

**References:**

1. J. Kotz, P. Treichel, & J. Townsend. *Chemistry & Chemical Reativity*. 7<sup>th</sup> Ed; Instructor's Edition; Brooks/Cole; 2009; P. 250
- 3)L. Summerlin, C. Borgford, J. Ealy. *Chemical Demonstrations: A Sourcebook for Teachers*. Volume 2. 1987 p. 99