

Heat

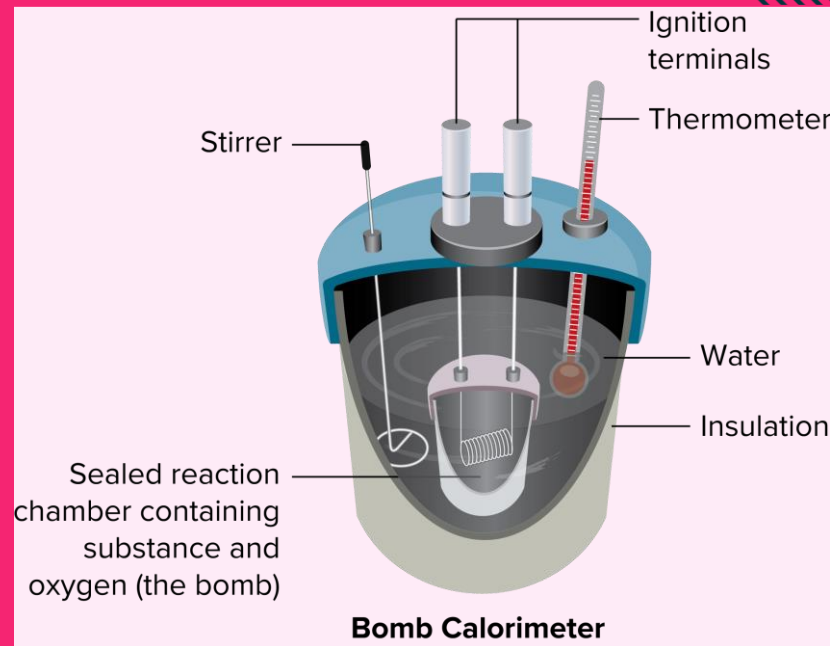
Done by : <https://t.me/stady12adv>

Calorimeter

- A **calorimeter** is an insulated device used for measuring the amount of heat absorbed or released during a chemical or physical process.

Using a Calorimeter

- **A known mass of water is placed in an insulated chamber to absorb the energy released from the reacting system or to provide the energy absorbed by the system.**
- **The data to be collected is the change in temperature of this mass of water.**
- **You can use a calorimeter to determine the specific heat of an unknown metal.**



USING SPECIFIC HEAT

IN-CLASS EXAMPLE

Use with Example Problem 3.

Problem

A piece of metal with a mass of 4.68 g absorbs 256 J of heat when its temperature increases by 182°C. What is the specific heat of the metal? Could the metal be one of the alkaline earth metals listed in Table 2 (on the next slide)?

Response

ANALYZE THE PROBLEM

You are given the mass of the metal, the amount of heat it absorbs, and the temperature change. You must calculate the specific heat. Use the equation for q , the quantity of heat, but solve for specific heat, c .

KNOWN

mass of metal, $m = 4.68 \text{ g}$

quantity of heat absorbed, $q = 256 \text{ J}$

$\Delta T = 182^\circ\text{C}$

UNKNOWN

specific heat, $c = ? \text{ J/(g}\cdot^\circ\text{C)}$

SOLVE FOR THE UNKNOWN

- State the equation for the quantity of heat, q .

$$q = c \times m \times \Delta T$$

- Solve for c .

$$c = \frac{q}{m \times \Delta T}$$

USING SPECIFIC HEAT

IN-CLASS EXAMPLE

SOLVE FOR THE UNKNOWN (continued)

- Substitute $q = 256 \text{ J}$, $m = 4.68 \text{ g}$, and $\Delta T = 182^\circ\text{C}$.

$$c = \frac{256 \text{ J}}{(4.68 \text{ g})(182^\circ\text{C})} = 0.301 \text{ J}/(\text{g}\cdot^\circ\text{C})$$

Table 2 indicates that the metal could be strontium.

EVALUATE THE ANSWER

The three quantities used in the calculation have three significant figures, and the answer is correctly stated with three digits. The calculations are correct and yield the expected unit.

Specific Heats at 298 K (25°C)	
Substance	Specific heat $\text{J}/(\text{g}\cdot^\circ\text{C})$
Water(l)	4.184
Ethanol(l)	2.44
Water(s)	2.03
Water(g)	2.01
Beryllium(s)	1.825
Magnesium(s)	1.023
Aluminum(s)	0.897
Concrete(s)	0.84
Granite(s)	0.803
Calcium(s)	0.647
Iron(s)	0.449
Strontium(s)	0.301
Silver(s)	0.235
Barium(s)	0.204
Lead(s)	0.129
Gold(s)	0.129

Chemical Energy and the Universe

- **Thermochemistry** is the study of heat changes that accompany chemical reactions and phase changes.
- A **system** is the specific part of the universe that contains the reaction or process you wish to study.
- The **surroundings** are everything else other than the system in the universe.
- The **universe** is defined as the system plus the surroundings.

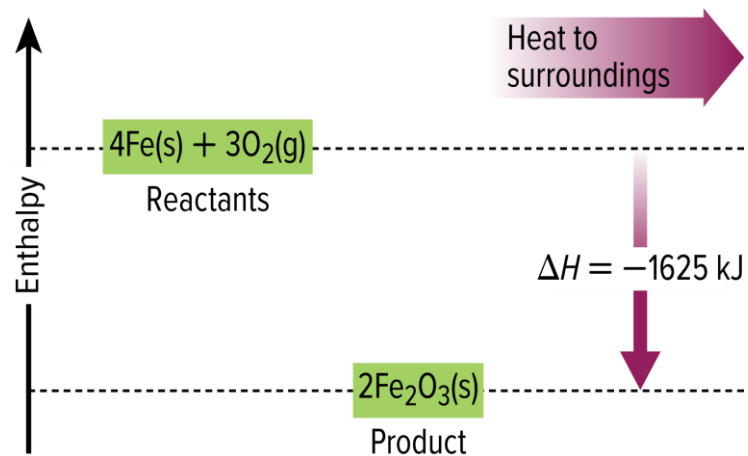
Chemical Energy and the Universe

- Chemists are interested in changes in energy during reactions.
- **Enthalpy** (H) is the heat content of a system at constant pressure.
- **Enthalpy (heat) of reaction** is the change in enthalpy during a reaction, symbolized as ΔH_{rxn} .

$$\Delta H_{\text{rxn}} = H_{\text{final}} - H_{\text{initial}}$$
$$\Delta H_{\text{rxn}} = H_{\text{products}} - H_{\text{reactants}}$$

- Enthalpy changes for exothermic reactions are always negative.
- Enthalpy changes for endothermic reactions are always positive.

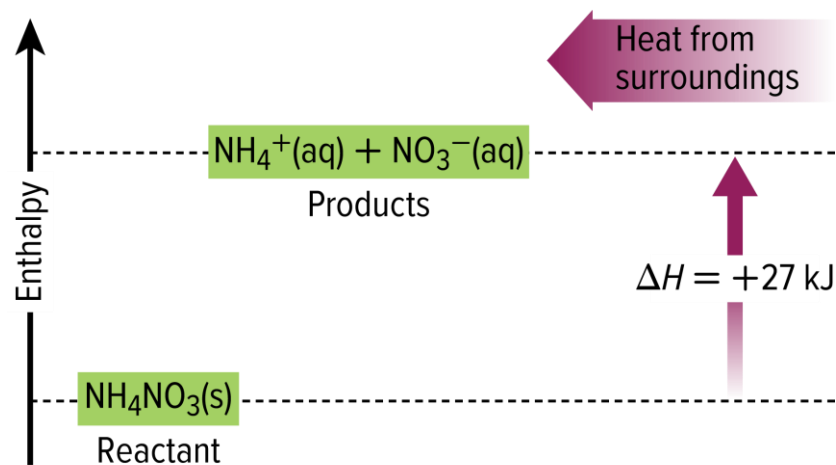
The Heat-Pack Reaction



Exothermic Reaction

$$\Delta H < 0$$

The Cold-Pack Process



Endothermic Process

$$\Delta H > 0$$

THANKS!



12 ADV

We are here to help you .

 Telegram