تم تحميل هذا الملف من موقع المناهج الإماراتية

مراجعة القسم الثاني الحرارة Heat من وحدة Chemical and Energy الكيميائية والتغيرات الطاقة Change

موقع المناهج ⇦ المناهج الإماراتية ⇦ الصف الثاني عشر المتقدم ⇦ كيمياء ⇦ الفصل الأول ⇦ الملف

تاريخ إضافة الملف على موقع المناهج: 21-09-2024 18:40:06

إعداد: SCHOOL ALFAROUQ

التواصل الاجتماعي بحسب الصف الثاني عشر المتقدم

اضغط هنا للحصول على جميع روابط "الصف الثاني عشر المتقدم"

روابط مواد الصف الثاني عشر المتقدم على تلغرام

التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات

المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة كيمياء في الفصل الأول

1	مراجعة القسم الأول الطاقة Energy من وحدة and Energy الكيميائية والتغيرات الطاقة Chemical Change
2	مذكرة الوحدة الأولى الطاقة والتغيرات الكيميائية أسئلة الاختبارات الوزارية السابقة

المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة كيمياء في الفصل الأول	
3	تدريبات على الوحدة الأولى الطاقة والتغيرات الكيميائية
4	عرض بوربوينت الوحدة الأولى الطاقة والتغيرات الكيميائية
5	عرض بوربوينت درس حالة الاتزان الكيميائي من الوحدة الثانية

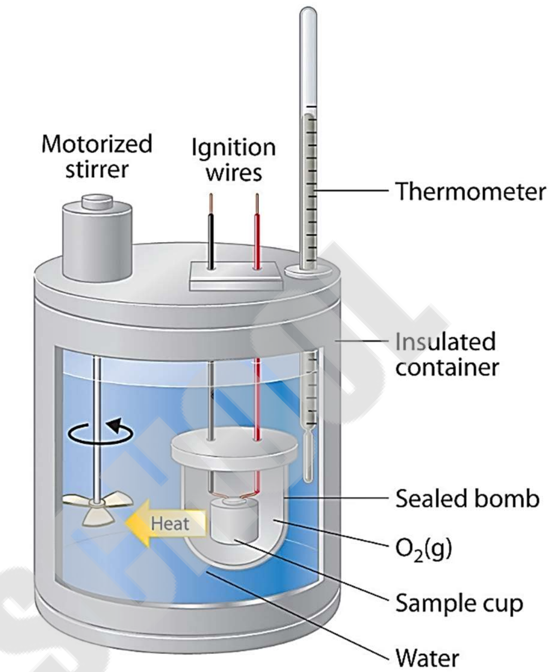
Section (2): Heat (Calorimetry)

CALORIMETRY

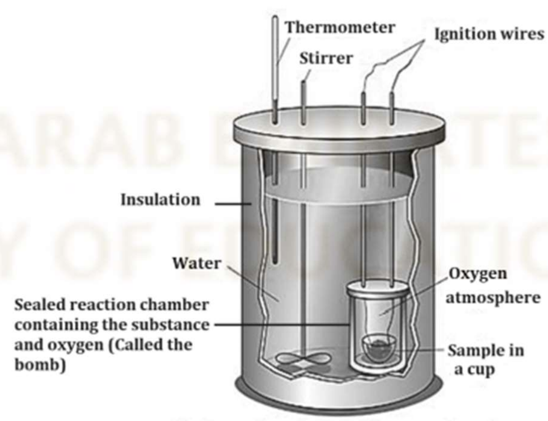
It is the measurement of heat flow into or out of a system for chemical and physical processes.

CALORIMETER

A calorimeter is an insulated device used for measuring the amount of heat absorbed or released (*enthalpy change of a reaction*) during a chemical or physical process.



Bomb Calorimeter

Coffee-cup Calorimeter	Bomb Calorimeter
Constant-Pressure Calorimeter	Constant-Volume Calorimeter
	

A coffee cup calorimeter is **used for measuring heat flow in a chemical solution.**

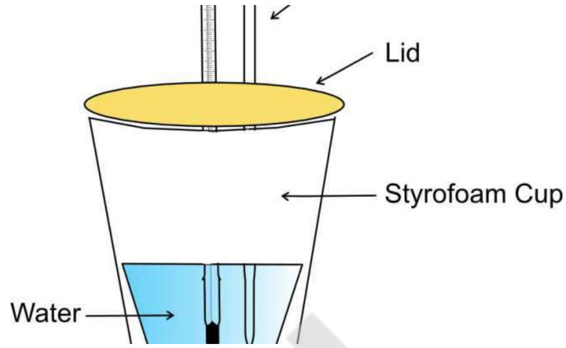
It cannot be used for

a) Reactions which involve gases since the gases would escape from the cup.

b) High temperature reactions as they'll melt the cup.

It is used by food chemists to **determine the caloric content of different food.**

- A coffee cup calorimeter is essentially a **polystyrene (Styrofoam)** cup or two with a lid.
- The cup is partially filled with a **known volume of water**.
- A sensitive thermometer is inserted through the lid of the cup so that its bulb is below the water surface.
- When a chemical reaction occurs in the coffee cup calorimeter, the water absorbs the heat of the reaction.



$$q_{system} = \Delta H = -\,q_{surrounding} = -\,m \times C \times \Delta T$$

$$q_{\ metal} = -\,q_{\ water}$$

Sources of Error:
1) The foam cup will absorb heat
2) Some heat will be lost to the air
3) If the reactants are not completely mixed, temperature measurements will not be accurate

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Example:

A 25 g block of an unknown metal [X] was heated to 95℃ then immersed in 13 mL of water (density = 1.0 g/mL) at 25℃. When the two substances reach equilibrium, the final temperature was 32℃.

Calculate the specific heat capacity of metal [X].

(Density of water = 1.0 g/mL and specific heat capacity of water is 4.184 J/g.℃)

Answer

$$q\ metal = -\,q\ water$$

$$m_{metal} \times C_{metal} \times \Delta T_{metal} = -\,(m_{water} \times C_{water} \times \Delta T_{water})$$

$$25 \times C_{metal} \times (32 - 95) = -\,(13 \times 4.184 \times (32 - 25))$$

$$C_{metal} = 0.24\ J/g.℃$$

<u>Example:</u>

A 100. g block of gold heated to 78°C is placed in a calorimeter containing 40.0 g of water at initial temperature of 21°C. If the specific heat capacity of gold is 0.129 J/g.°C, calculate the final temperature of the mixture.
(specific heat capacity of water is 4.184 J/g.°C)

$q_{metal} = -q_{water}$
$m_{metal} \times C_{metal} \times \Delta T_{metal} = -(m_{water} \times C_{water} \times \Delta T_{water})$
$100. \times 0.129 \times (T_{final} - 78) = -(40.0 \times 4.184 \times (T_{final} - 21))$
$T_{final} = 25.1°C$

<u>Example:</u>

A certain mass of a sample of lead is heated and placed in a coffee cup calorimeter containing 40.0 mL (density = 1.0 g/mL) of water at 18.0°C. The water reaches a temperature of 21.0°C. Calculate the amount of heat, in joules, released by the lead sample.
(Density of water = 1.0 g/mL and specific heat capacity of water is 4.184 J/g.°C)

$q_{metal} = -q_{water}$
$q_{metal} = -(m_{water} \times C_{water} \times \Delta T_{water}) = -(40.0 \times 4.184 \times 3.0) = -502\ J$
502 J are released

<u>Exercise</u>

(1) How many joules of heat are lost by 3580 kg of granite as it cools from 41.2°C to -12.9°C? The specific heat of granite is 0.803 J/(g·°C).

(2) A swimming pool measuring20.0 m × 12.5 m is filled with water to a depth of 3.75 m. If the initial temperature is 18.4°C, how much heat must be added to the water to raise its temperature to 29.0°C? Assume that the density of water is 1.0 g/mL.

(3) When 10.2 g of canola oil at 25.0°C is placed in a wok, 3.34 kJ of heat is required to heat it to a temperature of 196.4°C. What is the specific heat of the canola oil?

(4) When a 58.8 g piece of hot alloy is placed in 125 g of cold water in a calorimeter, the temperature of the alloy decreases by 106.1°C, while the temperature of the water increases by 10.5°C. What is the specific heat of the alloy?

THERMOCHEMISTRY

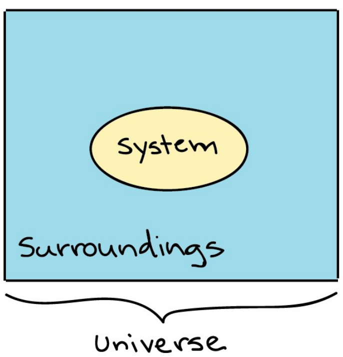
Thermochemistry is the study of heat changes that accompany chemical reactions and phase changes.

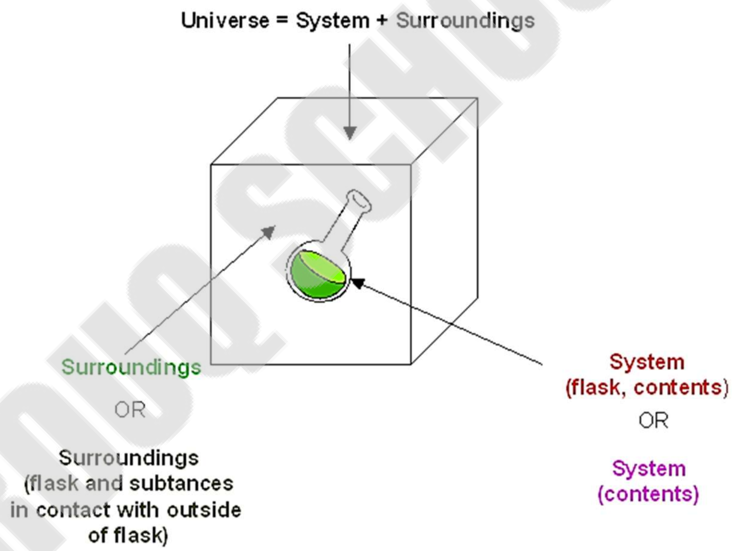
The system is the specific part of the universe that contains the reaction or process to study. *(Simply, the system is what you observe)*

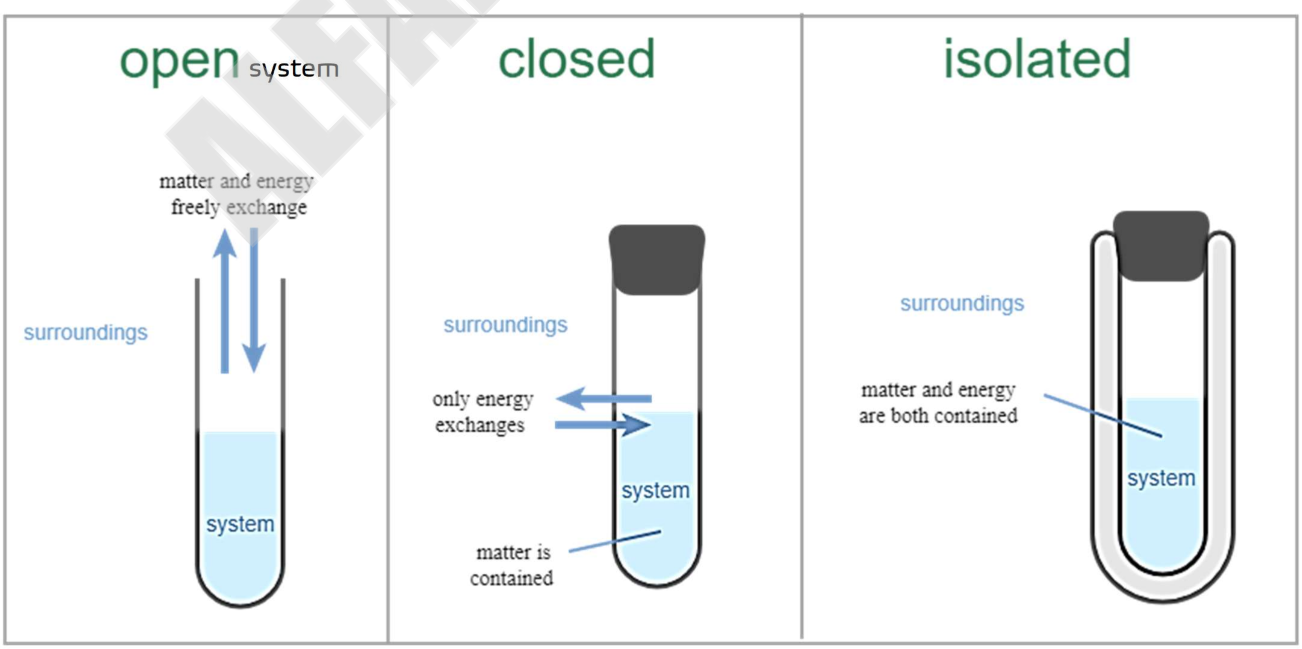
The surrounding is everything in the universe other than the system.

A universe is the system plus surroundings.

UNIVERSE = SYSTEM + SURROUNDINGS







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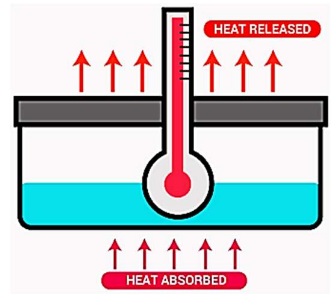
ENTHALPY (H)

It is the **heat content** of a system at constant pressure.

In any general chemical reaction, the reactants undergo chemical changes and combine to give products. It can be represented by the following equation:

$$Reactants \rightarrow Products$$



Case (1) : If Heat is absorbed into the system:

$H_{reactants} < H_{products}$

Endothermic Reaction

Case (2) : If Heat is released out of the system:

$H_{reactants} > H_{products}$

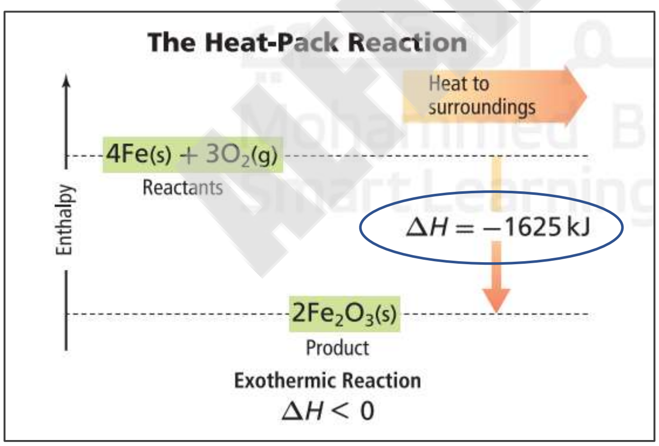
Exothermic Reaction

ENTHALPY CHANGE OF REACTION (ΔH_{rxn})

It's the amount of energy released or absorbed during a chemical reaction.

$$\Delta H_{rxn} = H_{products} - H_{reactants}$$

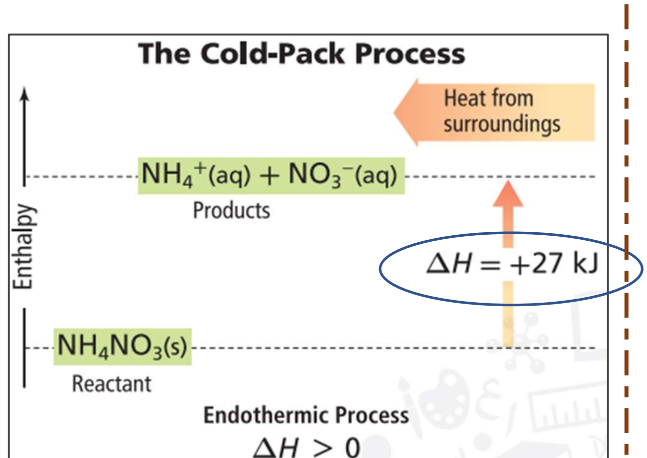
Exothermic Reaction



$$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s) + 1625\ kJ$$

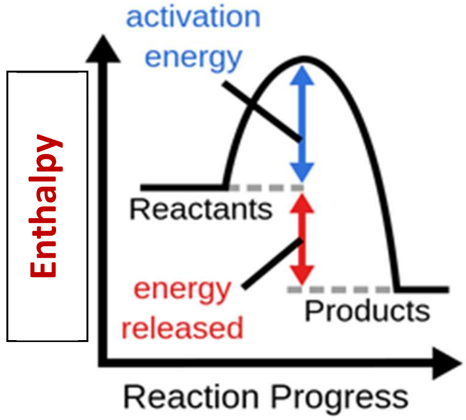
$$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$$
$$\Delta H_{rxn} = -1625\ kJ$$

Endothermic Reaction

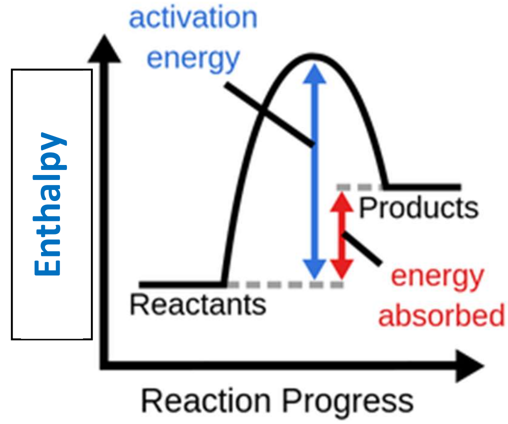


$$27\ kJ + NH_4NO_3(s) \rightarrow NH_4^+(aq) + NO_3^-(aq)$$

$$NH_4NO_3(s) \rightarrow NH_4^+(aq) + NO_3^-(aq)$$
$$\Delta H_{rxn} = 27\ kJ$$

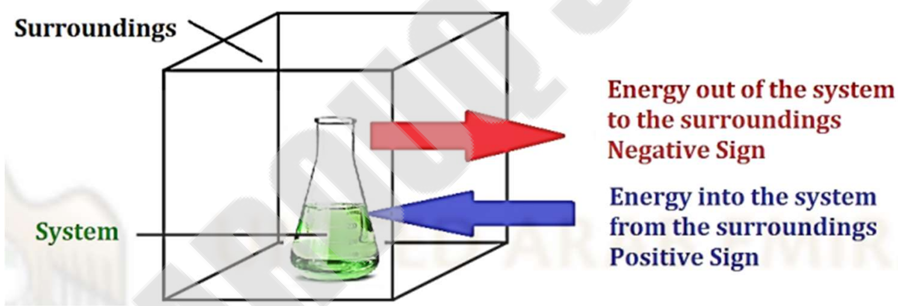


Exothermic reaction



Endothermic reaction

Exothermic Process	Endothermic Process
Heat flows from the system to its surroundings.	Heat flows into the system from its surroundings.
Heat flowing out of a system into its surroundings is defined as negative.	Heat flowing into a system from its surroundings is defined as positive.



The value of (ΔH_{rxn}) can be determined by measuring the heat flow of the reaction at constant pressure.

$$q = \Delta H_{rxn}$$

The enthalpy change, ΔH, is equal to q, the heat gained or lost in a reaction or process carried out at constant pressure. Because all reactions presented in this textbook occur at constant pressure, we can assume that $q = \Delta H_{rxn}$.

EXERCISES

(1) Describe how you would calculate the amount of heat absorbed or released by a substance when its temperature changes.

(2) Explain why ΔH for an exothermic reaction always has a negative value.

(3) Explain why a measured volume of water is an essential part of a calorimeter.

(4) Explain why you need to know the specific heat of a substance to calculate how much heat is gained or lost by the substance because of a temperature change.

(5) Describe what the system means in thermodynamics and explain how the system is related to the surroundings and the universe.

(6) Calculate the specific heat in J/(g·°C) of an unknown substance if a 2.50 g sample releases 12.0 cal as its temperature changes from 25.0°C to 20.0°C.

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