

تلخيص درس الحرارة



تم تحميل هذا الملف من موقع المناهج الإماراتية

موقع المناهج ⇨ المناهج الإماراتية ⇨ الصف الحادي عشر المتقدم ⇨ كيمياء ⇨ الفصل الأول ⇨ ملفات متنوعة ⇨ الملف

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ملفات اكتب للمعلم اكتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل
منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي للمدرس

المزيد من مادة
كيمياء:

التواصل الاجتماعي بحسب الصف الحادي عشر المتقدم



صفحة المناهج
الإماراتية على
فيسبوك

الرياضيات

اللغة الانجليزية

اللغة العربية

التربية الاسلامية

المواد على تلغرام

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

تجميعية مراجعة صفحات الكتاب وفق الهيكل الوزاري نظام حديث ثلاثة مواد

1

حل مراجعة نهائية وفق الهيكل الوزاري الجديد منهج انسباير

2

مراجعة نهائية وفق الهيكل الوزاري الجديد منهج انسباير

3

حل مراجعة نهائية وفق الهيكل الوزاري الجديد منهج بريدج

4

مراجعة نهائية وفق الهيكل الوزاري الجديد منهج بريدج

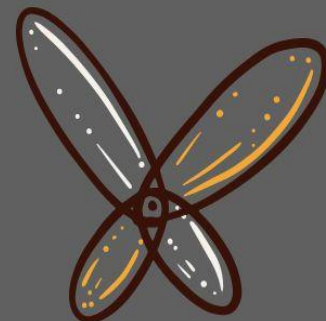
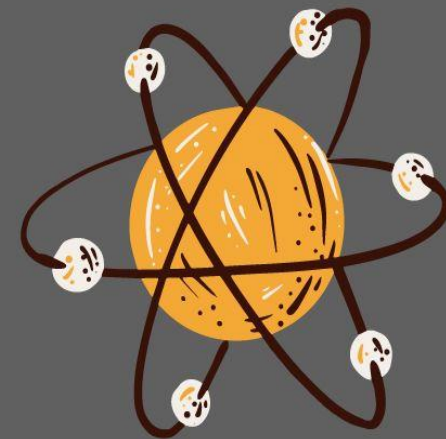
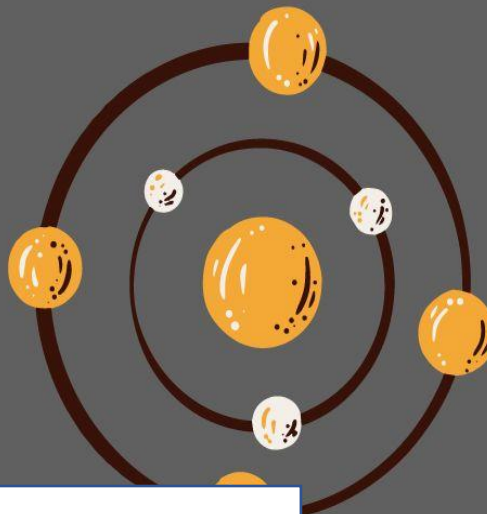
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CHEMISTRY



EasyChemistry4all by Mr. Mouad

مناهج دولة الإمارات

عام، متقدم ونخبة 9،10،11،12

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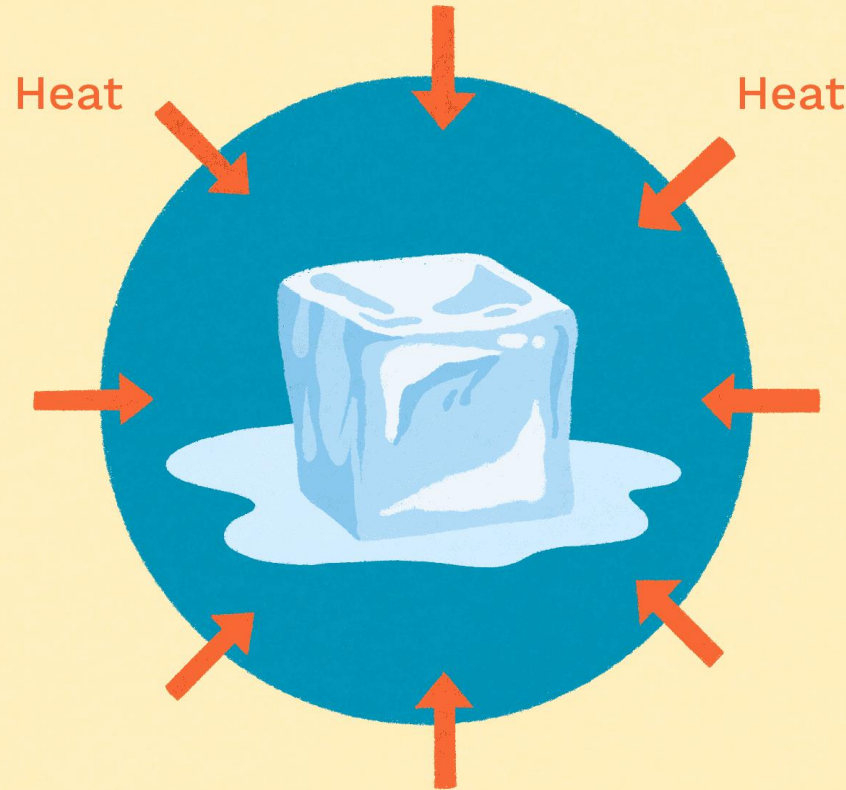
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Inspire Chemistry

Module 14_Lesson 2: “Heat”

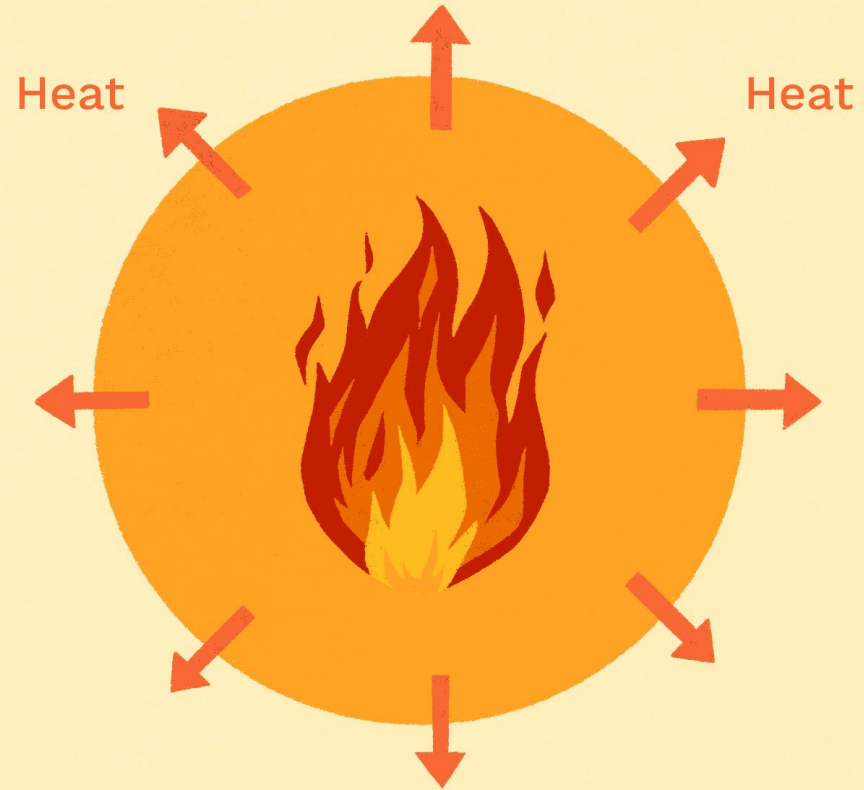
Endothermic vs. Exothermic Reactions

Energy is conserved in chemical reactions. The total energy of the system is the same before and after a reaction



Endothermic

The endothermic reaction is cooler than surroundings



Exothermic

The exothermic reaction is hotter than surroundings

Learning Outcomes

After this lesson, I can:

- ▶ **Describe** how a calorimeter is used to measure energy that is absorbed or released.
- ▶ ***Perform*** different calculations in a calorimetry experiment (*For adding a metal to water*).
- ▶ **Explain** the meaning of enthalpy and enthalpy change in chemical reactions and processes.

Part 1:

The calorimeter

Focus Question

How are ^{الحرارة}heat and ^{درجة الحرارة}temperature related?

MAIN Idea The enthalpy change for a reaction is the enthalpy of the products minus the enthalpy of the reactants.

Calorimetry is the process of measuring the amount of heat released or absorbed during a chemical reaction.

Calories

1 Cal = 1000 cal



How many calories are in the presented food? “60 Calories” or “60 kcal”

How did we know “How many calories” are in the food?



Using a device called: Calorimeter!

Nutrition Facts

16 servings per container

Serving size 1 Tbsp. (21g)

Amount per serving

Calories **60**

% Daily Value*

Total Fat 0g 0%

Saturated Fat 0g 0%

Trans Fat 0g

Cholesterol 0mg 0%

Sodium 0mg 0%

Total Carbohydrate 17g 6%

Dietary Fiber 0g 0%

Total Sugars 17g

34%†

Protein 0g

Vitamin D 0mcg 0%

Calcium 0mg 0%

Iron 0mg 0%

Potassium 0mg 0%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

† One serving adds 17g of sugar to your diet and represents 34% of the Daily Value for Added Sugars.

New Vocabulary

calorimeter

thermochemistry

system

surroundings

universe

enthalpy

enthalpy (heat) of reaction

Lesson ①

Remember the equation to calculate **heat**:

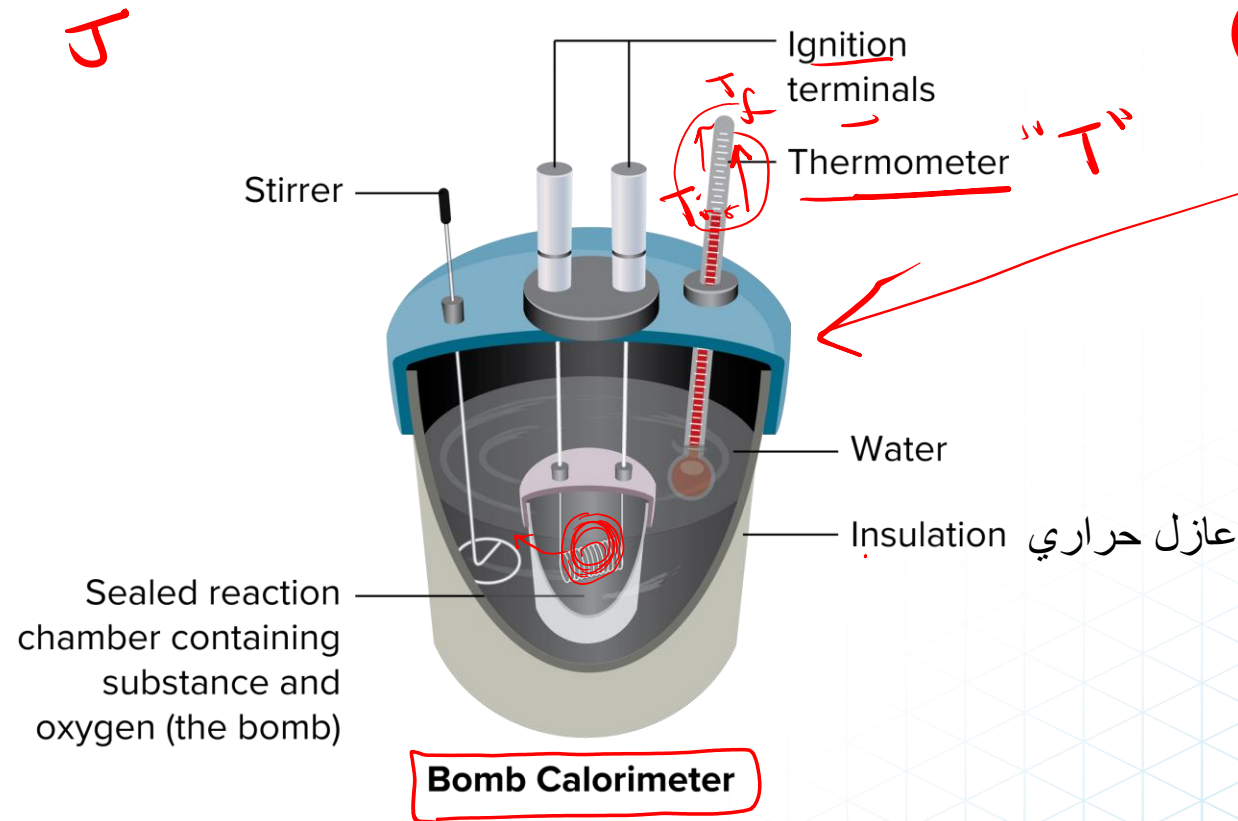
$$q = c \times m \times \Delta T$$

specific heat mass $T_f - T_i$

- Describe (Bomb calorimeter & Coffee-cup calorimeter).

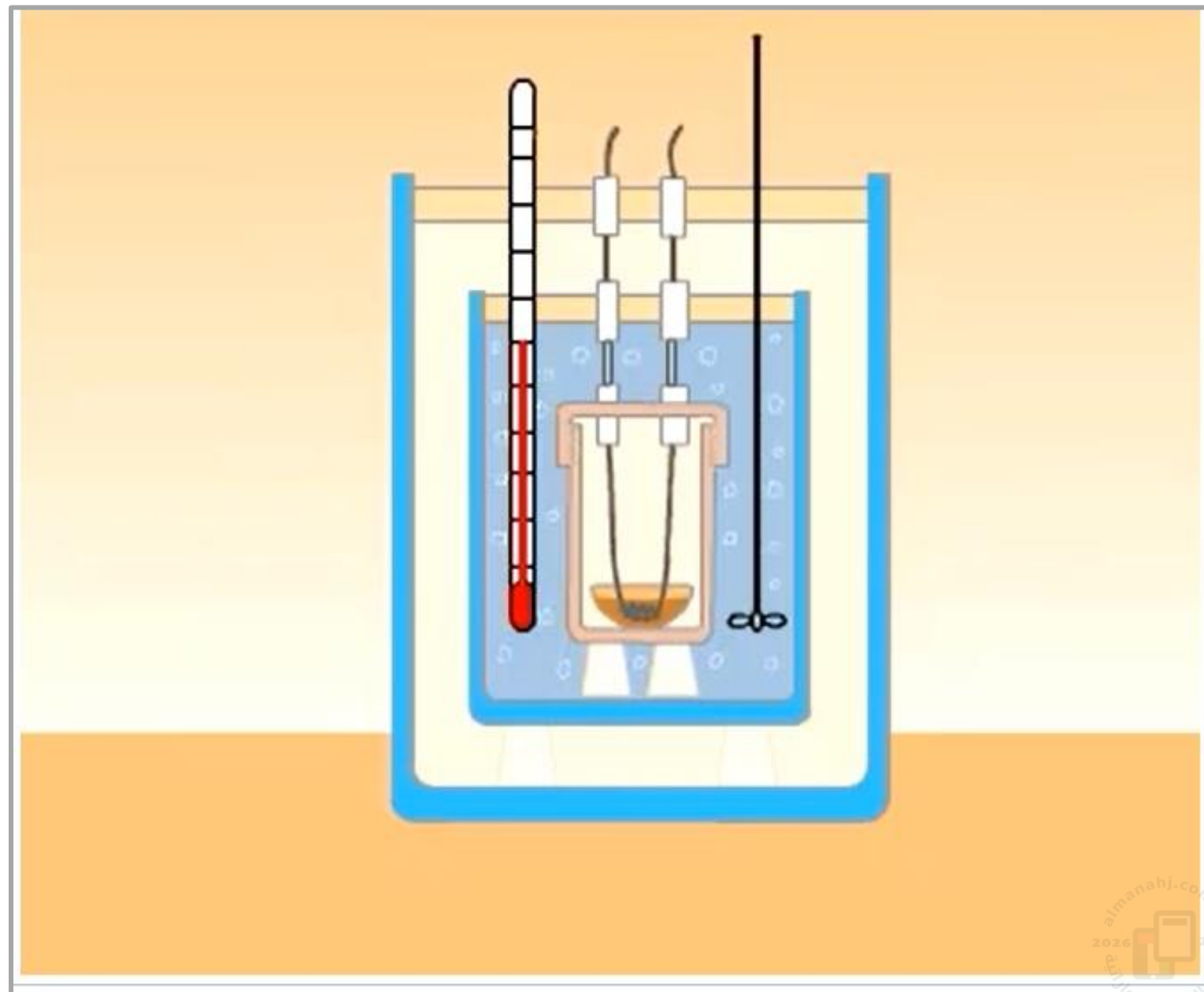
Calorimetry

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



- Describe (Bomb calorimeter & Coffee-cup calorimeter).

The Bomb Calorimeter



Calorimetric Studies on Combustion Reactions

Combustion reactions are usually studied using bomb calorimeters.

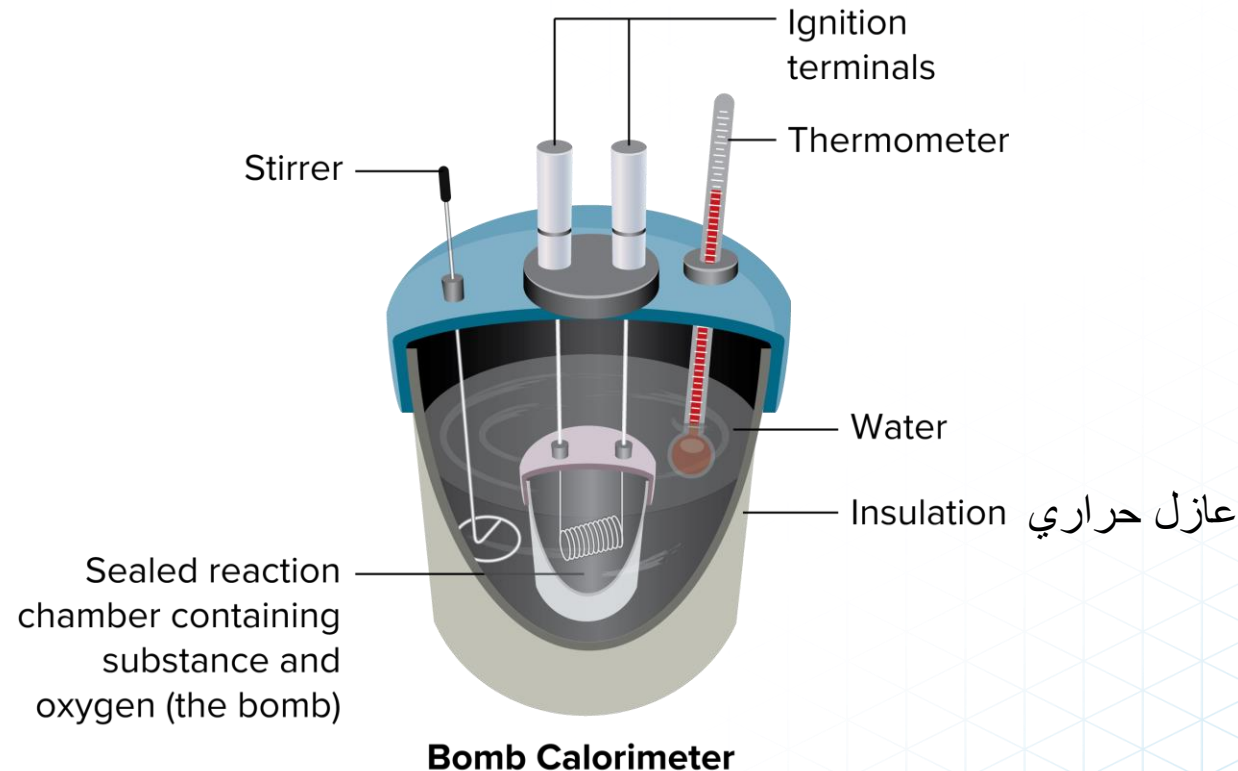
bomb calorimeter

A device used for measuring the heat evolved during combustion reactions

- Describe (Bomb calorimeter & Coffee-cup calorimeter).

Calorimetry

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



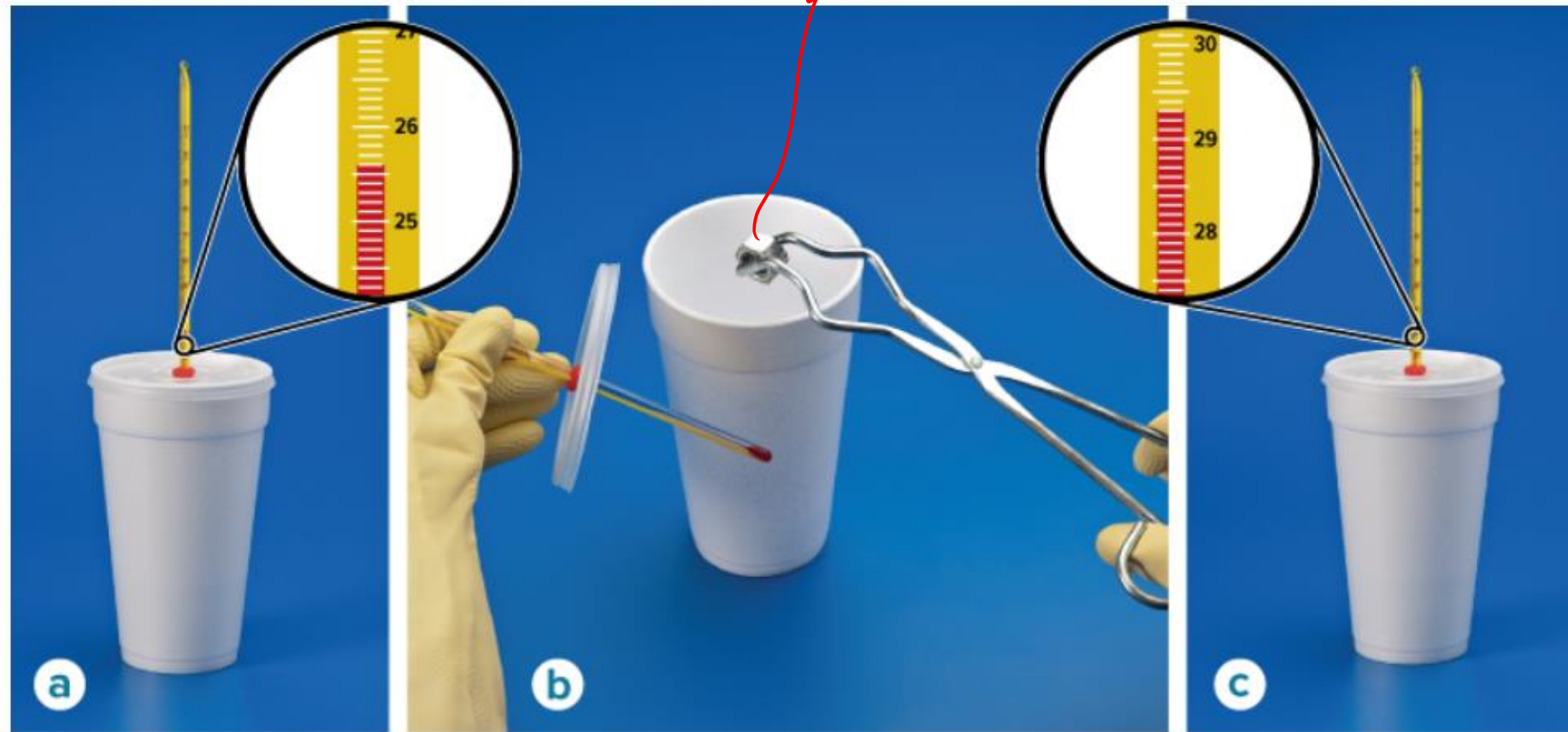
Calorimetry

“How is a calorimeter used?”

- 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 ΔT the change in temperature of this mass of water.
- You can use a calorimeter to determine the specific heat of an unknown metal.

- Describe (Bomb calorimeter & Coffee-cup calorimeter).

Coffee-cup calorimeter



calculate
(C) =

Coffee-cup calorimeter

Determining specific heat

- *Perform different calculations in a calorimetry experiment (For adding a metal to water).*

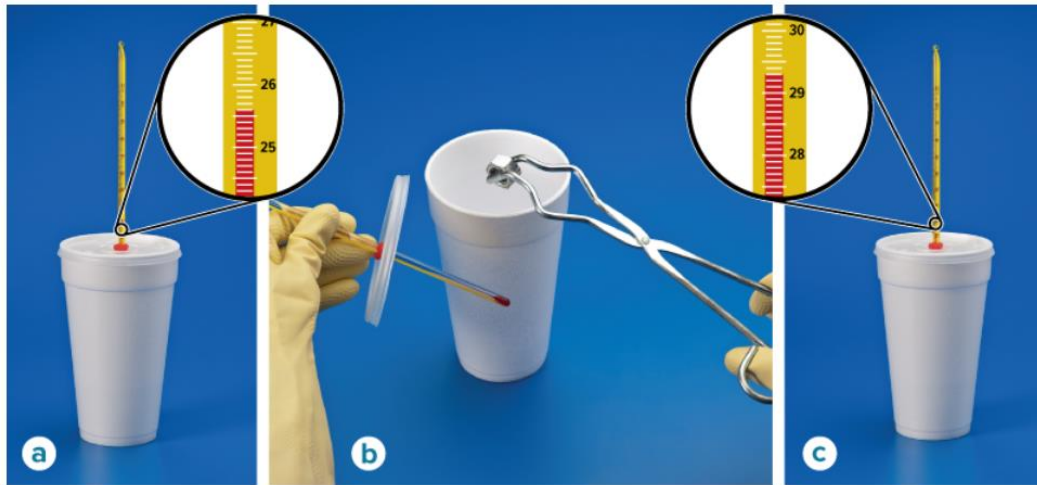


Figure 6 **a.** An initial temperature of 25.60°C is recorded for the 125 g of water in the calorimeter. **b.** A 50.0-g sample of an unknown metal is heated to 115.0°C and placed in the calorimeter. **c.** The metal transfers heat to the water until the metal and the water are at the same temperature. The final temperature is 29.30°C .

First, calculate the heat gained by the water. To do this, you need the specific heat of water, $4.184 \text{ J}/(\text{g} \cdot ^{\circ}\text{C})$.

$$q_{\text{water}} = 4.184 \text{ J}/(\text{g} \cdot ^{\circ}\text{C}) \times 125 \text{ g} \times (29.30^{\circ}\text{C} - 25.60^{\circ}\text{C})$$

$$q_{\text{water}} = 4.184 \text{ J}/(\cancel{\text{g} \cdot ^{\circ}\text{C}}) \times 125 \cancel{\text{g}} \times 3.70 \cancel{^{\circ}\text{C}}$$

$$q_{\text{water}} = 1940 \text{ J}$$

Determining specific heat

- **Perform different calculations in a calorimetry experiment (For adding a metal to water).**

The heat gained by the water, 1940 J, equals the heat lost by the metal, q_{metal} , so you can write this equation.

$$q_{\text{metal}} = q_{\text{water}}$$

$$q_{\text{metal}} = -1940 \text{ J}$$

$$c_{\text{metal}} \times m \times \Delta T = -1940 \text{ J}$$

Now, solve the equation for the specific heat of the metal, c_{metal} , by dividing both sides of the equation by $m \times \Delta T$.

$$c_{\text{metal}} = \frac{-1940 \text{ J}}{m \times \Delta T}$$

$$m = 50 \text{ g}$$

$$\Delta T = T_f - T_i = 29.3 - 115 = -85.7 \text{ }^{\circ}\text{C}$$

$$c_{\text{metal}} = \frac{-1940 \text{ J}}{(50.0 \text{ g})(-85.7^{\circ}\text{C})} = 0.453 \text{ J/(g}\cdot^{\circ}\text{C)}$$

Coffee-cup calorimeter

Determining specific heat

- Perform different calculations in a calorimetry experiment (For adding a metal to water).

$w \rightarrow$ water
 $met \rightarrow$ metal

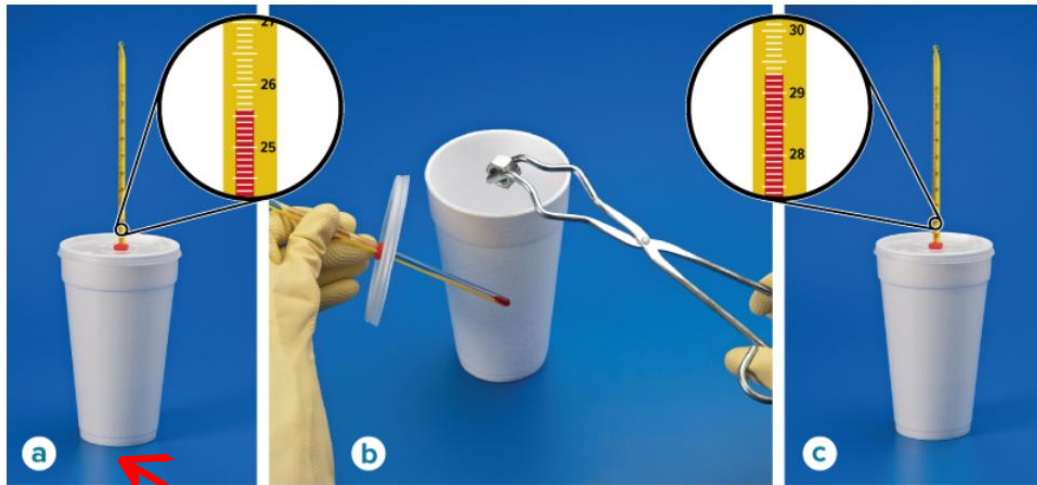


Figure 6 **a.** An initial temperature of 25.60°C is recorded for the 125 g of water in the calorimeter. **b.** A 50.0-g sample of an unknown metal is heated to 115.0°C and placed in the calorimeter. **c.** The metal transfers heat to the water until the metal and the water are at the same temperature. The final temperature is 29.30°C .

$$T_{f,w} = T_{f,met}$$

First, calculate the heat gained by the water. To do this, you need the specific heat of water, $4.184\text{ J}/(\text{g}\cdot^{\circ}\text{C})$.

$$q_w = C_w \times m_w \times \Delta T$$

$$q_{\text{water}} = 4.184\text{ J}/(\text{g}\cdot^{\circ}\text{C}) \times 125\text{ g} \times (29.30^{\circ}\text{C} - 25.60^{\circ}\text{C})$$

$$q_{\text{water}} = 4.184\text{ J}/(\text{g}\cdot^{\circ}\text{C}) \times 125\text{ g} \times 3.70^{\circ}\text{C}$$

$$\checkmark q_{\text{water}} = 1940\text{ J} \rightarrow \text{positive}$$

why (Absorbed endothermic)

Determining specific heat

- Perform different calculations in a calorimetry experiment (For adding a metal to water).

The heat gained by the water, 1940 J, equals the heat lost by the metal, q_{metal} , so you can write this equation.

metal lost heat

$$\begin{aligned} q_{\text{metal}} &= q_{\text{water}} \\ q_{\text{metal}} &= -1940 \text{ J} \\ c_{\text{metal}} \times m \times \Delta T &= -1940 \text{ J} \end{aligned}$$

$m \times \Delta T_{\text{metal}}$ $m \times \Delta T$

Now, solve the equation for the specific heat of the metal, c_{metal} , by dividing both sides of the equation by $m \times \Delta T$.

$$c_{\text{metal}} = \frac{-1940 \text{ J}}{m \times \Delta T}$$

$$m = 50 \text{ g}$$

$$\Delta T = T_f - T_i = 29.3 - 115 = -85.7 \text{ }^{\circ}\text{C}$$

$$c_{\text{metal}} = \frac{-1940 \text{ J}}{(50.0 \text{ g})(-85.7^{\circ}\text{C})} = 0.453 \text{ J/(g}\cdot^{\circ}\text{C)}$$

USING SPECIFIC HEAT

IN-CLASS EXAMPLE

increase by $\Rightarrow \Delta \cdot$
decrease by $(f - i)$

Perform different calculations in a calorimetry experiment (For adding a metal to water).

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)?

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)?

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 .

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

SOLVE FOR THE UNKNOWN (continued)

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

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

Table 2 indicates that the metal could be strontium.

USING SPECIFIC HEAT

IN-CLASS EXAMPLE

SOLVE FOR THE UNKNOWN (continued)

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

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

Table 2 indicates that the metal could be strontium.

Table 2 Specific Heats
at 298 K (25°C)

Substance	Specific heat J/(g•°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



Practice

- ⚙ A scientist heats an unknown metal block with a mass of 132 grams to 116.5°C and places it into a coffee-cup calorimeter. The temperature of the water rises from 24.0°C to 32.5°C as the water absorbs 4,978.96 J of heat. Calculate the specific heat of the unknown metal.



Practice

Last problem in set ①

A scientist heats an unknown metal block with a mass of 132 grams to 116.5°C and places it into a coffee-cup calorimeter. The temperature of the water rises from 24.0°C to 32.5°C as the water absorbs 4,978.96 J of heat. Calculate the specific heat of the unknown metal.

q_w

unknown

$C_{\text{met}} = ??$

$$q_{\text{met}} = C_{\text{met}} \times m_{\text{met}} \times \Delta T_{\text{met}}$$

$$C_{\text{met}} = \frac{q_{\text{met}}}{m_{\text{met}} \times \Delta T_{\text{met}}}$$

$$q_{\text{met}} = -q_w$$

$$C_{\text{met}} = \frac{-4978.96}{132 \times 784} = 0.449 \text{ J/g}^\circ\text{C}$$

known

$$m_{\text{met}} = 132 \text{ g}$$

$$\Delta T_{\text{met}} = T_f - T_i = 32.5 - 116.5 = -84^\circ\text{C}$$

$$q_w = 4978.96 \text{ J}$$

$$\Delta T_w = 32.5 - 24 = 8.5^\circ\text{C}$$

$$q_{\text{met}} = -4978.96 \text{ J}$$

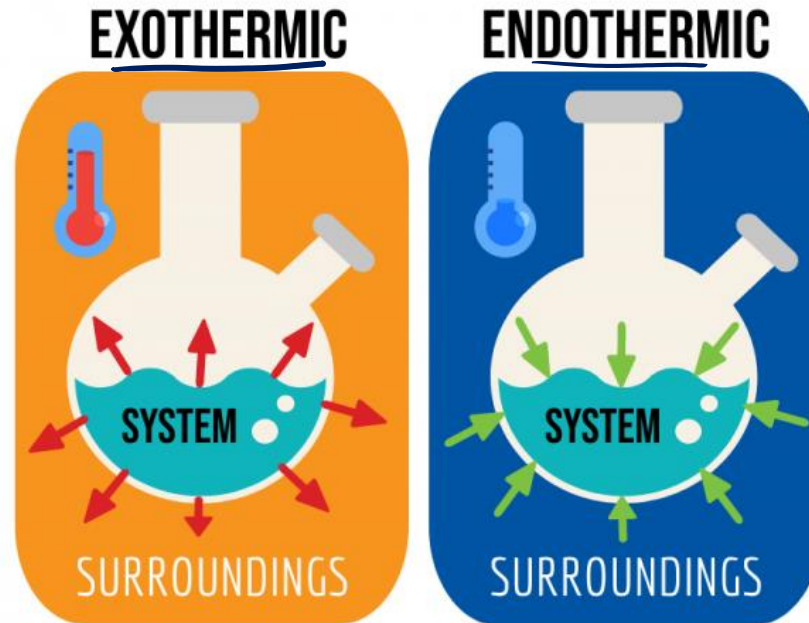
Part 2:

Chemical Energy & The Universe

Chemical Energy and the Universe

الكيمياء الحرارية

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



let's talk
science

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Heat **leaves** the
system

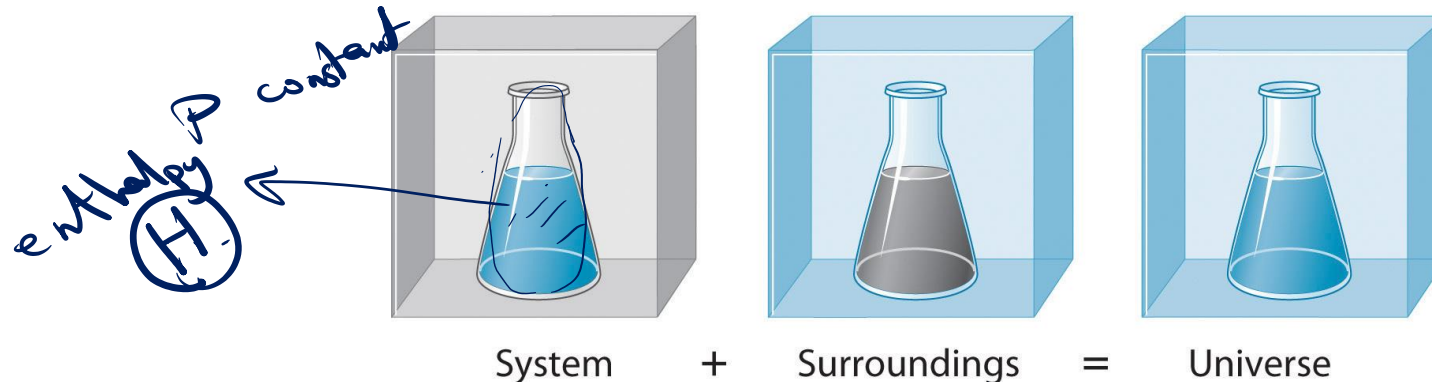
Heat **enters** the
system

Chemical Energy and the Universe

Terminologies “Keywords”:



- 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

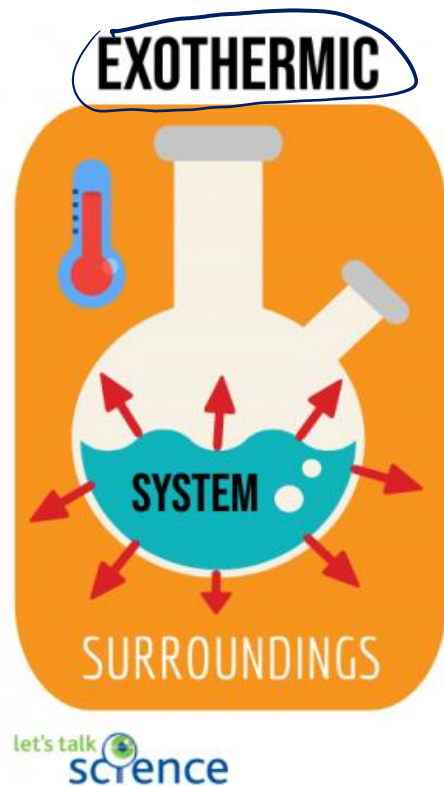
- Chemists are interested in changes in energy during reactions.
- The energy released or evolved from reactions carried **out at constant pressure** is sometimes given the symbol q_p .
ناجست
heat
- Enthalpy (H) is the *المحتوى الحرارى* heat content of a system at constant pressure.
alone
we can't calculate it
- Enthalpy (heat) of reaction is **the change** in enthalpy during a reaction, symbolized as ΔH_{rxn} .
Δ

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

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

rxn = reaction

Chemical Energy and the Universe



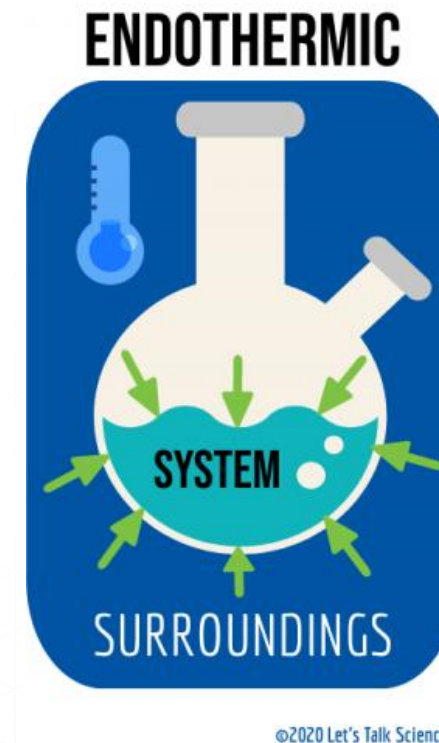
$$\Delta H_{\text{rxn}} < 0$$

Which one will have a negative enthalpy change

$$\Delta H_{\text{rxn}} < 0? \text{ Why?}$$

Which one will have a positive enthalpy change $\Delta H_{\text{rxn}} > 0?$
Why?

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



$$\Delta H_{\text{rxn}} > 0$$

Chemical Energy and the Universe

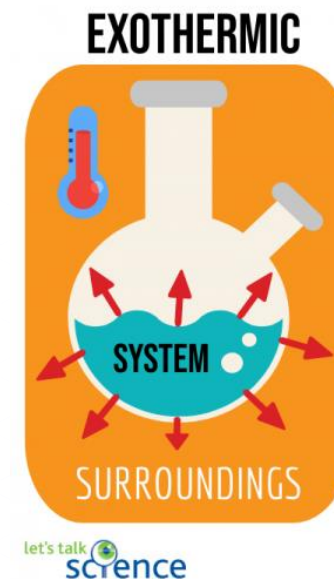
- Enthalpy changes for exothermic reactions are always negative.

- ❖ Exothermic reactions: energy is released out of the system (reaction).

- ❖ $\Delta H_{\text{rxn}} < 0$ "Negative"

$$H_f < H_i$$

$$H_f - H_i < 0 \quad (-)$$



- Enthalpy changes for endothermic reactions are always positive.

- ❖ Endothermic reactions: energy is absorbed into the system (reaction).

- ❖ $\Delta H_{\text{rxn}} > 0$ "Positive"

$$H_f > H_i$$

$$H_f - H_i > 0$$



Chemical Energy and the Universe



Do you know about heat pads?

What are they used for?

Do they release heat or absorb heat?



Chemical Energy and the Universe

The Heat-Pack Reaction

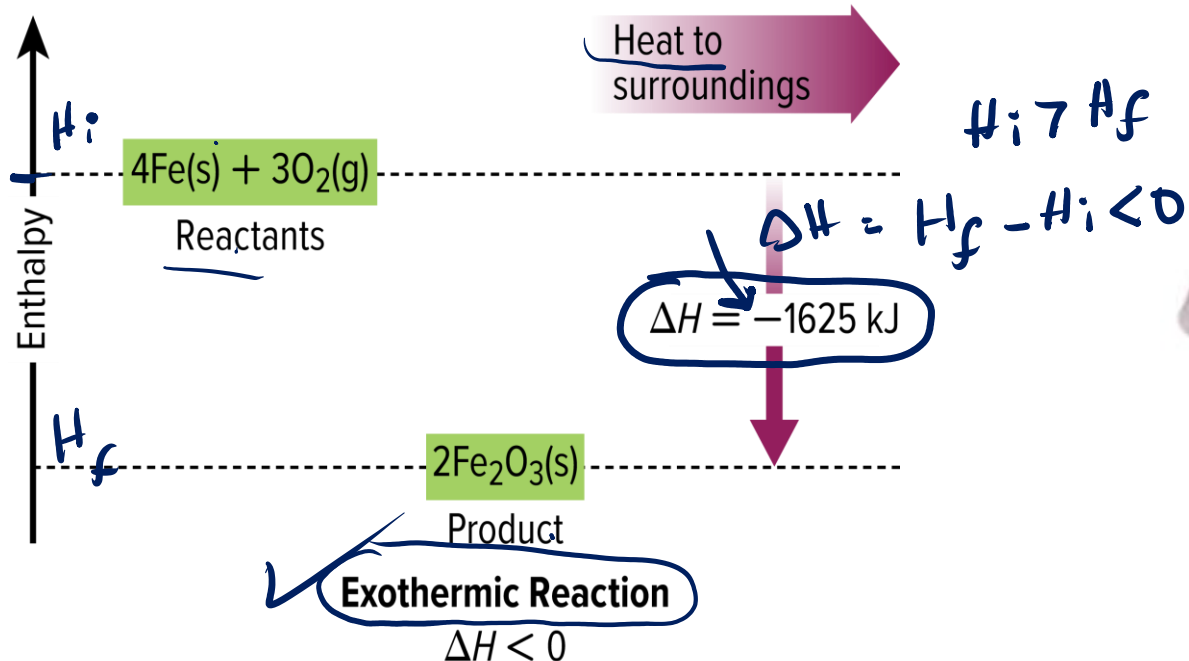
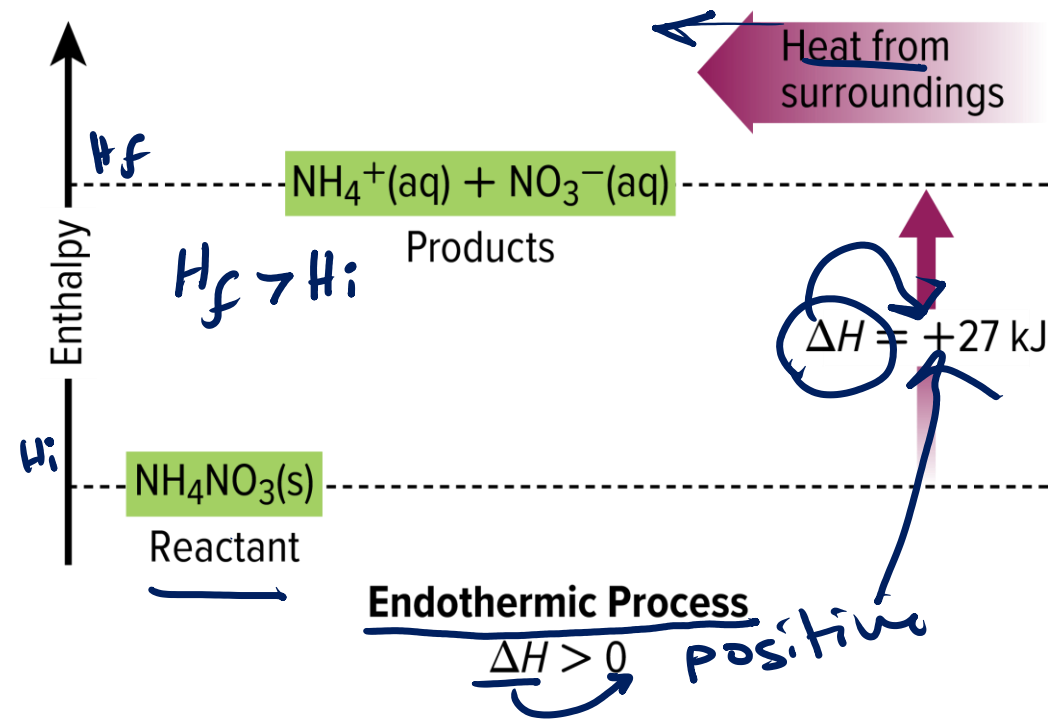


Figure 8 The downward arrow shows that 1625 kJ of heat is released to the surroundings in the reaction between iron and oxygen to form Fe_2O_3 . A heat pack utilizing this reaction of iron and oxygen provides energy for warming cold hands.

Explain how the diagram shows that the reaction is exothermic.

Chemical Energy and the Universe

The Cold-Pack Process



✓ **Figure 9** The upward arrow shows that 27 kJ of heat is absorbed from the surroundings in the process of dissolving NH_4NO_3 . This reaction is the basis for the cold pack. When the cold pack is placed on a person's ankle, his ankle supplies the required heat and is itself cooled.

Determine how much energy is absorbed by ammonium nitrate when the cold pack is activated.

Check your understanding!

$$H_f > H_i$$

$$\Delta H = H_f - H_i > 0$$

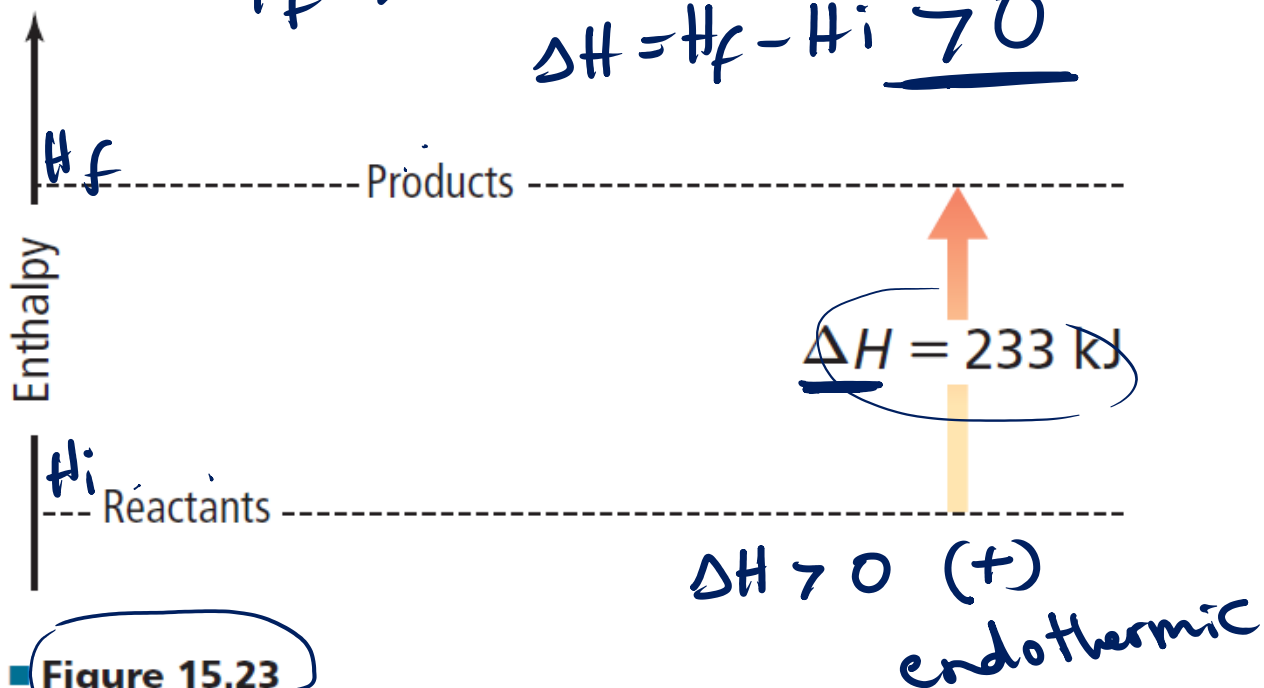


Figure 15.23

Is the reaction shown in Figure 15.23 endothermic or exothermic? How do you know?

Endothermic. $H_{\text{products}} > H_{\text{reactants}}$ “ ΔH is positive”

Is heat flowing **out of the** system or **into the** system?

Into the system because it absorbed energy.

Quiz

Identify the equation that defines the enthalpy (heat) of reaction.

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

 **B** $\Delta H_{\text{rxn}} = H_{\text{products}} - H_{\text{reactants}}$ **CORRECT**

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

 No equation defines this.

Check your understanding!

The enthalpy change for a reaction, ΔH , is negative.

What does this indicate about the chemical potential energy of the system before and after the reaction?

- **Before > After**
- Before < After
- Before = After

after - before

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

If $\Delta H < 0$ “negative”, so H_{initial} > H_{final}

Important point

The enthalpy change, ΔH , is equal to q_p , 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, you might assume that $q = \Delta H_{\text{rxn}}$.

Plenary

What is the name of the insulated device that is used to measure the amount of heat absorbed or released during a chemical or physical process?

 thermometer

 dosimeter

 calorimeter **CORRECT**

 altimeter

Plenary

Which of the following best describes what is studied in thermochemistry?

 physical changes

 heat changes

CORRECT

 phase changes

 temperature changes

Plenary

Which of the following is NOT true of enthalpy?

-  The actual enthalpy of a substance cannot be measured. ✓
-  It is represented by H . ✓
-  c It is a measure of temperature. ✗ **CORRECT**
-  It is the heat content of a system at constant pressure. ✓

$$q_p = \Delta H$$

Plenary

The chemical reaction that occurs in a heat pack is exothermic. What is true of the enthalpy change for the reaction?

$\Delta H < 0$ negative

ΔH

 It is greater than zero.

 It is zero.

 It is less than zero.

CORRECT

 The enthalpy change cannot be determined.

Learning Outcomes

- ▶ **Describe** how a calorimeter is used to measure energy that is absorbed or released.
- ▶ **Perform** *different calculations in a calorimetry experiment (For adding a metal to water).*
- ▶ **Explain** the meaning of enthalpy and enthalpy change in chemical reactions and processes.