

Chemical and Physical Changes

Use with textbook pages 140, 142-144.

1. a) How do you distinguish a chemical change from a physical change?

b) Give three examples of evidence or observations that support a chemical change has taken place.

2. Complete the table below.

Description	Physical or chemical change?	Endothermic or exothermic?	Temperature of surroundings increases or decreases?
photosynthesis			
cellular respiration			
boiling water			
a lake freezing over			
cooking an egg			
instant cold pack to treat sports injuries			
fireworks lighting up the sky			
burning wood on a fire			
$I_2(s) + \text{energy} \rightarrow I_2(g)$			
$H_2O(g) \rightarrow H_2O(l) + \text{energy}$			
$C(s) + H_2O(l) + \text{energy} \rightarrow CO(g) + H_2(g)$			
$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g) + \text{energy}$			

3. From the table above, what relationship do you notice between the type of reaction and the change in temperature of the surroundings?

4. If the temperature of the surroundings increases, does the energy of the system increase or decrease? Explain why.

Representing Energy Changes

Use with textbook page 145.

1. Methane (CH_4) gas reacts with oxygen in the air to form gaseous carbon dioxide and liquid water. As the reaction proceeds, the reaction mixture and its surroundings become noticeably hotter. The total energy of methane and oxygen is more than the total energy of carbon dioxide and water by 890 kJ. It requires an initial spark of 325 kJ to start the reaction.

- a) Write the word equation and skeleton equation for this reaction. Then balance the equation.

Word equation: _____

Balanced equation: _____

- b) What is the value of activation energy for this reaction? _____

- c) Is energy released or absorbed during the reaction? Explain your answer.

- d) Using the language of breaking and making bonds, describe the temperature change of the surroundings when methane burns in oxygen.

- e) Is this an endothermic or exothermic reaction? Justify your answer.

- f) Would the energy-level diagram for this reaction show products with more energy than reactants or less energy than reactants?

Name _____

Date _____

2. Solid calcium carbonate breaks down to form solid calcium oxide and carbon dioxide gas. The total energy of calcium carbonate is 177 kJ less than the total energy of calcium oxide and carbon dioxide. The activation energy for this reaction is 190 kJ.

- a) Write the word equation and skeleton equation for this reaction. Then balance the equation.

Word equation: _____

Balanced equation: _____

- b) What is the minimum amount of energy needed for this reaction to occur?

- c) Is this an endothermic or exothermic reaction? Justify your answer.

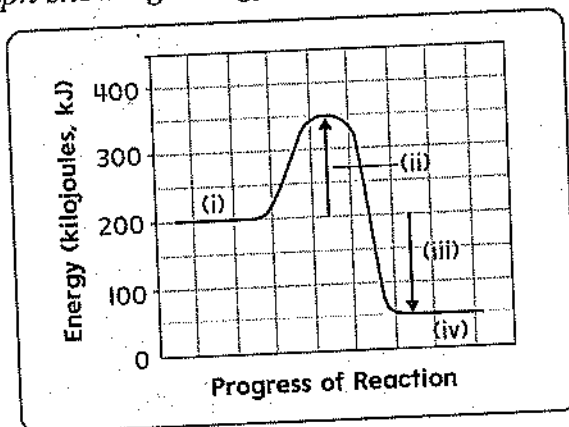
- d) Does the temperature of the surroundings increase or decrease with this reaction? Explain your answer.

- e) Would the energy-level diagram for this reaction show products with more energy than reactants or less energy than reactants?

Reading Energy-Level Diagrams

Use with textbook pages 143-145.

Use the following graph showing energy change of a reaction to answer questions 1 to 7.



- Which Roman numeral in the diagram (i to iv) represents the energy of the reactants? _____
- Which Roman numeral indicates the energy of the products? _____
- Describe the relative energy levels and stability of the reactants and products.

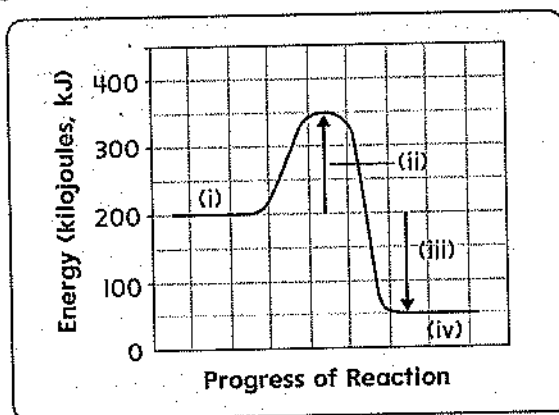
- Which Roman numeral indicates the activation energy? _____
- Which Roman numeral indicates the overall energy change? _____
- Does the diagram represent an exothermic or endothermic reaction? Explain your answer.

- How much energy is released or absorbed during the reaction? _____

Reading Energy-Level Diagrams

Use with textbook pages 143-145.

Use the following graph showing energy change of a reaction to answer questions 1 to 7.



1. Which Roman numeral in the diagram (i to iv) represents the energy of the reactants? _____
2. Which Roman numeral indicates the energy of the products? _____
3. Describe the relative energy levels and stability of the reactants and products.

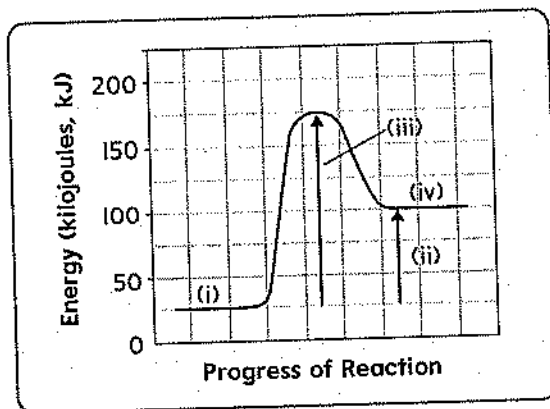
4. Which Roman numeral indicates the activation energy? _____
5. Which Roman numeral indicates the overall energy change? _____
6. Does the diagram represent an exothermic or endothermic reaction? Explain your answer.

7. How much energy is released or absorbed during the reaction? _____

Name _____

Date _____

Use the following graph showing energy change of a reaction to answer questions 8 to 14.



8. Which Roman numeral in the diagram (i to iv) represents the energy of the reactants? _____

9. Which Roman numeral indicates the energy of the products? _____

10. Describe the relative energy levels and stability of the reactants and products.

11. Which Roman numeral indicates the activation energy? _____

12. Does the diagram represent an exothermic or endothermic reaction? Explain your answer.

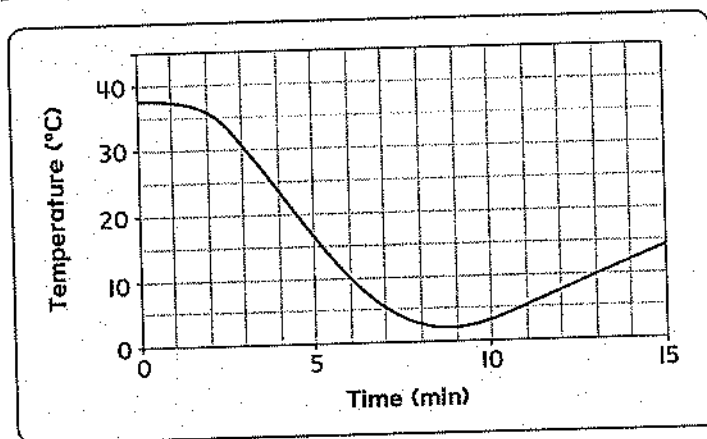
13. Which Roman numeral indicates the overall energy change? _____

14. How much energy is released or absorbed during the reaction? _____

Measuring Energy Changes

Use with textbook page 144.

A student places a small piece of solid potassium hydrogen carbonate into a test tube containing hydrochloric acid solution. The temperature of the solution is recorded every minute, and a temperature versus time graph is drawn from the collected data.



1. What was the initial temperature of the solution? _____
2. What was the temperature in the test tube at 3 min? _____
3. When was the first time the temperature reached 10 °C? _____
4. By approximately how many degrees Celsius did the temperature change between 2 min and 7 min? _____
5. Is the reaction endothermic or exothermic? What evidence supports your conclusion?

6. How long did it take for the reaction to complete? Explain how you can tell.

7. At what temperature did the reaction stop? Explain your answer.
