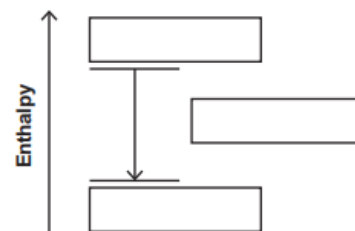
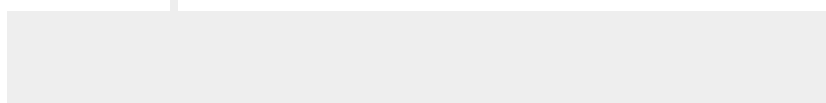
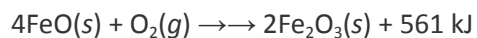


1. Which action is **not** necessary for a successful reaction?

- A. Molecules must collide in order to react.
- B. Molecules must move slowly to collide, or they bounce off one another.
- C. Molecules must collide with proper orientation.
- D. Molecules must collide with sufficient energy.

2. Label the enthalpy diagram for the reaction:



3. Choose the words to finish the sentence.

The enthalpy change of a reaction is the difference in the energy released to the surroundings in bond _____ and the energy consumed from the surroundings in bond _____ during a chemical reaction.

4. How much heat is absorbed when 2.8 mol of NH_4NO_3 are dissolved in water? The heat of the solution of NH_4NO_3 is 25.4 kJ/mol.

- | | |
|--------------|-------------|
| A. -71.12 kJ | C. 9.07 kJ |
| B. -9.07 kJ | D. 71.12 kJ |

5 How many moles of CaCl_2 must be dissolved in water to produce 100 kJ of heat? The heat of the solution for CaCl_2 is -82.8 kJ/mol.

- | | |
|--------------|--------------|
| A. 0.828 mol | C. 91.9 mol |
| B. 1.21 mol | D. 134.2 mol |

6. Choose the words to finish the sentence.

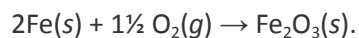
If 22 kJ of energy are provided to 16 g of ammonia (NH_3), ammonia will change its phase from _____ to _____. ΔH_{fus} of ammonia is 5.65 kJ/mol and ΔH_{vap} of ammonia is 23.4 kJ/mol.

7. Classify these reactions as exothermic or endothermic. Place each reaction into the correct box.

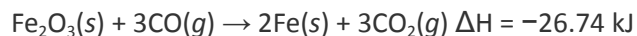
- burning gasoline
- reactions inside a chemical cold pack
- photosynthesis, where plants use sunlight and carbon dioxide to produce sugar and oxygen
- adding sulfuric acid to water, which gives off heat

Exothermic	Endothermic

8. Use Hess's law to calculate the value of ΔH for the equation



Use these equations to help you:



A. -875.74 kJ/mol

C. 309.74 kJ/mol

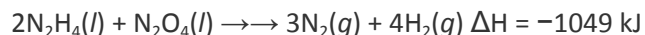
B. 256.26 kJ/mol

D. 822.26 kJ/mol

9. If heat is released by a chemical system, which statement is true?

- A. An equal amount of heat is absorbed by the surroundings.
- B. An equal amount of heat is released by the surroundings.
- C. An equal amount of heat is released by the universe.
- D. An equal amount of heat is absorbed by the universe.

10. This reaction was used to fuel the rockets in the Apollo mission landing module:



How many kilojoules of energy are produced when 5.40 g of N_2O_4 react with excess N_2H_4 ?

- A. -177.02 kJ
- B. -61.6 kJ
- C. 61.6 kJ
- D. 177.02 kJ

11. Hess's law states that change in enthalpy of a chemical reaction is independent of the route by which chemical reactions take place.

Which statement summarizes the conditions necessary for Hess's law?

- A. The initial conditions of the reactions are the same.
- B. The final conditions of the reaction are the same.
- C. The initial and final conditions of the reactions are the same.
- D. The conditions in the intermediate steps are the same.

12. The heat of sublimation of dry ice (solid CO_2) is 25.2 kJ/mol. How many grams of water at 0°C would be frozen by the complete sublimation of 48.0 g of dry ice dropped into water? The heat of fusion of water is 6.01 kJ/mol.

- A. 4.57 g
- B. 27.5 g
- C. 48.0 g
- D. 82.3 g

13. Which statement **best** explains activation energy?

- A. the energy required to break bonds in the product molecules
- B. the minimum energy needed to convert reactants into the activated complex
- C. the energy required to make molecules collide
- D. the energy required to form bonds in the products