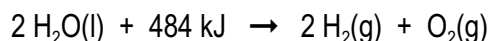


REVIEW AND PRACTICE 3

1. A beaker contains 150 mL of water at 21.6 °C. A student dissolves some potassium iodide in the water and finds that the temperature of the water drops to 15.2 °C. What quantity of thermal energy was lost by the water?

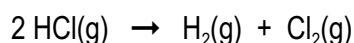
[ANSWER 4.0 kJ]

2. Water can be decomposed by electrolysis.



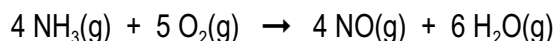
- (a) Is the reaction exothermic or endothermic?
(b) What is the molar enthalpy change with respect to water?
(c) Draw a potential energy diagram for the reaction (you do not need to include the activation energy).

3. Use bond energies to estimate the enthalpy change for the decomposition of hydrogen chloride.



[ANSWER +183 kJ]

4. Use enthalpies of formation to calculate the enthalpy change for the following chemical reaction.



[ANSWER -906.4 kJ]

5. Using the four thermochemical equations given below, apply Hess's law to find the enthalpy change for the chemical reaction, $\text{P}_4\text{O}_{10}(\text{s}) + 6 \text{PCl}_5(\text{g}) \rightarrow 10 \text{POCl}_3(\text{g})$.

- ① $\text{P}_4(\text{s}) + 6 \text{Cl}_2(\text{g}) \rightarrow 4 \text{PCl}_3(\text{g})$ $\Delta H = -1226 \text{ kJ}$
② $\text{P}_4(\text{s}) + 5 \text{O}_2(\text{g}) \rightarrow \text{P}_4\text{O}_{10}(\text{s})$ $\Delta H = -2967 \text{ kJ}$
③ $\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow \text{PCl}_5(\text{g})$ $\Delta H = -84 \text{ kJ}$
④ $2 \text{PCl}_3(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2 \text{POCl}_3(\text{g})$ $\Delta H = -572 \text{ kJ}$

[ANSWER -615 kJ]

6. Refer to the potential-energy diagram in figure 1.

- (a) Is the forward reaction exothermic or endothermic?
(b) What is the activation energy for the forward reaction?
(c) What is the activation energy for the reverse reaction?
(d) What is the enthalpy change for the forward reaction?
(e) Write a chemical equation for the forward reaction including an energy term.

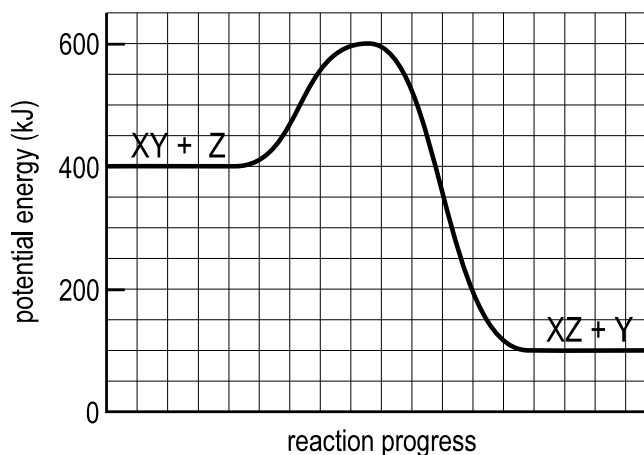


Figure 1

7. Refer to the reaction mechanism in figure 2.
- Write a chemical equation for the overall reaction.
 - List the reaction intermediates.
 - What is the catalyst in the reaction?

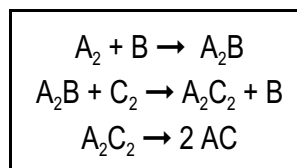


Figure 2

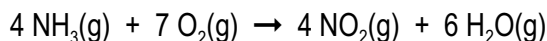
8. A chemistry student is using calorimetry to find the molar enthalpy change with respect to barium nitrate for the following reaction.



In a calorimeter, the student adds 19.6 g of barium nitrate to 150.0 mL of potassium sulfate solution. The initial temperature of the solution was 26.0 °C. When the barium nitrate had completely reacted the temperature of the solution reached 29.1 °C. Complete the analysis (state any assumptions).

[ANSWER -26 kJ/mol]

9. Calculate the heat released when 1.0 g of ammonia reacts with oxygen by the following reaction.

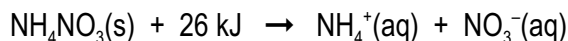


[ANSWER 17 kJ]

10. What minimum mass of methane must be used to bring 2.0 L of water to a boil on a gas stove (assume complete combustion, that all the heat is transferred to the water, and that the water starts at 20.0 °C)?

[ANSWER 13 g]

11. The dissolution of ammonium nitrate is an endothermic process. If 10.0 g of ammonium nitrate is added to 100.0 mL of water at 20.0 °C then what is the final temperature after the solid dissolves? Assume that the process takes place in an isolated system.



[ANSWER 12.2 °C]