

SCH 4UI: Unit 2 - Energy Changes and Rates of Reaction

Big Ideas

- All chemical and physical changes involve an exchange of energy with the surroundings.
- Energy changes and rates of chemical reactions can be described quantitatively.

Learning Goals

By the end of this unit, I will be able to...

| Date | Learning Goal |
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| | 1. Outline the first and second law of thermodynamics and how they relate to chemical reactions |
| | 2. Describe what the enthalpy of reaction represents and how it is represented |
| | 3. Distinguish between an endothermic and exothermic reaction |
| | 4. Calculate the heat exchanged for a given chemical reaction using enthalpy and amount of reactant |
| | 5. Compare enthalpy changes associated with physical, chemical and nuclear changes |
| | 6. Calculate the enthalpy of reaction by experiment |
| | 7. Describe how a simple calorimeter works in relation to the first and second law of thermodynamics |
| | 8. Build a simple calorimeter and experimentally determine the enthalpy change for a given physical change and chemical reaction |
| | 9. Use Hess's Law of Heat of Summation to determine the enthalpy change for a chemical reaction |
| | 10. Write out formation equations |
| | 11. Apply Hess's Law using standard molar enthalpies of formation to determine the enthalpy change for a chemical reaction |
| | 12. Experimentally determine the enthalpy of reaction using Hess's Law for a given chemical reaction |
| | 13. Outline how reaction rates can be measured |
| | 14. Express reaction rates mathematically |
| | 15. Calculate the rate of reaction for a given reactant or product in a chemical equation |
| | 16. Express reaction equations as a rate law equation and determine the order of the reaction with respect to the reactants |
| | 17. Calculate the rate constant for a chemical reaction with the appropriate units |

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| | 18. Determine the order of reaction based on graphical analysis of reaction rates |
| | 19. Outline the factors that affect the quality of collisions in a chemical reaction |
| | 20. Draw a complete potential energy diagram by including enthalpy change and activation energy for a chemical reaction |
| | 21. Calculate the activation energy and enthalpy change for the forward and reverse reaction on a given potential energy diagram |
| | 22. Identify reaction intermediates and catalysts in a reaction mechanism |
| | 23. Determine the molecularity for a given elementary step in a reaction mechanism |
| | 24. Evaluate a proposed reaction mechanism |
| | 25. Determine the rate-determining step in a reaction mechanism |
| | 26. Determine the rate law equation based on the rate-determining step of a reaction mechanism |
| | 27. Describe how a catalyst affects the rate of a reaction with respect to enthalpy and activation energy |
| | 28. Experimentally determine the order of reaction of the reactants and the rate law equation for a given chemical reaction |