SCH 4U
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Unit 3 Test Review

Concepts

- Temperature vs thermal energy, exothermic vs endothermic, open vs close system
- First and second law of thermodynamics
- Rate of reactions
- Average vs instantaneous reaction rates
- Collision theory
  - Effective vs ineffective collision, transition state vs activated complex
- Rate determining step
- Factors that may impact reaction rate
- First order vs second order reactions
- Symbol and units for:
  - Specific heat capacity
  - Heat
  - Molar Enthalpy
  - Enthalpy of a system (reaction)

Skills

- Be able to calculate:
  - Heat of a reaction
  - Molar enthalpy of a substance
  - Number of moles using mass of concentration
  - Use data from calorimetry to solve for molar enthalpy
  - Use Hess's Law to determine total enthalpy
  - Use the standard enthalpy of formation
  - Calculate rate of reaction
  - Be able to recognize a first and second order reaction

Practice Questions:

1) A 7.0 g sample of cesium is sealed in a vial and placed into a calorimeter containing 250.0 mL of water at 90.00 °C. When the cesium had melted, the temperature of the water had dropped to 88.98 °C. Determine the molar heat of fusion for cesium in kJ/mol.

2) A 12.7 g sample of sulfur (S_8) is burned in a calorimeter. The calorimeter contains 2.20 kg of water at 21.08 °C. The reaction mixture is ignited and the temperature rises to 33.88 °C. From this data, calculate the molar heat of combustion of sulfur. Assume Q= 100 J of energy.

3) Calculate the mass of pentane required to combust to heat 250.0 g of water at -6°C to 85°C. The enthalpy of combustion for pentane is –3509 kJ/mol. The formula for pentane is C_5H_{12}.

4) Calculate H fort he reaction:

$3N_2H_{4(l)} + 4ClF_{3(g)} \rightarrow 3N_{2(g)} + 12HF_{(g)} + 2Cl_{2(g)}$

use the following data:

$2ClF_{3(g)} + 2NH_{3(g)} \rightarrow N_{2(g)} + 6HF_{(g)} + Cl_{2(g)}$	ΔH=-1196kJ
$N_2H_{4(l)} + O_{2(g)} \rightarrow N_{2(g)} + 2H_2O_{(l)}$	ΔH=-622kJ
$4NH3(g) + 3O2(g) \rightarrow 2N2(g) + 6H2O(l)$	ΔH=-1530kJ

5) For each of the following, calculate the enthalpy change for each reaction, ΔHf. Provide your answer in kJ.

$NaOH_{(s)} + HCl_{(g)} \rightarrow NaCl_{(s)} + H_2O_{(g)}$

$CH_{4(g)} + 2\ O_{2(g)} \rightarrow CO_{2(g)} + 2\ H_2O_{(l)}$

$2\ H_2S_{(g)} + 3\ O_{2(g)} \rightarrow 2\ H_2O_{(l)} + 2\ SO_{2(g)}$

$2\ NO_{(g)} + O_{2(g)} \rightarrow 2\ NO_{2(g)}$

Compound ΔHf (kJ/ mol)

$CH_4(g)$ -74.8	$CO_{2(g)}$ -393.5	$NaCl_{(s)}$ -411.0	$H2O_{(l)}$ -285.8
$H_2S(_{g})$ -20.1	$H_2SO_{4(l)}$ -811.3	$MgSO_{4(s)}$ -1278.2	$MnO_{(s)}$ -384.9
$MnO_{2(s)}$ -519.7	$NaCl_{(s)}$ -411.0	$NaF_{(s)}$ -569.0	$NaOH_{(s)}$ -426.7
$NH_{3(g)}$ -46.2	$HCl_{(g)}$ -92.3	$H_2O_{(g)}$ -241.8	$SO_{2(g)}$ -296.1
$NH_4Cl_{(s)}$ -315.4	$NO_{(g)}$ +90.4	$NO_{2(g)}$ +33.9	$SnCl_{4(l)}$ -545.2
$SnO_{(s)}$ -286.2	$SnO_{2(s)}$ -580.7	$SO_{2(g)}$ -296.1	$SO_{3(g)}$ -395.2
$ZnO_{(s)}$ -348.0	$ZnS_{(s)}$ -202.9		

6) If kHI is $1.8 \times 10^{-4}\ M^{-1}s^{-1}$, [I2] is 4.0 M and [$H_2$] is 2.0 M, find the reaction rate for the following reaction. Assume it is first order with respect to both reactants.

$H_{2(g)} + I_{2(g)} \rightarrow 2HI_{(g)}$