1. KT6 6.P.020. [489840]  Show Details

The heat energy required to melt 1.00 g of ice at 0°C is 333 J. If one ice cube has a mass of 57.0 g, and a tray contains 16 ice cubes, what quantity of energy is required to melt a tray of ice cubes to form liquid water at 0°C?

\[ 48 \text{ } \text{J} \]

2. KT6 6.P.018. [489879]  Show Details

A 237 g piece of molybdenum, initially at 100.0°C, is dropped into 244 g of water at 10.0°C. When the system comes to thermal equilibrium, the temperature is 15.3°C. What is the specific heat capacity of molybdenum?

\[ 48 \text{ } \text{J/g \cdot K} \]

3. KT6 6.P.028. [467506]  Show Details

Calcium carbide, CaC₂, is manufactured by the reaction of CaO with carbon at a high temperature. (Calcium carbide is then used to make acetylene.)

\[ \text{CaO(s) } + 3 \text{C(s) } \rightarrow \text{CaC}_2(s) + \text{CO(g)} \quad \Delta H_{rxn} = -464.8 \text{ kJ} \]

Is this reaction endothermic or exothermic?

\( \text{° exothermic} \)

\( \text{° endothermic} \)

If 19.7 g of CaO is allowed to react with an excess of carbon, what quantity of heat is absorbed or evolved by the reaction?

\[ 48 \text{ } \text{kJ} \]

4. KT6 6.P.032. [467265]  Show Details

You mix 125 mL of 0.250 \( M \) CsOH with 50.0 mL of 0.625 \( M \) HF in a coffee-cup calorimeter, and the temperature of both solutions rises from 21.50°C before mixing to 24.40°C after the reaction.

\[ \text{CsOH(aq) } + \text{HF(aq) } \rightarrow \text{CsF(aq) } + \text{H}_2\text{O(l)} \]

What is the enthalpy of reaction per mole of CsOH? Assume the densities of the solutions are all 1.00 g/mL and the specific heats of the solutions are 4.2 J/g \cdot K.

\[ 48 \text{ } \text{kJ/mol} \]

5. KT6 6.P.037. [467588]  Show Details

Sulfur (1.81 g) is burned in a constant volume calorimeter with excess O₂(g). The temperature increases from 21.25°C to 25.13°C. The bomb has a heat capacity of 923 J/K, and the calorimeter contains 815 g of...
water. Calculate the heat evolved, per mole of SO₂ formed, for the reaction

\[ \text{S₈(s) + 8 O₂(g) → 8 SO₂(g)} \]

\( \text{kJ/mol} \)

Sulfur burns in oxygen, with a bright blue flame, to give sulfur dioxide gas, SO₂. (C.D. Winters)

6. KT6 6.P.039. [467575]  Show Details

Suppose you burn 1.558 g of benzoic acid, C₆H₅CO₂H, in a constant volume calorimeter and find that the temperature increases from 22.50°C to 31.85°C. The calorimeter contains 775 g of water, and the bomb has a heat capacity of 893 J/K. What quantity of heat is evolved in this combustion reaction, per mole of benzoic acid?

\( \text{kJ/mol} \)

7. KT6 6.P.041. [467216]  Show Details

An “ice calorimeter” can be used to determine the specific heat of a metal. A piece of hot metal is dropped into a weighed quantity of ice. The quantity of heat transferred from the metal to the ice can be determined from the amount of ice melted. Suppose you heat a 40.0 g piece of metal to 99.8°C and then drop it onto ice. When the metal’s temperature has dropped to 0.0°C, it is found that 7.03 g of ice has melted. What is the specific heat capacity of silver?

\( \text{J/g} \cdot \text{K} \)

8. KT6 6.P.046. [467149]  Show Details
You wish to know the enthalpy change for the formation of liquid PCl₃ from the elements shown below.

\[ \text{P}_4(s) + 6 \text{Cl}_2(g) \rightarrow 4 \text{PCl}_3(l) \quad \Delta H^\circ = ? \]

The enthalpy change for the formation of PCl₅ from the elements can be determined experimentally, as can the enthalpy change for the reaction of PCl₃(l) with more chlorine to give PCl₅(s).

\[ \text{P}_4(s) + 10 \text{Cl}_2(g) \rightarrow 4 \text{PCl}_5(s) \quad \Delta H^\circ_{\text{rxn}} = -1774.0 \text{ kJ} \]

\[ \text{PCl}_3(l) + \text{Cl}_2(g) \rightarrow \text{PCl}_5(s) \quad \Delta H^\circ_{\text{rxn}} = -123.8 \text{ kJ} \]

Use these data to calculate the enthalpy change for the formation of 1.80 mol of PCl₃(l) from phosphorus and chlorine.

\[ \Delta H = \text{? kJ} \]

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9. KT6 6.P.054. [467461]  Show Details

The Romans used calcium oxide, CaO, to produce a strong mortar. The CaO was mixed with water to give Ca(OH)₂, which reacted slowly with CO₂ in the air to give CaCO₃.

\[ \text{Ca(OH)}_2(s) + \text{CO}_2(g) \rightarrow \text{CaCO}_3(s) + \text{H}_2\text{O}(g) \]

(a) Calculate the standard enthalpy change for this reaction.

\[ \Delta H = \text{? kJ} \]

(b) What quantity of heat is evolved or absorbed if 1.40 kg of Ca(OH)₂ reacts with a stoichiometric amount of CO₂?

\[ \Delta H = \text{? kJ} \]

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10. KT6 6.P.107. [467354]  Show Details

You want to heat the air in your house with natural gas (CH₄). Assume your house has 241 m² (about 2531 ft²) of floor area and that the ceilings are 2.20 m from the floors. The air in the house has a molar heat capacity of 29.1 J/mol ⋅ K. (The number of moles of air in the house can be found by assuming that the average molar mass of air is 28.9 g/mol and that the density of air at these temperatures is 1.22 g/L.) What mass of methane do you have to burn to heat the air from 17.5°C to 22.0°C?

\[ \Delta H = \text{? g} \]