Practice Quiz
Thermodynamics

Answers

1. Calcium carbide can be made by heating calcium oxide (lime) with carbon (charcoal) according to the following reaction:

$$CaO_{(s)} + 3C_{(s)} \rightarrow CaC_{2(s)} + CO_{(g)} \qquad \Delta H = +464.8\ kJ$$

How many kilojoules of heat are absorbed in a reaction in which 50.0 grams C(s) is consumed?

$50.0g\ C \times \frac{1mol}{12.01g} \times \frac{464.8\ kJ}{3mol} = 645.018kJ = 645kJ$ (3 sig. figs)

2. Large beds of granite rock are used in some solar-heated homes to store heat. Calculate the quantity of heat absorbed by 200.0 kg of rocks if their temperature increased by 16°C. The specific heat capacity of the granite rocks is 0.79 J/g°.

$q = mass \times \Delta T \times S.H. = (200.0kg)(16)(0.79) = 2528kJ$

2500kJ (2 sig figs)

$CsOH_{(aq)} + HCl_{(aq)} = CsCl_{(aq)} + H_2O_{(l)}$

3. In a coffee-cup calorimeter, 0.0200 moles of CsOH and 0.0200 moles of HCl are mixed together with water to make a solution with a total volume of 150.0mL. The temperature of the solution before mixing was 22.50°C. After mixing the temperature of the solution is 24.28°C. What is the enthalpy of the reaction (ΔH) per mole of cesium hydroxide? Assume that the density of the solution is 1.01g/mL and that the specific heat of the solution is 4.2J/g°C.

$\Delta H_{rxn} = -57kJ/mol\ CsOH$ (2 s.f.)

$150.0ml \times 1.01g/mL = 151.5g$

24.28
− 22.50
1.78

$q_{solution} = -\Delta H_{rxn}$

$q = \Delta T \cdot S.H \cdot mass = (1.78)(151.5g)(4.2) =$ 1132.614 joules of heat for 0.0200 mol

$-\Delta H = \frac{1132.614J}{0.0200mol} = 56630J/mol$

4. Using the data provided, calculate the standard reaction enthalpy for the following reaction:

$$2Ag_2S_{(s)} + 2H_2O_{(l)} \rightarrow 4Ag_{(s)} + 2H_2S_{(g)} + O_{2(g)}$$

-32.6 -285.5 ∅ -20.5 ∅

Compound	ΔH°f (kJ/mol)
$Ag_2S_{(s)}$	-32.6
$H_2O_{(l)}$	-285.5
$H_2S_{(g)}$	-20.5
$NO_{2(g)}$	33.84
$HNO_{3(aq)}$	-206.6
$NO_{(g)}$	90.37

$\Delta H = \sum n H^f_{products} - \sum m H^f_{reactants}$

$(2)(-20.5) - [(2)(-32.6) + (2)(-285.5)]$

products reactants

$-41.0 + 65.2 + 571.0 = 595.2\ kJ$

(to nearest tenth of a KJ)