Question 4: Short Answer — 4 points

(a) For the correct calculated value with units: **1 point**

$q = mc\Delta T = (15.0\text{ g})(0.72\text{ J/(g}\cdot{}^\circ\text{C}))(39.7^\circ\text{C} - 22.0^\circ\text{C}) = 190\text{ J}$

(b) For the correct calculated value of the moles of reaction, consistent with part (a) (may be implicit): **1 point**

$q_{sys} = -q_{surr}$

$-190\text{ J} \times \frac{1\text{ kJ}}{1000\text{ J}} \times \frac{1\text{ mol}_{rxn}}{-1650\text{ kJ}} = 0.00012\text{ mol}_{rxn}$

For the correct calculated value of the mass of iron: **1 point**

$0.00012\text{ mol}_{rxn} \times \frac{4\text{ mol Fe}}{1\text{ mol}_{rxn}} \times \frac{55.85\text{ g Fe}}{1\text{ mol Fe}} = 0.027\text{ g Fe}$ *(0.026 g if decimals are carried)*

Total for part (b) **2 points**

(c) For the correct answer and a valid justification: **1 point**

Greater than. A greater mass of iron provides a greater number of moles of reaction, which would transfer a greater quantity of thermal energy to the same mass of sand and therefore lead to a greater maximum temperature.

Total for question 4 **4 points**