**Quiz 6**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. Which of the following is true of the internal energy of a system and its surroundings during an energy exchange with a negative ΔEsys (2 points)?
	1. The internal energy of the system increases, and the internal energy of the surroundings decreases.
	2. The internal energy of both the system and the surroundings increases.
	3. The internal energy of both the system and the surroundings decreases.
	4. The internal energy of the system decreases, and the internal energy of the surroundings increases.
	5. None of the above
2. Suppose that a person eats a diet of 2395 Calories per day (4 points).
	1. Convert this energy into kilojoules.
	2. Convert this energy into kilowatt-hours (4 points).
3. Suppose that 23 g of gold (specific heat of gold is 0.128 J/g °C) is initially at 29.0 °C. What is the final temperature of gold upon absorbing 2.45 kJ of heat (4 points)?
4. Suppose that 23 g of silver (specific heat of silver is 0.235 J/g °C) is initially at 29.0 °C. What is the final temperature of gold upon absorbing 2.45 kJ of heat (4 points)?
5. What mass of natural gas (CH4) must you burn to emit 267 kJ of heat (5 points)?

CH4 (g) + 2 O2 (g) 🡪 CO2 (g) + 2 H2O (l) ∆H°rxn = -802.3 kJ

1. Calculate the enthalpy of formation of SO2 (g) from the standard enthalpy changes of the following reactions (5 points):

2 SO2 (g) + O2 (g) 🡪 2 SO3 (g) ∆Hrxn° = -196 kJ

¼ S8 (s) + 3 O2 (g) 🡪 2 SO3 (g) ∆Hrxn° = -790 kJ

1/8 S8 (s) + O2 (g) 🡪 SO2 (g) ∆Hrxn° = ?

**Quiz 6**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. Which of the following is true of the internal energy of a system and its surroundings during an energy exchange with a negative ΔEsys (2 points)?
	1. The internal energy of the system increases, and the internal energy of the surroundings decreases.
	2. The internal energy of both the system and the surroundings increases.
	3. The internal energy of both the system and the surroundings decreases.
	4. The internal energy of the system decreases, and the internal energy of the surroundings increases.
	5. None of the above
2. Suppose that a person eats a diet of 2395 Calories per day (4 points).
	1. Convert this energy into kilojoules.

$$2395 Cal×\frac{1000 cal}{1 Cal}×\frac{4.184 J}{1 cal}×\frac{1 kJ}{1000 J}=10020.68 kJ ≈1.002×10^{4} kJ$$

* 1. Convert this energy into kilowatt-hours (4 points).

$$2395 Cal×\frac{1000 cal}{1 Cal}×\frac{4.184 J}{1 cal}×\frac{1 kWh}{3.6×10^{6} J}=2.78352222 kWh ≈2.784 kWh$$

1. Suppose that 23 g of gold (specific heat of gold is 0.128 J/g °C) is initially at 29.0 °C. What is the final temperature of gold upon absorbing 2.45 kJ of heat (4 points)?

$$q=mc∆T ⟹∆T=\frac{q}{mc}⇒T\_{f}-T\_{i}=\frac{q}{mc}⇒T\_{f}=\frac{q}{mc}+T\_{i}$$

$$T\_{f}=\frac{2.45 kJ}{(23 g)(0.128\frac{J}{g ℃})}\frac{1000 J}{1 kJ}+29.0 ℃$$

$$T\_{f}=832.201087 ℃+29.0 ℃$$

$$T\_{f}=861.201087 ℃≈860 ℃$$

1. Suppose that 23 g of silver (specific heat of silver is 0.235 J/g °C) is initially at 29.0 °C. What is the final temperature of gold upon absorbing 2.45 kJ of heat (4 points)?

$$q=mc∆T ⟹∆T=\frac{q}{mc}⇒T\_{f}-T\_{i}=\frac{q}{mc}⇒T\_{f}=\frac{q}{mc}+T\_{i}$$

$$T\_{f}=\frac{2.45 kJ}{(23 g)(0.235\frac{J}{g ℃})}\frac{1000 J}{1 kJ}+29.0 ℃$$

$$T\_{f}=453.2839963 ℃+29.0 ℃$$

$$T\_{f}=482.2839963 ℃≈480 ℃$$

1. What mass of natural gas (CH4) must you burn to emit 267 kJ of heat (5 points)?

CH4 (g) + 2 O2 (g) 🡪 CO2 (g) + 2 H2O (l) ∆H°rxn = -802.3 kJ

$$-267 kJ×\frac{1 mol CH\_{4}}{-802.3 kJ}×\frac{16.05 g CH\_{4} }{1 mol CH\_{4}}=5.34 g CH\_{4}$$

1. Calculate the enthalpy of formation of SO2 (g) from the standard enthalpy changes of the following reactions (5 points):

2 SO2 (g) + O2 (g) 🡪 2 SO3 (g) ∆Hrxn° = -196 kJ

¼ S8 (s) + 3 O2 (g) 🡪 2 SO3 (g) ∆Hrxn° = -790 kJ

1/8 S8 (s) + O2 (g) 🡪 SO2 (g) ∆Hrxn° = ?

(¼ S8 (s) + 3 O2 (g) 🡪 2 SO3 (g) ∆Hrxn° = -790 kJ) x ½

(2 SO3 (g) 🡪 2 SO2 (g) + O2 (g) ∆Hrxn° = 196 kJ) x ½

1/8 S (g) + 3/2 O2 (g) + SO3 (g) 🡪 SO3 (g) + SO2 (g) + ½ O2 (g) ∆Hrxn° = -297 kJ

1/8 S (g) + O2 (g) 🡪 SO2 (g) ∆Hrxn° = -297 kJ