Quiz I: Thermodynamics

SCH4U_2018 - 2019_V3

NAME: _____

(Total Score: /30)

Problems (20)

1. When 15.90 kJ of heat is applied to a sample of metal that has a mass of 155.0 g the temperature rises from 26.0 ^{O}C to 80.5 ^{O}C. Calculate the specific heat capacity of the metal. 3

2. A 1.000 g sample of naphthalene, $C_{10}H_{8(s)}$, is completely burned in a bomb calorimeter. The 225 mL of water that surrounds the bomb calorimeter warms from 22.30 ^{O}C to 39.60 ^{O}C during the combustion.

a. Calculate molar enthalpy of combustion of naphthalene. 4

b. Write a thermochemical equation for the complete combustion of naphthalene. 1

c. Explain what information may be obtained from your calculation to part (b) (iii), about the bonds made and the bonds broken in the combustion of the alcohol. 2

3. 3.00 g zinc powder was added to 50.0 mL of 0.100 mol dm^{-3} silver nitrate solution, in a polystyrene cup. Initially, the temperature was 21.10 °C and it rose to 25.40 °C.

a. Write a balanced equation for the reaction of zinc metal and silver nitrate solution. 1

b. Calculate the molar enthalpy change, in kJ mol^{-1}, for the reaction of zinc metal and silver nitrate solution.. (State clearly any assumptions you have made in your calculation.) 5

4. Dry ice is solid carbon dioxide. It does not melt, but instead it sublimes directly to the gas state.

a. Is this change, from solid to gas, an endothermic or an exothermic process? Explain your choice. 2

b. What sign would ΔH have? 1

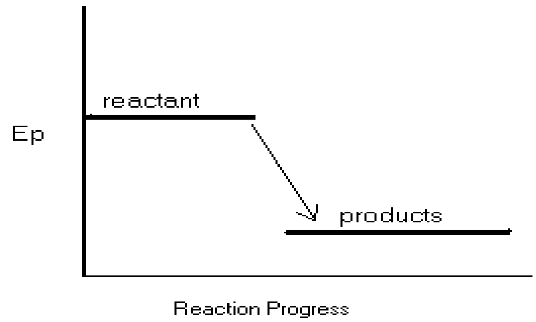
c. Briefly explain the transfer of energy between the system and the surroundings involved in this change. 1

Multiple Choice (10)

1. A reaction is **most** likely to be spontaneous if :

A. the reaction is endothermic and has a high activation energy
B. the reaction is endothermic and has a low activation energy
C. the reaction is exothermic and has a high activation energy
D. the reaction is exothermic and has a low activation energy

2. Which statement concerning the accompanying diagram is true?



a. the system is endothermic
b. the system releases heat to the surrounding
c. the heat content of the reactants is less than the heat content of the products
d. the enthalpy of the products is greater than the enthalpy of reactants

3. The activation energy for an endothermic reaction is 50 kJ/mol. The activation energy for the reverse reaction is:

a. More than 50 kJ/mol b. Less than 50 kJ/mol c. 50 kJ/mol d. 0 kJ/mol

4. For the reaction:

$$H_2 + F_2 \longrightarrow 2HF + 542.2\text{ kJ}$$

Which of the following statements best accounts for this behavior?

A. The bonds in HF are stronger than those in H_2 and F_2.
B. HF is an ionic compound whereas H_2 and F_2 are covalent.
C. More bonds are formed than broken.
D. HF is unstable and can not exist.

5. The specific heat of ethyl alcohol is 2.45 J/g°C and that of silver is 0.235 J/g°C. Therefore, 10.0 J of energy delivered to 10.0 g of each substance:

a) raises the temperature of both by the same number of degrees
b) raises the temperature of the ethyl alcohol more than that of the silver
c) raises the temperature of the silver more than that of the ethyl alcohol
d) raises the heat capacity of the silver more than that of the ethyl alcohol
e) changes the specific heat of the silver more than that of ethyl alcohol

6. Choose the false statement concerning the following reaction:

$$N_{2(g)} + 5/2O_{2(g)} \longrightarrow N_2O_{5(s)} \qquad \Delta H = -42.84\text{ kJ}$$

a) the enthalpy (or heat content) of the product, $N_2O_{5(s)}$, is less than that of the reactants
b) if the reaction could be carried out as written, in an insulated container, the temperature in the container would increase
c) the potential energy of the reactants is less than that of the products
d) for each mole of $N_2O_{5(s)}$ formed, 42.84 kJ of heat are released
e) the reaction is exothermic

7. The standard state of a substance is the:

a) pure form at 101.3 kPa
b) most stable form at 25 ^{O}C and 101.3 kPa
c) most stable form at 0 ^{O}C
d) pure gaseous form at 25 ^{O}C

8. Which of the following statements is correct concerning the chemical reaction represented by

$$\frac{1}{2}\ N_{2(g)} + O_{2(g)} + 33.8\text{ kJ} \longrightarrow NO_{2(g)}$$

a) the reaction is exothermic
b) the change in potential energy is 33.8 kJ
c) the enthalpy of the reactants is greater than that of the products
d) the temperature of the system does not vary during the reaction

9. The specific heat capacity of nickel is 0.264 J $g^{-1}\ {}^{O}C^{-1}$. What would be the rise in temperature of a 100.0 g block of nickel if 528 J of of heat energy is supplied to it?

A. 200 ^{O}C B. 1.42 ^{O}C C. 20.0 ^{O}C D. 1.39 ^{O}C

10. The heat capacity of a calorimeter is 2.22 kJ/^{O}C. What is the temperature change if 997 J of energy is absorbed by a reaction in that calorimeter?

A. 2.21 ^{O}C higher B. 2.21 ^{O}C lower C. 0.449 ^{O}C higher D. 0.449 ^{O}C lower

Multiple Choice Answers

1	2	3	4	5	6	7	8	9	10