**Chapter 6 Concept Questions**

1. Natural gas consists primarily of methane, CH4. It is used in a process called steam reforming to prepare a gaseous mixture of carbon monoxide and hydrogen for industrial use.

CH4(*g*) + H2O(*g*) → CO(*g*) + 3H2(*g*) Δ*H* = 206 kJ

The reverse reaction, the reaction of carbon monoxide and hydrogen, has been explored as a way to prepare methane (synthetic natural gas). Which of the following are exothermic? Of these, which one is the most exothermic?

a. CH4(*g*) + H2O(*g*) → CO(*g*) + 3H2(*g*)

b. 2CH4(*g*) + 2H2O(*g*) → 2CO(*g*) + 6H2(*g*)

c. CO(*g*) + 3H2(*g*) → CH4(*g*) + H2O(*g*)

d. 2CO(*g*) + 6H2(*g*) → 2CH4(*g*) + 2H2O(*g*)

2. The heat of fusion (also called heat of melting), Δ*Hfus*, of ice is the enthalpy change for

H2O(*s*) → H2O(*l*); Δ*Hfus.*

Similarly, the heat of vaporization, Δ*Hvap*, of liquid water is the enthalpy change for

H2O(*l*) → H2O(*g*); Δ*Hvap.*

How is the heat of sublimation, Δ*Hsub*, the enthalpy change for the reaction H2O(*s*) → H2O(*g*); Δ*Hsub* related to Δ*Hfus* and Δ*Hvap* ?

3.A 250g sample of water at 20.0 degrees Celsius is placed in a freezer that is held at a constant temperature of –20.0 degrees Celsius. Considering the water as the “system,” answer the following questions

a. What is the sign of *q*sys for the water after it is placed in the freezer?

b. After a few hours, what will be the state of the water?

c. What will the temperature of the water be after several hours in the freezer?

4. The internal energy of a system is always increased by \_\_\_\_\_\_\_\_\_\_.

A) adding heat to the system

B) having the system do work on the surroundings

C) withdrawing heat from the system

D) adding heat to the system and having the system do work on the surroundings

E) a volume compression

5. For ΔEsys to always be -, what must be true?

A) q = w

B) +q > -w

C) +w > -q

D) -w > +q

6. Which one of the following statements is true?

A) Enthalpy is an intensive property.

B) The enthalpy change for a reaction is independent of the state of the reactants and products.

C) Enthalpy is a state function.

D) H is the value of q measured under conditions of constant volume.

E) The enthalpy change of a reaction is the reciprocal of the ΔH of the reverse reaction.

7. Which of the following signs on q and w represent a system that is doing work on the surroundings, as well as gaining heat from the surroundings?

A) q = +, w = -

B) q = -, w = +

C) q = +, w = +

D) q = -, w = -

E) None of these represent the system referenced above.

9. ) Define molar heat capacity.

A) the quantity of heat required to raise the temperature of 1 mole of a substance by 1°C

B) the quantity of heat required to change a system's temperature by 1°C

C) the quantity of heat required to raise the temperature of 1 gram of a substance by 1°C

D) the quantity of heat required to lower the temperature of 1 g of a substance by 1°F

E) the quantity of heat required to lower the temperature of 1 liter of a substance by 1°C

10.) A piece of iron (C=0.449 J/g°C) and a piece of gold (C=0.128 J/g°C) have identical masses. If the iron has an initial temperature of 488 K and the gold has an initial temperature of 308 K, which of the following statements is TRUE of the outcome when the two metals are placed in contact with one another? Assume no heat is lost to the surroundings.

A) Since the two metals have the same mass, the final temperature of the two metals will be 398 K, exactly halfway between the two initial temperatures.

B) Since the two metals have the same mass, but the specific heat capacity of gold is much smaller than that of iron, the final temperature of the two metals will be closer to 308 K than to 488 K.

C) Since the two metals have the same mass, the thermal energy contained in the iron and gold after reaching thermal equilibrium will be the same.

D) Since the two metals have the same mass, the thermal energy contained in each metal after equilibrium will be the same.

E) None of the above are true.

11.) Which of the following processes is endothermic?

A) mixing water and acid

B) rusting iron

C) photosynthesis

D) the electron affinity of a fluorine atom

E) None of the above processes are endothermic.

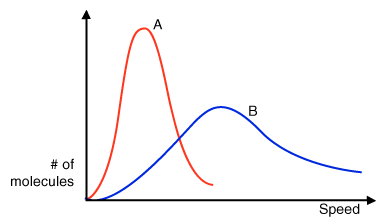
12.)When the average kinetic energy of the particles in a sample doubles, what happens to the temperature of the sample in Kelvin?

A) It remains the same

B) It doubles

C) It halves

D) It depends on the mass of the sample.



13. )Refer to the graph above. A sample of a compound is cooled from 350K to 289K. Which of the following is accurate?

A) Curve A = 350K Curve B = 289K

B) Curve A and Curve B are different samples

C) Curve A = 289K Curve B = 350K