Chem 112-2014 Name: ___________________________

Vining- Exam #1 February 7, 2014

1. Specific heat capacity is

a) the quantity of heat needed to change the temperature of 1.00 g of a substance by 1.00 K.

b) the quantity of heat needed to change the temperature of 1.00 g of a substance by 4.184 K.

c) the mass of a substance that 1.00 J of energy will heat by 1.00 K.

d) the temperature change undergone when 1.00 g of a substance absorbs 4.184 J.

e) the maximum amount of heat that 1.00 g of a substance may absorb without decomposing.

2. If 245 J is required to change the temperature of 14.4 g of chromium by 38.0 K, what is the specific heat capacity of chromium?

a) 0.448 J/g·K b) 2.23 J/g·K c) 4.18 J/g·K d) 4.68 J/g·K e) 92.8 J/g·K

3. What quantity of energy is required to heat 50.0 g of water from 25.0 ^{o}C to 95 ^{o}C?

a) 14600 J b) 19900 c) 3500 J d) 12800 J e) 333 J

4. Determine the heat of condensation of titanium(IV) chloride,

$TiCl_4(g) \rightarrow TiCl_4(\vartheta)$ $\Delta H° = ?$

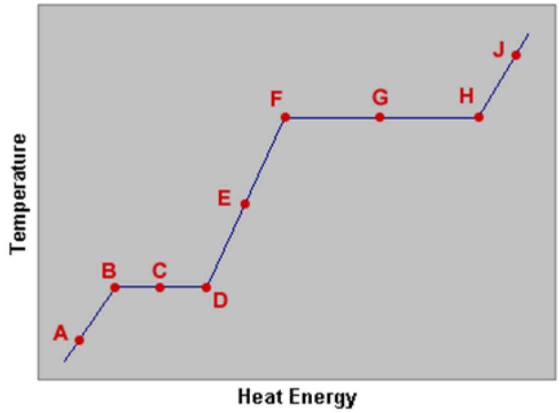
given the enthalpies of reaction below.

$Ti(s) + 2\ Cl_2(g) \rightarrow TiCl_4(\vartheta)$ $\Delta H° = -804.2$ kJ

$Ti(s) + 2\ Cl_2(g) \rightarrow TiCl_4(g)$ $\Delta H° = -763.2$ kJ

a) -1567.4 kJ b) -41.0 kJ c) +1.054 kJ d) +41.0 kJ e) +1567.4 kJ

5. Which portion on the heating curve below represents melting ice and warming the liquid that forms?



a) AC　　b) BD　　c) CF　　d) AF　　e) FJ

6. When 10.0 g KOH is dissolved in 100.0 g of water in a coffee-cup calorimeter, the temperature rises from 25.18 °C to 47.53 °C. What is the enthalpy change per gram of KOH dissolved in the water? Assume that the solution has a specific heat capacity of 4.18 J/g·°C. Assume the cup absorbs no heat.

a) -116 J/g　　b) -934 J/g　　c) -1.03×10^3 J/g

d) -2.19×10^3 J/g　　e) -1.03×10^4 J/g

7. Which of the following chemical equations corresponds to the standard molar enthalpy of formation of SO_3?

a) $SO_2(g) + \frac{1}{2} O_2(g) \rightarrow SO_3(g)$

b) $2\ SO_2(g) + O_2(g) \rightarrow 2\ SO_3(g)$

c) $S(s) + 12\ O_2(g) \rightarrow 8\ SO_3(g)$

d) $2\ S(s) + 3\ O_2(g) \rightarrow 2\ SO_3(g)$

e) $S(s) + 3/2\ O_2(g) \rightarrow SO_3(g)$

8. Calculate Δ*H*° for the reaction below,

$$Fe_2O_3(s) + 3\ H_2(g) \longrightarrow 2\ Fe(s) + 3\ H_2O(g)$$

using standard molar enthalpies of formation.

molecule	ΔH_f° (kJ/mol)
$Fe_2O_3(s)$	-824.2
$H_2O(g)$	-241.8

a) -582.4 kJ b) 582.4 kJ c) -1066 kJ d) 1066 kJ e) 98.8 kJ f) -98.8 kJ

9. Calculate the enthalpy change (ΔH) for the reaction below,

$$Br_2(g)\ +\ 3\ F_2(g)\ \rightarrow\ 2\ BrF_3(g)$$

given the bond enthalpies of the reactants and products.

Bond	Bond Enthalpy (kJ/mol·rxn)
Br-Br	193
F-F	155
Br-F	249

a) -836 kJ b) -89 kJ c) +89 kJ d) +99 kJ e) +836 kJ

10. Consider the enthalpy diagram here. What can be said of a system this diagram represents?

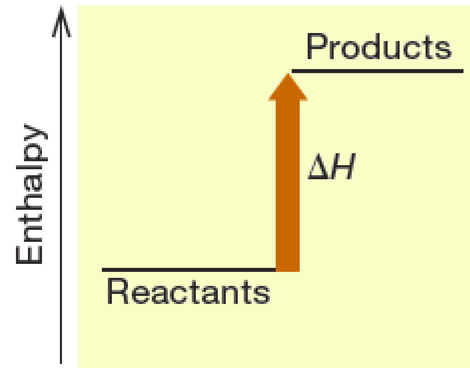
a) thermal energy is released and the system is exothermic

b) thermal energy is released and the system is endothermic

c) thermal energy is absorbed and the system is exothermic

d) thermal energy is absorbed and the system is endothermic

e) products are lower in energy than reactants



11. The specific heat capacity of Al is 0.897 J/g ^{o}C. That of Cu is 0.385 J/g ^{o}C.

What will the final temperature be if a 10-g block of Al at 0 ^{o}C is allowed to thermally equilibrate with a 10-g block of Cu at 100 ^{o}C?

a) 100 ^{o}C

b) greater than 50 ^{o}C but less than 100 ^{o}C

c) 0 ^{o}C

d) greater than 0 ^{o}C but less than 50 ^{o}C

12. You have two samples of gas, O_2 at 250 K and CO_2 at 250 K. Which is true?

a) O_2 has higher kinetic energy and greater average molecular speed

b) CO_2 has higher kinetic energy and lower average molecular speed

c) they have equal kinetic energy and O_2 has greater average molecular speed

d) they have equal kinetic energy and CO_2 has greater average molecular speed

e) they have equal kinetic energy and equal average molecular speed

13. You fill a balloon with 2.50 moles of gas at 22°C at a pressure of 1.62 atm. What is the volume of the balloon?

a) 15.7 L

b) 98.0 L

c) 37.4 L

d) 2.79 L

e) 22.4 L

14. Which gas has the greatest density at room temperature and pressure?

a) He

b) Cl_2

c) CH_4

d) CH_3CH_3

e) all gases the same

15. The mass of 1.12 liters of a gas at 1.00 atm and 0 ^{o}C is found to be 6.23 g. What is the molar mass of the gas?

a) 56.0 g/mol

b) 89.0 g/mol

c) 125 g/mol

d) 140. g/mol

e) 157 g/mol

16. A gas sample is heated from -20.0°C to 57.0°C and the volume is increased from 2.00 L to 4.50 L. If the initial pressure is 0.140 atm, what is the final pressure?

a) 0.0477 atm

b) –0.177 atm

c) 0.411 atm

d) 0.242 atm

e) 0.0811 atm

17. What is the root-mean-square velocity of oxygen (O_2) gas at a temperature of 492 K?

a) 19.6 m/s

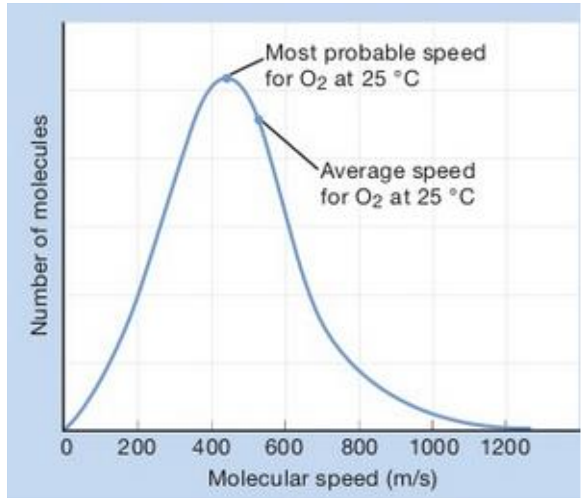
b) 619 m/s

c) 456 m/s

d) 153 m/s

e) 722 m/s

18. The plot here shows the Boltzmann distribution curve for O_2 gas at 25 ^oC. Which would be true for CO_2 gas at 25 ^oC and for O_2 at 75 ^oC?



a) both the curve for CO_2 gas at 25 ^oC and for O_2 at 75 ^oC would be to the left

b) both the curve for CO_2 gas at 25 ^oC and for O_2 at 75 ^oC would be to the right

c) the curve for CO_2 gas at 25 ^oC would be to the left and for O_2 at 75 ^oC would be to the right

d) the curve for CO_2 gas at 25 ^oC would be to the right and for O_2 at 75 ^oC would be to the left

19. Gases at relatively low temperatures can exhibit nonideal behavior. Which describes this behavior and its cause?

a) pressure is higher due to molecules taking up volume

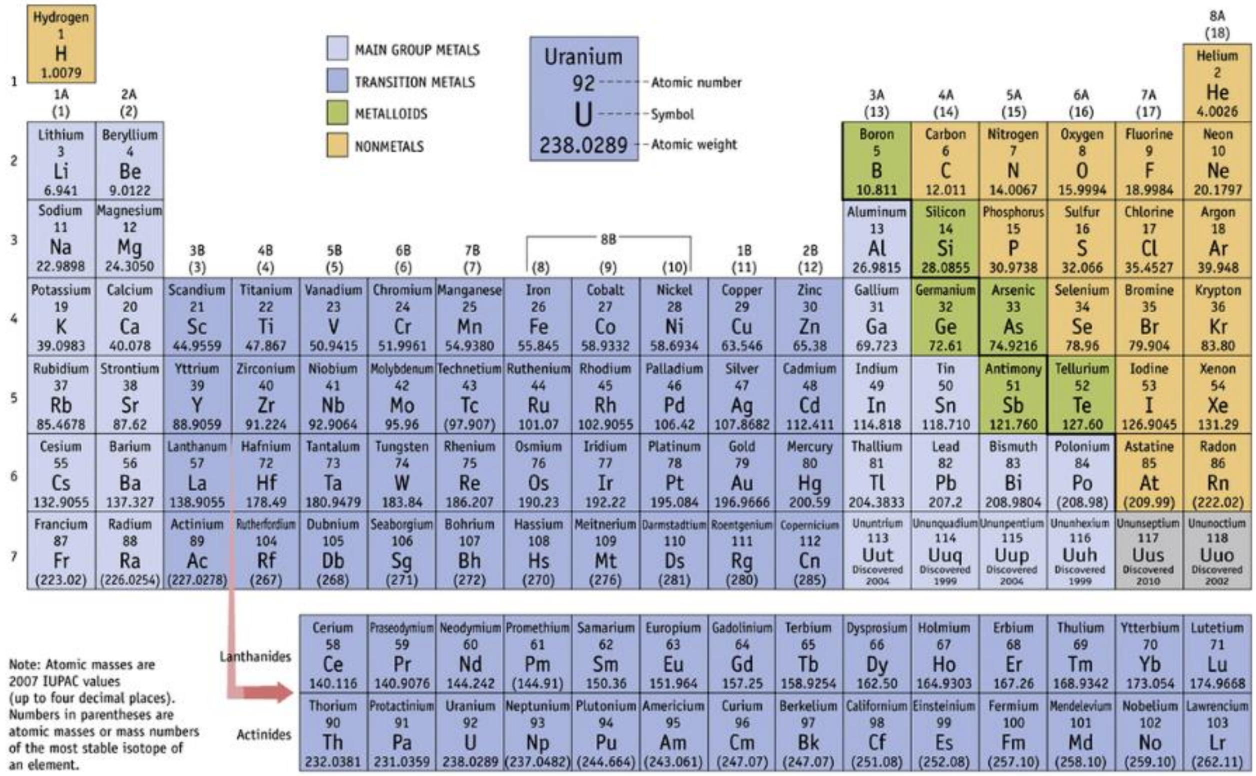
b) pressure is lower due to molecules taking up volume

c) pressure is higher due to intermolecular interactions

d) pressure is lower due to intermolecular interactions

BE SURE TO DO LONG ANSWER QUESTION on BACK of ANSWER SHEET

Scrap Paper



$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

PV = nRT

1 atm = 760 mm Hg

R = 0.0821 L·atm/ K·mol

R = 8.314 J/K·mol

$$v_{rms} = \sqrt{\frac{3RT}{M}}$$

ΔH = Σenergy needed to break bonds – Σenergy released forming bonds

$$\Delta H^o_{rxn} = \sum \Delta H^o_f(products) - \sum \Delta H^o_f(reactants)$$