Name _____   **Chemistry**   ___/___/___

SOL Questions – Chapter 9

For each of the following, fill in the correct answer on **the BLUE side** of the scantron.

1. _____ Which number on the graph to the right
represents the effect of the catalyst?

         a. 1   b. 2
         c. 3   d. 4

2. _____ Which number on the graph to the right
represents the change in enthalpy?

         a. 1   b. 2
         c. 3   d. 4

3. _____ If the heat of fusion of water is 80 cal/gram, the
amount of energy required to change 15.0 grams of ice at 0°C
to 15.0 grams of water at 0°C is –

         a.   80 cal   b.   560 cal
         c.   1200 cal   d.   2400 cal

4. _____ Water molecules have the greatest kinetic
energy in –

         a.   ice at 0°C   b.   water at 373 K
         c.   water at 98°C   d.   steam at 150°C

Progress of Reaction

5. _____ Which number in the chart to the right represents
condensation?

         a.   1   b.   2
         c.   3   d.   4

6. _____ Which number in the chart to the right represents
crystallization?

         a.   1   b.   2
         c.   3   d.   4

7. _____ Which number in the chart to the right represents melting?

         a.   1   b.   2
         c.   3   d.   4

8. _____ The system that shows a decrease in entropy is –

         a.   air escaping from a tire   b.   snow melting
         c.   salt dissolving in water   d.   water freezing

9. _____ A catalyst is a substance used in chemical reactions to –

         a.   provide a higher activation energy
         b.   decrease collisions between reactant molecules
         c.   increase the rate of the reaction
         d.   change the equilibrium to favor products

10. _____ The diagram to the right shows a reaction that is –

         a.   reversible   b.   exothermic
         c.   endothermic   d.   at equilibrium
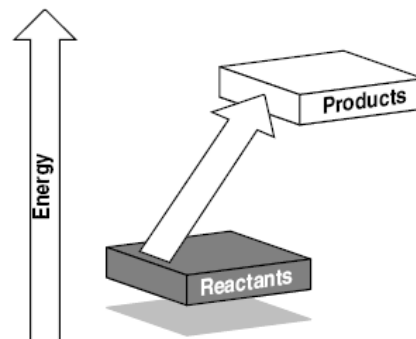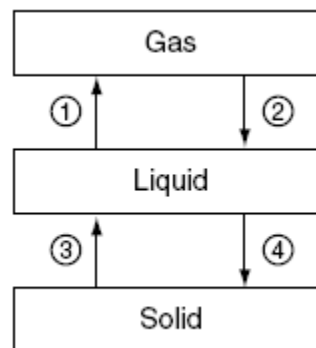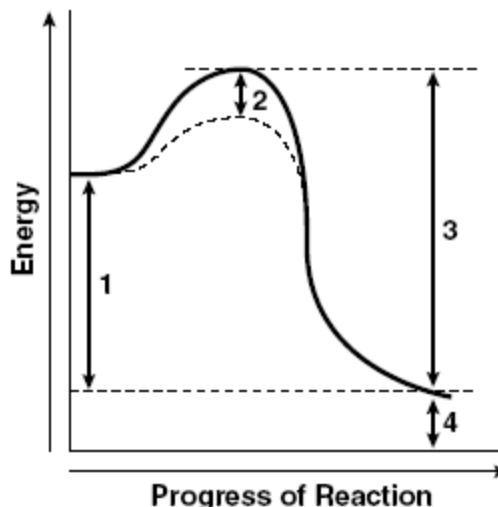
11. _____The specific heat capacity of a substance is the quantity of heat required to change the temperature of 1 gram of a substance by –
        a. 1°C   b. 5°C
        c. 10°C   d. 100°C

12. _____Which of the following substances in the chart to the right would be the best conductor of heat?
        a. aluminum   b. alcohol
        c. water   d. wood

Specific Heat Capacities of Some Common Substances	
Substance	Specific Heat Capacity (cal/g °C)
Aluminum	0.21
Alcohol	0.58
Water	1.00
Wood	0.42

13. _____What probably causes water to have the highest specific heat of the substances listed to the right?
        a. molecular size   b. molecular mass
        c. strong hydrogen bonds d. high density of ice

14. _____A catalyst accelerates a chemical reaction because the –
        a. catalyst decreases the number of collisions in a reaction
        b. activation energy of the reaction is lowered in the presence of a catalyst
        c. catalyst decreases the concentration of the reactants
        d. temperature of the reaction increases due to the catalyst

15. _____If the heat of fusion of water is 3.4×10^2 J/g, the amount of heat energy required to change 15.0 grams of ice at 0°C to 15.0 grams of water at 0°C is –
        a. 3.4×10^2 J   b. 2.4×10^3 J
        c. 5.1×10^3 J   d. 1.0×10^4 J

16. _____Which phase change involves the absorption of heat?
        a. gas to liquid   b. liquid to solid
        c. liquid to gas   d. gas to solid

17. _____ What probably causes chloroform to have the lowest heat of vaporization of the substances listed in the chart to the right?
        a. smallest size of the molecules listed
        b. smallest mass of the molecules listed
        c. smallest intermolecular forces of attraction
        d. fewest number of bonds

Substance	Heat of Vaporization at the Boiling Point
Water (H_2O)	529 calories per gram
Alcohol (CH_3CH_2OH)	204 calories per gram
Chloroform ($CHCl_3$)	59 calories per gram

18. _____ Which is NOT necessary in calculating the heat of fusion for ice?
        a. the mass of the ice   b. the temperature change of the water and the ice
        c. the heat of fusion of water d. all are necessary

19. _____According to the diagram below, as energy is added to a solid, at which point does melting begin?
        a. A   b. B   c. C   d. D
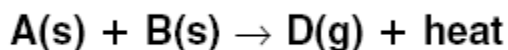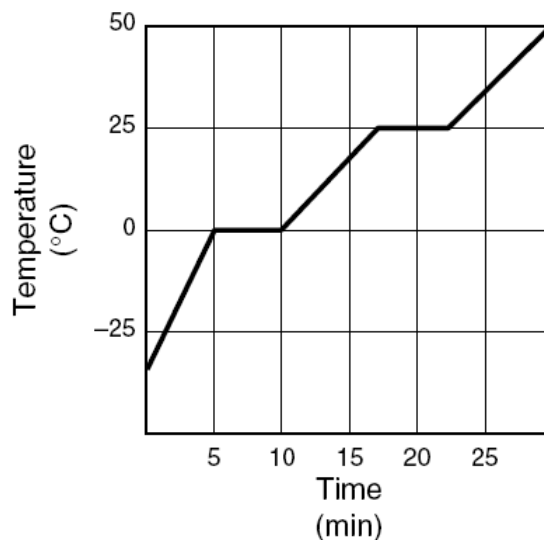
20. _____According to the diagram to the right, at which point does vaporization of a gas end?
        a. C   b. D
        c. E   d. F
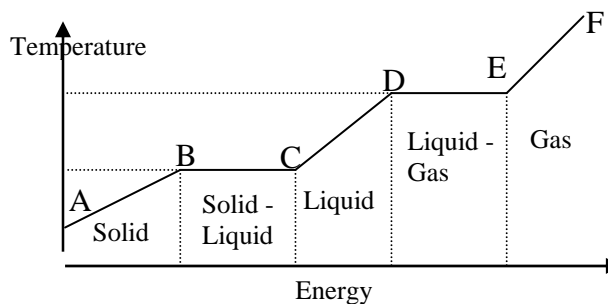
21. _____An experiment yielded the temperature and time information shown to the right. What is the freezing point of the material in this experiment if the material is a solid at time zero?

      a. -25°C   b. 0°C
      c. 25°C   d. 50°C

$$A(s) + B(s) \rightarrow D(g) + heat$$

22. _____The reaction shown above is —
   a. an endothermic reaction
    b. an exothermic reaction
    c. a decomposition reaction
    d. a double-replacement reaction

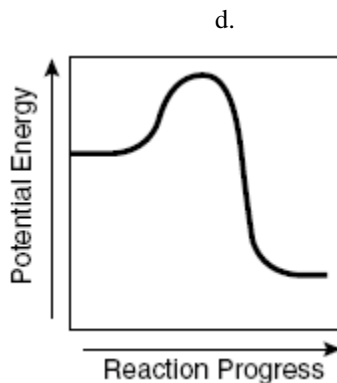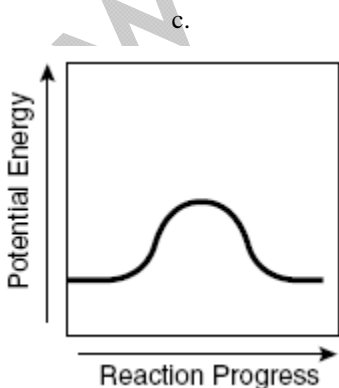23. _____ If the heat of fusion is 32.2 kJ/mol, the amount of heat energy required to melt 5.67 grams of FeO is —
    a. 2.54 kJ   b. 3.26 kJ
    c. 5.32 kJ   d. 18.3 kJ

24. _____How many calories are required to raise the temperature of 105 g of water from 30.0°C to 70. 0°C?
    a. 1.05×10^3 b. 2.10×10^3 c. 4.20×10^3 d. 8.40×10^3

25. _____

$$2NO(g) + O_2(g) \rightarrow 2NO_2(g) \; \Delta H = {}^-27 \; kcal$$
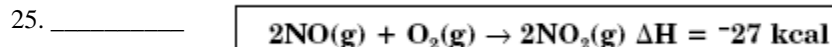
Which graph represents the reaction shown to above?

    a.

    b.

    c.

    d.
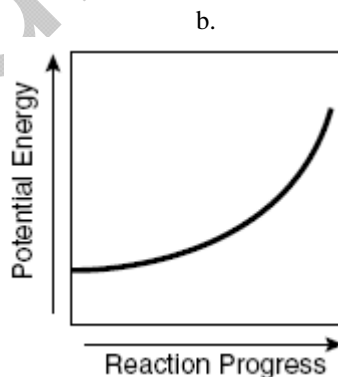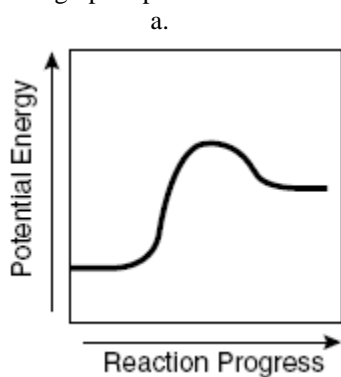
26. _____ Solid magnesium has a specific heat of 1.01 J/g°C. How much heat is given off by a 20.0 gram sample of magnesium when it cools from 70.0°C to 50.0°C?

       a. 202 J   b. 404 J   c. 808 J   d. 1010 J
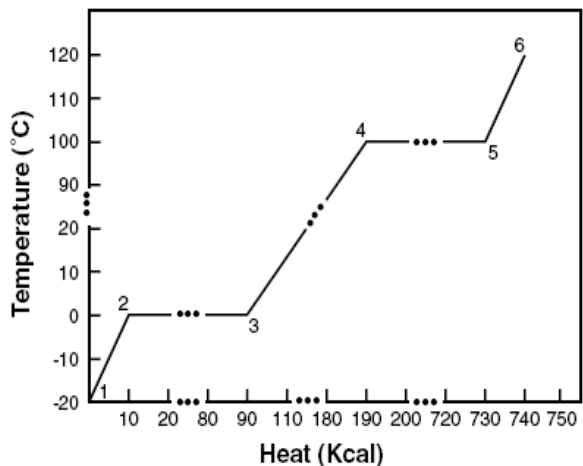
27. _____ The energy required to melt a solid into a liquid is called —

       a. heat of vaporization   b. heat of fusion   c. cooling curve   d. triple point

28. _____ In the graph to the right, between points 2 and 3, energy is being used to —

       a. melt ice   b. evaporate water

       c. heat water   d. heat water vapor

1 Kilogram of Water Heating

29. _____ The amount of energy needed to raise one gram of a substance one degree Celsius is a characteristic property known as —

       a. heat of formation

       b. heat of vaporization

       c. molar heat of fusion

       d. specific heat capacity

30. _____ The role of a catalyst is to affect —

       a. electronegativity   b. heat content

       c. activation energy   d. ionization energy

31. _____ Which of these statements describes what happens to the molecules of a solid as the temperature is lowered to absolute zero(-273°C)?

       a. They begin to take up more space.

       b. They become farther apart.

       c. Their kinetic energy gradually increases to a maximum.

       d. Their motion gradually decreases and eventually stops.

32. _____ Catalytic converters made of palladium (Pd) reduce automobile pollution by catalyzing the reaction between unburned hydrocarbons and oxygen. How does Pd increase the rate of this reaction?

       a. By cooling the reactants

       b. By splitting the oxygen atoms

       c. By giving the hydrocarbons a negative charge

       d. By decreasing the activation energy

33. _____ The boiling point of ethanol is 78.3°C. The boiling point of ethanol on the Kelvin scale is approximately —

       a. 26 K   b. 178 K   c. 351 K   d. 451 K

34. _____ Water and ammonia have different molar heats of vaporization. The best interpretation, at the molecular level, is that water molecules —

       a. have stronger intermolecular attractions

       b. occupy larger molecular volumes

       c. set up stronger repulsive nuclear forces

       d. collide more frequently with each other

Molar Heat of Vaporization

H_2O	40.7 kJ/mole
NH_3	23.4 kJ/mole

35. _____ What is the amount of heat required to raise 200.0 g of water from 22.00°C to 100.0°C? Specific heat of water is 4.180 J/g °C

a. 652.1 joules   b. 6,521 joules   c. 65,210 joules   d. 652,100 joules

36. _____ Examine the graph of the temperature of a compound versus heat added to the compound. Which of the following most likely happens as the compound is heated from point *x* to point *y*?
a. The phase of the compound changes.
b. The mass of the compound is increasing.
c. The molecules of the compound lose potential energy.
d. The molecules of the compound are breaking apart into atoms.
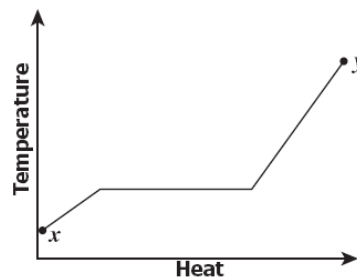
37. _____ To determine if a reaction is exothermic, a student should use a:
a. pH probe   b. motion sensor   c. pressure sensor   d. temperature probe

38. _____ As heat is added to a substance undergoing a phase change, the temperature remains constant because the energy is being used to —
a. break covalent bonds   b. lower the specific heat capacity
c. overcome intermolecular forces   d. oppose electron cloud repulsions

39. _____ The accepted value for the specific heat of aluminum is 0.897 J/g°C. Which of the following sets of specific heat values for aluminum, calculated from a prior experiment, has the greatest accuracy and precision?
a. 0.847 J/g°C, 0.847 J/g°C, 0.848 J/g°C   b. 0.896 J/g°C, 0.899 J/g°C, 0.896 J/g°C
c. 0.897 J/g°C, 1.04 J/g°C, 1.03 J/g°C   d. 0.936 J/g°C, 0.876 J/g°C, 0.879 J/g°C

40. _____ AB + energy → A + B
The general equation shown is a reaction that is an —
a. exothermic decomposition   b. endothermic decomposition
c. endothermic synthesis   d. exothermic synthesis

41. _____ The table shows the specific heat capacity of four substances. For an equal mass of each substance, which one will require the least amount of heat to raise its temperature from 20°C to 30°C?
a. Aluminum   b. Glass
c. Carbon dioxide   d. Water

Substance	Heat Capacity J/g°C
Aluminum	0.900
Glass	0.50
Carbon dioxide	0.843
Water	4.18

42. _____ The specific heat of aluminum is 0.900 J/g°C. How much heat is required to raise the temperature of a 30.0 g block of aluminum from 25.0 °C to 75°C ?
a. 0.540 J   b. 1.50 J
c. 1350 J   d. 1670 J

43. _____ A student attempts to measure the specific heat capacity of an unknown liquid through repeated trials. She measures its specific heat capacity, in as 2.14, 2.11, 2.13, 2.12, and 2.11. The specific heat capacity of the liquid should be recorded as —
a. 2.122 J/g°C   b. 2.12 J/g°C
c. 2.1 J/g°C   d. 2 J/g°C

44. _____ Using the information in the chart to the right, which substance will release the greatest amount of heat when 1.00 mol is frozen?
a. Argon   b. Benzene
c. Mercury   d. Water

Molar Heat of Fusion and Melting Point for Selected Substances		
Substance	Melting Pt. (°C)	ΔH_{fus} (kJ/mol)
Argon	-190	1.18
Benzene	5.5	9.87
Mercury	-39	2.29
Water	0	6.01