Name: _____

___ 1) According to the *Heat of Reaction at 101.3 kPa and 298 K* chemistry reference table, which compound forms exothermically?

1) NO_2
2) C_2H_6
3) NO
4) C_2H_4

___ 2) As the randomness of a system increases, the entropy of the system

1) remains the same
2) increases
3) decreases

___ 3) Which change represents an increase of entropy?

1) $I_2(g) \longrightarrow I_2(s)$
2) $H_2O(g) \longrightarrow H_2O(\ell)$
3) $H_2O(\ell) \longrightarrow H_2O(g)$
4) $I_2(g) \longrightarrow I_2(\ell)$

___ 4) A student dissolved a salt in water and noted that the temperature of the water decreased during the dissolving process. A logical conclusion based on this observation is that the salt

1) dissolved endothermically
2) dissolved exothermically
3) ionized in water
4) oxidized in water

___ 5) Which of the following statements describes characteristics of an endothermic reaction?

1) The sign of ΔH is negative, and the products have less potential energy than the reactants.
2) The sign of ΔH is positive, and the products have more potential energy than the reactants.
3) The sign of ΔH is positive, and the products have less potential energy than the reactants.
4) The sign of ΔH is negative, and the products have more potential energy than the reactants.

___ 6) Given the reaction:

$$HF(aq) \rightleftharpoons H^+(aq) + F^-(aq)$$

Which expression represents the equilibrium constant (K_a) for the acid HF?

1) $K_a = 2[HF]$
2) $K_a = \frac{[HF]}{[H^+][F^-]}$
3) $K_a = \frac{[H^+][F^-]}{[HF]}$
4) $K_a = [H^+][F^-]$

___ 7) What change does the ΔH of a chemical reaction represent?

1) entropy
2) activation energy
3) heat of reaction
4) free energy

___ 8) Activation energy is required to initiate

1) exothermic reactions, only
2) endothermic reactions, only
3) both exothermic and endothermic reactions
4) neither exothermic nor endothermic reactions

___ 9) What is the equilibrium expression for the reaction $3A(g) + B(g) \rightleftharpoons 2C(g)$?

1) $K = \frac{[A]^3[B]}{[C]^2}$
2) $K = \frac{[3A][B]}{[2C]}$
3) $K = \frac{[C]^2}{[A]^3[B]}$
4) $K = \frac{[2C]}{[3A][B]}$

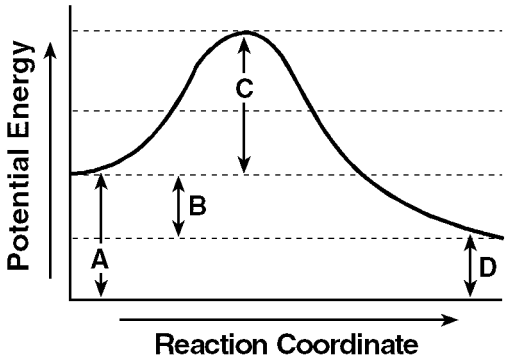
___ 10) Which equilibrium constant indicates an equilibrium mixture that favors the formation of products?

1) $K_{eq} = 1 \times 10^{-1}$
2) $K_{eq} = 1 \times 10^{-5}$
3) $K_{eq} = 1 \times 10^{0}$
4) $K_{eq} = 1 \times 10^{5}$

___ 11) The change in free energy of a chemical reaction is represented by

1) ΔH
2) ΔG
3) ΔT
4) ΔS

___ 12) The potential energy diagram of a chemical reaction is shown below.



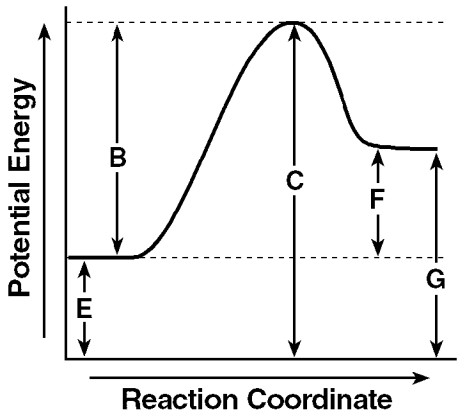
Which letter in the diagram represents the heat of reaction (ΔH)?

1) *A*
2) *B*
3) *C*
4) *D*

___ 13) Which condition will increase the rate of a chemical reaction?

1) decreased temperature and decreased concentration of reactants
2) increased temperature and increased concentration of reactants
3) increased temperature and decreased concentration of reactants
4) decreased temperature and increased concentration of reactants

___ 14) The diagram below represents a potential energy diagram of a chemical reaction.



Interval *B* represents the

1) potential energy of the reactants
2) potential energy of the products
3) activation energy
4) activated complex

___ 15) As the number of effective collisions between the reactant particles in a chemical reaction decreases, the rate of the reaction

1) remains the same
2) increases
3) decreases

___ 16) A catalyst changes the rate of a chemical reaction by lowering the

1) activation energy of the reaction
2) potential energy of the products
3) potential energy of the reactants
4) heat of the reaction

___ 17) Given the reaction at equilibrium:

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

As the pressure is increased at constant temperature, the number of moles of $SO_3(g)$ produced will

1) remain the same
2) increase
3) decrease

___ 18) Given the reaction at equilibrium:

$$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$$

As the concentration of $N_2(g)$ increases, the concentration of $O_2(g)$ will

1) decrease
2) increase
3) remain the same

___ 19) Given the reaction at equilibrium:

$$H_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons H_2O(g) + \text{heat}$$

The value of the equilibrium constant for this reaction can be changed by

1) changing the temperature
2) adding a catalyst
3) adding more O_2
4) changing the pressure

___ 20) According to the *Heats of Reaction at 101.3 kPa and 298 K* chemistry reference table, in which reaction do the products have a *higher* energy content than the reactants?

1) $2CH_3OH(\ell) + 3O_2(g) \longrightarrow 2CO_2(g) + 4H_2O(\ell)$
2) $NaOH(s) \xrightarrow{H_2O} Na^+(aq) + OH^-(aq)$
3) $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(\ell)$
4) $NH_4Cl(s) \xrightarrow{H_2O} NH_4^+(aq) + Cl^-(aq)$

___ 21) A reaction must be spontaneous if its occurrence is

1) exothermic with an increase in entropy
2) endothermic with a decrease in entropy
3) endothermic with an increase in entropy
4) exothermic with a decrease in entropy

___ 22) A system is said to be in a state of dynamic equilibrium when the

1) rate at which products are formed is the same as the rate at which reactants are formed
2) rate at which products are formed is greater than the rate at which reactants are formed
3) concentration of products is greater than the concentration of reactants
4) concentration of products is the same as the concentration of reactants

___ 23) What change takes place when a catalyst is added to a reaction at equilibrium?

1) The point of equilibrium is shifted to the left.
2) The point of equilibrium is shifted to the right.
3) The rates of the forward and reverse reactions are increased equally.
4) The rates of the forward and reverse reactions are increased unequally.

___ 24) Given the reaction at equilibrium:

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) + 184\ kJ$$

Which change will increase the concentration of $SO_3(g)$?

1) increasing the concentration of $O_2(g)$
2) increasing the temperature
3) decreasing the concentration of $SO_2(g)$
4) decreasing the pressure

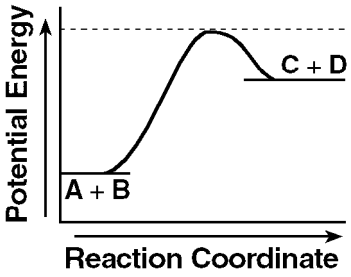
___ 25) Given the equation:

$$I + I \longrightarrow I_2 + 146\ kJ$$

This equation shows that the formation of an iodine molecule is an

1) endothermic process in which energy is released
2) exothermic process in which energy is released
3) endothermic process in which energy is absorbed
4) exothermic process in which energy is absorbed

___ 26) According to the potential energy diagram shown below for the reaction $A + B \longrightarrow C + D$, the activation energy is *highest* for the



1) reverse reaction, which is endothermic
2) forward reaction, which is endothermic
3) forward reaction, which is exothermic
4) reverse reaction, which is exothermic

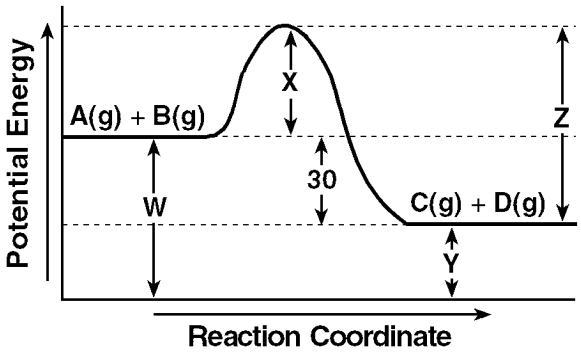
___ 27) Raising the temperature speeds up the rate of a chemical reaction by increasing

1) both the effectiveness and the frequency of the collisions
2) the frequency of the collisions, only
3) the effectiveness of the collisions, only
4) neither the effectiveness nor the frequency of the collisions

___ 28) Which equation correctly represents the free energy change in a chemical reaction?

1) $\Delta G = \Delta H - T\Delta S$
2) $\Delta G = \Delta S - T\Delta H$
3) $\Delta G = \Delta H + T\Delta S$
4) $\Delta G = \Delta T - \Delta H\Delta S$

___ 29)



The potential energy of the activated complex is equal to the sum of

1) $X + Y + W$
2) $X + Y$
3) $X + W + Z$
4) $X + W$

___ 30) The table below records the production of 50 milliliters of CO_2 in the reaction of HCl with $NaHCO_3$. Five trials were performed under different conditions as shown. (The same mass of $NaHCO_3$ was used in each trial.)

Trial	Particle Size of $NaHCO_3$	Concentration of HCl	Temperature (°C) of HCl
A	small	1 M	20
B	large	1 M	20
C	large	1 M	40
D	small	2 M	40
E	large	2 M	40

What trial would produce the *fastest* reaction?

1) trial *A*
2) trial *B*
3) trial *C*
4) trial *D*