Kinetics Worksheet   NAME_____

1. Which event must *always* occur for a chemical reaction to take place?
   - (A) formation of a precipitate
   - (B) formation of a gas
   - (C) effective collisions between reacting particles
   - (D) addition of a catalyst to the reaction system

2. Increasing the temperature increases the rate of a reaction by
   - (A) lowering the activation energy
   - (B) increasing the activation energy
   - (C) lowering the frequency of effective collisions between reacting molecules
   - (D) increasing the frequency of effective collisions between reacting molecules

3. After being ignited in a Bunsen burner flame, a piece of magnesium ribbon burns brightly, giving off heat and light. In this situation, the Bunsen burner flame provides
   - (A) ionization energy
   - (B) activation energy
   - (C) heat of reaction
   - (D) heat of vaporization

4. The energy needed to start a chemical reaction is called
   - (A) potential energy
   - (B) kinetic energy
   - (C) activation energy
   - (D) ionization energy

5. As the number of effective collisions between reacting particles increases, the rate of reaction
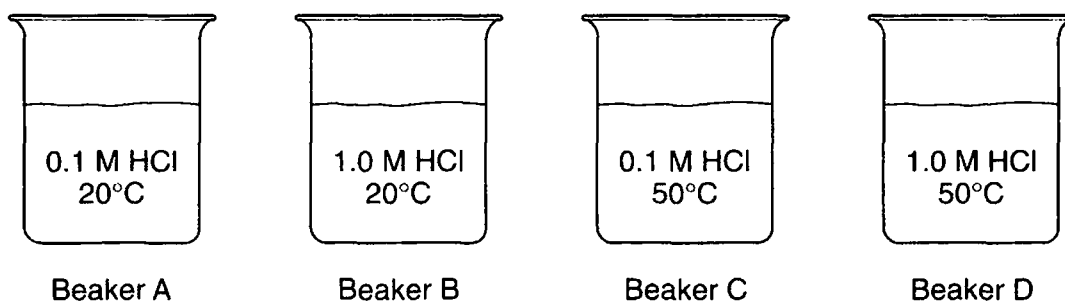   - (A) decreases
   - (B) increases
   - (C) remains the same

6. Base your answer to the following question on the table below, which represents 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

Which two trials could be used to measure the effect of surface area?
   - (A) trials *A* and *B*
   - (B) trials *A* and *C*
   - (C) trials *A* and *D*
   - (D) trials *B* and *D*

7. Which conditions will increase the rate of a chemical reaction?
   - (A) decreased temperature and decreased concentration of reactants
   - (B) decreased temperature and increased concentration of reactants
   - (C) increased temperature and decreased concentration of reactants
   - (D) increased temperature and increased concentration of reactants

Version A

8. In each of the four beakers shown below, a 2.0-centimeter strip of magnesium ribbon reacts with 100 milliliters of HCl(aq) under the conditions shown.


| Beaker A | Beaker B | Beaker C | Beaker D |

0.1 M HCl 20°C — Beaker A
1.0 M HCl 20°C — Beaker B
0.1 M HCl 50°C — Beaker C
1.0 M HCl 50°C — Beaker D

In which beaker will the reaction occur at the fastest rate?
(A) A   (B) B   (C) C   (D) D

9. Which statement explains why the speed of some chemical reactions is increased when the surface area of the reactant is increased?

(A) This change increases the density of the reactant particles.
(B) This change increases the concentration of the reactant.
(C) This change exposes more reactant particles to a possible collision.
(D) This change alters the electrical conductivity of the reactant particles.

10. Adding a catalyst to a chemical reaction results in

(A) a decrease in activation energy and a decrease in the reaction rate
(B) a decrease in activation energy and an increase in the reaction rate
(C) an increase in activation energy and a decrease in the reaction rate
(D) an increase in activation energy and an increase in the reaction rate

11. When a spark is applied to a mixture of hydrogen and oxygen, the gases react explosively. Which potential energy diagram best represents the reaction?
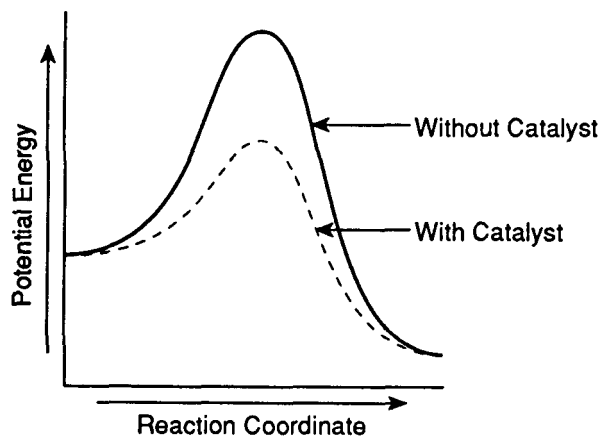
(A)

(B)

(C)

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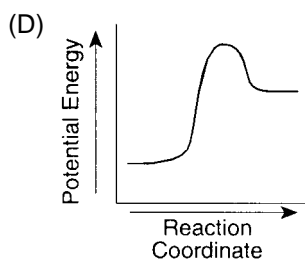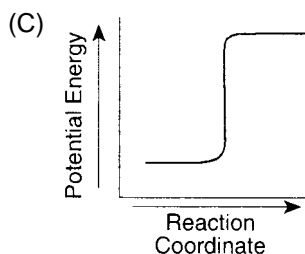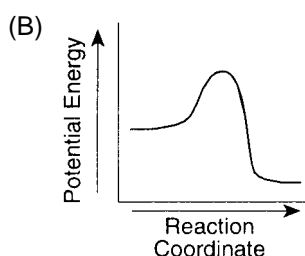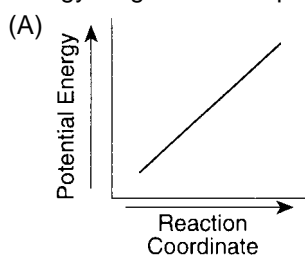
12. The potential energy diagram of a chemical reaction is shown below.

Reaction Coordinate
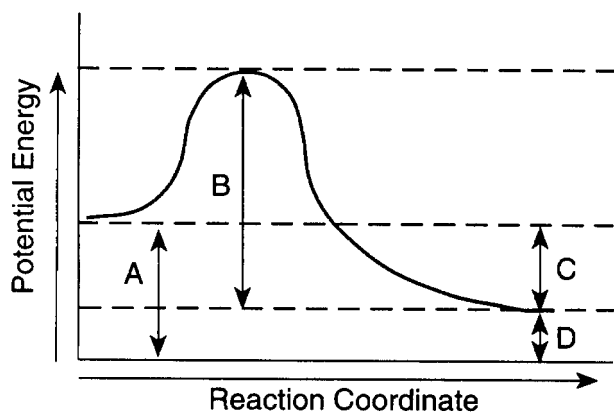
Which arrow represents the part of the reaction most likely to be affected by the addition of a catalyst?

(A) *A*   (C) *C*
(B) *B*   (D) *D*

13. A potential energy diagram is shown below.

Reaction Coordinate

Which reaction would have the lowest activation energy?

(A) the forward catalyzed reaction
(B) the forward uncatalyzed reaction
(C) the reverse catalyzed reaction
(D) the reverse uncatalyzed reaction

14. The graph below represents the potential energy changes that occur in a chemical reaction. Which letter represents the activated complex?

REACTION COORDINATE
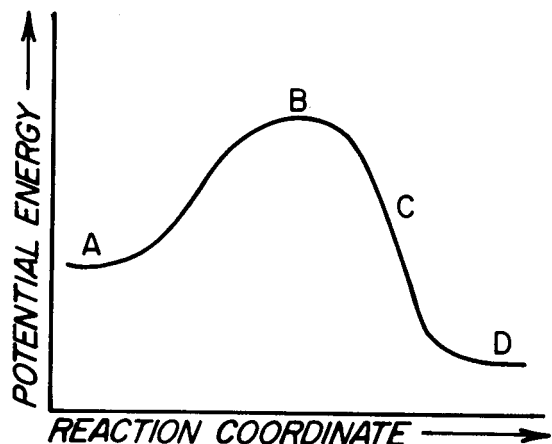
(A) *A*   (C) *C*
(B) *B*   (D) *D*

15. Which potential energy diagram indicates a reaction can occur spontaneously?
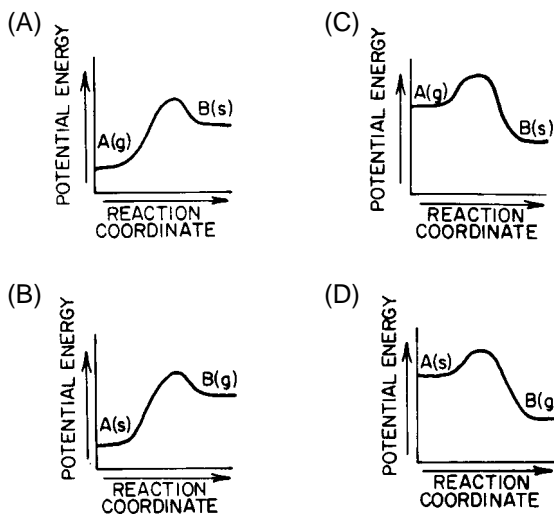
16. When a reaction has a negative ΔG, it must be

(A) exothermic   (C) spontaneous
(B) endothermic   (D) non-spontaneous

17. Given the equation:

$$\Delta G = \Delta H - T\Delta S$$
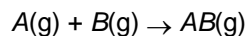
The ΔS represents a change in

(A) entropy   (C) enthalpy
(B) free energy   (D) temperature

18. In the free energy equation

$$\Delta G = \Delta H - T\Delta S,$$

the symbol *T* refers to

(A) time in seconds   (C) Celsius temperature
(B) time in hours   (D) Kelvin temperature

19. Given the reaction:

$$A(g) + B(g) \rightarrow AB(g)$$

with $\Delta H_f^0 = -10$ kilocalories per mole and $\Delta G_f^0 = +2$ kilocalories per mole. This reaction is

(A) exothermic and will occur spontaneously
(B) exothermic and will not occur spontaneously
(C) endothermic and will occur spontaneously
(D) endothermic and will not occur spontaneously

20. Four aluminum samples are each reacted with separate 1 M copper sulfate solutions under the same conditions of temperature and pressure. Which aluminum sample would react most rapidly?

(A) 1 gram bar of Al
(B) 1 gram of Al ribbon
(C) 1 gram of Al pellets
(D) 1 gram of Al powder

Version A