

Chemistry 12 (Rates formal #1)

Name: _____

Date: _____

- The kinetic energy of the activated complex is
 - greater than the kinetic energy of only the reactants
 - greater than the kinetic energy of only the products
 - greater than the kinetic energy of both the reactants and the products
 - less than the kinetic energy of both the reactants and the products
- As the rate of a given reaction increases due to an increase in concentration of the reactants, the activation energy for that reaction
 - decreases
 - increases
 - remains the same
 - impossible to determine
- Given the reaction $A + B \longrightarrow AB + 50\text{kJ}$. If an activation energy of 5kJ is required for the forward reaction, the activation energy of the reverse reaction is
 - 5kJ
 - 45kJ
 - 50kJ
 - 55kJ
- In a reversible reaction, the difference between the activation energy of the forward reaction and the activation energy of the reverse reaction is equal to
 - activation complex
 - heat of the reaction
 - potential energy of reactants
 - potential energy of products
- Consider the following reaction:
$$2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$$

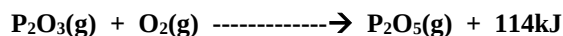
When a piece of raw potato is added to the above reaction, the reaction rate increased dramatically. An enzyme in the potato was found to be responsible for the increase in the reaction rate. In this reaction, the enzyme would be referred to as

 - a catalyst
 - an inhibitor
 - an activated complex
 - a reaction intermediate
- The addition of a catalyst to an exothermic reaction increases the rate of the reaction because it decrease the
 - ΔH
 - activation energy
 - ΔH and the activation energy
 - activation energy and the amount of energy released

7. An increase in concentration of a reactant increases reaction rate. This increase in reaction rate is due to
- an increase in the ΔH
 - an increase in kinetic energy
 - a decrease in activation energy
 - an increase in frequency of successful collisions
8. Increasing the temperature in a reacting system
- increases the number of collisions
 - increases the energy of the collisions
 - does both A and B
 - does neither A nor B
9. Consider the following factors:
- the total number of collisions/second
 - the number of collisions which are effective
 - the fraction of collisions which occur at the proper collision angle

According to collision theory, which of these factors affects the rate of a reaction between two gases?

- I only
 - I and II only
 - II and III only
 - I, II and III
10. A doubling of the rate of a reaction due to an increase in temperature is most likely due to:
- a doubling of the total energy of all the collisions
 - a doubling of the total number of collisions
 - cutting the activation energy in half
 - a doubling of the number of collisions in which the energy is equal to or greater than the activation energy
11. When two atoms form a bond, their potential energy
- decreases
 - increases
 - remains the same
 - varies
12. Consider the reaction:



This reaction may be described as:

- exothermic and $\Delta H = 114\text{kJ}$
- endothermic and $\Delta H = 114\text{kJ}$
- exothermic and $\Delta H = -114\text{kJ}$
- endothermic and $\Delta H = -114\text{kJ}$

13. Which of the following reactions is endothermic?

- a. $\text{H}_2(\text{g}) + \text{S}(\text{s}) \rightarrow \text{H}_2\text{S}(\text{g}) + 20\text{kJ}$
- b. $\text{S}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{SO}_2(\text{g}) \quad \Delta\text{H} = -296\text{kJ}$
- c. $6\text{C}(\text{s}) + 3\text{H}_2(\text{g}) \rightarrow \text{C}_2\text{H}_6(\text{l}) \quad \Delta\text{H} = +83\text{kJ}$
- d. $2\text{C}(\text{s}) + 4\text{H}_2(\text{g}) + \text{O}_2(\text{g}) -402\text{kJ} \rightarrow 2\text{CH}_3\text{OH}(\text{g})$

14. Consider the reaction between barium carbonate and an acid:



Which one of the following changes increase the rate of evolution of CO_2 in this reaction?

- a. decreasing the temperature of the system
- b. increasing the concentration of Ba^{+2}
- c. adding water to the system
- d. finely powdering the BaCO_3

15. At 25°C and considering only the nature of reactants, which one of the following reactions most likely has the highest rate?

- a. $\text{Ca}^{+2}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{CaCO}_3(\text{s})$
- b. $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
- c. $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightarrow 2\text{HI}(\text{g})$
- d. $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$

16. If the pressure on a gaseous system is increased, the rate of reaction increases because

- a. the activation energy is increased
- b. the temperature is decreased
- c. the concentration is increased
- d. the volume is increased

17. Which of the following does not influence the rate of a chemical reaction involving only aqueous solutions?

- a. the pressure of the system
- b. the stability of the bonds
- c. the temperature of the system
- d. the number of reacting particles per litre

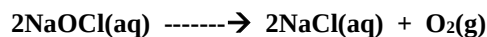
18. When reacting zinc with sulphuric acid, which experimental conditions would be expected to result in the greatest rate?

- a. 0.50M H_2SO_4 , powdered Zn, 50°C
- b. 1.0M H_2SO_4 , powdered Zn, 50°C
- c. 1.0M H_2SO_4 , block of Zn, 50°C
- d. 1.0M H_2SO_4 , powdered Zn, 25°C

19. Increasing the temperature by 10°C generally doubles the rate of reaction because the

- a. increase represents a doubling of the temperature
- b. fraction of molecules with sufficient energy is doubled
- c. average PE of colliding molecules is doubled
- d. average KE of colliding molecules is doubled

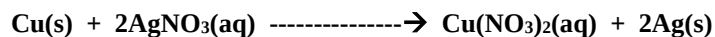
20. Given the following reaction:



The catalyst Co_2O_3 is added to the above reaction and the system is closed. Which of the following properties could be monitored in order to determine the reaction rate?

- a. pressure
- b. mass of Co_2O_3
- c. concentration of Na^+
- d. concentration of Co_2O_3

21. The following equation represents the reaction between copper metal and aqueous silver nitrate solution:



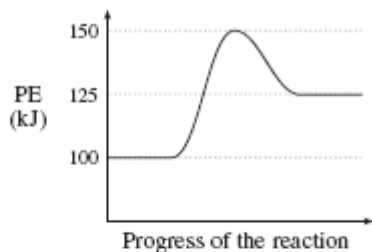
Which of the following properties, measure per unit time, would BEST monitor the rate of this reaction?

- a. the concentration of $\text{NO}_3^-\text{(aq)}$
- b. the total gas pressure
- c. the colour of the solution
- d. the mass of the system

22. At 10°C , a 5.0g piece of Zn reacts with 2.0M HCl to produce 15.0mL of H_2 gas in 25s. What is the rate of this reaction?

- a. 0.20 grams Zn per second
- b. 0.4°C/s
- c. 0.6 mL/s H_2
- d. 0.80mol/L per second HCl

23. Given the following potential energy diagram:



Which of the following is true for the forward reaction?

	ΔH (kJ)	PE of Activated Complex (kJ)
A.	-25	50
B.	-25	150
C.	+25	50
D.	+25	150

24.

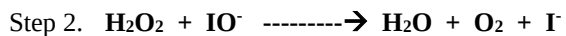
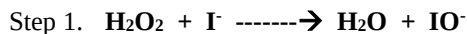
Consider the following information for a reversible chemical reaction:

1	forward activation energy = 20kJ
2	reverse activation energy = 30kJ

Which of the following describes the reaction type and enthalpy change for the forward reaction?

	Reaction Type	ΔH Value
A.	exothermic	-10 kJ
B.	exothermic	+10 kJ
C.	endothermic	-10 kJ
D.	endothermic	+10 kJ

25. Consider this two-step reaction mechanism:



The reaction intermediate is:

- a. I^-
- b. O_2
- c. IO^-
- d. H_2O

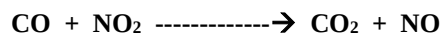
26. The catalyst in question #25 is:

- a. I^-
- b. O_2
- c. IO^-
- d. H_2O

27. A chemical reaction in which the product appears quickly has a

- a. slow reaction rate
- b. rate-determining step with a low threshold energy
- c. high activation energy
- d. complex reaction

28. Consider the following reaction:



- a. The first step in each of the two proposed reaction mechanisms for the above reaction is listed below. If each proposed reaction mechanism consists of only two steps, determine the second step for each mechanism. (2 marks)

Proposed Mechanism One

Step one: $2\text{NO}_2 \longrightarrow \text{NO}_3 + \text{NO}$ (*slow*)

Step two: (*fast*)

Proposed Mechanism Two

Step one: $2\text{NO}_2 \longrightarrow \text{N}_2\text{O}_4$ (*fast*)

Step two: (*slow*)

- b. Experimental data show that the rate of the reaction is not affected by a change in the CO concentration. Which of the two proposed mechanisms would be consistent with these data? Explain. (1 mark)

29. Explain why the reaction mechanism for the following reaction probably involves more than one step. (1 mark)

