Test Review Unit 3_2
Chemical reactions. Fundamentals

Identify the letter of the choice that best completes the statement or answers the question.

1. Which of the following are chemical changes: a) Sugar dissolves in warm water. b) A nail rusts. c) A glass breaks. d) A piece of paper burns.
   a. a, b and c  
   b. a, b and c  
   c. a and b  
   d. b and d

2. Which of the following are physical changes: a) Iron and sulfur mix and form a partially magnetic black and yellow mixture. b) Iron and sulfur are heated and form a non-magnetic shiny grey substance. c) Dry Ice (solid carbon dioxide -- CO2) is sublimed at room temperature. d) Water boils at 100 degrees Celsius:
   a. a, b and c  
   b. a, c and d  
   c. a and b  
   d. c and d

3. Which of the following statements describes a difference between a chemical change and a physical change in a substance?
   a. A physical change occurs only in elements; a chemical change occurs only in compounds.
   b. A chemical change occurs only in elements; a physical change occurs only in compounds.
   c. The result of a physical change is a different composition; in a chemical change, the composition remains the same.
   d. The result of a chemical change is a different composition; in a physical change, the composition remains the same.

4. Which of the following is not evidence of a chemical reaction taking place?
   a. A substance boiling  
   b. Gas being given off.  
   c. Energy being given out.  
   d. A precipitate being formed.

5. Which of the following always occurs in a chemical reaction?
   a. A gas is given off  
   b. A solid is produced.  
   c. There is a colour change.  
   d. A new substance is formed.

6. A(n) __ uses chemical symbols and formulas to describe a chemical reaction
   a. Reactant  
   b. Symbol equation  
   c. Product  
   d. Chemical equation

7. Which of the following equations shows a chemical change?
   a. H2O (l) + heat → 2 H2O (g)  
   b. H2O (l) → H2O (s) + heat  
   c. H2O (l) + Na2O (s) → 2NaOH (aq) + heat  
   d. H2O (l) + NaCl (s) → Na+ (aq) + Cl− (aq) + H2O (l)

8. A(n) __ is a substance that reacts with another substance in a chemical reaction.
   a. Reactant  
   b. Symbol equation  
   c. Product  
   d. Chemical equation
9. A(n) __ is a substance that is produced during a chemical reaction.
   a. Reactant          c. Product
   b. Symbol equation    d. Chemical equation

10. During an investigation, a student combined the two clear, colorless solutions shown below.

![Solution 1](Compound A dissolved in water at 25°C)

![Solution 2](Compound B dissolved in water at 25°C)

The student observed that the temperature changed from 25°C to 23°C when the solutions were combined and that a white substance rapidly formed and settled to the bottom of the container. What most likely happened to produce these results?
   a. One of the original compounds came out of solution.
   b. The solutions reacted chemically.
   c. Some of the water froze into ice crystals.
   d. Rapid evaporation of water occurred, leaving a solid.

11. Use each of the terms below just once to complete the passage:
   Collision theory, Activated complex, Activation energy, Reaction rate

According to the (1) ________________, atoms, ions and molecules must collide in order to react. Once formed, the (2) ________________ is a temporary, unstable arrangement of atoms that may then form products or may break apart to reform the reactants. Every chemical reaction requires energy. The minimum amount of energy that reacting particles must have to form the activated complex is the (3) ________________. In a chemical reaction, the (4) ________________, is the change in the concentration of a reactant or product per unit time.

   a. (1) Collision theory, (2) activated complex, (3) activation energy, (4) reaction rate
   b. (1) Activation energy, (2) activated complex, (3) collision theory, (4) reaction rate
   c. (1) Collision theory, (2) reaction rate, (3) activation energy, (4) activated complex
   d. (1) Reaction rate, (2) Collision theory, (3) activation energy, (4) activated complex

12. Which of the following statements about collisions is correct?
   a. All colliding particles have the same amount of energy
   b. Only fast-moving particles collide with each other
   c. Reactions can happen if the colliding particles have enough energy
   d. Particles do not collide at all
13. A successful collision is one in which:
   a. The particles hit each other
   b. Enough energy is transferred for particles to react
   c. Enough energy is transferred for particles to bounce off each other
   d. Particles have enough energy and collide with the proper orientation

14. Given the equation representing a reaction: \( \text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightarrow 2\text{HI}(\text{g}) \)
Which statement describes the energy changes that occur in this reaction?
   a. Energy is absorbed as bonds are formed, only.
   b. Energy is released as bonds are broken, only.
   c. Energy is absorbed as bonds are formed, and energy is released as bonds are broken.
   d. Energy is absorbed as bonds are broken, and energy is released as bonds are formed.

15. Given the balanced equation: \( \text{F}_2 \rightarrow 2\text{F} \)
Which statement describes what occurs during this reaction?
   a. Energy is absorbed as a bond is formed.
   b. Energy is absorbed as a bond is broken.
   c. Energy is released as a bond is formed.
   d. Energy is released as a bond is broken.

16. What occurs when two fluorine atoms react to produce a fluorine molecule?
   a. Energy is absorbed as a bond is broken.
   b. Energy is absorbed as a bond is formed.
   c. Energy is released as a bond is formed.
   d. Energy is released as a bond is broken.

17. In which type of chemical reaction do two or more reactants combine to form one product, only?
   a. decomposition
   b. single replacement
   c. double replacement
   d. synthesis

18. Given the balanced equation: \( 2\text{PbO}_2 \rightarrow 2\text{PbO} + \text{O}_2 \)
What type of chemical reaction is represented by this equation?
   a. double replacement
   b. decomposition
   c. single replacement
   d. synthesis

19. Given the balanced equation: \( \text{Mg} + \text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2 \)
What type of chemical reaction is represented by this equation?
   a. double replacement
   b. decomposition
   c. single replacement
   d. synthesis

20. Which of the following is a combination type reaction?
   a. \( 2\text{C}_2\text{H}_2 + 5\text{O}_2 \rightarrow 4\text{CO}_2 + 2\text{H}_2\text{O} \)
   b. \( 4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3 \)
   c. \( 2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2 \)
   d. \( 2\text{CH}_3\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 4\text{H}_2\text{O} \)
21. Given the balanced equations representing two chemical reactions:
\[ \text{Cl}_2 + 2\text{NaBr} \rightarrow 2\text{NaCl} + \text{Br}_2 \quad \text{and} \quad 2\text{NaCl} \rightarrow 2\text{Na} + \text{Cl}_2 \]
Which types of chemical reactions are represented by these equations?
- a. single replacement and double replacement
- b. synthesis and decomposition
- c. single replacement and decomposition
- d. synthesis and double replacement

22. A student investigated the reaction between zinc and dilute acid.

Which experiments show how changing acid concentration affects the rate of the reaction?
- a. 1 and 2
- b. 2 and 3
- c. 3 and 4
- d. 1 and 4

23. A student set up three experiments to investigate the speed of the reaction between magnesium and dilute acid. Which factor was the student investigating?
a. Mass of magnesium ribbon in grams  

b. Volume of the acid

c. The concentration of the acid  
d. Temperature of the acid

24. Three reactions took different times to stop. Which one had the greatest rate?

a. The one that took 45 s  
b. The one that took 25 s  
c. The one that took 0.5 min  
d. None of the above

25. Using data from the table, when did the reaction stop?

a. 40 s  
b. 60 s  
c. 80 s  
d. 100 s

26. Why does reaction rate increase as the concentration increases?

a. The particles have more energy so there are more collisions  
b. There are more particles so there are more collisions  
c. The surface area is increased so there are more collisions  
d. None of the above

27. Why does reaction rate increase as the temperature increases?

a. Particles begin to collide at higher temperatures  
b. At higher temperatures particles move faster and collide more often  
c. There are more particles at higher temperatures, so they collide more  
d. None of the above
28. Reactions eventually stop. What is generally the reason for this?
   a. The catalyst has been used up  
   b. One or more of the reactants has been used up  
   c. The particles have run out of energy  
   d. None of the above

29. Which line represents the fastest reaction?
   [Diagram with lines A, B, C]
   a. A  
   b. B  
   c. C  
   d. We cannot decide about it

30. Use the diagram in the question above and answer: Which curve represents the lowest temperature for a certain reaction?
   a. A  
   b. B  
   c. C  
   d. We cannot decide about it

31. Use the diagram in the question above and answer: Which curve represents the lowest concentration of acid for a certain reaction?
   a. A  
   b. B  
   c. C  
   d. We cannot decide about it

32. Use the diagram in the question above and answer: Which curve represents the highest pressure of two reacting gases?
   a. A  
   b. B  
   c. C  
   d. We cannot decide about it

33. A student observed that the rate of a chemical reaction increased as the temperature of the system increased. Which of the following statements best explains why thermal energy caused an increase in the reaction rate?
   a. The surface area of the product particles decreased  
   b. The collision rate of the reactant particles increased.  
   c. The concentrations of the reactant particles increased.  
   d. The concentrations of the product particles decreased.

34. The table shows the times taken for 0.5 g of magnesium to react completely with acid under different conditions.
The time for 0.5 g of magnesium to react completely with 0.2 mol l$^{-1}$ acid at 25 ºC will be:

a. less than 10 s  
b. between 10 s and 20 s  
c. between 20 s and 60 s  
d. more than 80 s.

35. Which of these describes the rate of this chemical reaction?

\[ \text{H}_2 + \text{Cl}_2 \rightarrow 2 \text{HCl} \]

a. an increase in the concentration of HCl  
b. an increase in H$_2$ and Cl$_2$ with time  
c. an increase in H$_2$ and Cl$_2$ with time  
d. a decrease in HCl and Cl$_2$ with time

36. Which of the following changes will cause an increase in the rate of the above reaction?

\[ \text{C}_6\text{H}_6 + \text{Br}_2 \rightarrow \text{C}_6\text{H}_5\text{Br} + \text{HBr} \]

a. increasing the concentration of Br$_2$  
b. decreasing the concentration of C$_6$H$_6$  
c. increasing the concentration of HBr  
d. decreasing the temperature

37. If the above reaction takes place inside a sealed reaction chamber, then which of these procedures will cause a decrease in the rate of reaction?

\[ 2 \text{CO} (g) + \text{O}_2 (g) \rightarrow 2 \text{CO}_2 (g) \]

a. Raising the temperature of the reaction chamber  
b. Increasing the volume inside the reaction chamber  
c. Removing the CO$_2$ as it is formed  
d. Adding more CO to the reaction chamber
If you have 30 correct answers you can feel confident.