Topic 6 Neutralization and Fire Triangle

Multiple Choice

1. A basic solution of NaOH was neutralized with an acidic solution of H_3PO_4. Which of the following is the balanced equation representing this neutralization reaction?

   A) $NaOH + H_3PO_4 \longrightarrow Na_3PO_4 + H_2O$

   B) $3NaOH + H_3PO_4 \longrightarrow Na_3PO_4 + 3H_2O$

   C) $NaOH + H_3PO_4 \longrightarrow Na_3PO_4 + H_2O$

   D) $3NaOH + 2H_3PO_4 \longrightarrow Na_3PO_4 + 3H_2O$

Answer: B (it is the balanced equation)

2. You find a bottle containing an unidentified liquid. By using universal indicator paper, you determine that the pH of this liquid is 11. Therefore you have to neutralize it before disposing of it. Which of the following methods can be used to neutralize the liquid?
   A) Add a solution of NaOH.
   B) Add distilled water.
   C) Add a solution whose pH is 5.
   D) Add a solution whose pH is 8.

Answer: C

3. Which one of the following substances can be used to neutralize a solution whose pH is 8?
   A) Na_2CO_3 B) NH_4Cl C) HI D) $Mg(OH)_2$

Answer: C

4. In neutralizing sulfuric acid, H_2SO_4, with caustic soda, NaOH, sodium sulfate, NA_2SO_4, and water are produced. Which equation represents this chemical reaction?
   A) $H_2SO_4 + 2\ NaOH \rightarrow Na_2SO_4 + 2\ H_2O$
   B) $Na_2SO_4 + 2\ H_2O \rightarrow H_2SO_4 + 2\ NaOH$
   C) $H_2SO_4 + NaOH \rightarrow Na_2SO_4 + 2\ H_2O$
   D) $Na_2SO_4 + H_2O \rightarrow H_2SO_4 + 2\ NaOH$

Answer: A

5. Hydrochloric acid, HCl, in one of the acids found in the stomach. Heartburn is a symptom that occurs when the stomach produces too much HCl. Heartburn can be relieved by taking an antacid. Felix is suffering from heartburn and takes an antacid made up of magnesium hydroxide. What are the products of the chemical reaction between the stomach acid and the antacid?
   A) Magnesium hydroxide and hydrogen chloride
   B) Magnesium hydroxide and hydrogen chlorate
   C) Magnesium chloride and water
   D) Hydrogen chloride and water

Answer: C (water and a salt)

6. Four substances involved in an acid-base neutralization reaction are listed below.

   1- H_2O 2- KOH 3- KCl 4- HCl

   Which of these substances are the products of this acid-base neutralization reaction?

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

Answer: A

7. Because of an accident involving a truck, 150 000 litres of acid spilled into a river. After removing the vehicle from the water, the emergency response team dumped a substance to neutralize the acid. Which of the following equations correctly represents the chemical reaction involved in this situation?

A) $C_2H_4 + 3\ O_2 \rightarrow 2\ CO_2 + 2\ H_2O$
B) $Ca(OH)_2 + 2\ HF \rightarrow CaF_2 + 2\ H_2O$
C) $NaOH + KCl \rightarrow NaCl + KOH$
D) $HBr + KI \rightarrow HI + KBr$

Answer: B

8. Which of the following balanced equations corresponds to an acid-base neutralization reaction?

A) $C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$
B) $6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$
C) $Ca + 2\ HCl \rightarrow H_2 + CaCl_2$
D) $Mg(OH)_2 + 2\ HBr \rightarrow MgBr_2 + 2\ H_2O$

Answer: D

9. The incomplete equation for an acid-base neutralization reaction is given below.

   Acid + Base → _____ + _____

   Which of the following choices indicates possible products of an acid-base neutralization reaction?

A) CO_2 and H_2O B) $MgCl_2$ and H_2O C) NaCl and O_2 D) MgO and O_2

Answer: B

10. Calcium hydroxide, $Ca(OH)_2$, is one of the chemicals used to neutralize the acid draining from mines. When calcium hydroxide is added to the acid draining from mines, one of the reactions that occurs is the acid-base neutralization reaction between $Ca(OH)_2$ and sulphuric acid, H_2SO_4, in the drainage water. What are the products of the acid-base neutralization reaction between these two substances?

A) CaH_2 and H_2O B) $CaSO_4$ and H_2 C) $CaSO_4$ and H_2O D) $CaSO_4$ and H_2

Answer: C

11. On a hot and dry afternoon, some hay in a barn caught fire, but there were no external causes involved. Water was used to put out the fire. Spraying the water with fire affected one of the fire triangle components in particular. Which statement indicates both the type of combustion that caused the fire triangle component that the water affected?
    A) Slow combustion and the water affected the fuel.
    B) Slow combustion and the water affected the oxidizer.
    C) Spontaneous combustion and the water affected the ignition temperature.
    D) Spontaneous combustion and the water affected the fuel.

Answer: C

12. Iron rusting over a few years is an example of a combustion reaction. Which of the following statements below completes the following sentence correctly? Iron rusting is an example of ….
    A) …. slow combustion, and the oxidizing agent is iron.
    B) …. slow combustion, and the oxidizing agent is oxygen.
    C) …. spontaneous combustion, and the oxidizing agent is iron.
    D) …. Spontaneous combustion, and the oxidizing agent is oxygen.

Answer: B

13. A fire is extinguished by removing at least one of the three conditions required for combustion to occur.

    The following table describes three functions of a CO_2 extinguisher.

    Table I -Functions of a CO_2 Extinguisher

1	The main function of the carbon dioxide (CO_2) is to smother the fire by reducing the amount of oxygen gas (O_2) that feeds it
2	In the very early stages of a fire, the CO_2 has a cooling effect, since it comes out of the extinguisher at a temperature of -78°C.
3	The gas comes out of the extinguisher as a powerful spray that puts out small paper fires by scattering the pieces of material involved.

    Which of the following shows the correct match between the numbered functions of the CO_2 extinguisher and the conditions required for combustion to occur?

    A) 1 – fuel 2 – ignition temperature 3 – oxidizer
    B) 1 – oxidizer 2 – ignition temperature 3 – fuel
    C) 1 – ignition temperature 2 – oxidizer 3 – fuel
    D) 1 – fuel 2 – oxidizer 3 – ignition temperature

Answer: B

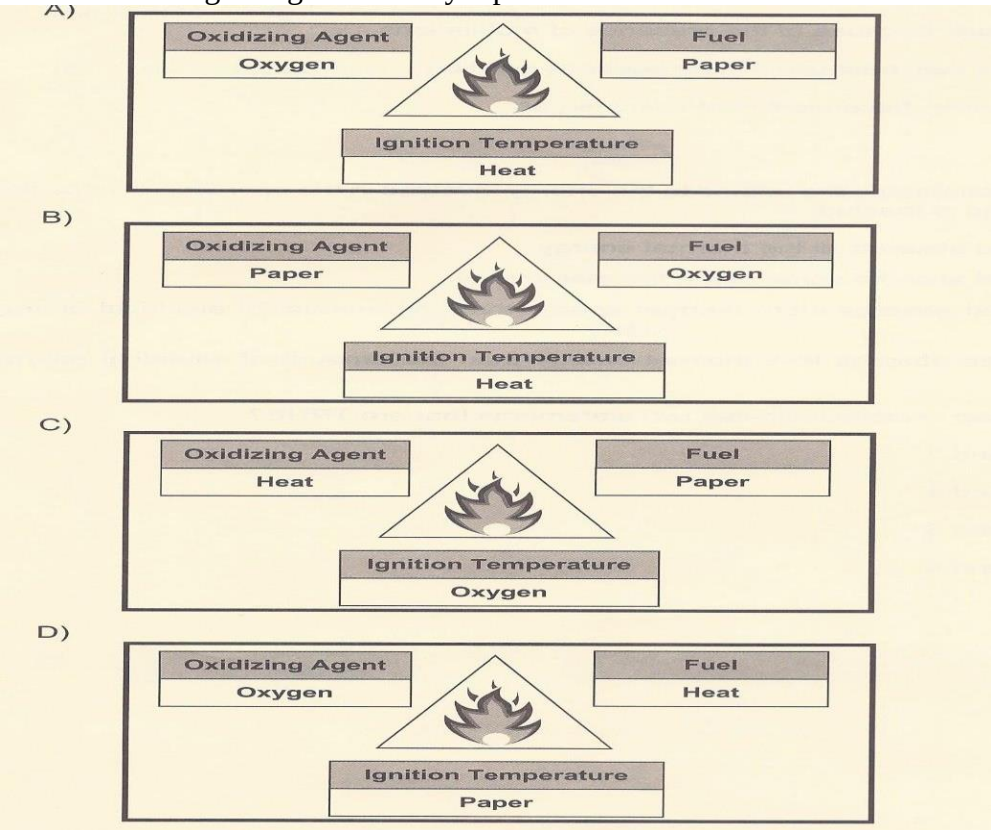
14. Each of the three statements listed below can be matched with the fire triangle component.
    Statement 1- One way of fighting forest fires is to remove all the vegetation from certain areas.
    Statement 2- Most laboratories have a blanket that can be wrapped around a person whose clothes catch fire.
    Statement 3- Buildings adjacent to the one on fire can be sprayed with water to prevent a fire from spreading in a city.

    Which of the following choices shows the correct match between the three statements above and the fire triangle components?

	Statement 1	Statement 2	Statement 3
A	Fuel	Oxidizer	Ignition temperature
B	Ignition temperature	Fuel	Oxidizer
C	Fuel	Ignition temperature	Oxidizer
D	Oxidizer	Ignition temperature	Fuel

Answer: A

15. Arthur brings a burning match close to a piece of paper to light a campfire. Which of the following triangles correctly represents the situation?



Answer: A

Short Answer

16. The following equation represents the reaction that occurs when a solution of hydrogen bromide is combined with a solution of lithium hydroxide :

$$HBr + LiOH \rightarrow \boxed{\text{product 1}} + \boxed{\text{product 2}}$$

The products are not identified in the above equation. Identify these products.

Answer: H_2O and LiBr (salt and water)

17. A candle will continue to burn as long as all three components of the fire triangle are present. Four lit candles are placed in front of you. You decide to try a different experiment on each.

a- You do nothing to candle #1. You let the candle burn and the flame eventually goes out.

b- You cover candle #2 with a glass jar. A few seconds later you notice the flame has gone out.

c- You pour water over candle #3 and the flame goes out.

d- You cover the flame of candle #4 with sand and the flame goes out.

What part of the fore triangle does each example correspond to?

Answer:
a- fuel
b- oxidizing agent
c- ignition temperature
d- oxidizing agent

18. Ethanol is a flammable liquid that can be used in cars instead of gasoline. A spark is needed to trigger the combustion of ethanol, which occurs according to the following reaction:

Ethanol + Oxygen gas → Carbon dioxide + Water + Energy

$$C_2H_5OH + 3\,O_2 \rightarrow 2\,CO_2 + 3\,H_2O + \text{Energy}$$

a) For each fire triangle component, check off the corresponding element associated with the reaction for the combustion of ethanol.

Fire triangle component	Element associated with the reaction for the combustion of ethanol
Fuel	☐ Ethanol (C_2H_5OH) ☐ Oxygen gas (O_2) ☐ Spark
Oxidizing agent	☐ Ethanol (C_2H_5OH) ☐ Oxygen gas (O_2) ☐ Spark
Ignition temperature	☐ Ethanol (C_2H_5OH) ☐ Oxygen gas (O_2) ☐ Spark

b) What is an observable sign indicating that the combustion of ethanol is an example of rapid combustion?

Answer: a) Fuel- ethanol O_2 agent- oxygen gas Ign. Temp- spark
b- The reaction happens instantly