

## 8

## Acids and Bases

For each question, choose the most suitable option and write the letter (A, B, C or D) in the brackets provided.

## Level 1

- Which of the following reacts with **both** an acid and an alkali?  
A Ammonia  
B Ammonium nitrate  
C Calcium carbonate  
D Zinc oxide ( )
- Which of the following ionic equations represents the reaction between an acid and an alkali?  
A  $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$   
B  $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$   
C  $2\text{Na}^+ + \text{SO}_4^{2-} \rightarrow \text{Na}_2\text{SO}_4$   
D  $\text{NH}_4^+ + \text{OH}^- \rightarrow \text{NH}_3 + \text{H}_2\text{O}$  ( )
- Which of the following can be added to soil to **increase** its pH?  
A Calcium oxide  
B Magnesium chloride  
C Sulfur dioxide  
D Zinc nitrate ( )
- Which of the following oxides can react with aqueous potassium hydroxide?  
A  $\text{CO}_2$  and  $\text{BaO}$   
B  $\text{CO}_2$  and  $\text{H}_2\text{O}$   
C  $\text{CO}_2$  and  $\text{PbO}$   
D  $\text{CO}_2$  only ( )
- Which of the following suggests that sulfuric acid behaves as an acid?  
A It dissolves in water.  
B It forms a neutral solution with sodium hydroxide.  
C It has a sour taste.  
D It turns red litmus paper blue. ( )

**Level 2**

6. Sodium hydroxide is a useful alkali that can be used to make many products like soaps and detergents.

Which of the following statements about sodium hydroxide is/are likely to be **correct**?

- 1 Sodium hydroxide is formed when sodium oxide dissolves in water.
- 2 When excess sodium chloride is added into a solution of sodium hydroxide, the pH of the solution decreases to 7.
- 3 When zinc oxide is added into sodium hydroxide solution, no reaction takes place.

A 1 only

B 1 and 2 only

C 2 and 3 only

D 3 only

( )

7. Zinc carbonate granules were added into a mixture of hydrogen chloride gas dissolved in an organic solvent called benzene. No reaction was observed.

Which of the following change could be made so that the zinc carbonate would react with hydrogen chloride gas?

A Add more hydrogen chloride gas.

B Change the benzene solvent to water.

C Crush the zinc carbonate into a powder.

D Heat the reaction mixture.

( )

8. Which of the following about hydrochloric acid and aqueous ammonia is **true**?

A A gas is produced when ammonium carbonate is added into separate solutions of hydrochloric acid and aqueous ammonia.

B Both solutions have lower pH values than aqueous sodium hydroxide.

C Copper(II) oxide dissolves in both solutions.

D Universal Indicator solution shows the same colour when added into both solutions. ( )

9. When ammonia gas dissolves in water, \_\_\_\_\_.

A it combines with water to form ammonium hydroxide

B the resultant solution is able to react with solid iron(II) oxide

C the resultant solution is alkaline

D the resultant solution turns blue litmus paper red

( )

**Level 3**

10. Which of the following reactions does **not** produce a gas?
- A Adding calcium carbonate into dilute nitric acid
  - B Adding copper metal into a mixture of nitric acid and sulfuric acid
  - C Bubbling sulfur dioxide gas into a mixture of zinc and water
  - D Mixing ammonium chloride solution with potassium hydroxide solution ( )

11. Table 8.1 below shows the colours of two indicators in different environments.

**Table 8.1**

Indicator	Colour in Acid	Colour in Alkali
P	W	X
Q	Y	Z

- When a few drops of indicator Q were added into a mixture containing sulfuric acid and potassium nitrate, the mixture turned red.
- When two drops of indicator P and two drops of indicator Q were added into a flask containing hydrochloric acid, the mixture turned orange.
- When indicators P and Q were added into a flask containing sodium hydroxide, the mixture turned blue.
- When ammonia gas was bubbled into a solution containing indicator P, the solution turned blue.

Based on the above information, what are the colours W, X, Y and Z?

	W	X	Y	Z
A	Orange	Blue	Red	Yellow
B	Orange	Red	Green	Blue
C	Yellow	Blue	Red	Blue
D	Yellow	Red	Orange	Yellow

12. 28 g of solid potassium hydroxide (KOH) was added into 0.2 mol of sulfuric acid ( $H_2SO_4$ ). After stirring the solution for some time, a few drops of Universal Indicator solution were added into the reaction mixture.
- What would likely be the colour of the resultant mixture?
- A Blue
  - B Green
  - C Orange
  - D Red ( )

13. Solid **M** was added into 25 cm<sup>3</sup> of sulfuric acid. The pH of the reaction mixture was monitored until solid **M** was added in excess.

Which of the following is likely to be **true**?

- A If solid **M** is aluminium oxide, the final pH of the reaction mixture will be 7.
- B If solid **M** is aluminium oxide, the final pH of the reaction mixture will be 14.
- C If solid **M** is sodium oxide, the final pH of the reaction mixture will be 7.
- D If solid **M** is zinc oxide, the final pH of the reaction mixture will be 14. ( )

14. Calcium sulfite, CaSO<sub>3</sub>, is a white solid that has similar chemical properties as calcium carbonate. Calcium sulfite releases an acidic gas when it reacts with acids.

Which of the following statements about calcium sulfite are likely to be **true**?

- 1 A white precipitate of calcium sulfite is formed when sulfur dioxide reacts with limewater.
  - 2 Calcium sulfite can be formed from the reaction between calcium chloride and sulfur dioxide.
  - 3 Calcium sulfite dissolves in aqueous ammonia.
  - 4 The chemical equation for the reaction between calcium sulfite and hydrochloric acid is  $\text{CaSO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{SO}_2 + \text{H}_2\text{O}$ .
- A 1 and 3 only
  - B 1 and 4 only
  - C 2 and 3 only
  - D 2 and 4 only ( )

15. A student is given two samples, one of which is aluminium oxide and the other is magnesium carbonate. He needs to find a method to identify the two samples.

Which of the following show(s) the **correct** method(s) and observation(s)?

	Method	Observation(s)
1	Add nitric acid.	Only aluminium oxide dissolves.
2	Add nitric acid.	Only magnesium carbonate dissolves. Bubbles are given off.
3	Add sodium hydroxide.	Only aluminium oxide dissolves.
4	Add sodium hydroxide.	Only magnesium carbonate dissolves. Bubbles are given off.

- A 1 and 4 only
- B 2 only
- C 2 and 3 only
- D 3 only ( )