08 Acids and Bases

Set A **Answer key**

A From the lesson

9 MARKS

1

C a carbonate [1]

The gas is carbon dioxide, which only a carbonate gives with an acid. A metal gives hydrogen, and a metal oxide or an alkali gives no gas.

2

B ammonium sulfate and sodium hydroxide [1]

An alkali heated with an ammonium salt gives off ammonia. A has no alkali, C has no ammonium salt, and water is not an alkali.

3

B P has a higher concentration of H^+ ions than Q. [1]

The lower the pH, the higher the concentration of H^+ ions. Both solutions are acidic.

4

C sulfur [1]

Sulfur is a non-metal, so its oxide is acidic and dissolves to form an acid. Sodium oxide dissolves to form an alkali.

5

(a) A substance that produces hydrogen ions, H^+, in aqueous solution. [1]

(b) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ [1]

(c) A strong acid is completely ionised in aqueous solution. [1]

A weak acid is only partially ionised in aqueous solution. [1]

(d) Amphoteric, because it reacts with both acids and alkalis. [1]

B Practice

14 MARKS

6

A H^+ high, OH^- low [1]

pH 1 is strongly acidic, so the H^+ concentration is high. Some OH^- ions are still present, at a low concentration.

7

A It reacts with a carbonate to form carbon dioxide. [1]

It is acids that react with carbonates to give carbon dioxide. Alkalis neutralise acids, give ammonia with ammonium salts and turn Universal Indicator blue.

8

C amphoteric, acidic, basic [1]

Aluminium oxide is one of the amphoteric oxides (with zinc oxide and lead(II) oxide). Nitrogen is a non-metal, so its oxide is acidic. Sodium is a metal, so its oxide is basic.

9

A calcium hydroxide [1]

Calcium hydroxide (slaked lime) neutralises acidity in soil and raises the pH. Sodium hydroxide is an alkali that is too strong to use on soil.

10

D Water is a product. [1]

Carbonate + acid gives salt + water + carbon dioxide, and base + acid gives salt + water. Water is the product in both. Only the carbonate gives a gas, and neither is a soluble base.

11

C yellow, blue, colourless [1]

Pure water has pH 7. That is above 3 (methyl yellow is yellow) and above 5 (bromocresol green is blue), but below 9 (thymolphthalein stays colourless).

12

B $RO(s) + 2OH^-(aq) \rightarrow RO_2^{2-}(aq) + H_2O(l)$ [1]

Every metal oxide that is a base reacts with acids, as in A. A metal oxide that also reacts with an alkali (OH^- ions), as in B, is amphoteric.

13

D solid calcium carbonate [1]

Calcium carbonate neutralises the acid, and the excess is an insoluble solid, so the solution is not left alkaline. Excess aqueous ammonia or sodium hydroxide leaves an alkaline solution, and ammonium nitrate does not remove acid.

14

(a) Al_2O_3 [1]

(b) SO_2 [1]

15

(a) A substance that ionises partially in water to form a low concentration of hydrogen ions. [1]

(b)

Add a reactive metal such as magnesium, *or* a carbonate such as sodium carbonate, to separate samples of each acid. **[1]**

Sulfuric acid gives more vigorous bubbling, *or* the solid disappears in a shorter time. **[1]**

So sulfuric acid is the strong acid and ethanoic acid is the weak acid. **[1]**