

1.

Equal volumes of saturated solutions of magnesium hydroxide, calcium hydroxide and strontium hydroxide are completely neutralised with dilute sulfuric acid.

The water is gently evaporated from each of the resulting solutions, leaving the corresponding solid sulfates.

These solid sulfates are completely dissolved in the minimum volume of water needed to produce saturated solutions.

Which statement about the volumes of water needed to dissolve the sulfates is correct?

- A** The calcium sulfate will require the greatest volume of water.
- B** The magnesium sulfate will require the greatest volume of water.
- C** The strontium sulfate will require the greatest volume of water.
- D** They will all require the same volume of water.

Ans: C

2.

A solution contains both $\text{Mg}^{2+}(\text{aq})$ and $\text{Sr}^{2+}(\text{aq})$ at the same concentration.

The solution is divided into two equal portions. Aqueous sodium hydroxide is added dropwise to one portion. Dilute sulfuric acid is added dropwise to the other portion.

Which row is correct?

	precipitate seen first when $\text{NaOH}(\text{aq})$ is added	precipitate seen first when $\text{H}_2\text{SO}_4(\text{aq})$ is added
A	magnesium hydroxide	magnesium sulfate
B	magnesium hydroxide	strontium sulfate
C	strontium hydroxide	magnesium sulfate
D	strontium hydroxide	strontium sulfate

Ans: B

3.

Element X has the second largest atomic radius in its period. An atom of X has three occupied electron shells only.

The oxide of X is shaken with water.

What could be the pH of the resulting solution?

- A** 5 **B** 7 **C** 9 **D** 14

Ans: C

4.

Compound Z is insoluble in water but soluble at low pH.

What could be compound Z?

- A** barium carbonate
- B** barium chloride
- C** barium hydroxide
- D** barium sulfate

Ans: A

At low pH, barium carbonate reacts to form BaO, CO₂, and H₂O.

5.

Which row correctly describes the separate reactions of calcium and strontium with water?

	substance reduced	substance oxidised	more vigorous reaction
A	calcium or strontium	water	calcium + water
B	calcium or strontium	water	strontium + water
C	water	calcium or strontium	calcium + water
D	water	calcium or strontium	strontium + water

Ans: D

6.

A 5.00 g sample of an anhydrous Group 2 metal nitrate loses 3.29 g in mass when heated strongly.

Which metal is present?

- A** magnesium
- B** calcium
- C** strontium
- D** barium

Ans: B

7.

The table gives some data for compounds of two elements from Group 2 of the Periodic Table.

element	decomposition temperature of carbonate / °C	solubility of sulfate in mol / 100 g of water	solubility of hydroxide in mol / 100 g of water
calcium	840	4.66×10^{-3}	1.53×10^{-3}
Z	?	?	2.00×10^{-5}

What is the missing data for element Z?

	decomposition temperature of carbonate / °C	solubility of sulfate in mol / 100 g of water
A	350	1.83×10^{-1}
B	350	7.11×10^{-5}
C	1100	1.83×10^{-1}
D	1100	7.11×10^{-5}

Ans: A

8.

Dolomite is a double carbonate, $\text{CaMg}(\text{CO}_3)_2$, and can be used instead of calcium carbonate for treating acidic soils.

The three statements all refer to the agricultural use of these carbonates.

- 1 Dolomite and calcium carbonate are both less soluble than $\text{Ca}(\text{OH})_2$.
- 2 One mole of dolomite has the same neutralising effect as one mole of calcium carbonate.
- 3 Dolomite and calcium carbonate both increase the pH of acidic soils.

Which statements are correct?

- A** 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

Ans: B

9.

Four properties of beryllium, Be, or a beryllium compound are listed.

Which property is different from the property of magnesium or the equivalent magnesium compound?

- A** Be reacts with O_2 when heated in air; Mg does not.
- B** Be reacts with aqueous H_2SO_4 to form a metal sulfate and H_2 ; Mg does not.
- C** $Be(NO_3)_2$ decomposes on heating to form a metal oxide, NO_2 and O_2 ; $Mg(NO_3)_2$ does not.
- D** $BeCl_2$ reacts with water to form fumes of HCl ; $MgCl_2$ does not.

Ans: D

NOTE: $BeCl_2$ undergoes hydrolysis in water. It is the only group 2 metal chloride to do so. All other group 2 metal chlorides only dissolve in water, they don't react.

10.

V and W are two compounds. Each one contains a different Group 2 element.

A sample of each solid is added to water, shaken, and the pH of the resulting solution is measured.

compound	V	W
pH	13.6	9.4

Which row could identify V and W?

	V	W
A	$BaSO_4$	$MgSO_4$
B	$MgSO_4$	$BaSO_4$
C	$Ba(OH)_2$	$Mg(OH)_2$
D	$Mg(OH)_2$	$Ba(OH)_2$

Ans: C

- Cannot be $BaSO_4$, as it is insoluble