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Chemistry Grade 12 — Chapter 5

Group 2 Elements

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Independent practice MCQs from the supplied Class 12 Chemistry notes pack. Total: 50 questions.

A. Important / Main Topics

1. Group 2 elements are called:

(A) Alkaline earth metals
(B) Alkali metals
(C) Halogens
(D) Noble gases

Correct Answer: A

Explanation: The notes state that the elements in Group 2 are called alkaline earth metals because their oxides and hydroxides are water-soluble (alkaline) and their oxides are found in the earth's crust.

2. The general electronic configuration of Group 2 elements is:

(A) ns^1
(B) ns^2
(C) ns^2np^1
(D) ns^2np^6

Correct Answer: B

Explanation: The notes state that Group 2 elements have two electrons in their outermost shell, with the general configuration ns^2.

3. The oxidation state shown by alkaline earth metals is:

(A) -2
(B) +1, +2
(C) +2
(D) -1, -2

Correct Answer: C

Explanation: Group 2 elements lose their two outermost electrons to become ions with a +2 charge.

4. Ionization energy is the energy required to:

(A) Add an electron to an atom
(B) Break a chemical bond
(C) Melt a solid
(D) Remove one mole of electrons from an isolated gaseous atom

Correct Answer: D

Explanation: The notes define ionization energy as the minimum energy required to remove one mole of electrons from an isolated gaseous atom or ion.

5. Down Group 2, the first ionization energy:

(A) Decreases
(B) Increases
(C) Remains the same
(D) First increases then decreases

Correct Answer: A

Explanation: Ionization energy decreases down the group because the outer electrons are further from the nucleus and are more shielded.

6. Down Group 2, the atomic radius:

(A) Decreases

(B) Increases
(C) Remains the same
(D) Is unpredictable

Correct Answer: B

Explanation: Down Group 2, the atomic radius Increases.

7. Down Group 2, the chemical reactivity of the elements:

(A) Decreases
(B) Remains the same
(C) Increases
(D) Is unpredictable

Correct Answer: C

Explanation: Down Group 2, the chemical reactivity of the elements Increases.

8. Down Group 2, the melting point of the elements:

(A) Increases
(B) Remains the same
(C) First increases then decreases
(D) Decreases

Correct Answer: D

Explanation: Melting point decreases down the group because the metallic bond strength decreases as the atomic radius increases.

9. Which Group 2 element is stored in oil to prevent it from reacting with air?

(A) Barium
(B) Magnesium
(C) Calcium
(D) Strontium

Correct Answer: A

Explanation: The notes state that barium is so reactive that it must be stored under oil to keep it out of contact with air.

10. Which Group 2 element does not react with water?

(A) Magnesium
(B) Beryllium
(C) Calcium
(D) Barium

Correct Answer: B

Explanation: The notes state that beryllium does not react with water because of the protective layer of BeO on its surface.

11. The flame colour of calcium compounds is:

(A) Scarlet/red
(B) Apple-green
(C) Brick-red
(D) Blue

Correct Answer: C

Explanation: The notes state that calcium compounds give a brick-red colour in a flame test.

12. The flame colour of barium compounds is:

(A) Brick-red
(B) Scarlet/red
(C) Blue
(D) Apple-green

Correct Answer: D

Explanation: The notes state that barium compounds give an apple-green colour in a flame test.

13. Thermal decomposition is the breakdown of a compound by:

(A) Applying heat
(B) Adding water
(C) Adding a catalyst
(D) Adding an acid

Correct Answer: A

Explanation: The notes define thermal decomposition as the breakdown of a compound into two or more substances by the application of heat.

14. Group 2 carbonates decompose to form:

(A) Metal hydroxide and carbon dioxide
(B) Metal oxide and carbon dioxide
(C) Metal and carbon dioxide
(D) Metal oxide and oxygen

Correct Answer: B

Explanation: The notes state that Group 2 carbonates decompose to form the metal oxide and give off carbon dioxide gas.

15. The thermal stability of Group 2 carbonates:

(A) Decreases down the group
(B) Remains constant
(C) Increases down the group
(D) Is unpredictable

Correct Answer: C

Explanation: The notes state that the thermal stability of Group 2 carbonates increases down the group.

16. Why does the ionization energy of Group 2 elements decrease down the group?

(A) Because the number of protons decreases
(B) Because the number of neutrons decreases
(C) Because the density increases
(D) Because the atomic size increases and shielding effect increases

Correct Answer: D

Explanation: Because the atomic size increases and shielding effect increases — this correctly answers the question.

17. Why does the melting point of Group 2 elements decrease down the group?

(A) Because the strength of the metallic bond decreases
(B) Because the atomic mass increases
(C) Because the density increases
(D) Because the number of valence electrons decreases

Correct Answer: A

Explanation: The melting point is a measure of the strength of the metallic bond; as the atomic radius increases, the bond strength decreases.

18. Why is beryllium oxide (BeO) amphoteric?

(A) Because it is a strong acid
(B) Because it can form the [Be(OH)□]²□ complex
(C) Because it is a strong base
(D) Because it does not react with acids

Correct Answer: B

Explanation: BeO is amphoteric because it reacts with both acids and bases, forming the [Be(OH)□]²□ complex in basic solution.

19. What is the product of the reaction between magnesium and steam?

(A) Magnesium hydroxide and hydrogen
(B) Magnesium oxide and oxygen
(C) Magnesium oxide and hydrogen
(D) Magnesium hydroxide and oxygen

Correct Answer: C

Explanation: Magnesium reacts with steam to form magnesium oxide and hydrogen gas.

20. What is the product of the reaction between calcium and cold water?

(A) Calcium oxide and hydrogen
(B) Calcium hydroxide and oxygen
(C) Calcium oxide and oxygen
(D) Calcium hydroxide and hydrogen

Correct Answer: D

Explanation: Calcium reacts with cold water to form calcium hydroxide and hydrogen gas.

21. Which Group 2 metal is the most reactive with water?

(A) Barium
(B) Magnesium
(C) Calcium
(D) Strontium

Correct Answer: A

Explanation: Barium — this correctly answers the question.

22. Which of the following is an exception to the general density trend of Group 2 elements?

(A) Magnesium and calcium
(B) Beryllium and magnesium
(C) Calcium and strontium
(D) Strontium and barium

Correct Answer: B

Explanation: The notes state that the density generally increases down the group, although there is a slight decrease from Be to Mg.

23. Why do Group 1 metals have lower ionization energies than Group 2 metals in the same period?

(A) Because they have a smaller atomic radius and higher effective nuclear charge
(B) Because they have more protons in the nucleus
(C) Because they have a larger atomic radius and lower effective nuclear charge
(D) Because they have more neutrons in the nucleus

Correct Answer: C

Explanation: Group 1 metals have a larger atomic radius and lower effective nuclear charge, so their valence electron is less tightly held.

24. Why are Group 1 metals more reactive than Group 2 metals?

(A) They have more valence electrons
(B) They have higher atomic masses
(C) They have higher densities
(D) They have lower ionization energies

Correct Answer: D

Explanation: Group 1 metals have lower ionization energies, so they lose their valence electron more easily, making them more reactive.

25. What is the use of slaked lime in agriculture?

(A) To increase the pH of acidic soils
(B) To decrease the pH of basic soils
(C) To provide nutrients to plants
(D) To kill pests

Correct Answer: A

Explanation: The notes state that slaked lime (calcium hydroxide) is used in agriculture to increase the pH of acidic soils.

B. Less Important / Secondary Topics

26. Why is barium sulphate used in medicine?

(A) It is insoluble and opaque to X-rays
(B) It is a strong acid
(C) It is a source of barium ions
(D) It is a good reducing agent

Correct Answer: A

Explanation: Barium sulphate is used as an X-ray contrast medium because it is insoluble and safe, and it is opaque to X-rays.

27. Which Group 2 compound is used to make plaster of Paris?

(A) Calcium carbonate
(B) Calcium sulphate
(C) Calcium hydroxide
(D) Magnesium hydroxide

Correct Answer: B

Explanation: Calcium sulphate (CaSO□) is used to make plaster of Paris.

28. Why is magnesium metal used in flares and fireworks?

(A) It is a strong base
(B) It is insoluble in water
(C) It burns with a brilliant white light
(D) It is a good reducing agent

Correct Answer: C

Explanation: Magnesium burns with a brilliant white light, which is why it is used in flares and fireworks.

29. Which Group 2 carbonate decomposes at the lowest temperature?

(A) Barium carbonate
(B) Strontium carbonate
(C) Calcium carbonate
(D) Magnesium carbonate

Correct Answer: D

Explanation: Magnesium carbonate has the smallest cation and the highest polarizing power, so it decomposes at the lowest temperature (540°C).

30. What is the reason for the increase in thermal stability of Group 2 carbonates down the group?

(A) Decrease in cation polarizing power
(B) Increase in cation polarizing power
(C) Increase in anion size
(D) Decrease in lattice energy

Correct Answer: A

Explanation: As the cation gets larger, its polarizing power decreases, so it causes less distortion of the anion, making the compound more s.

31. Which of the following Group 2 elements forms the most stable complexes?

(A) Barium
(B) Beryllium
(C) Calcium
(D) Magnesium

Correct Answer: B

Explanation: Beryllium, with its small size and high charge density, has the greatest tendency to form complexes.

32. What is the coordination number of beryllium in [Be(H□O)□]²□?

(A) 2
(B) 6
(C) 4
(D) 8

Correct Answer: C

Explanation: In [Be(H□O)□]²□, the beryllium ion is surrounded by four water molecules, giving a coordination number of 4.

33. What is the coordination number of magnesium in [Mg(H□O)□]²□?

(A) 2
(B) 4
(C) 8
(D) 6

Correct Answer: D

Explanation: In [Mg(H□O)□]²□, magnesium is coordinated to six water molecules.

34. Why are Group 2 metals not found in their free state in nature?

(A) They are too reactive
(B) They are too dense
(C) They are too heavy
(D) They are radioactive

Correct Answer: A

Explanation: Group 2 metals are highly reactive, so they readily form compounds and are not found in their free elemental state.

35. Which process is used to convert metal carbonates to metal oxides during extraction?

(A) Electrolysis
(B) Roasting
(C) Reduction
(D) Distillation

Correct Answer: B

Explanation: Roasting is the process of heating a carbonate ore to convert it to an oxide.

36. Which of the following shows the correct order of first ionization energy for Group 2 elements?

(A) Ba > Sr > Ca > Mg > Be
(B) Mg > Be > Ca > Sr > Ba
(C) Be > Mg > Ca > Sr > Ba
(D) Ca > Mg > Be > Sr > Ba

Correct Answer: C

Explanation: Ionization energy decreases down the group, so the correct order is Be > Mg > Ca > Sr > Ba.

37. Why does the atomic radius increase from magnesium to calcium?

(A) Calcium has fewer protons than magnesium.
(B) Calcium has more neutrons than magnesium.
(C) Calcium is less reactive than magnesium.
(D) Calcium has one more electron shell than magnesium.

Correct Answer: D

Explanation: Calcium's valence electrons are in the fourth shell (n=4), while magnesium's are in the third shell (n=3), placing them further from the nucleus and increasing the atomic radius.

38. Which of the following is the strongest reducing agent among the Group 2 metals?

(A) Barium
(B) Beryllium
(C) Magnesium

(D) Calcium

Correct Answer: A

Explanation: Barium is the most easily oxidized (lowest ionization energy), making it the strongest reducing agent among the Group 2 metals.

39. A Group 2 metal M reacts with oxygen to form MO and with water to form M(OH)□. Based on the trends in Group 2, which metal is most likely to be the most vigorous in both reactions?

(A) Be
(B) Ba
(C) Mg
(D) Ca

Correct Answer: B

Explanation: Ba — this correctly answers the question.

40. Which Group 2 oxide is covalent in character?

(A) MgO
(B) CaO
(C) BeO
(D) BaO

Correct Answer: C

Explanation: The notes state that BeO is covalent in character due to the small size and high polarizing power of the mathrmBe²□ ion.

41. Which of the following is a correct statement about the thermal stability of Group 2 carbonates?

(A) BaCO□ < SrCO□ < CaCO□ < MgCO□
(B) CaCO□ < MgCO□ < SrCO□ < BaCO□
(C) SrCO□ < CaCO□ < MgCO□ < BaCO□
(D) MgCO□ < CaCO□ < SrCO□ < BaCO□

Correct Answer: D

Explanation: Thermal stability increases down the group, so the least s.

42. What is the decomposition temperature of calcium carbonate according to the table in the notes?

(A) 900°C
(B) 540°C
(C) 1280°C
(D) 1360°C

Correct Answer: A

Explanation: 900°C — this correctly answers the question.

43. Why does barium carbonate have a more positive enthalpy change of decomposition than magnesium carbonate?

(A) Barium carbonate is less thermally stable.
(B) Barium carbonate is more thermally stable.
(C) Barium carbonate has a smaller cation.
(D) Barium carbonate has a larger anion.

Correct Answer: B

Explanation: A more positive enthalpy change means more energy is required for decomposition, indicating greater thermal stability.

44. Which of the following statements about Group 2 elements is correct?

(A) They are more reactive than Group 1 elements because they have lower ionization energies.
(B) They have the same reactivity as Group 1 elements.
(C) They are less reactive than Group 1 elements because they have higher ionization energies.
(D) They are unreactive.

Correct Answer: C

Explanation: Group 2 elements have higher ionization energies than Group 1 elements, so they are less reactive.

45. Which of the following reactions will occur based on the activity series?

(A) Cu + ZnSO□ → CuSO□ + Zn
(B) Ag + CuSO□ → Ag□SO□ + Cu
(C) Au + ZnSO□ → Au□(SO□)□ + Zn
(D) Zn + CuSO□ → ZnSO□ + Cu

Correct Answer: D

Explanation: Zinc is higher than copper in the activity series (more negative reduction potential), so it can displace copper from copper sulphate.

46. Which Group 2 element is used in X-ray contrast media?

(A) Barium
(B) Magnesium
(C) Calcium
(D) Beryllium

Correct Answer: A

Explanation: Barium sulphate is used in medicine as an X-ray contrast medium.

47. Why is beryllium chloride the least ionic among the Group 2 chlorides?

(A) Beryllium is the most reactive.
(B) The mathrmBe²□ ion is very small and has high polarizing power, giving the chloride covalent character.
(C) Beryllium has the largest atomic radius.
(D) Beryllium chloride is insoluble in water.

Correct Answer: B

Explanation: The mathrmBe²□ ion is very small and has high polarizing power, giving the chloride covalent character. — this correctly answers the question.

48. Which of the following is a correct statement about the solubility of Group 2 sulphates?

(A) The solubility increases down the group.
(B) The solubility is the same for all Group 2 sulphates.
(C) The solubility decreases down the group.
(D) The solubility is independent of the cation size.

Correct Answer: C

Explanation: The notes state that the solubility of Group 2 sulphates decreases down the group (Mg > Ca > Sr > Ba).

49. Which of the following is a correct statement about the extraction of Group 2 metals?

(A) They are extracted by reduction with carbon.
(B) They are found free in nature.
(C) They are extracted by simple distillation.
(D) They are extracted by electrolysis of their molten chlorides or oxides.

Correct Answer: D

Explanation: The notes state that pure samples of most alkaline earth metals can be obtained by electrolysis of the chlorides or oxides.

50. A sample of Group 2 metal M is added to water and fizzes gently. Based on the trend in reactivity, which metal is most likely to be M?

(A) Magnesium
(B) Barium
(C) Calcium
(D) Beryllium

Correct Answer: A

Explanation: Magnesium does not react with cold water but reacts with steam, and among the options, calcium reacts more readily with cold water while barium reacts even more vigorously. If the sample fizzes gently with water, it is more likely to be calcium, but the best fit among the options for a gentle reaction is magnesium reacting with

steam. However, the question states "water," so calcium is the most likely among the options that react with cold water. The correct answer is C (Magnesium) if the question refers to a gentle reaction with steam, but since the options include calcium, the best answer is B (Calcium) for a gentle reaction with water. Given the ambiguity, the intended answer is C.