EnterMedSchool.org

Group Properties & Reactivity Series

Study Guide — Periodic Table & Trends

Beginner-friendly Pre-med/IB-style questions on periodic table group properties (Group 1, 2, 17, 18), how groups react with each other (especially metals + halogens, halogen displacement), and using the metal reactivity series to predict reactions, extraction, and corrosion protection.

45 items — Study Guide with Answers

Free & Open-Source

Generated February 20, 2026

Scan to visit online

1 **Elements in the same group (column) of the periodic table tend to have similar chemical properties mainly because they have the same number of:**

A Protons

B Neutrons

C Electron shells

D **Valence (outer-shell) electrons** ✓

E Isotopes

▶ **Explanation:** Chemical behavior is largely determined by valence electrons (the electrons involved in bonding). Same group → same valence electron count → similar bonding patterns and typical ion charges.

2 **Which list contains ONLY alkali metals (Group 1)?**

A **Li, Na, K** ✓

B Mg, Ca, Sr

C F, Cl, Br

D He, Ne, Ar

E Fe, Co, Ni

▶ **Explanation:** Alkali metals are Group 1 (Li, Na, K, Rb, Cs, Fr). Group 2 are alkaline earth metals, Group 17 are halogens, Group 18 are noble gases, and Fe/Co/Ni are transition metals.

3 **An element in Group 17 (a halogen) most commonly forms which ion in ionic compounds?**

A $1+$

B 2+

C 3+

D **1− ✓**

E 2−

▶ **Explanation:** Halogens have 7 valence electrons and typically gain 1 electron to reach a full outer shell, forming 1− ions (e.g., Cl−, Br−).

4 **An element in Group 2 most commonly forms which ion in ionic compounds?**

A 1+

B **2+ ✓**

C 3+

D 1−

E 2−

▶ **Explanation:** Group 2 metals have 2 valence electrons and typically lose both to reach a noble-gas-like configuration, forming 2+ ions (e.g., Mg^{2+}, Ca^{2+}).

5 **Which statement best compares Group 1 metals with Group 2 metals in the same period?**

A Group 2 metals form 1+ ions; Group 1 metals form 2+ ions

B **Group 1 metals are generally more reactive and form 1+ ions; Group 2 metals are less reactive and form 2+ ions ✓**

C Group 1 metals are nonmetals; Group 2 metals are noble gases

D Group 1 metals tend to gain electrons; Group 2 metals tend to gain electrons

E Group 2 metals are always more reactive than Group 1 metals

▶ **Explanation:** Group 1 metals lose 1 electron easily (forming 1+), making them very reactive. Group 2 metals lose 2 electrons (forming 2+), which generally requires more energy, so they're typically less reactive than Group 1 metals in the same period.

6 **Alkali metals are commonly stored under oil mainly to prevent them reacting with:**

A Nitrogen in the air

B **Moisture (water) in the air** ✓

C Glass containers

D Other metals

E Light (photons)

▶ **Explanation:** Group 1 metals react vigorously with water, even with moisture in air. Oil blocks contact with water vapor (and also reduces contact with oxygen).

7 **Reactivity of Group 1 metals increases down the group mainly because:**

A The nucleus gets smaller

B **The outer electron is farther from the nucleus and more shielded, so it is lost more easily** ✓

C They gain electrons more easily

D They have fewer electron shells

E They become less metallic

▶ **Explanation:** Down Group 1, atomic radius and electron shielding increase. The outer electron feels a weaker pull from the nucleus, lowering ionization energy and making electron loss (and thus reactions) easier.

8 **When a Group 1 metal reacts with water, the products are generally:**

A Metal chloride + oxygen gas

B **Metal hydroxide + hydrogen gas** ✓

C Metal oxide + carbon dioxide

D Metal nitrate + nitrogen gas

E Metal sulfate + sulfur dioxide

▶ **Explanation:** Group 1 metals react with water to form an alkaline solution of the metal hydroxide (MOH) and hydrogen gas (H_2).

9 **Which equation is correctly balanced for potassium reacting with water?**

A $K + H_2O \rightarrow KOH + H$

B $2K + H_2O \rightarrow 2KOH + H_2$

C **$2K + 2H_2O \rightarrow 2KOH + H_2$** ✓

D $K_2 + 2H_2O \rightarrow 2KOH + H_2$

E $2K + H_2O \rightarrow K_2O + H_2$

▶ **Explanation:** The correct pattern is $2M + 2H_2O \rightarrow 2MOH + H_2$ for Group 1 metals. Option C balances K, H, and O atoms correctly.

10 **Why does the water become alkaline when sodium reacts with it?**

A Because sodium releases H^+ ions into the solution

B **Because sodium hydroxide forms, producing OH− ions in solution** ✓

C Because hydrogen gas dissolves and makes OH− ions

D Because sodium turns into chlorine

E Because oxygen ions always make solutions alkaline

▶ **Explanation:** The reaction forms sodium hydroxide (NaOH). In water, NaOH dissociates to give OH−, making the solution alkaline (high pH).

11 **Compared with Group 1 metals, Group 2 metals generally react less vigorously with water in the same period mainly because:**

A Group 2 metals are nonmetals

B **Group 2 metals must lose two electrons to form stable ions, which is generally harder than losing one** ✓

C Group 2 metals have no valence electrons

D Group 2 metals gain electrons instead of losing them

E Water cannot react with 2+ ions

▶ **Explanation:** Forming M^{2+} typically requires removing two electrons, which is generally less energetically favorable than removing one (as in Group 1), so Group 2 tends to be less reactive in the same period.

12 **Which Group 2 metal is expected to react most vigorously with cold water (trend down the group)?**

A Be

B Mg

C Ca

D **Ba** ✓

E Al

▶ **Explanation:** Reactivity of Group 2 generally increases down the group due to increased shielding and lower ionization energies. Barium is lowest among the listed Group 2 metals. Aluminum is not Group 2.

13 **Which equation is correctly balanced for calcium reacting with water?**

A $Ca + H2O \rightarrow CaOH + H$

B **$Ca + 2H2O \rightarrow Ca(OH)2 + H2$** ✓

C $2Ca + H2O \rightarrow 2CaOH + H2$

D $Ca2 + 2H2O \rightarrow Ca(OH)2 + H2$

E $Ca + H2O \rightarrow CaO + H2$

▶ **Explanation:** Group 2 metals that react with water follow: $M + 2H2O \rightarrow M(OH)2 + H2$. Option B is correctly balanced.

14 **Magnesium reacts very slowly with cold water but reacts more readily with steam. The main products of magnesium reacting with steam are:**

A $Mg(OH)2$ and $O2$

B **MgO and H2** ✓

C $MgH2$ and $O2$

D $MgCl2$ and $H2$

E MgCO3 and H2

▶ **Explanation:** With steam (hot water vapor), magnesium forms magnesium oxide (MgO) and hydrogen gas (H2). With cold water, the reaction is much slower and can form Mg(OH)2.

15 **Halogens (Group 17) commonly exist as elemental molecules with which formula type?**

A X

B **X2** ✓

C X3

D X4

E X8

▶ **Explanation:** Halogens are typically diatomic as elements (F2, Cl2, Br2, I2) because each atom needs one more electron to reach a stable outer shell and can share one pair in X–X bonding.

16 **Reactivity of halogens generally changes down Group 17 in which way?**

A Increases

B **Decreases** ✓

C Stays exactly the same

D Becomes unpredictable with no pattern

E Increases then decreases

▶ **Explanation:** Halogen reactivity decreases down the group because atoms get larger and more shielded, so it becomes harder for the nucleus to attract an incoming electron.

17 **Why do halogens become less reactive down Group 17?**

A They have fewer electron shells

B They gain protons more easily

C **The attraction for an added electron decreases due to increased atomic radius and shielding** ✓

D They stop forming covalent bonds

E They become metals

▶ **Explanation:** Down the group, valence electrons are further from the nucleus and inner electrons shield the nuclear charge. This weakens attraction for an incoming electron, so the oxidizing power/reactivity decreases.

18 **Which halogen is a liquid at room temperature?**

A Fluorine

B Chlorine

C **Bromine** ✓

D Iodine

E Neon

▶ **Explanation:** At room temperature: F_2 and Cl_2 are gases, Br_2 is a liquid, and I_2 is a solid. Neon is a noble gas (Group 18), not a halogen.

19 **Chlorine gas is bubbled through a solution of potassium bromide (KBr). What is the key chemical change?**

A No reaction occurs because bromine is more reactive than chlorine

B **Chlorine displaces bromine, forming bromine (Br2) and chloride ions** ✓

C Bromine displaces chlorine, forming chloride (Cl−) and bromide ions

D Potassium metal is produced

E A precipitate of KCl forms because KCl is insoluble

▶ **Explanation:** A more reactive halogen displaces a less reactive halide from solution. Chlorine is more reactive than bromine, so Cl2 oxidizes Br− to Br2 (often seen as an orange/brown color).

20 **Chlorine gas is bubbled through a solution of potassium iodide (KI). Which product is formed from iodide ions?**

A Cl−

B **I2** ✓

C IO3−

D H2

E K metal

▶ **Explanation:** Chlorine (more reactive) displaces iodine from iodide: Cl2 oxidizes I− to I2. The iodide ion loses electrons to become iodine molecules.

21 **Bromine water is added to a solution of sodium chloride (NaCl). What happens?**

A Chlorine is displaced and chlorine gas forms

B Bromine is displaced and bromine gas forms

C **No halogen displacement occurs** ✓

D Sodium metal forms

E A precipitate of NaBr forms because NaBr is insoluble

▶ **Explanation:** Bromine is less reactive than chlorine, so it cannot displace chloride ions (Cl^-) to form Cl_2. Halogen displacement works only when the added halogen is MORE reactive than the halogen in the halide.

22 **Noble gases (Group 18) are generally unreactive mainly because they:**

A Have no electrons

B **Have a full outer electron shell** ✓

C Have no neutrons

D Are all liquids at room temperature

E Always form $2+$ ions

▶ **Explanation:** A full valence shell is very stable, so noble gases have little tendency to gain, lose, or share electrons in typical conditions.

23 **Which noble gas is most well-known for forming compounds (an exception to 'totally unreactive')?**

A Helium

B Neon

C Argon

D **Xenon** ✓

E Hydrogen

▶ **Explanation:** Heavier noble gases (especially xenon) can form compounds under suitable conditions because their outer electrons are less tightly held than in lighter noble gases like helium and neon.

24 **Which statement correctly describes a metal displacement reaction using the reactivity series?**

A A less reactive metal displaces a more reactive metal from its salt solution

B **A more reactive metal displaces a less reactive metal from its salt solution** ✓

C Only noble gases can cause displacement reactions

D Displacement happens only when both metals are in Group 1

E Displacement reactions produce water as the main product

▶ **Explanation:** A more reactive metal more easily loses electrons (is oxidized), so it can reduce the ions of a less reactive metal and "push" it out of solution as the solid metal.

25 **Which metal will displace copper from copper(II) sulfate solution (CuSO4) in a typical displacement reaction?**

A Gold (Au)

B Silver (Ag)

C Copper (Cu)

D **Zinc (Zn)** ✓

E Platinum (Pt)

▶ **Explanation:** Zinc is above copper in the reactivity series, so Zn atoms can be oxidized to Zn^{2+} while Cu^{2+} is reduced to Cu(s). Au/Ag/Pt are less reactive than copper.

26 **A strip of zinc metal is placed in blue copper(II) sulfate solution. Which observation best matches what you would expect?**

A No change because copper is more reactive than zinc

B The solution turns more intensely blue and zinc plates onto the strip

C **A reddish-brown solid (copper) forms on the zinc, and the blue color fades** ✓

D Hydrogen gas bubbles form but copper does not change

E A white precipitate of copper chloride forms

▶ **Explanation:** Zinc is more reactive and displaces copper: $Zn \rightarrow Zn^{2+} + 2e-$, $Cu^{2+} + 2e- \rightarrow Cu(s)$. Copper deposits (reddish-brown), and Cu^{2+} decreases so the blue color fades.

27 **A strip of copper metal is placed in a zinc sulfate solution (ZnSO4). What is most likely to happen?**

A Copper displaces zinc and zinc metal forms

B **No reaction because copper is less reactive than zinc** ✓

C Hydrogen gas forms because ZnSO4 is an acid

D Copper turns into Cu^{2+} and the solution becomes deep blue immediately

E A precipitate of copper sulfate forms

▶ **Explanation:** Copper is below zinc in the reactivity series, so copper cannot displace Zn^{2+} from solution. Displacement requires the solid metal to be MORE reactive than the metal ion in solution.

28 **A piece of magnesium is added to dilute hydrochloric acid (HCl). Which gas is produced?**

A Oxygen (O2)

B Nitrogen (N_2)

C **Hydrogen (H_2)** ✓

D Carbon dioxide (CO_2)

E Chlorine (Cl_2)

▶ **Explanation:** Metals above hydrogen in the reactivity series react with acids to form a salt and hydrogen gas. For magnesium: $Mg + 2HCl \rightarrow MgCl_2 + H_2$.

29 Copper metal is placed in dilute hydrochloric acid (HCl). What is most likely to happen at room temperature?

A Copper reacts vigorously, producing lots of hydrogen gas

B Copper slowly reacts, producing oxygen gas

C **No reaction (copper is below hydrogen in the reactivity series)** ✓

D Copper forms $CuCl_2$ and chlorine gas immediately

E Copper turns into sodium

▶ **Explanation:** Copper is less reactive than hydrogen, so it does not displace hydrogen from dilute non-oxidizing acids like HCl under typical conditions.

30 Which metal is more reactive according to the typical reactivity series?

A Copper (Cu) is more reactive than iron (Fe)

B **Iron (Fe) is more reactive than copper (Cu)** ✓

C Silver (Ag) is more reactive than magnesium (Mg)

D Gold (Au) is more reactive than zinc (Zn)

E Platinum (Pt) is more reactive than potassium (K)

▶ **Explanation:** In the reactivity series, Fe is above Cu, so iron is more reactive. Metals like Ag, Au, and Pt are very unreactive compared to Mg, Zn, and especially K.

31 **Which metal is below hydrogen in the typical metal reactivity series?**

A Magnesium (Mg)

B Zinc (Zn)

C Iron (Fe)

D **Copper (Cu)** ✓

E Aluminium (Al)

▶ **Explanation:** Copper is less reactive than hydrogen and sits below hydrogen in the reactivity series, which is why it does not normally react with dilute acids to produce hydrogen gas.

32 **A metal reacts with cold water to release hydrogen gas. Which statement must be true about this metal (using the reactivity series idea)?**

A It is less reactive than hydrogen

B **It is more reactive than hydrogen** ✓

C It must be a noble gas

D It must be a halogen

E It must be copper

▶ **Explanation:** If a metal can produce H2 from water, it must be very reactive (above hydrogen in the reactivity series). Metals less reactive than hydrogen cannot displace hydrogen from water or acids.

33 **Aluminium can seem less reactive than expected even though it is high in the reactivity series because:**

A Aluminium is a noble gas

B Aluminium has no valence electrons

C **A thin, protective aluminium oxide layer forms on its surface** ✓

D Aluminium cannot form ions

E Aluminium always gains electrons instead of losing them

▶ **Explanation:** Aluminium quickly forms a tough Al2O3 layer in air, which blocks further reaction. If the oxide layer is removed, aluminium's true reactivity becomes clearer.

34 **A student says: "Aluminium must be unreactive because it doesn't rust quickly like iron." What is the best correction?**

A Aluminium is unreactive because it is below hydrogen in the reactivity series

B **Aluminium is actually reactive, but it is protected by an oxide layer that prevents further corrosion** ✓

C Aluminium cannot react with oxygen at all

D Only iron can corrode; other metals cannot

E Aluminium is a nonmetal so it cannot corrode

▶ **Explanation:** Aluminium reacts with oxygen readily, but the product (Al2O3) forms a protective coating. Iron oxide is flaky and does not protect the metal, so rusting continues.

35 **Which metal is typically extracted from its ore mainly by electrolysis because it is too reactive for carbon reduction?**

A Copper (Cu)

B Iron (Fe)

C **Aluminium (Al)** ✓

D Tin (Sn)

E Lead (Pb)

▶ **Explanation:** Metals above carbon in the reactivity series (like Al) form very stable oxides that carbon cannot reduce efficiently, so electrolysis is used instead. Metals below carbon (like Fe, Sn, Pb) can often be extracted by carbon reduction.

36 **Which metal is commonly extracted by reducing its oxide with carbon in a blast furnace (high school-level idea)?**

A Potassium (K)

B Sodium (Na)

C Aluminium (Al)

D **Iron (Fe)** ✓

E Calcium (Ca)

▶ **Explanation:** Iron is below carbon in the reactivity series, so carbon (or carbon monoxide) can reduce iron oxides to iron. Very reactive metals like Na, K, Ca, and Al require electrolysis.

37 **Why is potassium NOT extracted from potassium oxide using carbon?**

A Because potassium oxide is insoluble

B **Because potassium is more reactive than carbon, so its oxide is too stable to be reduced by carbon** ✓

C Because carbon can only reduce noble metals

D Because potassium is a nonmetal

E Because potassium has no electrons to gain

▶ **Explanation:** Carbon can reduce oxides of metals that are below carbon in the reactivity series. Potassium is far above carbon, so K2O is too stable and carbon cannot remove oxygen from it effectively; electrolysis is needed.

38 **Galvanizing iron with zinc helps prevent rusting mainly because:**

A Zinc is less reactive than iron, so it blocks iron from reacting

B Zinc is more reactive than iron and will oxidize first (sacrificial protection), even if the coating is scratched ✓

C Zinc turns iron into a noble gas

D Zinc makes water unable to dissolve oxygen

E Zinc removes all electrons from iron permanently

▶ **Explanation:** Zinc is higher in the reactivity series than iron, so zinc preferentially oxidizes (loses electrons), protecting iron from oxidation. This is why zinc can protect even if the coating is damaged.

39 **In a simple cell made from zinc and copper electrodes in an electrolyte, which electrode is more likely to be the anode (the one that oxidizes)?**

A Copper, because it is less reactive and oxidizes more easily

B Zinc, because it is more reactive and loses electrons more readily ✓

C Neither electrode can oxidize in a cell

D Both oxidize at the same rate always

E The noble gas electrode

▶ **Explanation:** In electrochemical cells, the more reactive metal tends to be oxidized (anode). Zinc is more reactive than copper, so Zn $\rightarrow$ Zn^{2+} + 2e− occurs at the anode.

40 **Which statement correctly describes halogen displacement reactions?**

A A less reactive halogen displaces a more reactive halide from solution

B **A more reactive halogen displaces a less reactive halide from solution** ✓

C Only fluorine can displace other halogens

D Displacement depends only on the concentration of the halide, not reactivity

E Noble gases are the main displacing agents

▶ **Explanation:** Halogen displacement is about relative oxidizing power: the more reactive halogen gains electrons more readily and can oxidize the less reactive halide ion to the free halogen.

41 **Iodine is added to a solution of potassium bromide (KBr). What happens?**

A Iodine displaces bromine, forming Br2

B Bromine displaces iodine, forming I2

C **No displacement reaction occurs** ✓

D Potassium metal forms

E A precipitate of KBr forms because it is insoluble

▶ **Explanation:** Iodine is less reactive than bromine, so it cannot oxidize Br− to Br2. Therefore, no displacement occurs.

42 **Group 1 metals are typically softer and have lower melting points than Group 2 metals. The best explanation is that Group 1 metals usually have:**

A More delocalized electrons per atom, creating stronger metallic bonding

B Fewer delocalized electrons per atom and lower charge density, creating weaker metallic bonding ✓

C Covalent bonds instead of metallic bonds

D No electrons in the outer shell

E Only ionic bonds inside the metal

▶ **Explanation:** Metallic bonding strength increases with more delocalized electrons and higher charge on the metal ions. Group 1 contributes 1 delocalized electron per atom, while Group 2 contributes 2, so Group 2 typically has stronger metallic bonding and higher melting points.

43 **Which statement best explains why Group 2 metals generally have higher melting points than Group 1 metals?**

A Group 2 metals are nonmetals, so they melt at higher temperatures

B Group 2 metals form larger atoms, so they always melt higher

C Group 2 metals provide more delocalized electrons and form 2+ ions, strengthening metallic bonding ✓

D Group 2 metals have fewer electrons, so they melt higher

E Melting point depends only on atomic number, not bonding

▶ **Explanation:** Stronger metallic bonding requires stronger attraction between positive metal ions and delocalized electrons. Group 2 has 2 delocalized electrons per atom and 2+ ions, which strengthens this attraction compared with Group 1.

44 **Down Group 17 (F2 → Cl2 → Br2 → I2), boiling points generally increase mainly because:**

A The covalent bond inside each molecule becomes much stronger

B The molecules get larger, increasing London (dispersion) forces between molecules ✓

C Halogens become ionic down the group

D Halogens gain fewer electrons down the group

E The number of protons decreases down the group

▶ **Explanation:** Boiling points depend on intermolecular forces. As halogen molecules get larger with more electrons, temporary dipoles become stronger, increasing London dispersion forces and raising boiling points.

45 **Down Group 1 (Li → Na → K → Rb → Cs), melting points generally decrease mainly because:**

A The metallic bonding becomes weaker as atoms get larger and the attraction between ions and delocalized electrons decreases ✓

B They become nonmetals down the group

C They start forming covalent bonds instead of metallic bonds

D They gain electrons more easily down the group

E Their valence electron number changes from 1 to 2 down the group

▶ **Explanation:** Group 1 metals keep 1 valence electron, but atomic size increases down the group. The positive ions and delocalized electrons are farther apart, weakening metallic bonding and lowering melting points.