Octet Rule

1 Which ion in the ground state has the same electron confi guration as an atom of neon in the ground state?
(1) Ca^{2+} (3) Li^{+}
(2) Cl^{-} (4) O^{2-}

2 Which element tends not to react with other elements?
(1) helium (3) phosphorus
(2) hydrogen (4) potassium

3 Elements that have atoms with stable valence electron configurations in the ground state are found in
(1) Group 1 (3) Group 11
(2) Group 8 (4) Group 18

4 Which element is least likely to undergo a chemical reaction?
(1) lithium (3) fluorine
(2) carbon (4) neon

5 Which ion in the ground state has the same electron configuration as an atom of argon in the ground state?
(1) $A1^{3+}$ (3) K^{+}
(2) O^{2-} (4) F^{-}

6 Which group on the Periodic Table has elements with atoms that tend not to bond with atoms of other elements?
(1) Group 1 (3) Group 17
(2) Group 2 (4) Group 18

7 Which atom in the ground state has a stable valence electron configuration?
(1) Ar (3) Si
(2) Al (4) Na

Base your answers to questions 8 on the information below and on your knowledge of chemistry.

Sir William Ramsey is one scientist credited with identifying the noble gas argon. Sir Ramsey separated nitrogen gas from the air and reacted it with an excess of magnesium, producing solid magnesium nitride. However, a small sample of an unreactive gas remained with a density different from the density of the nitrogen gas. Sir Ramsey identifi ed the unreactive gas as argon and later went on to discover neon, krypton, and xenon.

8 Compare the chemical reactivities of nitrogen gas and argon gas based on Sir Ramsey's experiment using magnesium.

Base your answers to questions 9 on the information below and on your knowledge of chemistry.

Solid sodium chloride, also known as table salt, can be obtained by the solar evaporation of seawater and from underground mining. Liquid sodium chloride can be decomposed by electrolysis to produce liquid sodium and chlorine gas, as represented by the equation below.

$2NaCl(\ell) \rightarrow 2Na(\ell) + Cl_2(g)$

9 Identify the noble gas that has atoms with the same number of electrons as a chloride ion in table salt.

Base your answers to questions 10 on the information below and on your knowledge of chemistry.

The formulas and names of four chloride compounds are shown in the table below.

Formula	Name
CCl_4	carbon tetrachloride
RbCl	rubidium chloride
CsCl	cesium chloride
HCl	hydrogen chloride

10 Identify the noble gas that has atoms with the same electron configuration as the metal ions in rubidium chloride, when both the atoms and the ions are in the ground state.

11 Identify the element in Period 3 that is an unreactive gas at STP.

Base your answers to questions 12 on the information below and on your knowledge of chemistry.

Potassium phosphate, K_3PO_4, is a source of dietary potassium found in a popular cereal. According to the Nutrition-Facts label shown on the boxes of this brand of cereal, the accepted value for a one-cup serving of this cereal is 170. milligrams of potassium. The minimum daily requirement of potassium is 3500 milligrams for an adult human.

12 Identify the noble gas whose atoms have the same electron configuration as a potassium ion.

Base your answers to questions 13 on the information below and on your knowledge of chemistry.

The Lewis electron-dot diagrams for three substances are shown below.

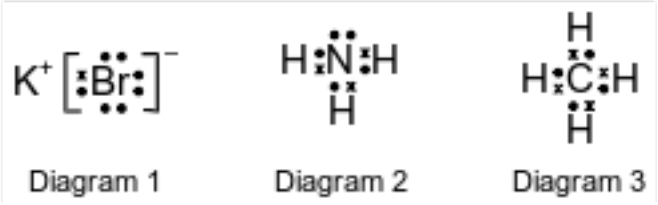

Diagram 1 Diagram 2 Diagram 3

13 Identify the noble gas that has atoms with the same electron configuration as the positive ion represented in diagram 1, when both the atoms and the ion are in the ground state.

14 Explain, in terms of atomic structure, why Group 18 elements on the Periodic Table rarely form compounds.

Base your answers to questions 15 on the information below and on your knowledge of chemistry.

Silver-plated utensils were popular before stainless steel became widely used to make eating utensils. Silver tarnishes when it comes in contact with hydrogen sulfide, H_2S, which is found in the air and in some foods. However, stainless steel does not tarnish when it comes in contact with hydrogen sulfide.

15 In the ground state, an atom of which noble gas has the same electron configuration as the sulfide ion in Ag_2S?

Answer Keys

1 4

2 1

3 4

4 4

5 3

6 4

7 1

8 Allow 1 credit. Acceptable responses include, but are not limited to:
- The Ar in the sample did not react, and the nitrogen did.
- Magnesium reacted with the nitrogen gas, and the argon gas did not react.
- Nitrogen is more reactive.

9 Allow 1 credit for Ar or argon.

10 Allow 1 credit for Kr or krypton.

11 Allow 1 credit. Acceptable responses include, but are not limited to:
- Ar
- argon
- element 18

12 Allow 1 credit. Acceptable responses include, but are not limited to:
- argon
- Ar
- element 18

13 Allow 1 credit. Acceptable responses include, but are not limited to:
- argon
- Ar

14 Allow 1 credit. Acceptable responses include, but are not limited to:
- Group 18 elements rarely form compounds because their atoms have stable electron configurations.
- Their valence shells are completely filled.
- All the elements have maximum numbers of valence electrons.
- Atoms of Group 18 have a stable octet except He, which is stable with two electrons.

15 Allow 1 credit. Acceptable responses include, but are not limited to:
- Ar
- argon
- element 18