

# The Noble Gases



Answer all the questions below then check your answers

1. Which of the following is NOT a characteristic of noble gases?

- a) They have full outer electron shells.
- b) They are monatomic.
- c) They readily form compounds.
- d) They have low boiling points.

True or False:

2. The strength of intermolecular forces in noble gases decreases as you go down Group 0.

3. Explain why noble gases are described as "unreactive."

Fill in the blanks to complete the questions below:

b. Noble gases exist as individual atoms, making them \_\_\_\_\_ gases. The forces between these atoms are called \_\_\_\_\_ forces.

4. Match the noble gas with its common use:

a) Helium                      b) Argon                      c) Neon

Noble gas
helium
argon
neon

Use
Light bulbs and welding
Advertising signs
Weather balloons and MRI scanners

5. The boiling point of krypton is  $-153^{\circ}\text{C}$ , and the boiling point of xenon is  $-108^{\circ}\text{C}$ .

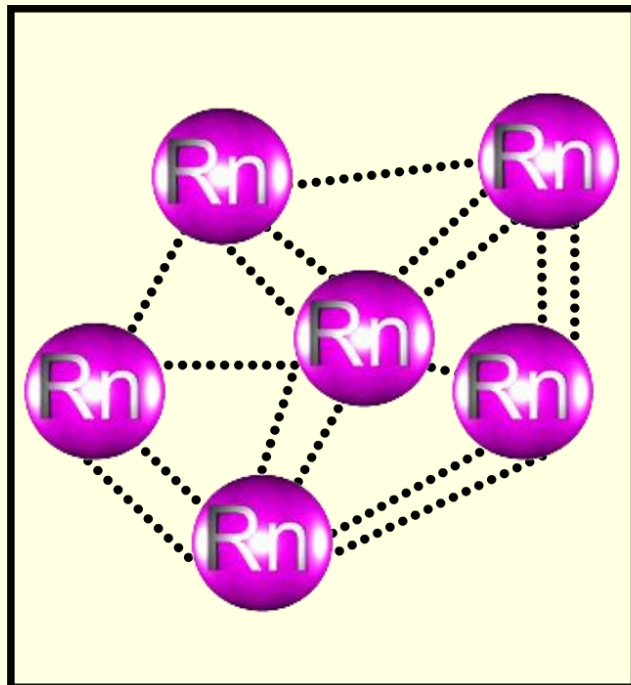
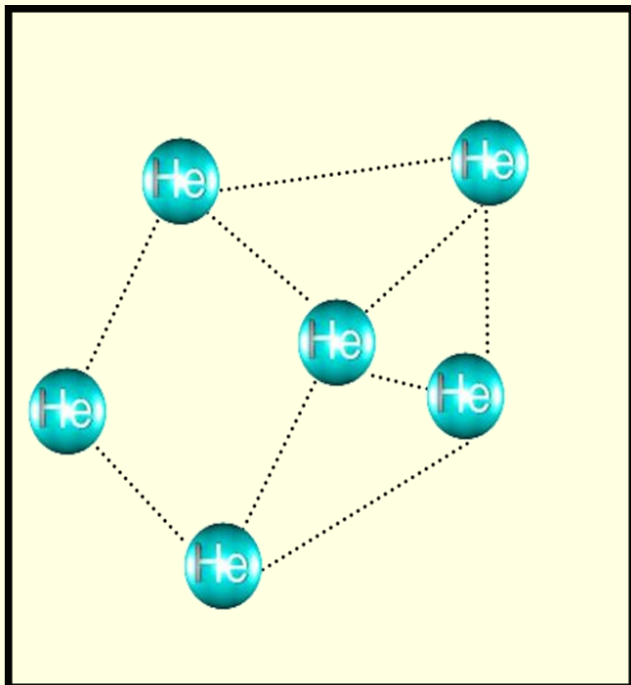
a) Explain why the boiling point increases from krypton to xenon.

b) Predict, with a justification, if radon has a boiling point above or below  $-100^{\circ}\text{C}$ .

Answer:

6. Why is argon used in welding instead of air?

7. By studying the image below which shows two boxes of equal volumes which contains the gases helium and radon, explain how the density of a gas is related to the mass of its atoms.



7. Describe the trends in physical properties (melting point, boiling point, and density) of the noble gases as you move down Group 0, and explain these trends in terms of intermolecular forces and atomic structure.

## Answers

1. Which of the following is NOT a characteristic of noble gases?

a) They have full outer electron shells.

b) They are monatomic.

c) They readily form compounds.

d) They have low boiling points.

Answer: c) They readily form compounds.

True or False:

2. The strength of intermolecular forces in noble gases decreases as you go down Group 0.

Answer: False.

3. Explain why noble gases are described as "unreactive."

Answer: Noble gases are unreactive because they have full outer electron shells, meaning they do not need to gain or lose electrons to become stable.

Fill in the blanks to complete the questions below:

3b. Noble gases exist as individual atoms, making them \_\_\_\_\_ gases. The forces between these atoms are called \_\_\_\_\_ forces.

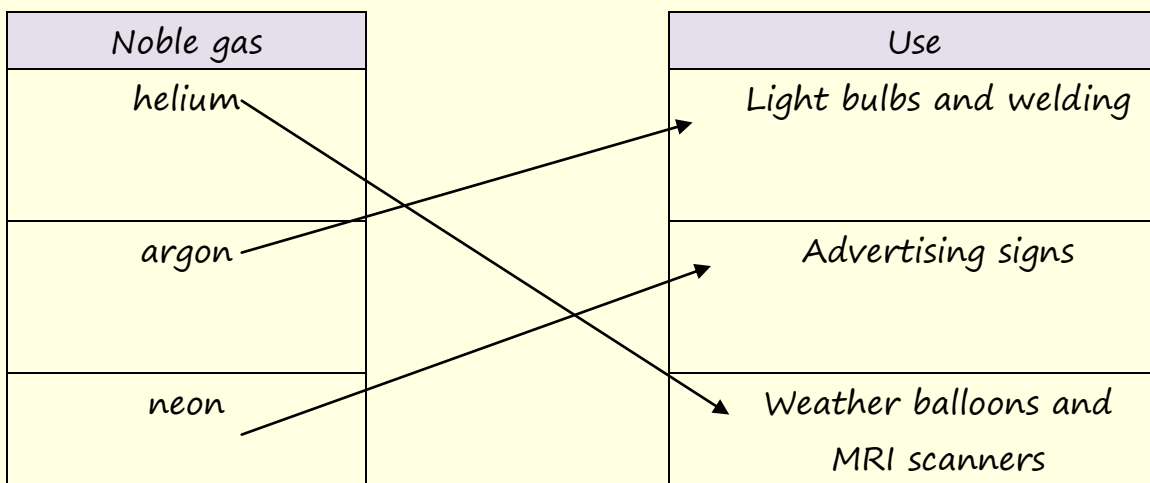
Answer: monatomic, intermolecular (or Van der Waals/London dispersion)

4. Match the noble gas with its common use:

a) Helium

b) Argon

c) Neon



5. The boiling point of krypton is  $-153^{\circ}\text{C}$ , and the boiling point of xenon is  $-108^{\circ}\text{C}$ .

a) Explain why the boiling point increases from krypton to xenon.

Answer:

a) As you go down Group 0, the atomic mass and the number of electrons increase. This leads to stronger intermolecular forces (Van der Waals forces), requiring more energy to overcome, hence a higher boiling point.

b) Predict, with a justification, if radon has a boiling point above or below  $-100^{\circ}\text{C}$ .

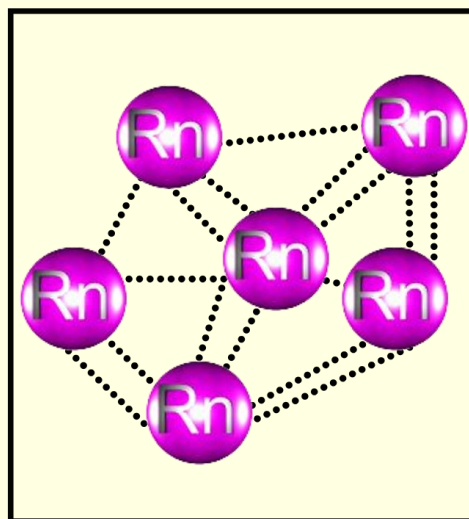
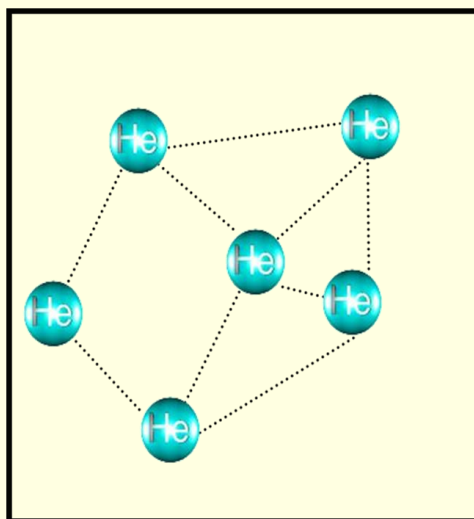
Answer:

Radon will have a boiling point above  $-100^{\circ}\text{C}$ . The trend shows an increase in boiling point down the group, so radon, being below xenon, will have an even higher boiling point.

6. Why is argon used in welding instead of air?

Answer: Argon is used because it is unreactive and denser than air. This prevents the hot metal from reacting with oxygen in the air (oxidation), which would weaken the weld.

7. By studying the image below which shows two boxes of equal volumes which contain the noble gases helium and radon, explain how the density of a gas is related to the mass of its atoms.



Answer: If equal volumes of gasses contain the same number of atoms, then the gas with the heavier atoms will have a greater mass in the same volume, therefore having a higher density.

7. Describe the trends in physical properties (melting point, boiling point, and density) of the noble gases as you move down Group 0, and explain these trends in terms of intermolecular forces and atomic structure.

Answer:

Melting and boiling points increase down the group. This is because atomic mass and the number of electrons increase, leading to stronger intermolecular (Van der Waals) forces. More energy is needed to overcome these forces.

Density also increases down the group. As atomic mass increases, the mass of individual atoms increases, and equal volumes of gases contain the same number of atoms, therefore the heavier atoms produce a denser gas.

The full outer shells of the noble gases, means that the only forces between the atoms are weak intermolecular forces.