

EB Education Revision Guide



How to work with Noble Gases

Group 0: The Noble Gases

The facts

Group 0 (sometimes called group 8) elements are known as the Noble Gases.

All the noble gases have a full outer shell. This means their **chemical properties** are similar and they are very unreactive or INERT.

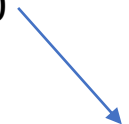
They are non-flammable – so they will not catch fire.

They are monoatomic. This means that they are made of single atoms and not molecules.

Physical properties:

- Low melting and boiling points – they are all colourless gases at room temperature.
- Melting points and boiling points increase as you go down Group 0. This is because, going down group 0, the atoms become larger, the intermolecular forces between the atoms become stronger and more energy is needed to overcome these forces.
- Density increases as you go down group 0.

Where to find the Noble Gases in the Periodic Table

Group 0 

1	2																	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36																			
H	He																	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr																			
3	4																	18	19	20																	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Li	Be																	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
11	12																	18	19	20																	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Na	Mg																	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54																				
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe																				
37	38			72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88			104	105	106	107	108	109	110	111	112	113	114	115	116	117	118																		
Rb	Sr			Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	Cs	Ba			Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Uut	Ff	Uup	Lv	Uus	Uuo																		
55	56			72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88			104	105	106	107	108	109	110	111	112	113	114	115	116	117	118																		
Cs	Ba			Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	Cs	Ba			Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Uut	Ff	Uup	Lv	Uus	Uuo																		
87	88			104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	87	88			104	105	106	107	108	109	110	111	112	113	114	115	116	117	118																		
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		57	58	59	60	61	62	63	64	65	66	67	68	69	70	71																																							
		La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu																																							
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Reactivity

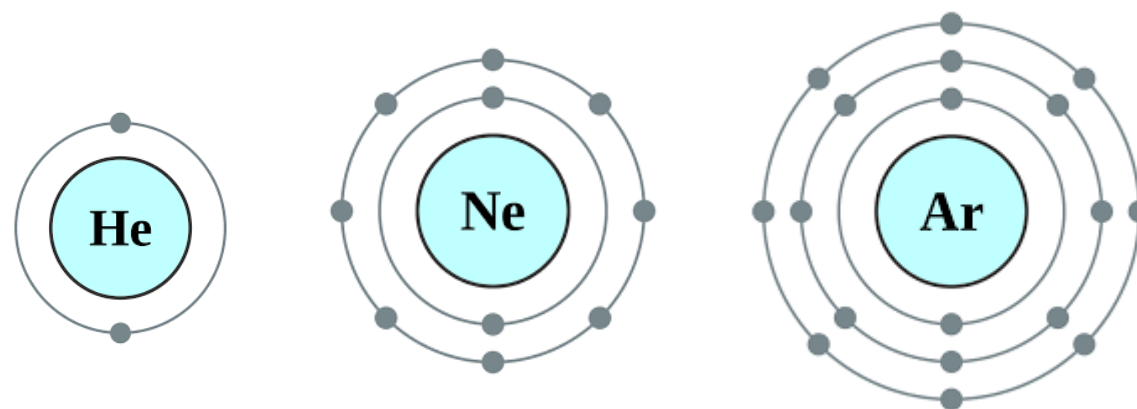
Why are noble gases unreactive?

Group 0 elements are called the noble gases because they are all chemically unreactive. The term noble in chemistry signifies a lack of chemical reactivity.

They are unreactive because their atoms have stable arrangements of electrons.

All noble gases have the maximum number of electrons in their outer shell; 2 electrons for helium and 8 for the other five.

This means they do not need to lose or gain electrons to become stable.



Uses of Noble Gases

What are their uses?

Noble gases have many different uses.

Helium:

This is used in party balloons and airships.

It is:

- non-flammable so the helium will not set on fire and makes it much safer to use than hydrogen.
- less dense than air so the balloons and the airships will rise.



Argon:

This is used as a 'shield gas' when welding pieces of metal together.

It is:

- denser than air, so it stops air getting to the metal
- inert, so it doesn't react with the hot metal and prevents oxygen reacting with the metal.

It is also used in filament lamps (light bulbs) as it prevents the hot filament from burning. Argon, krypton and xenon are also used in flash photography to stop the flash filament burning up.

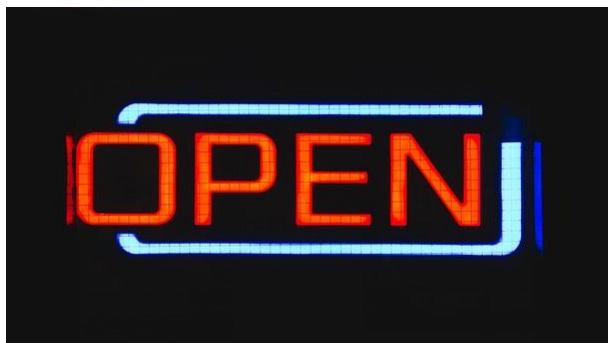


Uses of Noble Gases

What are their uses?

Neon:

Neon is used in neon signs for advertising. Red signs contain pure neon. It will glow an orange/red colour when electricity travels through it in a vacuum.



Krypton:

Krypton is used to fill energy saving fluorescent lights.

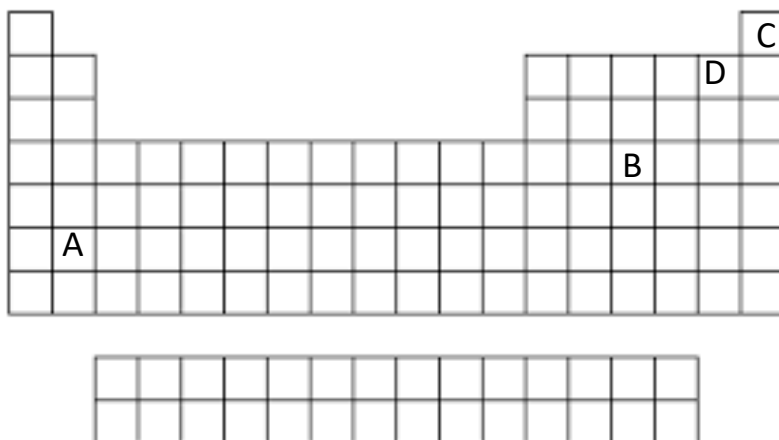
Krypton can be forced to react with fluorine to produce krypton fluoride. Krypton fluoride is used in lasers, for the manufacture of semiconductors and integrated circuit boards.

Krypton lasers are used by surgeons to treat certain eye problems and to remove birthmarks.

Your turn:

1. Explain, including reference to its electronic configuration, why argon can be used in lamps.

2. The Periodic Table is shown below.
Where would you find a gas that does not form a compound with lithium?



3. Elements in group 0 of the periodic table are unreactive.

Complete the sentence below.

The noble gas used to fill balloons is

The gas is unreactive because it has electrons in its outer shell.

4. Both hydrogen and helium can be used to fill balloons.

Which of the properties of helium below explains why helium is a better choice than hydrogen.

- A. Lower density
- B. Unreactive
- C. Compressed easily
- D. Forms monatomic molecules

Your turn:

5. Xenon is in group 0 of the periodic table. It is very unreactive.

a) Explain why xenon is unreactive.

b) Explain why xenon is monatomic.

c) Xenon can react with fluorine under certain conditions, but it cannot react with iodine.

Explain, in terms of the electronic structure of fluorine, why it is more reactive than iodine.

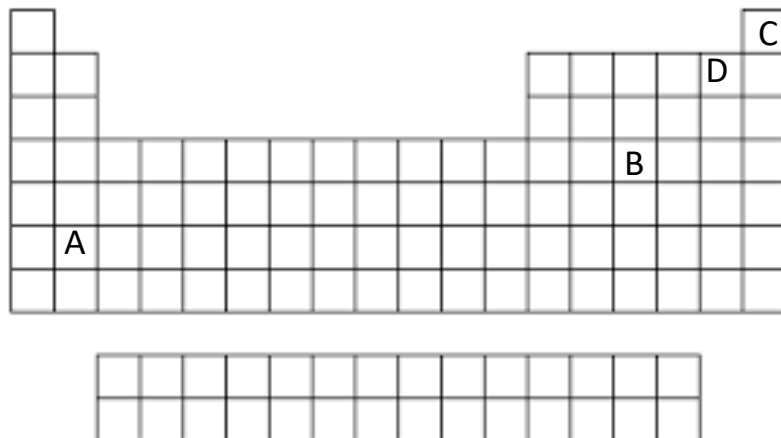
Answers:

1. Explain, including reference to its electronic configuration, why argon can be used in lamps.

Argon is unreactive because it has a full outer shell of electrons.
This means it can prevent hot filaments in bulbs from reacting.

2. The Periodic Table is shown below.
Where would you find a gas that does not form a compound with lithium?

C



3. Elements in group 0 of the periodic table are unreactive.

Complete the sentence below.

The noble gas used to fill balloons ishelium.....
The gas is unreactive because it has2..... electrons in its outer shell.

4. Both hydrogen and helium can be used to fill balloons.
Which of the properties of helium below explains why helium is a better choice than hydrogen.

- A. Lower density
- B. Unreactive
- C. Compressed easily
- D. Forms monatomic molecules

Answers:

5. Xenon is in group 0 of the periodic table. It is very unreactive.

a) Explain why xenon is unreactive.

It has a full outer shell of electrons, so it does not need to lose or gain electrons.

b) Explain why xenon is monatomic.

It has a full outer shell of electrons, so it does not need to lose or gain electrons, so does not need to covalently bond with another atom.

c) Xenon can react with fluorine under certain conditions, but it cannot react with iodine.

Explain, in terms of the electronic structure of fluorine, why it is more reactive than iodine.

Fluorine atoms are smaller/have fewer shells. This means the outer shell is closer to the nucleus, the electrons will be more attracted to the nucleus, so will be gained more easily.

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