



Answer all the questions below then check your answers

1. What state are the halogens in at room temperature?
2. The halogens are the most reactive non-metals in the periodic table. They are generally good oxidising agents. What is an oxidising agent?
 - a. Explain how the reactions of the halogens with iron wool can be used to show the trend in oxidising ability of the halogens.
 - b. Write equations to show the reaction of chlorine with iron wool to form iron(III) chloride and also the reaction of iodine with iron wool to form iron(II) iodide.
 - c. Write an ion-electron half equation to show chlorine acting as an oxidising agent.
3. Describe and explain the trend in the atomic radius of the halogens as you descend group 7.
4. The halogens are all diatomic elements. What does this statement mean?
5. What is electronegativity?
 - a. Describe and explain the trend in the electronegativity of the halogens.
6. Why is iodine a solid at room temperature but chlorine is a gas?

7. Write symbolic equations to show what forms when bromine dissolves in water.
Explain why this reaction is a disproportionate reaction.
8. Explain how iodine solution is made. Write an equation to show how iodine solution is made to back-up your answer.
9. Chlorine reacts with the non-metal phosphorus to form phosphorus trichloride. Write a balanced symbolic equation for this reaction.
 - a. Addition of chlorine to phosphorus trichloride forms a new chloride of phosphorus, phosphorus pentachloride. Write a balanced symbolic equation to show this transformation.

Answers

1. What state are the halogens in at room temperature?

halogen	State at room temperature
Fluorine	gas
Chlorine	gas
Bromine	liquid
Iodine	solid
astatine	solid

2. The halogens are the most reactive non-metals in the periodic table. They are generally good oxidising agents. What is an oxidising agent?

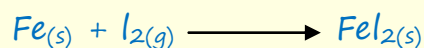
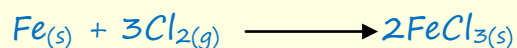
An oxidising agent is an electron acceptor. They oxidise substances when they react and by gaining electrons the halogens are reduced.

- a. Explain how the reactions of the halogens with iron wool can be used to show the trend in oxidising ability of the halogens.

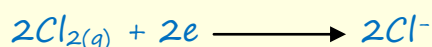
Fluorine is the strongest oxidising agent in group 7 and iodine is the weakest. As you descend group 7 the halogens become weaker oxidising agents.

halogen	Description of reaction with iron wool
fluorine	Reaction is violent and very quick, even when the iron wool is unheated.
Chlorine	Gently heating of the iron wool is enough to start a reaction with chlorine gas. Fe^{3+} ion is formed
Bromine	Iron wool needs to be heated to start the reaction. Bromine oxidises the iron to the form the Fe^{3+} ion
iodine	Slow reaction even when the iron wool is heated strongly, iodine only able to remove 2 electrons from the iron to form the Fe^{2+} ion

- b. Write equations to show the reaction of chlorine with iron wool to form iron(III) chloride and also the reaction of iodine with iron wool to form iron(II) iodide.



- c. Write an ion-electron half equation to show chlorine acting as an oxidising agent.



3. Describe and explain the trend in the atomic radius of the halogens as you descend group 7.

The halogens increase in size as you descend group 7. This is because as we go from one halogen to the next the number of electrons is increasing and every time we go from one period in the period table to the next a new principal energy level or extra shell of electrons is being added.

4. The halogens are all diatomic elements. What does this statement mean?

The halogens consist of small molecules made up of 2 atoms.

5. What is electronegativity?

The ability or power of an atom in a covalent bond to attract electron density towards itself.

- a. Describe and explain the trend in the electronegativity of the halogens.

To explain this trend we need to consider the factors which affect the electronegativity value for an atom:

1. The atomic number – as the number of protons in the nucleus increases then the attraction for the electrons in a covalent bond will increase. So as the atomic number

increases we might expect the electronegativity value to increase. Clearly this does not happen so we need to consider other factors.

2. As the atomic radius of the atom increases from fluorine to iodine more electron shells are being added as the atoms increase in size. As the number of electron shells increases the shielding of the nucleus will increase. This will mean that the atoms ability to attract electrons in a covalent bond will be reduced.

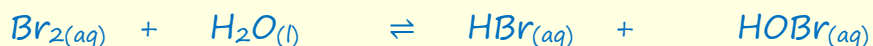
The electronegativity of any particular atom will depend upon a balance between these three factors:

- Nuclear charge.
- Number of shielding electron shells.
- Atomic radius

6. Why is iodine a solid at room temperature but chlorine is a gas?

Both iodine and chlorine are diatomic molecules but iodine is much larger than chlorine, it has more electrons and so will have more and stronger Van der Waals bonding between the molecules than chlorine. This stronger intermolecular bonding and the fact that it has a much higher A_r will mean it has a higher boiling and melting point than chlorine.

7. Write symbolic equations to show what forms when bromine dissolves in water. Explain why this reaction is a disproportionation reaction.

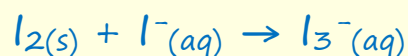


This bromine is both oxidised and reduced in this reaction, so it is an example of a disproportionation reaction.

8. Explain how iodine solution is made. Write an equation to show how iodine solution is made to back-up your answer.

Iodine is practically insoluble in water but it does dissolve in an aqueous solution of potassium iodide. When added to a potassium iodide solution the iodine molecules react with the soluble iodide ions (I^-) to form triiodide ions (I_3^-).

Equation to show formation of iodine solution:



9. Chlorine reacts with the non-metal phosphorus to form phosphorus trichloride. Write a balanced symbolic equation for this reaction.



- a. Addition of chlorine to phosphorus trichloride forms a new chloride of phosphorus, phosphorus pentachloride. Write a balanced symbolic equation to show this transformation.

