Answer all the questions below then check your answers

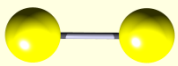
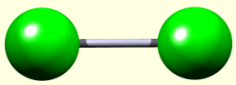
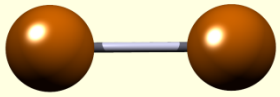
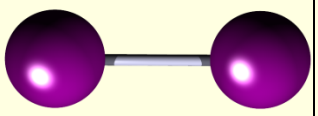
1. The halogens are found in group 7 of the periodic table. Name the first 4 halogens.

2. Which 2 halogens are gases at room temperature? Which halogen is a liquid and which halogen is a solid at room temperature?

b. Describe the appearance of the first 4 halogens at room temperature.

3. The halogens consist of diatomic molecules. What does this mean?

a. Complete the table below which shows the first 4 halogen molecules.

fluorine		bromine	
			
	Cl_2		I_2

b. Why must great care be taken when handling the halogens?

4. The table below contains information on the melting and boiling points of the halogens.

Halogen	Colour	Melting point/°C	Boiling point/°C	State at room temperature
fluorine	Pale yellow	-220	-188	gas
chlorine	Green-yellow	-101	-34	Gas
bromine	Red-brown	-7	59	liquid
iodine	Greyish-purple	114	131	solid

a. What is the trend in the melting and boiling points of the halogens? Can you explain the trends?

b. Explain why the halogens undergo similar chemical reactions.

5. Write word and balanced symbolic equations for the following reactions:

a. magnesium + chlorine $\longrightarrow$

$Mg + Cl_2 \longrightarrow$

b. aluminium + bromine $\longrightarrow$

$Al + Br_2 \longrightarrow$

c. calcium + iodine $\longrightarrow$

$Ca + I_2 \longrightarrow$

6. Which halogen is the most reactive? Which halogen is the least reactive? Give a reason for your answers.

7. A student investigates the reaction between magnesium and the three halogens (chlorine, bromine, iodine).

a. Predict the order of reactivity of the halogens with magnesium (most reactive first).

Explain the trend in reactivity.

b. Describe the safety precautions required when carrying out this experiment.

8. Compare the physical properties of chlorine, bromine, and iodine in terms of state, colour and density. Explain these trends in terms of intermolecular forces.

Answers

1. The halogens are found in group 7 of the periodic table. Name the first 4 halogens.

Fluorine, chlorine, bromine, iodine

2. Which 2 halogens are gases at room temperature? Which halogen is a liquid and which halogen is a solid at room temperature?

Fluorine and chlorine are gases, bromine is a liquid and iodine a solid.

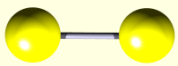
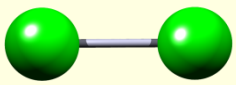
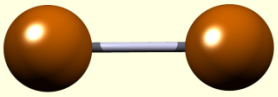
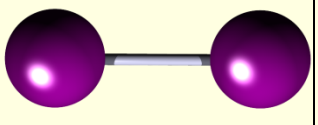
b. Describe the appearance of the first 4 halogens at room temperature.

Fluorine: pale yellow gas,
chlorine: greeny/yellow gas,
bromine: red/brown liquid,
iodine: purple solid with metallic sheen

3. The halogens consist of diatomic molecules. What does this mean?

The halogens go around in pairs! They consist of small molecules made up of 2 atoms.

a. Complete the table below which shows the first 4 halogen molecules.

fluorine	chlorine	bromine	iodine
			
F_2	Cl_2	Br_2	I_2

b. Why must great care be taken when handling the halogens? They are toxic- they will kill you!

4. The table below contains information on the melting and boiling points of the halogens.

Halogen	Colour	Melting point/°C	Boiling point/°C	State at room temperature
fluorine	Pale yellow	-220	-188	gas
chlorine	Green-yellow	-101	-34	Gas
bromine	Red-brown	-7	59	liquid
iodine	Greyish-purple	114	131	solid

a. What is the trend in the melting and boiling points of the halogens? Can you explain the trends?

The further down group 7 you go the higher the melting and boiling points become. This is because the molecules get larger which means more and stronger intermolecular bonding, the atomic masses of the molecules also increases greatly as you descend the group.

b. Explain why the halogens undergo similar chemical reactions. They all have 7 electrons in their last shell. Chemical reactivity depends only on the number of electrons in the outer shell.

5. Write word and balanced symbolic equations for the following reactions:

a. magnesium + chlorine $\longrightarrow$ magnesium chloride

$Mg + Cl_2 \longrightarrow MgCl_2$

b. aluminium + bromine ⟶ aluminium bromide

$2Al + 3Br_2 \longrightarrow 2AlBr_3$

c. calcium + iodine ⟶ calcium iodide

$Ca + I_2 \longrightarrow CaI_2$

6. Which halogen is the most reactive? Which halogen is the least reactive? Give a reason for your answers.

Fluorine being the smallest halogen will be able to attract electrons towards the nucleus relatively easily, iodine being large with lots of electron shells between any electrons it wants to attract and the positively charged nucleus will find it much harder to attract electrons. The large nuclear charge is shielded and is further away from any incoming electrons. The positive nuclear charge on fluorine is much smaller than in iodine but it is much closer to any incoming electrons. There are two competing factors here the size of the nuclear charge and the distance to the nucleus, in this case the distance factor wins and fluorine is the best oxidising agent (electron acceptor) in the periodic table.

7. A student investigates the reaction between magnesium and the three halogens (chlorine, bromine, iodine).

a. Predict the order of reactivity of the halogens with magnesium (most reactive first).

Explain the trend in reactivity.

b. Describe the safety precautions required when carrying out this experiment.

Reactivity order: Chlorine > Bromine > Iodine (Chlorine is most reactive)

Trend explanation: Reactivity decreases down the halogen group. Chlorine has the strongest attraction for electrons due to its smaller size and higher electronegativity.

Safety precautions:

Work in a fume hood due to the toxic fumes produced.

Wear safety goggles and gloves to protect from splashes.

Only use small quantities of reactants to minimize risk.

8. Compare the physical properties of chlorine, bromine, and iodine in terms of state, colour and density. Explain these trends in terms of intermolecular forces.

State: Chlorine (gas), Bromine (liquid), Iodine (solid)

Colour: Chlorine (pale yellow-green), Bromine (reddish-brown), Iodine (dark grey/purple)

Density: Increases down the group.

Explanation: The molecules get larger down the group, causing stronger intermolecular forces between the molecules, these forces are called Van der Waals forces. This leads to higher melting/boiling points (i.e., stronger bonds to break) and greater density.