**Diatomic interhalogens**



The interhalogens of form XY have physical properties intermediate between those of the two parent halogens. The [covalent](https://en.wikipedia.org/wiki/Covalent) bond between the two atoms has some [ionic](https://en.wikipedia.org/wiki/Ionic_bond) character, the less [electronegative](https://en.wikipedia.org/wiki/Electronegative) halogen, X, being oxidised and having a partial positive charge. All combinations of fluorine, chlorine, bromine, and iodine that have the above-mentioned general formula are known, but not all are stable. Some combinations of astatine with other halogens are not even known, and those that are known are highly unstable.

* [**Chlorine monofluoride**](https://en.wikipedia.org/wiki/Chlorine_monofluoride) (ClF) is the lightest interhalogen compound. ClF is a colorless gas with a [normal boiling point](https://en.wikipedia.org/wiki/Normal_boiling_point) of −100 °C.
* [**Bromine monofluoride**](https://en.wikipedia.org/wiki/Bromine_monofluoride) (BrF) has not been obtained as a pure compound — it dissociates into the trifluoride and free [bromine](https://en.wikipedia.org/wiki/Bromine). It is created according to the following equation:

Br2(l) + F2(g) → 2 BrF(g)

**Iodine monofluoride** is an [interhalogen compound](https://en.wikipedia.org/wiki/Interhalogen_compound%22%20%5Co%20%22Interhalogen%20compound) of [iodine](https://en.wikipedia.org/wiki/Iodine) and [fluorine](https://en.wikipedia.org/wiki/Fluorine) with formula IF. It is a chocolate-brown solid that decomposes at 0 C,[[1]](https://en.wikipedia.org/wiki/Iodine_monofluoride%22%20%5Cl%20%22cite_note-meagle-1) [disproportionating](https://en.wikipedia.org/wiki/Disproportionation%22%20%5Co%20%22Disproportionation) to elemental iodine and [iodine pentafluoride](https://en.wikipedia.org/wiki/Iodine_pentafluoride):

5 IF → 2 I2 + IF5

However, its molecular properties can still be precisely determined by [spectroscopy](https://en.wikipedia.org/wiki/Spectroscopy): the iodine-fluorine distance is 190.9 pm and the I−F [bond dissociation energy](https://en.wikipedia.org/wiki/Bond_dissociation_energy) is around 277 kJ mol−1. At 298 [K](https://en.wikipedia.org/wiki/Kelvin), its [standard enthalpy change of formation](https://en.wikipedia.org/wiki/Standard_enthalpy_change_of_formation) is Δ*H*f° = −95.4 kJ mol−1, and its [Gibbs free energy](https://en.wikipedia.org/wiki/Gibbs_free_energy) is Δ*G*f° = −117.6 kJ mol−1.

I2 + F2 → 2 IF

It can also be generated by the reaction of iodine with [iodine trifluoride](https://en.wikipedia.org/wiki/Iodine_trifluoride) at −78 °C in CCl3F:

I2 + IF3 → 3 IF

The reaction of iodine with [silver(I) fluoride](https://en.wikipedia.org/wiki/Silver%28I%29_fluoride) at 0 °C also yields iodine monofluoride:

I2 + AgF → IF + AgI

**Tetratomic interhalogens**



[Chlorine trifluoride](https://en.wikipedia.org/wiki/Chlorine_trifluoride)

* [**Chlorine trifluoride**](https://en.wikipedia.org/wiki/Chlorine_trifluoride) (ClF3) is a colourless gas that condenses to a green liquid, and freezes to a white solid. It is made by reacting chlorine with an excess of fluorine at 250 °C in a [nickel](https://en.wikipedia.org/wiki/Nickel) tube. It reacts more violently than fluorine, often explosively. The molecule is planar and T-shaped. It is used in the manufacture of [uranium hexafluoride](https://en.wikipedia.org/wiki/Uranium_hexafluoride).
* [**Bromine trifluoride**](https://en.wikipedia.org/wiki/Bromine_trifluoride) (BrF3) is a yellow-green liquid that conducts electricity — it ionises to form [BrF2]+ and [BrF4]−. It reacts with many metals and metal oxides to form similar ionised entities; with some others it forms the metal fluoride plus free bromine and [oxygen](https://en.wikipedia.org/wiki/Oxygen). It is used in [organic chemistry](https://en.wikipedia.org/wiki/Organic_chemistry) as a fluorinating agent. It has the same molecular shape as chlorine trifluoride.
* [**Iodine trifluoride**](https://en.wikipedia.org/wiki/Iodine_trifluoride) (IF3) is a yellow solid that decomposes above −28 °C. It can be synthesised from the elements, but care must be taken to avoid the formation of [IF5](https://en.wikipedia.org/wiki/Iodine_pentafluoride). [F2](https://en.wikipedia.org/wiki/Fluorine) attacks [I2](https://en.wikipedia.org/wiki/Iodine) to yield IF3 at −45 °C in [CCl3F](https://en.wikipedia.org/wiki/Trichlorofluoromethane). Alternatively, at low temperatures, the fluorination reaction I2 + 3 [XeF2](https://en.wikipedia.org/wiki/Xenon_difluoride) → 2 IF3 + 3[Xe](https://en.wikipedia.org/wiki/Xenon) can be used. Not much is known about iodine trifluoride as it is so unstable.
* [**Iodine trichloride**](https://en.wikipedia.org/wiki/Iodine_trichloride) (ICl3) forms lemon yellow crystals that melt under pressure to a brown liquid. It can be made from the elements at low temperature, or from iodine pentoxide and hydrogen chloride. It reacts with many metal chlorides to form tetrachloroiodides, and hydrolyses in water. The molecule is a planar [dimer](https://en.wikipedia.org/wiki/Dimer_%28chemistry%29%22%20%5Co%20%22Dimer%20%28chemistry%29) (ICl3)2, with each iodine atom surrounded by four chlorine atoms.

**Hexatomic interhalogens**



[Bromine pentafluoride](https://en.wikipedia.org/wiki/Bromine_pentafluoride)

All stable hexatomic and octatomic interhalogens involve a heavier halogen combined with five or seven fluorine atoms. Unlike the other halogens, fluorine atoms have high electronegativity and small size which is able to stabilize them.

* [**Chlorine pentafluoride**](https://en.wikipedia.org/wiki/Chlorine_pentafluoride) (ClF5) is a colourless gas, made by reacting chlorine trifluoride with fluorine at high temperatures and high pressures. It reacts violently with water and most [metals](https://en.wikipedia.org/wiki/Metals) and [nonmetals](https://en.wikipedia.org/wiki/Nonmetal%22%20%5Co%20%22Nonmetal).
* [**Bromine pentafluoride**](https://en.wikipedia.org/wiki/Bromine_pentafluoride) (BrF5) is a colourless fuming liquid, made by reacting bromine trifluoride with fluorine at 200 °C. It is physically stable, but reacts violently with water and most metals and [nonmetals](https://en.wikipedia.org/wiki/Nonmetal%22%20%5Co%20%22Nonmetal).
* [**Iodine pentafluoride**](https://en.wikipedia.org/wiki/Iodine_pentafluoride) (IF5) is a colourless liquid, made by reacting iodine pentoxide with fluorine, or iodine with [silver(II) fluoride](https://en.wikipedia.org/wiki/Silver%28II%29_fluoride). It is highly reactive, even slowly with glass. It reacts with water to form [hydrofluoric acid](https://en.wikipedia.org/wiki/Hydrofluoric_acid) and with fluorine gas to form [iodine heptafluoride](https://en.wikipedia.org/wiki/Iodine_heptafluoride). The molecule has the form of a tetragonal pyramid.

**Octatomic interhalogens**



* [**Iodine heptafluoride**](https://en.wikipedia.org/wiki/Iodine_heptafluoride) (IF7) is a colourless gas and a strong fluorinating agent. It is made by reacting iodine pentafluoride with fluorine gas. The molecule is a pentagonal bipyramid. This compound is the only known interhalogen compound where the larger atom is carrying seven of the smaller atoms.
* All attempts to [synthesize](https://en.wikipedia.org/wiki/Chemical_synthesis) bromine or chlorine heptafluoride have met with failure; instead, bromine pentafluoride or chlorine pentafluoride is produced, along with fluorine gas.

