



### Color of the Halogens

- The color of the halogens is solvent dependent.

Example



Iodine water



Iodine in hexane

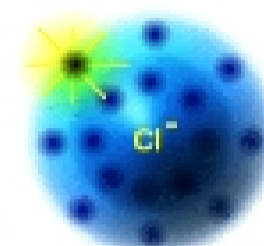
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- It is possible to visually distinguish between the halogens in hexane where each has distinct colors

### HALIDES



Cl<sup>-</sup> in NaCl(s)



chloride ion

- Exist as anions in salts
- Salt names end in ide (e.g., sodium bromide...)
- Oxidation state = -1.
- Reducing agents

### Halides

- The halides are provided as sodium salts in water solution.



Sodium halide (s)



Sodium halide (aq)

- The sodium salts of the halides visually look the same in the solid state and in aqueous solution.

### Salt Solubility Reminders

Salts (e.g., halide salts):

- are soluble in polar solvents (e.g., water).
- are NOT soluble in non-polar solvents (e.g., hexane).



"Like attracts like"

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### Part 2B. Reactivity of the Halogens and Halides.

- Collect experimental data on the reactivity:
  - oxidizing agent strength of the halogens
  - reducing agent strength of the halides.
- Compare the halogen reactivity data versus:
  - periodic table position
  - electronegativity values



Discussion questions 3 and 4, p.104

### OA Strength of Chlorine versus Bromine?


	Cl <sup>-</sup>	Br <sup>-</sup>
Cl <sub>2</sub>	NO	
Br <sub>2</sub>		NO

See expanded Table 5, p.84

Table: Oxidizing agents on one side and reducing agents on the other side.

**Caution: Check data. Does it make sense?**

	Cl <sup>-</sup>	Br <sup>-</sup>
Cl <sub>2</sub>	NO	No
Br <sub>2</sub>	No	NO



"These results don't make sense!"

One combination of halogen and halide should react -- the stronger OA and RA agent!


**Interpreting Experiment Results**

1) Cl<sub>2</sub> + 2 Br<sup>-</sup> → 2 Cl<sup>-</sup> + Br<sub>2</sub>  
     OA      RA      RA      OA

2) Br<sub>2</sub> + 2 Cl<sup>-</sup> → 2 Br<sup>-</sup> + Cl<sub>2</sub>

↗ "Reaction 1) or 2) should occur!"

1) OA strength: Cl<sub>2</sub> > Br<sub>2</sub>  
 2) OA strength: Br<sub>2</sub> > Cl<sub>2</sub>



**Q. Based solely on electronegativity values, compare Cl<sub>2</sub> and Br<sub>2</sub> as oxidizing agents?**

H																	B	C	N	O	F							
Li	Be											Al	Si	P	S	Cl												
Na	Mg											K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I												
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At												
Fr	Ra	Ac	Th	Pa	U	Np	Nb																					


OA: Cl<sub>2</sub> > Br<sub>2</sub>

**Q. If Cl<sub>2</sub> is a better oxidizing agent than Br<sub>2</sub>, should reaction 1) or 2) occur?**

1) Cl<sub>2</sub> + 2 Br<sup>-</sup> → 2 Cl<sup>-</sup> + Br<sub>2</sub>  
     OA      RA      RA      OA

2) Br<sub>2</sub> + 2 Cl<sup>-</sup> → 2 Br<sup>-</sup> + Cl<sub>2</sub>

Answer: Reaction 1)



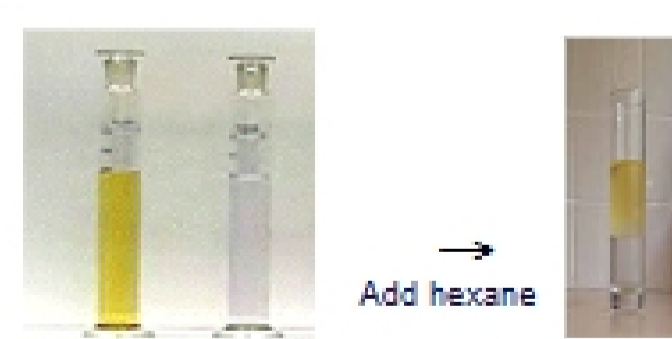
**Q. Based on electronegativity values (chlorine = 3.0 and bromine = 2.8), will the reaction below occur?**  
 Br<sub>2(aq)</sub> + NaCl(aq) → ?

- List the Oxidizing and reducing agent species and indicate the comparative strength

↑ Oxidizing Agent	Reducing Agent ↓
Cl <sub>2</sub>	Cl <sup>-</sup>
Br <sub>2</sub>	Br <sup>-</sup>

Answer: No. Br<sub>2</sub> and Cl<sup>-</sup> are the weaker OA and RA.

**Experiment:**  
 Q. Br<sub>2</sub> (aq) + NaCl (aq) → rxn or no rxn?



Br<sub>2(aq)</sub> + 2 NaCl<sub>(aq)</sub> → no reaction

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