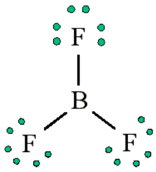
Get some extra practice…

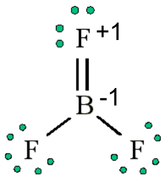
…working with Lewis structures and formal charges

1. Use formal charges to determine which of the following Lewis structures of boron trifluoride is the most acceptable.

(a)

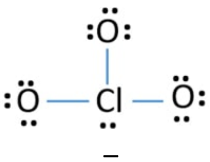


(b)

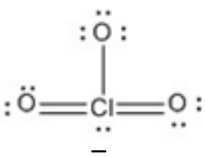


2. Use formal charges to determine which of the following Lewis structures of the chlorate ion (ClO_3^-) is the most acceptable.

(a)



(b)

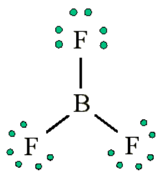


Scroll to the following pages to check your answers.

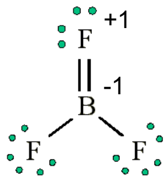
Answers

1. Use formal charges to determine which of the following Lewis structures of boron trifluoride is the most acceptable.

(a)

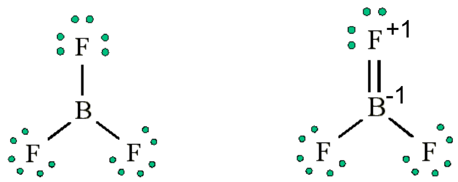


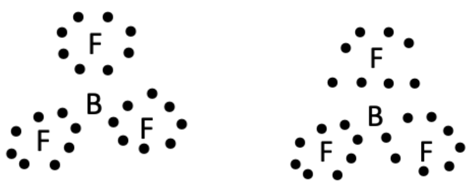
(b)



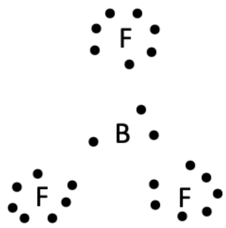
First, we write down the neutral atoms in boron trifluoride. Boron has three valence electrons, while fluorine has seven:

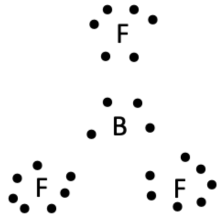
We then draw all of the valence electrons in the two Lewis structures:





Then, we separate the valence electrons in the bonding pairs equally between the joined atoms:





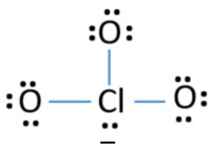
We then count the valence electrons on each atom and subtract the number of valence electrons on the *neutral* atoms:

B: 3 – 3 in neutral atom = 0	B: 4 – 3 in neutral atom = +1
F: 7 – 7 in neutral atom = 0	F joined by single bond: 7 – 7 in neutral atom = 0
	F joined by double bond: 6 – 7 in neutral atom = -1
All atoms have a formal charge of zero	**Two atoms have non-zero formal charges**

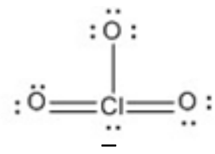
The structure with the formal charges closest to zero is the lowest-energy – and therefore most acceptable – structure. This is structure (a).

2. Use formal charges to determine which of the following Lewis structures of the chlorate ion (ClO_3^-) is the most acceptable.

(a)

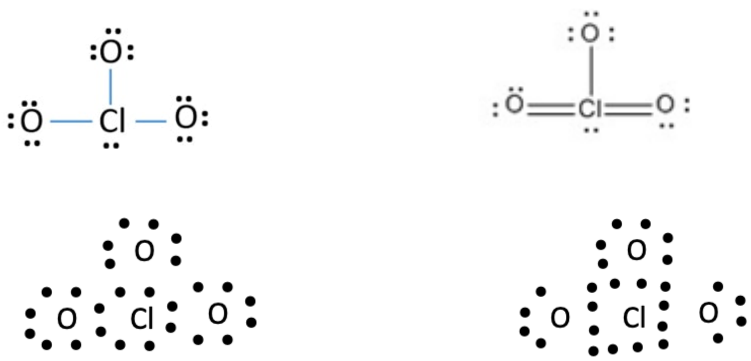


(b)



First, we write down the neutral atoms in the chlorate ion. Oxygen has six valence electrons, while chlorine has seven:

We then draw all of the valence electrons in the two Lewis structures:



Then, we separate the valence electrons in the bonding pairs equally between the joined atoms:

We then count the valence electrons on each atom and subtract the number of valence electrons on the *neutral* atoms:

O: 7 – 6 in neutral atom = +1

O joined by single bond: 7 – 6 in neutral

	atom = +1
Cl: 5 – 7 in neutral atom = -2	O joined by double bond: 6 – 6 in neutral atom = 0
	Cl: 7 – 7 in neutral atom = 0
All atoms have non-zero formal charge	**Only one atom has non-zero formal charge**

The structure with the formal charges closest to zero is the lowest-energy – and therefore most acceptable – structure. This is structure (b).