



Study the rules for assigning oxidation numbers and examine the sample problem below. Then determine the unknown oxidation state in each example.

RULES FOR ASSIGNING OXIDATION NUMBERS

- Oxidation numbers for atoms that are free elements are always zero
- The oxidation numbers of ions are the same as the charge on the ion
- Some elements have only one oxidation state
  - group 1 metals always form 1+ ions and always have a +1 oxidation state
  - group 2 metals always form 2+ ions and always have a +2 oxidation state
- Some elements usually have a particular oxidation state
  - oxygen has a -2 oxidation state except in peroxides where it is -1 and in compounds with fluorine ( $\text{OF}_2$ ) where it is +2
  - hydrogen has a +1 oxidation state except in hydrides with group 1 and group 2 metals
- the sum of the oxidation numbers
  - in a compound it is always zero
  - in a polyatomic ion it is equal to the charge on the ion

1. Chlorine in  $\text{KClO}_4$  1. \_\_\_\_\_

2. Nitrogen in  $\text{Ba}(\text{NO}_3)_2$  2. \_\_\_\_\_

3. Phosphorus in  $\text{Ca}_3(\text{PO}_4)_2$  3. \_\_\_\_\_

4. Manganese in  $\text{LiMnO}_4$  4. \_\_\_\_\_

5. Sulfur in  $\text{Na}_2\text{SO}_3$  5. \_\_\_\_\_

6. Chromium in  $\text{CaCrO}_4$  6. \_\_\_\_\_

7. Sulfur in  $\text{MgS}_2\text{O}_3$  7. \_\_\_\_\_

8. Nitrogen in  $\text{Zn}(\text{NO}_2)_2$  8. \_\_\_\_\_

9. Chlorine in  $\text{HClO}_3$  9. \_\_\_\_\_

10. Carbon in  $\text{CaC}_2\text{O}_4$  10. \_\_\_\_\_

11. Sulfur in  $\text{KHSO}_4$  11. \_\_\_\_\_

Sample Problem

Find the oxidation state of the elements in  $\text{K}_2\text{Cr}_2\text{O}_7$ .

Element	K	Cr	O	TOTAL
Subscript	2	2	7	
Oxidation state	+1	?	-2	
Sum of oxidation states	+2	??	-14	

- [a] potassium is a group one metal; its oxidation state is always +1
- [b] oxygen usually has an oxidation state of -2
- [c] the sum of oxidation states of each element is the product of the subscript and the oxidation state
- [d] find the sum of the oxidation states of chromium (??) by setting the sum of all the oxidation states to zero
- $$(+2) + ?? + (-14) = 0$$
- $$?? = +12$$
- [f] find the oxidation state of chromium (?) by dividing the sum (+12) by the subscript (2)
- $$+12 \div 2 = +6$$