Oxidation Numbers Practice

Determine the oxidation number of each element in these species:

1. Fe
2. S_8
3. Be^{2+}
4. SF_4
5. $ZnCl_2$
6. $Cr_2O_7^{2-}$
7. $HClO_4$
8. N_2O_5
9. ClF_2^-
10. H_2SO_4
11. ClO_3^-
12. $(NH_4)_2CO_3$
13. Na_3PO_4
14. PF_6^{3-}
15. $Fe(MnO_4)_2$

Answers

1. Fe **0** The oxidation number of an element is 0

2. S_8 **0** The oxidation number of an element is 0

3. Be^{2+} **+2** The oxidation number of an ion is equal to its charge.

4. SF_4 S = **+4**, F = **-1**

S	4F
	-1
	x 4
+4	-4

The most electronegative element is assigned an oxidation number equal to the charge of its anion.

The oxidation number for the less electronegative element is calculated so that the sum of the oxidation numbers of the molecule equals 0.

5. $ZnCl_2$ Zn = **+2**, Cl = **-1**

Zn	$2Cl^-$
	-1
	x 2
+2	-2

6. $Cr_2O_7^{2-}$ Cr = **+6**, O = **-2**

2Cr	7O
	-2
	x 7
+14	-14
- 2	
+12	
÷ 2	
+6	

Add the charge of the anion (the sum of the oxidation numbers in polyatomic ions must be equal to the charge).

Divide by the number of metal atoms in the ion or molecule.

7. $HClO_4$ H = **+1**, Cl = **+7**, O = **-2**

H^+	ClO_4^-	
H^+	Cl	4O
+1		**-2**
		x 4
	+8	-8
	- 1	
	+7	

Divide the formula unit into its respective ions. Oxygen is the most electronegative element, thus its oxidation number will equal the charge on its anion.
Add the charge on the polyatomic ion (the sum of the oxidation numbers will be -1).
Assign an oxidation number equal to the charge on the cation (H^+), so that the sum of all of the oxidation numbers will equal 0.

8. N_2O_5 N = **+5**, O = **-2**

2N	5O
	-2
	x 5
+10	-10
÷ 2	
+5	

9. ClF_2^- Cl = **+1**, F = **-1**

Cl	$2F^-$
	-1
	x 2
+2	-2
+(-1)	
+1	

Add the charge of the polyatomic ion, so that the sum of the oxidation numbers will have a difference equal to the charge of the ion.

10. H_2SO_4 H = **+1**, S = **+6**, O = **-2**

$2H^+$	SO_4^{2-}	
$2H^+$	S	4O
+1		**-2**
x 2		x 4
+2	+8	-8
	+(-2)	
	+6	

Divide the formula unit into its ions, then find the oxidation numbers for each of the elements in the ions.

11. ClO_3^- Cl = **+5**, O = **-2**

Cl	3O
	-2
	x 3
+6	-6
+(-1)	
+5	

12. $(NH_4)_2CO_3$ N = **-3**, H = **+1**, C = **+4**, O = **-2**

NH_4^+		CO_3^{2-}	
N	4H	C	3O
-4 +(+1) **-3**	**+1** x 4 +4	+6 +(-2) **+4**	**-2** x 3 -6

13. Na_3PO_4 Na = **+1**, P = **+5**, O = **-2**

$3Na^+$	PO_4^{3-}	
$3Na^+$	P	4O
+1 x 3 +3	+8 +(-3) **+5**	**-2** x 4 -8

14. PF_6^{3-} P = **+3**, F = **-1**

P	6F
+6 +(-3) **+3**	**-1** x 6 -6

15. $Fe(MnO_4)_2$ Fe = **+2**, Mn = **+7**, O = **-2**

Fe^{2+}	MnO_4^-	
Fe^{2+}	Mn	4O
+2	+8 +(-1) **+7**	**-2** x 4 -8