Chemistry 30

Unit 6: Redox Reactions and Electrochemistry — Answers

Practice Set 1: Oxidation Numbers and Redox Reactions

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1. Determine the oxidation number of each element in the following compounds.

Rules:
1. Pure elements have an oxidation number of 0
2. If the compound is an ionic compound, the oxidation number for each element is the ion's charge
3. The oxidation number of hydrogen in a compound is +1
4. The oxidation number of oxygen in most compounds is –2 (peroxides are the exception; in peroxides oxygen has an oxidation number of –1)
5. The sum of the oxidation numbers in a compound is zero.
6. The sum of the oxidation numbers in a polyatomic ion is equal to the ion charge.

		Hint	Oxidation Numbers for each Element						
a.	$SnCl_4$	*Rule 2*	Sn	+4	Cl	-1			
b.	Ca_3P_2	*Rule 2*	Ca	+2	P	-3			
c.	SnO	*Rules 4, 5*	Sn	+2	O	-2			
d.	Ag_2S	*Rule 2*	Ag	+1	S	-2			
e.	HI	*Rule 3, 5*	H	+1	I	-1			
f.	N_2H_4	*Rule 3, 5*	N	-2	H	+1	watch the sign for N!		
g.	Al_2O_3	*Rule 4, 5*	Al	+3	O	-2			
h.	S_8	*Rule 1*	S	0					
i.	HNO_2	*Rules 3, 4, 5*	H	+1	N	+3	O	-2	
j.	O_2	*Rule 1*	O	0			pure element!		
k.	H_3O^+	*Rules 3, 4, 6*	H	+1	O	-2	surprised?		
l.	ClO_3^-	*Rules 4, 6*	Cl	+5	O	-2			
m.	$S_2O_3^{2-}$	*Rules 4, 6*	S	+2	O	-2			
n.	$KMnO_4$	*Rules 4, 5, 6*	K	+1	Mn	+7	O	-2	
o.	$(NH_4)_2SO_4$	*Rules 4, 5, 6*	N	-3	H	+1	S	+6	O -2

Extra help for $KMnO_4$ & $(NH_4)_2SO_4$

You will need to recognize polyatomic ions. It will simplify determining oxidation numbers to break molecules with polyatomic ions into two separate ions, then find oxidation numbers for each part separately.

$KMnO_4$	K^+	Oxidation Number =		+1
	MnO_4^-	oxygen's oxidation number = -2	4 oxygens total =	-8
		sum of ox. nos. for MnO_4^-		-1
		therefore oxidation number of Mn		+7
$(NH_4)_2SO_4$	NH_4^+	Hydrogen's oxidation number = +1	4 hydrogens total =	+4
		charge of ammonium ion		+1
		therefore oxidation number of N		-3

Note – there are two NH_4^+ ions, but the oxidation numbers in both will be the same!

	SO_4^{2-}	oxygen's oxidation number = -2	4 oxygens total =	-8
		charge of sulfate ion		-2
		therefore oxidation number of S		+6

2. Determine the oxidation number of carbon in each of the following compounds:

a. methane, CH_4

C = -4

element	Ox. No.	No. Atoms	Total
H	**+1**	4	+4
C	**-4**	1	-4
		SUM	0

b. formaldehyde, CH_2O

C = 0

element	Ox. No.	No. Atoms	Total
H	**+1**	2	+2
O	**-2**	1	-2
C	**0**	1	0
		SUM	0

c. carbon monoxide, CO

C = +2

element	Ox. No.	No. Atoms	Total
O	**-2**	1	-2
C	**+2**	1	+2
		SUM	0

d. carbon dioxide, CO_2

C = +4

element	Ox. No.	No. Atoms	Total
O	**-2**	2	-4
C	**+4**	1	+4
		SUM	0