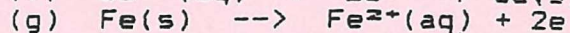
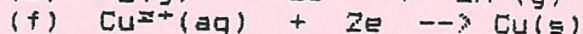
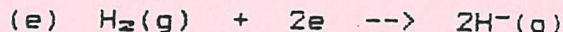
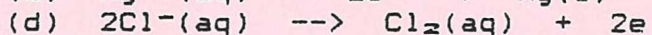
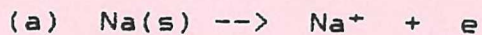


SENIOR CHEMISTRY ELECTIVE

"OXIDATION-REDUCTION"

Introductory Problems - Set Number 1

1. Identify each of the following as either oxidation or reduction :



2. The equations listed in question 1. can be described as being of what type?

3. Why must oxidation and reduction occur together (as paired processes)?

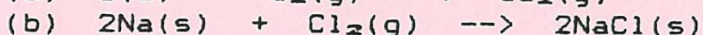
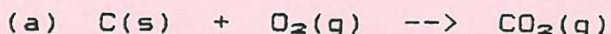
4. In each of the following oxidation-reduction equations, state :

(i) what is being oxidised

(ii) what is being reduced

(iii) the oxidising agent (oxidant)

(iv) the reducing agent (reductant)



5. For each of the following reactions, write the two ionic half-equations involved in the process, the overall equation, and the oxidising and reducing agents :

(a) Zinc reacting with hydrogen ions to produce zinc(II) ions and hydrogen gas.

(b) The sulfide ion reacting with iodine ( $\text{I}_2$ ) to produce sulfur and iodide ions.

(c) Silver ions reacting with copper metal to produce silver metal and copper(II) ions.

(d) The silver ion oxidising zinc metal.

(e) Fluorine gas reacting with chloride ions to produce chlorine gas and fluoride ions.

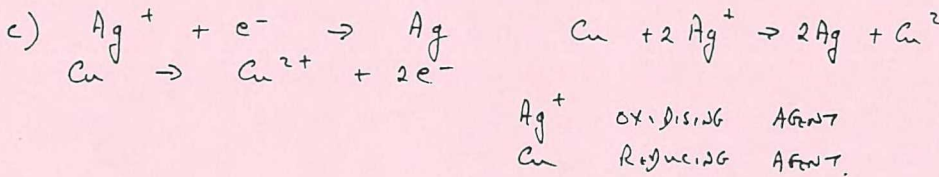
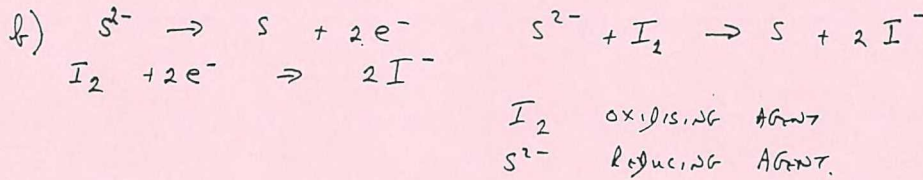
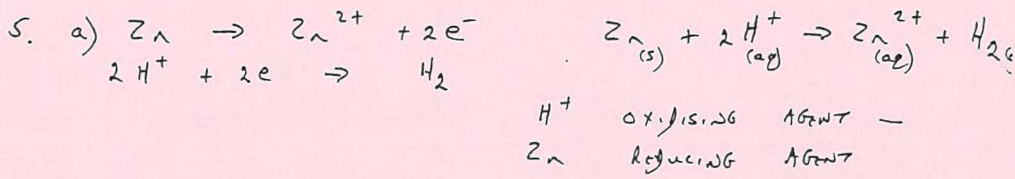
(f) Iron metal reacting with bromine to produce iron(II) bromide (containing iron(II) ions and bromide ions)

- 1.
- |              |              |
|--------------|--------------|
| a) Oxidation | e) Reduction |
| f) Reduction | f) Reduction |
| c) Reduction | g) Oxidation |
| d) Oxidation | h) Oxidation |

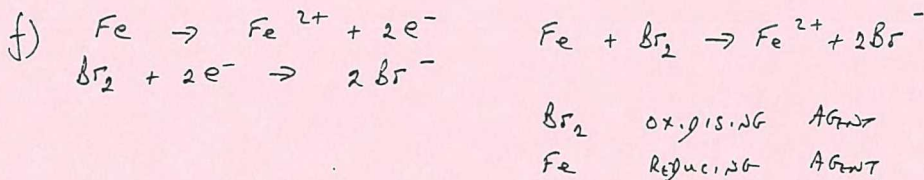
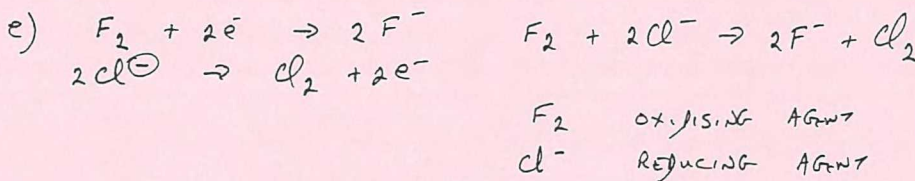
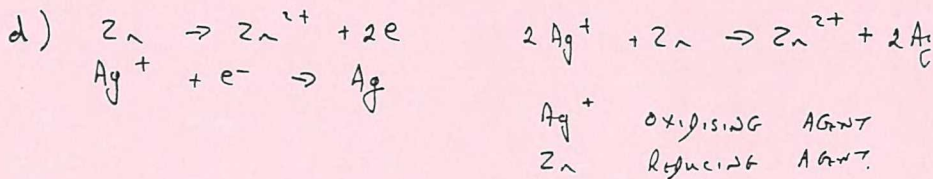
2. HALF-EQUATIONS

3.

- 4.
- |  |  |
|--|--|
| a) C oxidised (Reductant)                | O <sub>2</sub> is reduced (Oxidant)    |
| b) Na oxidised (Reductant)               | Cl <sub>2</sub> is reduced (Oxidant)   |
| c) Pb oxidised (Reductant)               | Cu <sup>2+</sup> is reduced (Oxidant)  |
| d) Fe oxidised (Reductant)               | Ag <sup>+</sup> is reduced (Oxidant)   |
| e) Fe <sup>2+</sup> oxidised (Reductant) | I <sub>2</sub> is reduced (Oxidant)    |
| f) Ce <sup>3+</sup> oxidised (Reductant) | Fe <sup>2+</sup> is reduced (Oxidant)  |
| g) F <sub>2</sub> reduced (Oxidant)      | I <sup>-</sup> is oxidised (Reductant) |
| h) Hg oxidised (Reductant)               | H <sup>+</sup> is reduced (Oxidant)    |



P.T.O.





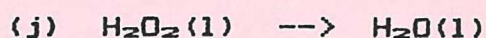
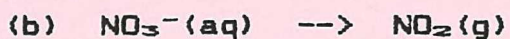
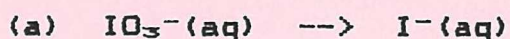
SENIOR CHEMISTRY ELECTIVE

"OXIDATION-REDUCTION"

Problems in Balancing Redox Equations - Set Number 2

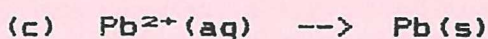
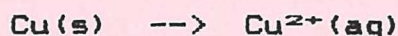
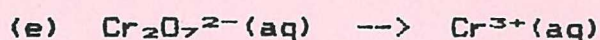
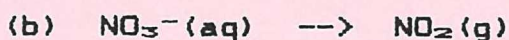
SET (A)

1. Balance each of the following ionic half-equations :

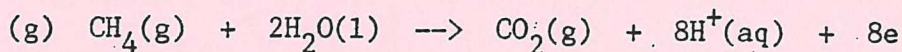
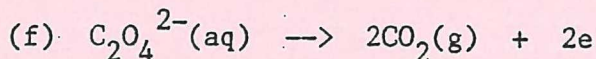
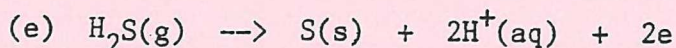
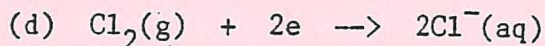
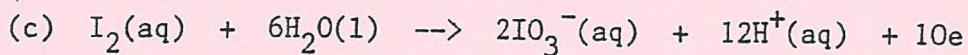
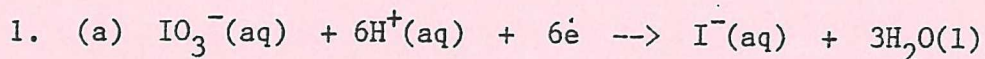


SET (B)

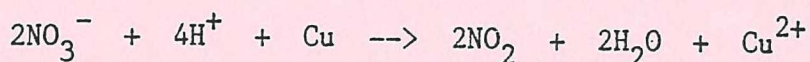
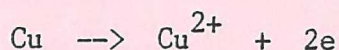
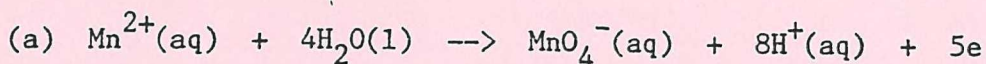
1. Balance the following PAIRS of ionic equations, then write the OVERALL NET IONIC EQUATION.



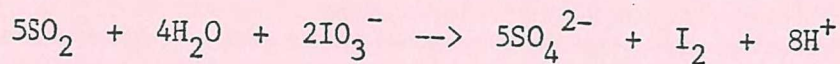
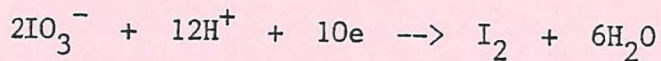
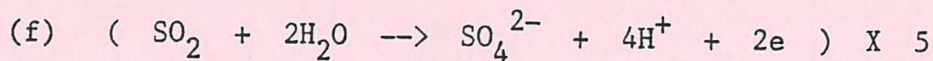
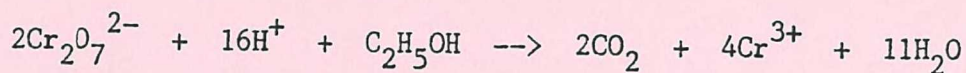
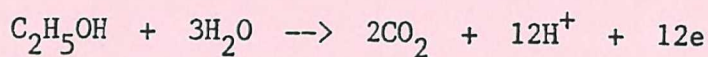
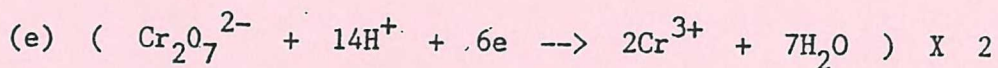
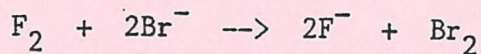
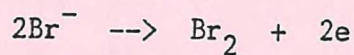
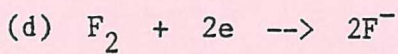
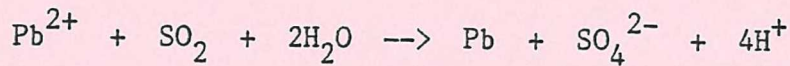
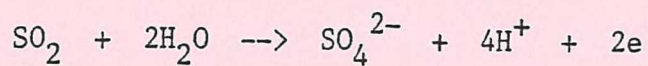
SET (A)



SET (B) :







## REDOX EQUATIONS

1. Determine the unit oxidation numbers (oxidation states) of the elements mentioned in the following:

*N* in  $\text{NO}_3^-$ ,  $\text{NH}_3$ ,  $\text{NH}_4^+$ ,  $\text{NO}$ ,  $\text{N}_2\text{O}$ ,  $\text{NO}_2$ ,  $\text{N}_2\text{O}_4$ ,  $\text{N}_2\text{O}_5$ ,  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{N}_2$ .

*S* in  $\text{H}_2\text{S}$ ,  $\text{SO}_2$ ,  $\text{H}_2\text{SO}_3$ ,  $\text{SO}_3^{--}$ ,  $\text{HSO}_3^-$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{SO}_4^{--}$ ,  $\text{SO}_3$ ,  $\text{S}_2\text{O}_3^{--}$ ,  $\text{S}_4\text{O}_6^{--}$ .

*C* in  $\text{CO}_2$ ,  $\text{CaC}_2$ ,  $\text{CH}_4$ ,  $\text{HCHO}$ ,  $\text{C}_2\text{H}_5\text{OH}$ ,  $\text{CHCl}_3$ ,  $\text{CS}_2$ ,  $\text{SiC}$ ,  $\text{CO}_3^{--}$ ,  $\text{HCO}_3^-$ ,  $\text{C}_2\text{O}_4$

*C* in  $\text{HC}_2\text{O}_4^-$ ,  $\text{CO}$ , *Diamond*,  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ,  $\text{C}_6\text{H}_6$ ,  $\text{C}_2\text{H}_4$ ,  $\text{C}_2\text{H}_2$ .

*Fe* in Metallic iron, ferrous oxide, ferric oxide,  $\text{Fe}_3\text{O}_4$ ,  $\text{Fe}_2(\text{SO}_4)_3$ .

*Mn* in  $\text{KMnO}_4$ ,  $\text{MnO}_4^-$ ,  $\text{MnO}_2$ ,  $\text{MnSO}_4$ ,  $\text{Mn}(\text{OH})_2$ ,  $\text{K}_2\text{MnO}_4$ ,  $\text{Mn}^{++}$

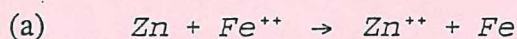
*Boron* in  $\text{B}_4\text{O}_7^{--}$ ,  $\text{H}_3\text{BO}_3$ ,  $\text{B}_2\text{H}_6$ .

*Cl* in  $\text{HCl}$ ,  $\text{Cl}_2$ ,  $\text{Cl}^-$ ,  $\text{KClO}_3$ ,  $\text{ClO}_2$ ,  $\text{HClO}$ ,  $\text{ClO}^-$ ,  $\text{ClO}_2^-$ .

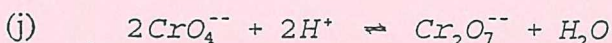
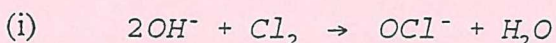
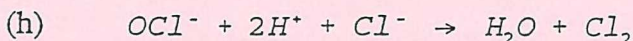
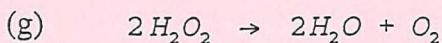
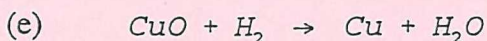
*O* in  $\text{O}_2$ ,  $\text{O}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{ClO}_3^-$ ,  $\text{Na}_2\text{O}_2$ .

*Cr* in  $\text{Cr}_2\text{O}_7^{--}$ ,  $\text{CrO}_4^{--}$ ,  $\text{Cr}_2\text{O}_3$ , *Chromite anions*

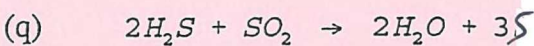
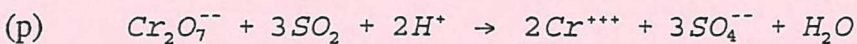
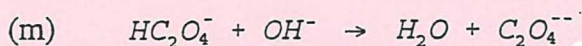
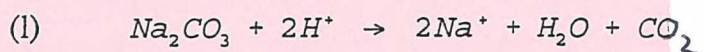
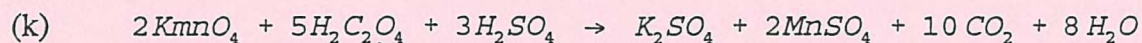
2. State whether the following reactions involve redox or not and, if so, which substance is oxidized and which reduced.



Now have another look at it!!







Give ionic half equations (partial equations) for:

- (a) the oxidation of ferrous ions to ferric ions,
- (b) the reduction of nitric acid to nitric oxide,
- (c) the oxidation of hydrogen peroxide to oxygen,
- (d) the reduction of hydrogen peroxide to water,
- (e) the oxidation of oxalic acid  $\text{H}_2\text{C}_2\text{O}_4$  to carbon dioxide,
- (f) the reduction of potassium permanganate to manganous sulphate,
- (g) the reduction of potassium permanganate to manganese dioxide.



# Redox EQUATIONS (ANSWERS)

Q1.

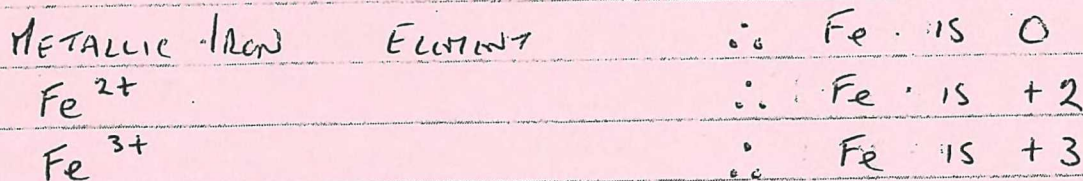
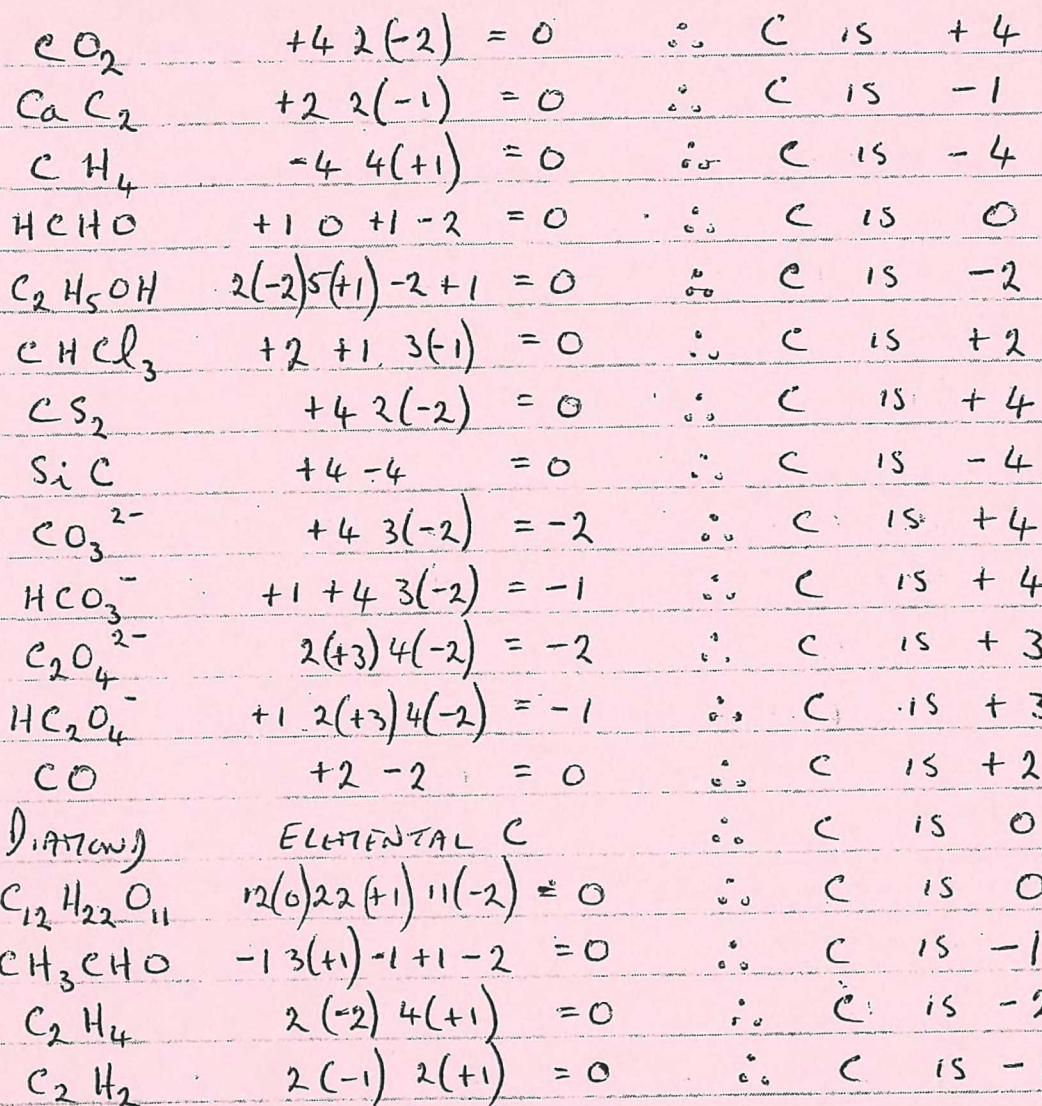
$\text{NO}_3^-$	$+5$	$3(-2)$	$= -1$	$\therefore$	N	IS	$+5$
$\text{NH}_3$	$-3$	$3(+1)$	$= 0$	$\therefore$	N	IS	$-3$
$\text{NH}_4^+$	$-3$	$4(+1)$	$= +1$	$\therefore$	N	IS	$-3$
$\text{NO}$	$+2$	$-2$	$= 0$	$\therefore$	N	IS	$+2$
$\text{N}_2\text{O}$	$2(+1)$	$-2$	$= 0$	$\therefore$	N	IS	$+1$
$\text{NO}_2$	$+4$	$2(-2)$	$= 0$	$\therefore$	N	IS	$+4$
$\text{N}_2\text{O}_4$	$2(+4)$	$4(-2)$	$= 0$	$\therefore$	N	IS	$+4$
$\text{N}_2\text{O}_5$	$2(+5)$	$5(-2)$	$= 0$	$\therefore$	N	IS	$+5$
$\text{NO}_3^-$	$+5$	$3(-2)$	$= -1$	$\therefore$	N	IS	$+5$
$\text{NO}_2^-$	$+3$	$2(-2)$	$= -1$	$\therefore$	N	IS	$+3$
$\text{N}_2$	ELEMENT				N	IS	$0$

$\text{H}_2\text{S}$	$2(+1)$	$-2$	$= 0$	$\therefore$	S	IS	$-2$	
$\text{SO}_2$	$+4$	$2(-2)$	$= 0$	$\therefore$	S	IS	$+4$	
$\text{H}_2\text{SO}_3$	$2(+1)$	$+4$	$3(-2)$	$= 0$	$\therefore$	S	IS	$+4$
$\text{SO}_3^{2-}$	$+4$	$3(-2)$	$= -2$	$\therefore$	S	IS	$+4$	
$\text{HSO}_3^-$	$+1$	$+4$	$3(-2)$	$= -1$	$\therefore$	S	IS	$+4$
$\text{H}_2\text{SO}_4$	$2(+1)$	$+6$	$4(-2)$	$= 0$	$\therefore$	S	IS	$+6$
$\text{SO}_4^{2-}$	$+6$	$4(-2)$	$= -2$	$\therefore$	S	IS	$+6$	
$\text{SO}_3$	$+6$	$3(-2)$	$= 0$	$\therefore$	S	IS	$+6$	
$\text{S}_2\text{O}_3^{2-}$	$2(+2)$	$3(-2)$	$= -2$	$\therefore$	S	IS	$+2$	
$\text{S}_4\text{O}_6^{2-}$	$4( )$	$6(-2)$	$= -2$		S	WILL HAVE		

A number of OXIDATION STATES HERE

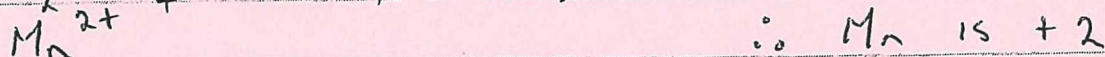
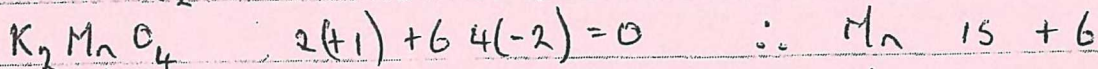
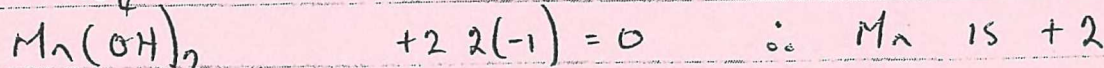
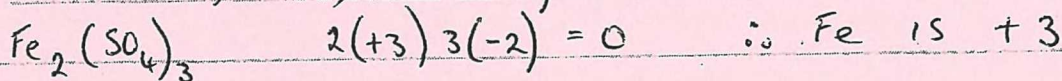
$3(+2)$  AND  $1(+4)$





A NUMBER OF OXIDATION STATES HERE

1(+2) AND 2(+3)





HCl	+1 -1 = 0	∴ Cl is -1
Cl <sub>2</sub>	ELEMENT	∴ Cl is 0
Cl <sup>-</sup>		∴ Cl is -1
KClO <sub>3</sub>	+1 +5 3(-2) = 0	∴ Cl is +5
ClO <sub>2</sub>	+4 2(-2) = 0	∴ Cl is +4
HClO	+1 +1 -2 = 0	∴ Cl is +1
ClO <sup>-</sup>	+1 -2 = -1	∴ Cl is +1
ClO <sub>2</sub> <sup>-</sup>	+3 2(-2) = -1	∴ Cl is +3
O <sub>2</sub>	ELEMENT	∴ O is 0
O <sub>3</sub>	ELEMENT	∴ O is 0
H <sub>2</sub> O	2(+1) -2 = 0	∴ O is -2
ClO <sub>3</sub> <sup>-</sup>	+5 3(-2) = -1	∴ O is -2
Na <sub>2</sub> O <sub>2</sub>	2(+1) 2(-1) = 0	∴ O is -1
Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup>	2(+6) 7(-2) = -2	∴ Cr is +6
CrO <sub>4</sub> <sup>2-</sup>	+6 4(-2) = -2	∴ Cr is +6
Cr <sub>2</sub> O <sub>3</sub>	2(+3) 3(-2) = 0	∴ Cr is +3
Cr <sub>2</sub> O <sub>4</sub> <sup>2-</sup>	2(+3) 4(-2) = 0	∴ Cr is +3

- Q 2
- a) YES ; Zn is oxidised Fe<sup>2+</sup> is Reduced
- b) YES ; Na is oxidised H(H<sub>2</sub>O) is Reduced
- c) NO
- d) YES ; N(NH<sub>4</sub><sup>+</sup>) is oxidised N(NO<sub>3</sub><sup>-</sup>) is Reduced  
THIS IS CALLED DISPROPORTIONATION
- e) YES ; H<sub>2</sub> is oxidised Cu is Reduced
- f) YES ; O is oxidised Mn is Reduced
- g) YES ; O is oxidised O is Reduced  
THIS IS CALLED DISPROPORTIONATION
- h) YES ; Cl<sup>-</sup> is oxidised Cl(OCl<sup>-</sup>) is Reduced
- i) YES ; Cl<sub>2</sub> is oxidised SPECIES REDUCED IS MISSING FROM EQUATION OR OTHER PRODUCT NOT SHOWN
- j) NO



(k) YES  $C(H_2C_2O_4)$  is oxidised  $Mn(KMnO_4)$  is reduced

(l) NO

(m) NO

(n) YES  $Zn$  is oxidised  $H(HCl)$  is reduced

(o) YES  $N$  is oxidised  $Cr$  is reduced

(p) YES  $S$  is oxidised  $Cr$  is reduced

(q) YES  $S(H_2S)$  is oxidised  $S(SO_2)$  is reduced

