

## Séquence 6

## Ajuster une équation d'oxydo-réduction

## Activité Dirigée

(a)  $\text{Cl}_2 + \text{Br}^- = \text{Br}_2 + \text{Cl}^-$ 

$\text{Cl}_2$	$\text{Cl}^-$	couple
$no(\text{Cl}) = 0$	$no(\text{Cl}) = -1$	$\text{Cl}_2/\text{Cl}^-$

$\text{Br}^-$	$\text{Br}_2$	couple
$no(\text{Br}) = -1$	$no(\text{Br}) = 0$	$\text{Br}_2/\text{Br}^-$

$\text{Cl}_2/\text{Cl}^-$	$\text{Cl}_2 + 2 \text{ e}^- = 2\text{Cl}^-$
$\text{Br}_2/\text{Br}^-$	$2\text{Br}^- = \text{Br}_2 + 2 \text{ e}^-$

(b)  $\text{Mn}^{3+} + \text{I}^- = \text{I}_2 + \text{Mn}^{2+}$ 

$\text{Mn}^{3+}$	$\text{Mn}^{2+}$	couple
$no(\text{Mn}) = +3$	$no(\text{Mn}) = -1$	$\text{Mn}^{3+}/\text{Mn}^{2+}$

$\text{I}^-$	$\text{I}_2$	couple
$no(\text{I}) = -1$	$no(\text{I}) = 0$	$\text{I}_2/\text{I}^-$

$\text{Mn}^{3+}/\text{Mn}^{2+}$	$\text{Mn}^{3+} + \text{e}^- = \text{Mn}^{2+}$
$\text{I}_2/\text{I}^-$	$2 \text{ I}^- = \text{I}_2 + 2 \text{ e}^-$

X2

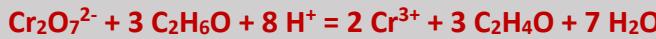
(c)  $\text{Cr}_2\text{O}_7^{2-} + \text{C}_2\text{H}_6\text{O} = \text{Cr}^{3+} + \text{C}_2\text{H}_4\text{O}$ 

$\text{Cr}_2\text{O}_7^{2-}$	$\text{Cr}^{3+}$	couple
$no(\text{Cr}) = +6$	$no(\text{Mn}) = +3$	$\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}$

$\text{C}_2\text{H}_6\text{O}$	$\text{C}_2\text{H}_4\text{O}$	couple
$no(\text{C}) = -2$	$no(\text{C}) = -1$	$\text{C}_2\text{H}_4\text{O}/\text{C}_2\text{H}_6\text{O}$

$\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}$	$\text{Cr}_2\text{O}_7^{2-} + 6 \text{ e}^- + 14 \text{ H}^+ = 2 \text{ Cr}^{3+} + 7 \text{ H}_2\text{O}$
$\text{C}_2\text{H}_4\text{O}/\text{C}_2\text{H}_6\text{O}$	$\text{C}_2\text{H}_6\text{O} = \text{C}_2\text{H}_4\text{O} + 2 \text{ e}^- + 2 \text{ H}^+$

X3

(d)  $\text{ClO}_4^- + \text{NO}_2 = \text{Cl}^- + \text{NO}_3^-$ 

$\text{ClO}_4^-$	$\text{Cl}^-$	couple
$no(\text{Cl}) = +7$	$no(\text{Cl}) = -1$	$\text{ClO}_4^- / \text{Cl}^-$

$\text{NO}_2$	$\text{NO}_3^-$	couple
$no(\text{N}) = +4$	$no(\text{N}) = +5$	$\text{NO}_3^- / \text{NO}_2$

$\text{ClO}_4^- / \text{Cl}^-$	$\text{ClO}_4^- + 8 \text{ H}^+ + 8 \text{ e}^- = \text{Cl}^- + 4 \text{ H}_2\text{O}$
$\text{NO}_3^- / \text{NO}_2$	$\text{NO}_2 + \text{H}_2\text{O} = \text{NO}_3^- + \text{e}^- + 2 \text{ H}^+$

X8

(e)  $\text{MnO}_4^- + \text{Fe}^{2+} = \text{Mn}^{2+} + \text{Fe}^{3+}$ 

$\text{MnO}_4^-$	$\text{Mn}^{2+}$	couple
$no(\text{Mn}) = +7$	$no(\text{Mn}) = +2$	$\text{MnO}_4^- / \text{Mn}^{2+}$

$\text{Fe}^{2+}$	$\text{Fe}^{3+}$	couple
$no(\text{Fe}) = +2$	$no(\text{Fe}) = +3$	$\text{Fe}^{3+} / \text{Fe}^{2+}$

$\text{MnO}_4^- / \text{Mn}^{2+}$	$\text{MnO}_4^- + 8 \text{ H}^+ + 5 \text{ e}^- = \text{Mn}^{2+} + 4 \text{ H}_2\text{O}$
$\text{Fe}^{3+} / \text{Fe}^{2+}$	$\text{Fe}^{2+} = \text{Fe}^{3+} + \text{e}^-$

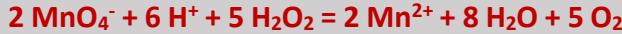
X5



(f)  $\text{MnO}_4^- + \text{H}_2\text{O}_2 = \text{Mn}^{2+} + \text{O}_2$ 

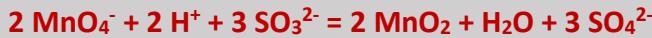
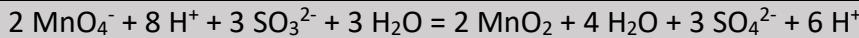
$\text{MnO}_4^-$	$\text{Mn}^{2+}$	couple	$\text{H}_2\text{O}_2$	$\text{O}_2$	couple
$no(Mn) = +7$	$no(Mn) = +2$	$\text{MnO}_4^- / \text{Mn}^{2+}$	$no(O) = -1$	$no(O) = 0$	$\text{O}_2 / \text{H}_2\text{O}_2$

$\text{MnO}_4^- / \text{Mn}^{2+}$	$\text{MnO}_4^- + 8 \text{ H}^+ + 5 \text{ e}^- = \text{Mn}^{2+} + 4 \text{ H}_2\text{O}$	X2
$\text{O}_2 / \text{H}_2\text{O}_2$	$\text{H}_2\text{O}_2 = \text{O}_2 + 2 \text{ e}^- + 2 \text{ H}^+$	X5

(g)  $\text{SO}_3^{2-} + \text{MnO}_4^- = \text{SO}_4^{2-} + \text{MnO}_2$ 

$\text{MnO}_4^-$	$\text{MnO}_2$	couple	$\text{SO}_3^{2-}$	$\text{SO}_4^{2-}$	couple
$no(Mn) = +7$	$no(Mn) = +4$	$\text{MnO}_4^- / \text{MnO}_2$	$no(S) = +4$	$no(S) = +6$	$\text{SO}_4^{2-} / \text{SO}_3^{2-}$

$\text{MnO}_4^- / \text{MnO}_2$	$\text{MnO}_4^- + 4 \text{ H}^+ + 3 \text{ e}^- = \text{MnO}_2 + 2 \text{ H}_2\text{O}$	X2
$\text{SO}_4^{2-} / \text{SO}_3^{2-}$	$\text{SO}_3^{2-} + \text{H}_2\text{O} = \text{SO}_4^{2-} + 2 \text{ e}^- + 2 \text{ H}^+$	X3

(h)  $\text{MnO}_4^- + \text{MnO}_2 = \text{MnO}_4^{2-}$ 

$\text{MnO}_4^-$	$\text{MnO}_4^{2-}$	couple	$\text{MnO}_2$	$\text{MnO}_4^{2-}$	couple
$no(Mn) = +7$	$no(Mn) = +6$	$\text{MnO}_4^- / \text{MnO}_4^{2-}$	$no(Mn) = +4$	$no(Mn) = +6$	$\text{MnO}_4^{2-} / \text{MnO}_2$

$\text{MnO}_4^- / \text{MnO}_4^{2-}$	$\text{MnO}_4^- + \text{e}^- = \text{MnO}_4^{2-}$	X2
$\text{MnO}_4^{2-} / \text{MnO}_2$	$\text{MnO}_2 + 2 \text{ H}_2\text{O} = \text{MnO}_4^{2-} + 2 \text{ e}^- + 4 \text{ H}^+$	

$\text{MnO}_2 + 2 \text{ H}_2\text{O} + 2 \text{ MnO}_4^- = 3 \text{ MnO}_4^{2-} + 4 \text{ H}^+$   
 $\text{MnO}_2 + 2 \text{ H}_2\text{O} + 2 \text{ MnO}_4^- + 4 \text{ OH}^- = 3 \text{ MnO}_4^{2-} + 4 \text{ H}^+ + 4 \text{ OH}^-$   
 $\text{MnO}_2 + 2 \text{ H}_2\text{O} + 2 \text{ MnO}_4^- + 4 \text{ OH}^- = 3 \text{ MnO}_4^{2-} + 4 \text{ H}_2\text{O}$   
 $\text{MnO}_2 + 2 \text{ MnO}_4^- + 4 \text{ OH}^- = 3 \text{ MnO}_4^{2-} + 2 \text{ H}_2\text{O}$

(i)  $\text{NH}_3 + \text{OCl}^- = \text{Cl}_2 + \text{N}_2\text{H}_4$ 

$\text{NH}_3$	$\text{N}_2\text{H}_4$	couple	$\text{OCl}^-$	$\text{Cl}_2$	couple
$no(H) = -3$	$no(Mn) = -2$	$\text{N}_2\text{H}_4 / \text{NH}_3$	$no(Cl) = +1$	$no(Cl) = 0$	$\text{OCl}^- / \text{Cl}_2$

$\text{N}_2\text{H}_4 / \text{NH}_3$	$2 \text{ NH}_3 = \text{N}_2\text{H}_4 + 2 \text{ e}^- + 2 \text{ H}^+$
$\text{OCl}^- / \text{Cl}_2$	$2 \text{ OCl}^- + 2 \text{ e}^- + 4 \text{ H}^+ = \text{Cl}_2 + 2 \text{ H}_2\text{O}$

$2 \text{ NH}_3 + 2 \text{ OCl}^- + 4 \text{ H}^+ = \text{N}_2\text{H}_4 + 2 \text{ H}^+ + \text{Cl}_2 + 2 \text{ H}_2\text{O}$   
 $2 \text{ NH}_3 + 2 \text{ OCl}^- + 2 \text{ H}^+ = \text{N}_2\text{H}_4 + \text{Cl}_2 + 2 \text{ H}_2\text{O}$   
 $2 \text{ NH}_3 + 2 \text{ OCl}^- + 2 \text{ H}^+ + 2 \text{ OH}^- = \text{N}_2\text{H}_4 + \text{Cl}_2 + 2 \text{ H}_2\text{O} + 2 \text{ OH}^-$   
 $2 \text{ NH}_3 + 2 \text{ OCl}^- + 2 \text{ H}_2\text{O} = \text{N}_2\text{H}_4 + \text{Cl}_2 + 2 \text{ H}_2\text{O} + 2 \text{ OH}^-$   
 $\text{2 NH}_3 + 2 \text{ OCl}^- = \text{N}_2\text{H}_4 + \text{Cl}_2 + 2 \text{ OH}^-$



$\text{Cr}_2\text{O}_7^{2-}$	$\text{Cr}^{3+}$	couple
$no(\text{Cr}) = +6$	$no(\text{Mn}) = +3$	$\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}$

$\text{Cl}^-$	$\text{Cl}_2$	couple
$no(\text{Cl}) = -1$	$no(\text{Cl}) = 0$	$\text{Cl}_2/\text{Cl}^-$

$\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}$	$\text{Cr}_2\text{O}_7^{2-} + 6 \text{e}^- + 14 \text{H}^+ = 2 \text{Cr}^{3+} + 7 \text{H}_2\text{O}$	
$\text{Cl}_2/\text{Cl}^-$	$2 \text{Cl}^- = \text{Cl}_2 + 2 \text{e}^-$	X3
	$\text{Cr}_2\text{O}_7^{2-} + 14 \text{H}^+ + 6 \text{Cl}^- = 2 \text{Cr}^{3+} + 7 \text{H}_2\text{O} + 3 \text{Cl}_2$	
	$\text{Cr}_2\text{O}_7^{2-} + 14 \text{H}^+ + 14 \text{OH}^- + 6 \text{Cl}^- = 2 \text{Cr}^{3+} + 7 \text{H}_2\text{O} + 3 \text{Cl}_2 + 14 \text{OH}^-$	
	$\text{Cr}_2\text{O}_7^{2-} + 14 \text{H}_2\text{O} + 6 \text{Cl}^- = 2 \text{Cr}^{3+} + 7 \text{H}_2\text{O} + 3 \text{Cl}_2 + 14 \text{OH}^-$	
	<b><math>\text{Cr}_2\text{O}_7^{2-} + 7 \text{H}_2\text{O} + 6 \text{Cl}^- = 2 \text{Cr}^{3+} + 3 \text{Cl}_2 + 14 \text{OH}^-</math></b>	