

Fiche 9 :

Les réactions d'oxydoréduction

Exercice 1

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

Cl_2	Cl^-	couple
$no(\text{Cl}) = 0$	$no(\text{Cl}) = -1$	Cl_2/Cl^-

Br^-	Br_2	couple
$no(\text{Br}) = -1$	$no(\text{Br}) = 0$	Br_2/Br^-

Cl_2/Cl^-	$\text{Cl}_2 + 2 \text{e}^- = 2 \text{Cl}^-$
Br_2/Br^-	$2 \text{Br}^- = \text{Br}_2 + 2 \text{e}^-$

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

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

I^-	I_2	couple
$no(\text{I}) = -1$	$no(\text{I}) = 0$	I_2/I^-

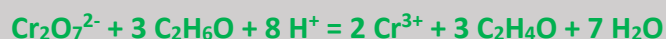
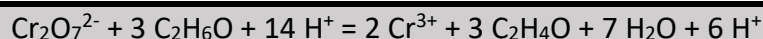
$\text{Mn}^{3+}/\text{Mn}^{2+}$	$\text{Mn}^{3+} + \text{e}^- = \text{Mn}^{2+}$	X2
I_2/I^-	$2 \text{I}^- = \text{I}_2 + 2 \text{e}^-$	

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

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

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

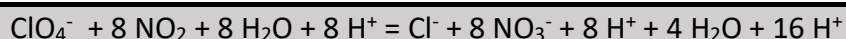
$\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}$	$\text{Cr}_2\text{O}_7^{2-} + 6 \text{e}^- + 14 \text{H}^+ = 2 \text{Cr}^{3+} + 7 \text{H}_2\text{O}$	X3
$\text{C}_2\text{H}_4\text{O}/\text{C}_2\text{H}_6\text{O}$	$\text{C}_2\text{H}_6\text{O} = \text{C}_2\text{H}_4\text{O} + 2 \text{e}^- + 2 \text{H}^+$	

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

ClO_4^-	Cl^-	couple
$no(\text{Cl}) = +7$	$no(\text{Cl}) = -1$	$\text{ClO}_4^-/\text{Cl}^-$

NO_2	NO_3^-	couple
$no(\text{N}) = +4$	$no(\text{N}) = +5$	$\text{NO}_3^-/\text{NO}_2$

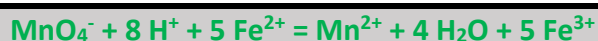
$\text{ClO}_4^-/\text{Cl}^-$	$\text{ClO}_4^- + 8 \text{H}^+ + 8 \text{e}^- = \text{Cl}^- + 4 \text{H}_2\text{O}$	X8
$\text{NO}_3^-/\text{NO}_2$	$\text{NO}_2 + \text{H}_2\text{O} = \text{NO}_3^- + \text{e}^- + 2 \text{H}^+$	

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

MnO_4^-	Mn^{2+}	couple
$no(\text{Mn}) = +7$	$no(\text{Mn}) = +2$	$\text{MnO}_4^-/\text{Mn}^{2+}$

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

$\text{MnO}_4^-/\text{Mn}^{2+}$	$\text{MnO}_4^- + 8 \text{H}^+ + 5 \text{e}^- = \text{Mn}^{2+} + 4 \text{H}_2\text{O}$	X5
$\text{Fe}^{3+}/\text{Fe}^{2+}$	$\text{Fe}^{2+} = \text{Fe}^{3+} + \text{e}^-$	



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

MnO₄⁻	MnO₂	couple	SO₃²⁻	SO₄²⁻	couple
<i>no(Mn) = +7</i>	<i>no(Mn) = +4</i>	MnO₄⁻ / MnO₂	<i>no(S) = +4</i>	<i>no(S) = +6</i>	SO₄²⁻ / SO₃²⁻

MnO ₄ ⁻ / MnO ₂	MnO ₄ ⁻ + 4 H ⁺ + 3 e ⁻ = MnO ₂ + 2 H ₂ O	X2
SO ₄ ²⁻ / SO ₃ ²⁻	SO ₃ ²⁻ + H ₂ O = SO ₄ ²⁻ + 2 e ⁻ + 2 H ⁺	X3
2 MnO ₄ ⁻ + 8 H ⁺ + 3 SO ₃ ²⁻ + 3 H ₂ O = 2 MnO ₂ + 4 H ₂ O + 3 SO ₄ ²⁻ + 6 H ⁺		
2 MnO₄⁻ + 2 H⁺ + 3 SO₃²⁻ = 2 MnO₂ + H₂O + 3 SO₄²⁻		

(7) En milieu basique : $\text{MnO}_4^- + \text{MnO}_2 = \text{MnO}_4^{2-}$

MnO₄⁻	MnO₄²⁻	couple	MnO₂	MnO₄²⁻	couple
<i>no(Mn) = +7</i>	<i>no(Mn) = +6</i>	MnO₄⁻ / MnO₄²⁻	<i>no(Mn) = +4</i>	<i>no(Mn) = +6</i>	MnO₄²⁻ / MnO₂

MnO ₄ ⁻ / MnO ₄ ²⁻	MnO ₄ ⁻ + e ⁻ = MnO ₄ ²⁻	X2
MnO ₄ ²⁻ / MnO ₂	MnO ₂ + 2 H ₂ O = MnO ₄ ²⁻ + 2 e ⁻ + 4 H ⁺	
MnO ₂ + 2 H ₂ O + 2 MnO ₄ ⁻ = 3 MnO ₄ ²⁻ + 4 H ⁺		
MnO ₂ + 2 H ₂ O + 2 MnO ₄ ⁻ + 4 OH ⁻ = 3 MnO ₄ ²⁻ + 4 H ⁺ + 4 OH ⁻		
MnO ₂ + 2 H ₂ O + 2 MnO ₄ ⁻ + 4 OH ⁻ = 3 MnO ₄ ²⁻ + 4 H ₂ O		
MnO₂ + 2 MnO₄⁻ + 4 OH⁻ = 3 MnO₄²⁻ + 2 H₂O		

(8) En milieu basique : $\text{NH}_3 + \text{OCl}^- = \text{Cl}_2 + \text{N}_2\text{H}_4$

NH₃	N₂H₄	couple	OCl⁻	Cl₂	couple
<i>no(H) = -3</i>	<i>no(Mn) = -2</i>	N₂H₄ / NH₃	<i>no(Cl) = +1</i>	<i>no(Cl) = 0</i>	OCl⁻ / Cl₂

N ₂ H ₄ / NH ₃	2 NH ₃ = N ₂ H ₄ + 2 e ⁻ + 2 H ⁺	
OCl ⁻ / Cl ₂	2 OCl ⁻ + 2 e ⁻ + 4 H ⁺ = Cl ₂ + 2 H ₂ O	
2 NH ₃ + 2 OCl ⁻ + 4 H ⁺ = N ₂ H ₄ + 2 H ⁺ + Cl ₂ + 2 H ₂ O		
2 NH ₃ + 2 OCl ⁻ + 2 H ⁺ = N ₂ H ₄ + Cl ₂ + 2 H ₂ O		
2 NH ₃ + 2 OCl ⁻ + 2 H ⁺ + 2 OH ⁻ = N ₂ H ₄ + Cl ₂ + 2 H ₂ O + 2 OH ⁻		
2 NH ₃ + 2 OCl ⁻ + 2 H ₂ O = N ₂ H ₄ + Cl ₂ + 2 H ₂ O + 2 OH ⁻		
2 NH₃ + 2 OCl⁻ = N₂H₄ + Cl₂ + 2 OH⁻		

(9) En milieu basique : $\text{Cr}_2\text{O}_7^{2-} + \text{Cl}^- = \text{Cr}^{3+} + \text{Cl}_2$

Cr₂O₇²⁻	Cr³⁺	couple	Cl⁻	Cl₂	couple
<i>no(Cr) = +6</i>	<i>no(Mn) = +3</i>	Cr₂O₇²⁻ / Cr³⁺	<i>no(Cl) = -1</i>	<i>no(Cl) = 0</i>	Cl₂ / Cl⁻

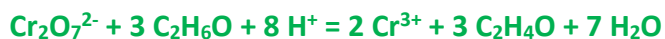
Cr ₂ O ₇ ²⁻ / Cr ³⁺	Cr ₂ O ₇ ²⁻ + 6 e ⁻ + 14 H ⁺ = 2 Cr ³⁺ + 7 H ₂ O	
Cl ₂ / Cl ⁻	2 Cl ⁻ = Cl ₂ + 2 e ⁻	X3
Cr ₂ O ₇ ²⁻ + 14 H ⁺ + 6 Cl ⁻ = 2 Cr ³⁺ + 7 H ₂ O + 3 Cl ₂		
Cr ₂ O ₇ ²⁻ + 14 H ⁺ + 14 OH ⁻ + 6 Cl ⁻ = 2 Cr ³⁺ + 7 H ₂ O + 3 Cl ₂ + 14 OH ⁻		
Cr ₂ O ₇ ²⁻ + 14 H ₂ O + 6 Cl ⁻ = 2 Cr ³⁺ + 7 H ₂ O + 3 Cl ₂ + 14 OH ⁻		
Cr₂O₇²⁻ + 7 H₂O + 6 Cl⁻ = 2 Cr³⁺ + 3 Cl₂ + 14 OH⁻		

Exercice 2



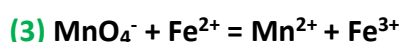
$\text{Cr}_2\text{O}_7^{2-}$	Cr^{3+}	couple
$no(\text{Cr}) = +6$	$no(\text{Mn}) = +3$	$\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}$

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



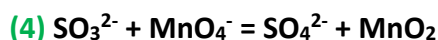
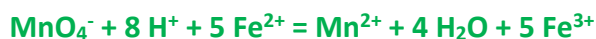
ClO_4^-	Cl^-	couple
$no(\text{Cl}) = +7$	$no(\text{Cl}) = -1$	$\text{ClO}_4^-/\text{Cl}^-$

NO_2	NO_3^-	couple
$no(\text{N}) = +4$	$no(\text{N}) = +5$	$\text{NO}_3^-/\text{NO}_2$



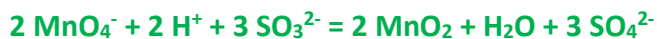
MnO_4^-	Mn^{2+}	couple
$no(\text{Mn}) = +7$	$no(\text{Mn}) = +2$	$\text{MnO}_4^-/\text{Mn}^{2+}$

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



MnO_4^-	MnO_2	couple
$no(\text{Mn}) = +7$	$no(\text{Mn}) = +4$	$\text{MnO}_4^-/\text{MnO}_2$

SO_3^{2-}	SO_4^{2-}	couple
$no(\text{S}) = +4$	$no(\text{S}) = +6$	$\text{SO}_4^{2-}/\text{SO}_3^{2-}$



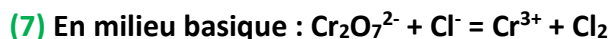
MnO_4^-	MnO_4^{2-}	couple
$no(\text{Mn}) = +7$	$no(\text{Mn}) = +6$	$\text{MnO}_4^-/\text{MnO}_4^{2-}$

MnO_2	MnO_4^{2-}	couple
$no(\text{Mn}) = +4$	$no(\text{Mn}) = +6$	$\text{MnO}_4^{2-}/\text{MnO}_2$



NH_3	N_2H_4	couple
$no(\text{H}) = -3$	$no(\text{Mn}) = -2$	$\text{N}_2\text{H}_4/\text{NH}_3$

OCl^-	Cl_2	couple
$no(\text{Cl}) = +1$	$no(\text{Cl}) = 0$	OCl^-/Cl_2



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

Cl^-	Cl_2	couple
$no(\text{Cl}) = -1$	$no(\text{Cl}) = 0$	Cl_2/Cl^-

