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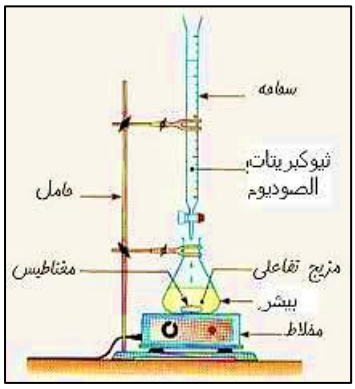
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سماعه
ثيوكبريتات الصوديوم
حامل
مغناطيس
مزيج تفاعلي
بيشر
مفلاط

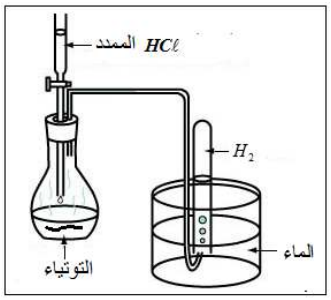
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5

$v = \frac{dx}{dt}$		
$v = \frac{1}{V} \times \frac{dx}{dt}$		
$v = \frac{dn}{dt}$		
$v = \frac{dc}{dt}$ $v = \frac{1}{V} \times \frac{dn}{dt}$		
$v = -\frac{dn}{dt}$		
$v = -\frac{dc}{dt}$ $v = -\frac{1}{V} \times \frac{dn}{dt}$		

6

$N_A = 6{,}023.10^{23}$	N_A N	$n = \frac{N}{N_A}$	(mol)	n
(g/mol)	M	$n = \frac{m}{M}$		
(g)	m			
(L)	V_g	$n = \frac{V_g}{V_M}$		
(L/mol)	V_M			
(mol)	n	$c = \frac{n}{V}$	$(mol/)$	c
(L)	V			
(g)	m	$c_m = \frac{m}{V}$	(g/L)	t c_m
(L)	V			
(g)	m	$\rho = \frac{m}{V}$	(g/mL)	ρ
(mL)	V			
$\rho_e = 1\,g/ml = 1kg/l$	ρ_e	$d = \frac{\rho}{\rho_e}$		d
(g/ml)	ρ			
	ρ_g	$d = \frac{\rho_g}{\rho_a}$		
	ρ_a			
g/mol	M	$d = \frac{M}{29}$		
$V_e = V_2 - V_1$	c_1 c_2 V_1 V_2 V	$c_1V_1 = c_2V_2$		
	c_1 c_2 V_1 V_2	$F = \frac{c_1}{c_2} = \frac{V_2}{V_1}$		F
	P d M	$C = \frac{10.P.d}{M}$		
( )	I	$G = \frac{I}{U} = \frac{1}{R} = k\sigma$	(S)	G
( )	U			
(Ω)	R			
$k = \frac{s}{L}$ ( )	k			
$(S.m/mol)$	λ_1	$\sigma = \lambda_1[X_1] + \lambda_2[X_2] + \cdots$	(S/m)	σ
(mol/m^3)	$[X_1]$			

2011 1

$(2K^+ + S_2O_8^{2-})$ $V_1 = 200ml$ $t = 0$

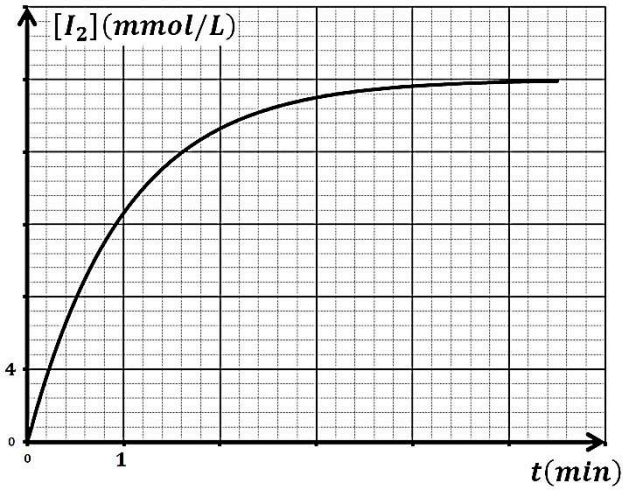
$(K^+ + I^-)$ $V_2 = 200ml$ $C_1 = 0.04\ mol/l$

$C_2 = 0.4\ mol/l$

(I_2/I^-) $(S_2O_8^{2-}/SO_4)$ Ox/Red 1

I_2 2

$[I_2] = f(t)$



3

$V = 10ml$

$(2Na^+ + S_2O_3^{2-})$

$C' = 0.01\,mol/l$

$$I_{2(aq)} + 2S_2O_3^{2-}{}_{(aq)} = 2I^-{}_{(aq)} + S_4O_6^{2-}{}_{(aq)}$$

$10ml$

E V_E V, C', V_E $[I_2]$

$t = 1.2min$ V_E

2011 2

$C_1 = 0.045\,mol/l$ H_2O_2 $V_1 = 100ml$ (S)

$C_2 = 0.2\,mol/l$ $(K^+ + I^-)$ $V_2 = 100ml$

(H_2O_2/H_2O) (I_2/I^-)

$t = 3min$ $V = 20ml$ (S)

$(2Na^+ + S_2O_3{}^{2+})$ $I_{2(aq)}$

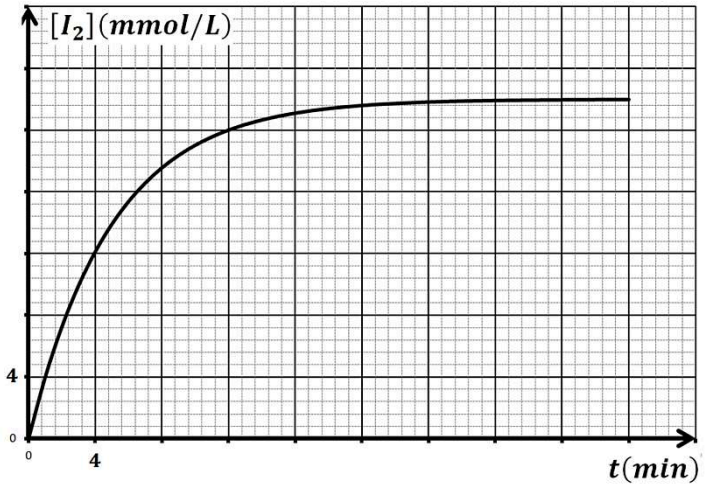
$C = 1.0\,mol/l$

V_E

-

$$I_{2(aq)} + 2S_2O_3^{2-}{}_{(aq)} = 2I^-{}_{(aq)} + S_4O_6^{2-}{}_{(aq)}$$

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t -

$[I_2] = \frac{CV_E}{2V}$

$[I_2]_f$

I_2

$t = 8min$

$t = 0s$

$c_1 = 0.05\,mol/l$ $V_1 = 368ml$ (s)

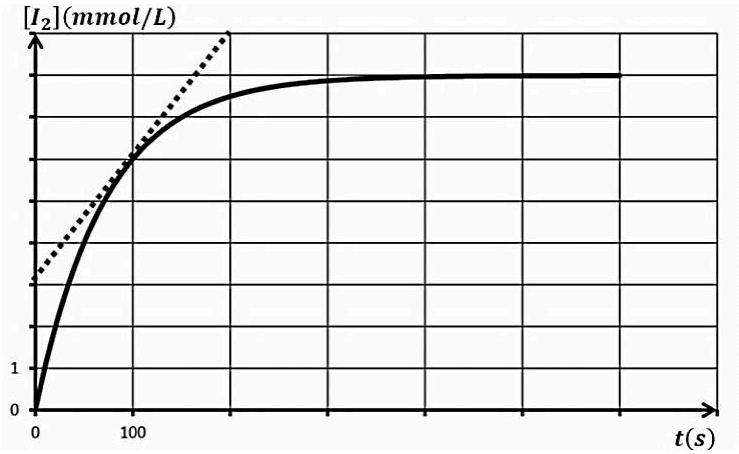
$c_2 = 0.1\,mol/l$ $V_2 = 32ml$

$H_2O_{2(aq)} + 2I^-{}_{(aq)} + 2H^+{}_{(aq)} = 2H_2O_{(l)} + I_{2(aq)}$

(s) $V = 40ml$ t

$c_3 = 0.1\,mol/l$ $\left(2\mathrm{Na}^+{}_{(aq)} + S_2O_3^{2-}{}_{(aq)}\right)$

t



$40ml$

I_2/I^- ; $S_4O_6^{2-}/S_2O_3^{2-}$

V_E V $[I_2]$

c_3

$t = 100s$ v

$t_{\frac{1}{2}}$

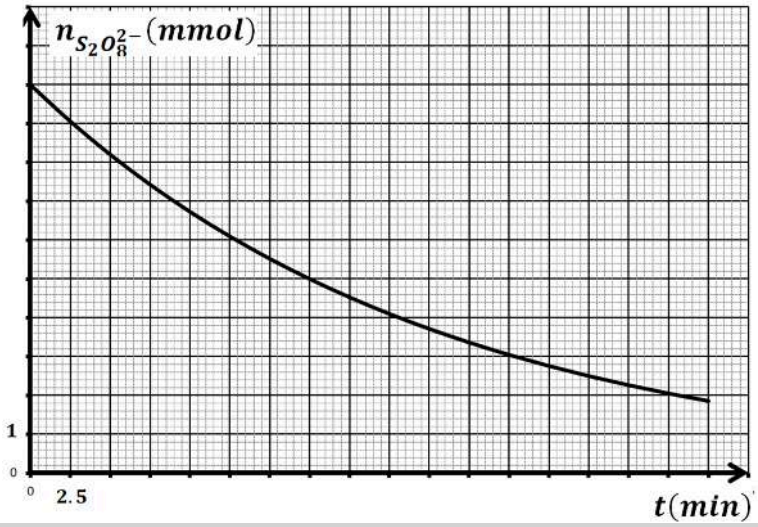
$(2K^+ + S_2O_8^{2-})$ (S_1)

$V_1 = 50ml$ $t = 0$ $(K^+ + I^-)$ (S_2)

$C_2 = 1.0\ mol/l$ (S_2) $.2\ mol/l$ (S_1)

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$S_2O_8^{2-}$



$$2I^-_{(aq)} + S_2O_8^{2-}{}_{(aq)} = I_{2(aq)} + 2SO_{4(aq)}$$

Ox/Red

$t_{\frac{1}{2}}$

$t_{\frac{1}{2}}$

$t = 10min$

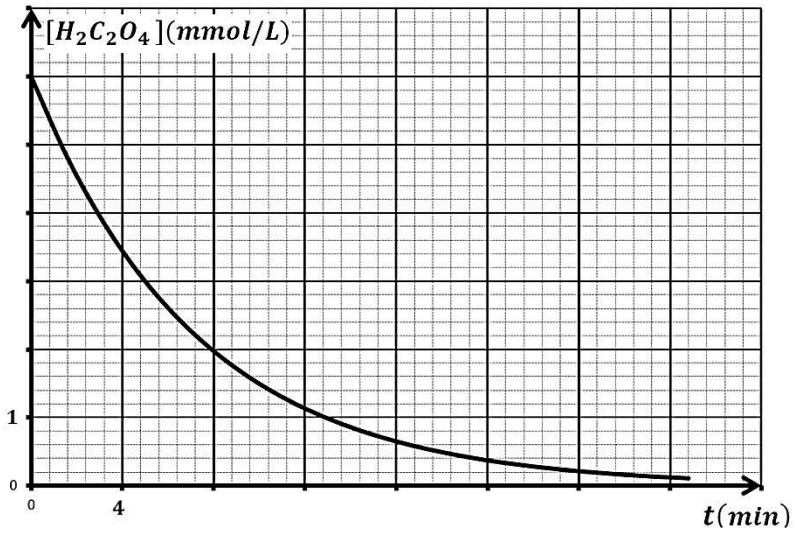
$V_1 = 50ml$ $t = 0$ $Cr_2O_7^{2-}$ $H_2C_2O_4$

$V_2 = 50ml$ $c_1 = 12\ mmol/l$

$c_2 = 16\,mmol/l$ $(2K^+ + Cr_2O_7^{2-})$

$$3H_2C_2O_4{}_{(aq)} + Cr_2O_7^{2-}{}_{(aq)} + 8\,H^+{}_{(aq)} = 2Cr^{3+}{}_{(aq)} + 6CO_{2(aq)} + 7H_2O_{(l)}$$

Ox/Red 1



$$[Cr^{3+}] = \frac{c_1}{3} - \frac{2[H_2C_2O_4]}{3}$$

2

$$v = -\frac{1}{3} \times \frac{d[H_2C_2O_4]}{dt}$$

$t = 12min$ $t = 4min$

CO_2

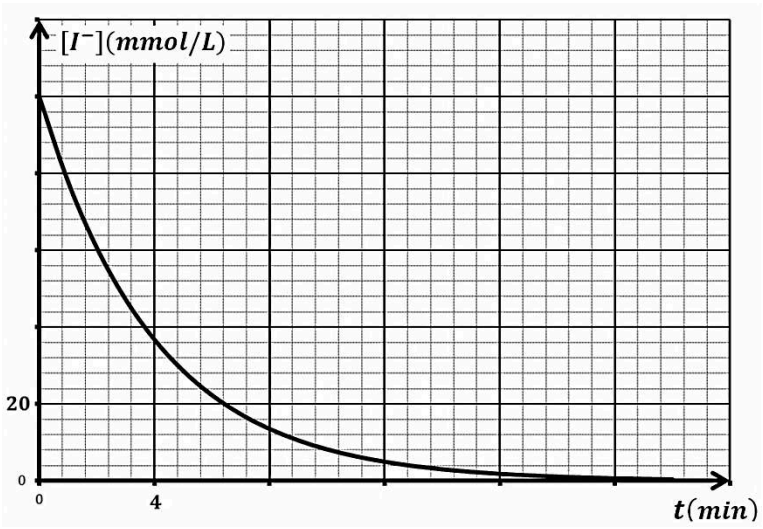
3

6

ClO^- $V_1 = 50ml$

$C_2 = 0.20\,mol/l$ $(K^+ + I^-)$ $V_2 = 50ml$ $C_1 = 0.56\,mol/l$

$$ClO^-_{(aq)} + 2I^-_{(aq)} + 2H^+_{(aq)} = Cl^-_{(aq)} + I_{2(aq)} + H_2O_{(l)}$$



Ox/Red 1

2

$[I^-]_0$ $[ClO^-]_0$ 3

4

5

$[I^-] = \frac{C_2}{2} - 2[I_2]$ 6

$[ClO^-] = \frac{C_1}{2} - [I_2]$

7

$V = 10ml$

$(2Na^+ + {S_2O_3}^{2-})$

. $C_0 = 0.04\,mol/l$

${S_4O_6}^{2-}/{S_2O_3}^{2-}$ I_2/I^-

c V_E V $[I_2]$

$t = 4min$ V_E

$t = 4min$

$t = 0$ 8

$(K^+ + MnO_4^-)$ $V_1 = 50ml$ $t = 0$

$c_2 = 0.6\,mol/L$ $H_2C_2O_4$ $V_2 = 50ml$ $c_1 = 0.2\,mol/L$

MnO_4^- Mn^{+2} CO_2 $H_2C_2O_4$

MnO_4^-

$t\,(min)$								
$[MnO_4^-](\times 10^{-3} mol.L^{-1})$								

$H_2C_2O_4$ MnO_4^-

$[Mn^{+2}](t) = \frac{c_1}{2} - [MnO_4^-](t)$ t $[Mn^{+2}]$

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$[MnO_4^-]$

$t = 2min$ $[MnO_4^-]$

$Cr_2O_7^{2-}$ $C_2H_6O_{(l)}$

$\rho = 0.8g/ml$ $V_1 = 3{,}4ml$ $t = 0$

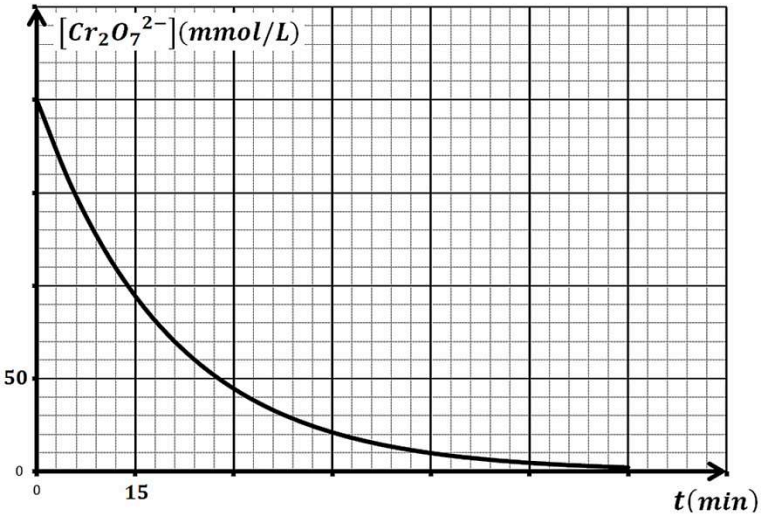
$(2K^+ + Cr_2O_7^{2-})$ $V_2 = 100ml$ $M = 46g/mol$

$C_2 = 0{,}2mol/l$

$[Cr_2O_7{}^{2-}]$

$V_T \approx 100ml$

$(C_2H_4O_2/C_2H_6O)$ $(Cr_2O_7{}^{2-}/Cr^{3+})$



Cr^{3+}

$n_{Cr^{3+}} = 2V_T(C_2 - [Cr_2O_7{}^{2-}])$

$Cr_2O_7{}^{2-}$ v

$t = 15min$

Cr^{3+}

$v_{Cr^{3+}} = 2 \times V_T \times v$

$t = 30min$

CH_4O $(K^+ + MnO_4^-)$

$C_1 = 0.2mol/l$ $V_1 = 100ml$

$\rho = 0.32g/ml$ $V = 2ml$

$V_1 = 100ml$

CH_2O_2 / CH_4O MnO_4^-/Mn^{2+}

$[CH_4O] = \frac{\rho V}{MV_1} - \frac{5n_{(Mn^{2+})}}{4V_1}$ $[CH_4O]$

Mn^{2+}

$t\ (s)$	0	5	10	15	25	30	40	50	60
$n_{(Mn^{2+})}\ (mmol)$	0	4	6	8.5	11	12	14	15	16

$n_{(Mn^{2+})}$

$t_{1/2}$

$t = 30s$ $t = 10s$ Mn^{2+} v

$v_{vol} = \frac{5v}{4V_1}$ CH_4O v_{vol}

$O = 16g/mol$ $C = 12g/mol$ $H = 1g/mol$

$\theta = 12°C$ H_2O_2

$2H_2O_2 = 2H_2O + O_2$

$V_M = 24l/mol$

$[H_2O_2]_0 = 0.08\ mol/l$ $V_S = 500ml$ $t = 0$

O_2

$t\ (min)$	0	4	8	12	16	20	24	28	32	36	40
$V_{O_2}\ (ml)$	0	60	114	162	204	234	253	276	288	294	300
$[H_2O_2](mol/l)$											

V_M V_S V_{O_2} $[H_2O_2]_0$ t $[H_2O_2]$

$[H_2O_2] = (t)$

$t = 24min$ $t = 16min$

$t_{\frac{1}{2}}$

$[H_2O_2]$ $\theta` = 35°C$

11

$(H^+ + Cl^-)$

$Zn_{(s)} + 2H^+_{(aq)} = Zn^{2+}_{(aq)} + H_{2(g)}$

$V = 40\ ml$ $m = 1g$ $t = 0$

$C = 0.05mol/l$

$V_M = 25\ l/mol$ V_{H_2}

$t\ (min)$	0	1	2	3	4	5
$V_{H_2}\ (ml)$	0	6.3	9.9	12	13.5	14.2

V V_M V_{H_2} C $[H^+]$

H^+ $[H^+] = f(t)$

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$t = 5min$

$t = 5min$

$t = 4min$ $t = 0$ H^+

$M(Zn) = 65.4\ g/mol$

$(K^+ + I^-)$ $H_2O_{2(aq)}$

$H_2O_{2(aq)} + 2I^-{}_{(aq)} + 2H_3O^+{}_{(aq)} = 4H_2O_{(l)} + I_{2(aq)}$

$V_1 = 100ml$ $25℃$ $t = 0s$

$c_2 = 6 \times 10^{-2}\ mol/l$ $V_2 = 100ml$ $c_1 = 4.5 \times 10^{-2}\ mol/l$

$\left(2H_3O^+{}_{(aq)} + SO_4{}^-{}_{(aq)}\right)$

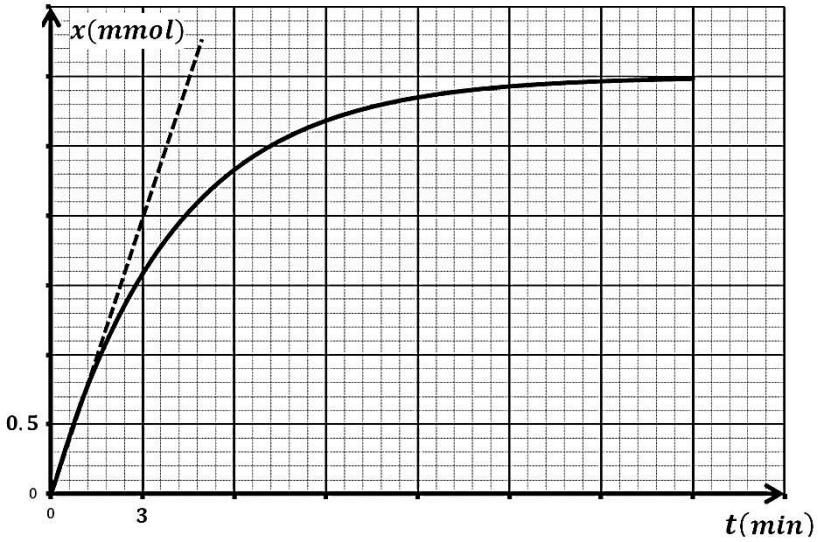
$n_0(I^-)$ $n_0(H_2O_2)$

معادلة التفاعل		$H_2O_{2(aq)} + 2I^-{}_{(aq)} + 2H_3O^+{}_{(aq)} = 4H_2O_{(l)} + I_{2(aq)}$				
حالة الجملة	التقدم	كميات المادة بـ mol				
الابتدائية	0			بوفرة	بوفرة	
الانتقالية	x			بوفرة	بوفرة	
النهائية	x_f			بوفرة	بوفرة	3×10^{-3}

t $I_{2(aq)}$

$\left(2Na^+{}_{(aq)} + S_2O_3^{2-}{}_{(aq)}\right)$

$x = f(t)$



$t_0 = 0$

$t_1 = 9min$

I^-

t_1

$20L$ $V = 1L$ 20

H_2O_2 $V_1 = 2mL$ $V_M = 22.4\,L/mol$

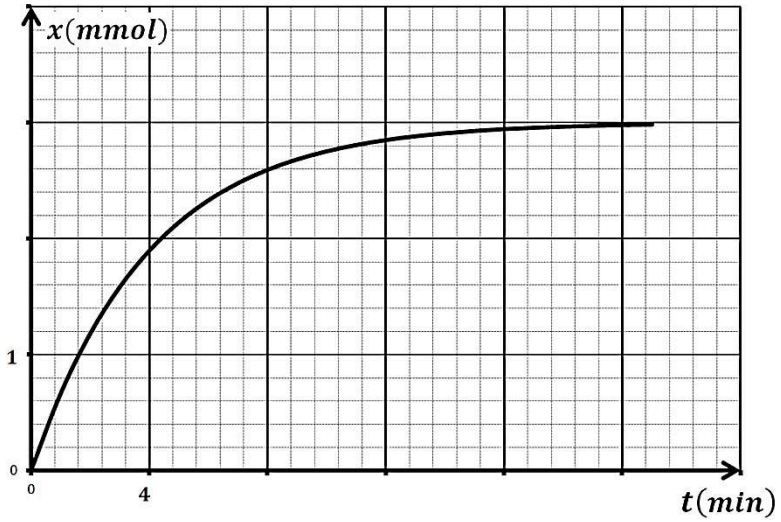
c_2 $(K^+ + I^-)$ $V_2 = 200mL$

$V_T = 200mL$

$$2H_2O_{2(aq)} = O_{2(g)} + 2H_2O_{(l)}$$

$$c_1 = \frac{2V_{O_2}}{V \times V_M}$$

(H_2O/H_2O_2) (I_2/I^-)



x_{max}

c_2

$t = 10min$

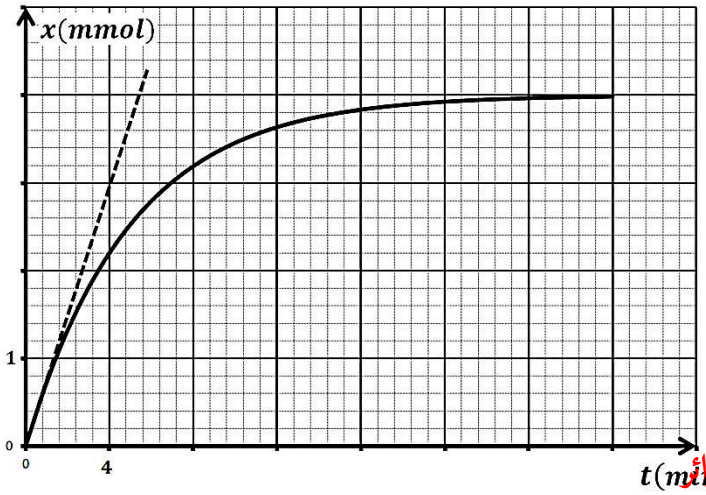
I^-

H_2O_2 I^-

$$H_2O_{2(aq)} + 2I^-_{(aq)} + 2H_3O^+_{(aq)} = I_{2(aq)} + 4H_2O_{(l)}$$

H_2O_2 $V_1 = 100mL$ (S_1) $t = 0$

$C_2 = 0.1mol/L$ $V_2 = 100mL$ KI (S_2) C_1



$x = f(t)$ x

H_2O_2 I^-

$[H_2O_2]_0$ $[I^-]_0$

$[I^-]_0$

V_2 V_1 C_1 $[H_2O_2]_0$

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$[I^-]_f$ $[I_2]_f$

H_2O_2

C_1

$t = 0$

$C'_1 = 0.05mol/L$ H_2O_2

x_f

$t = 0$

$t = 0$ $H_2C_2O_4$ $Cr_2O_7^{2-}$

$c_1 = 0.2\,mol/l$ $(2K^+ + Cr_2O_7^{2-})$ $V_1 = 40ml$

c_2 $V_2 = 60ml$

$Cr_2O_7^{2-}/Cr^{3+}$ $CO_2/H_2C_2O_4$



Cr^{3+3+}

$t = 20min$ Cr^{3+}

x_f

$t_{\frac{1}{2}}$

c_2

C_1 ClO^- $V_1 = 50ml$

C_2 KI $V_2 = 50ml$

(S)

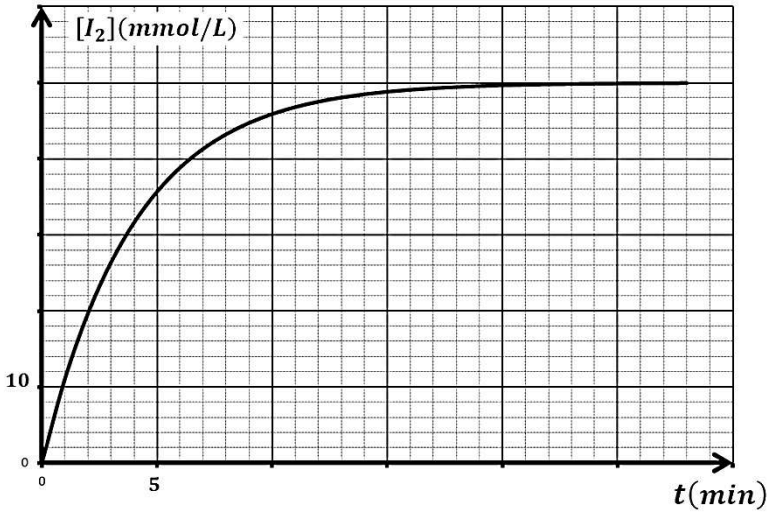
$$ClO^-_{(aq)} + 2I^-_{(aq)} + 2H^+_{(aq)} = Cl^-_{(aq)} + I_{2(aq)} + H_2O_{(l)}$$

(S) $V = 10ml$

$C_0 = 0.04\,mol/l$ $(2Na^+ + {S_2O_3}^{2-})$

${S_4O_6}^{2-}/{S_2O_3}^{2-}$ I_2/I^-

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V_E V $[I_2]$

C_0

C_1 C_2

$t = 5min$ I_2

I^-

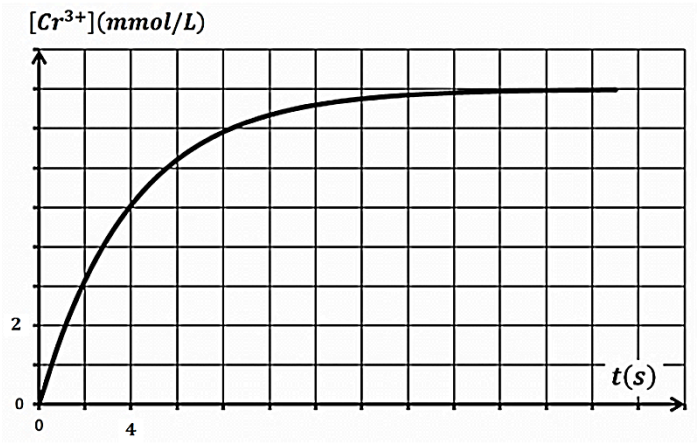
$(2K^+ + Cr_2O_7^{2-})$ $H_2C_2O_4$

$V_1 = 100ml$

$c_2 = 0.8 \times 10^{-2}\, mol/l$ $V_2 = 100ml$ $c_1 = 3 \times 10^{-2}\, mol/l$

$Cr^{3+}{}_{(aq)}$

	$3H_2C_2O_{4\,(qa)} + Cr_2O_7^{2-}{}_{(qa)} + 8\,H^+{}_{(aq)} = 2Cr^{3+}{}_{(aq)} + 6CO_{2(qa)} + 7H_2O_{(l)}$					
الحالة	كمية المادة $mmol$					
الابتدائية			بوفرة			بوفرة
الانتقالية			بوفرة			بوفرة
النهائية			بوفرة			بوفرة



$t_{1/2}$

v

$[Cr^{3+}]$

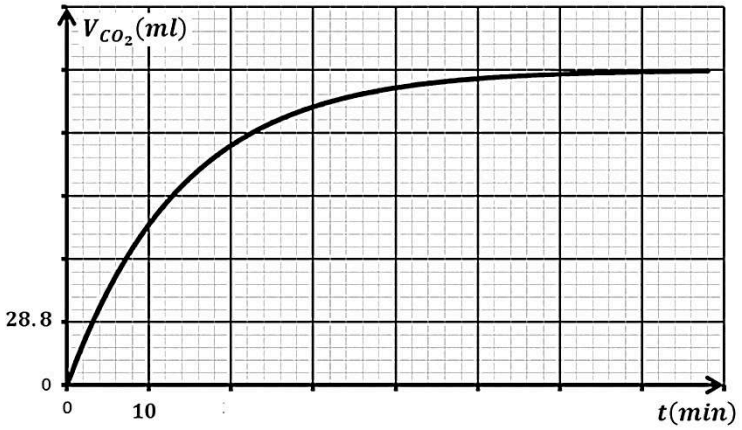
$t = 0s$

$t = 8s$

$c_1 = 0.04\, mol/l$ $(2K^+ + Cr_2O_7^{2-})$ $V_1 = 50ml$

c_2 $H_2C_2O_4$ $V_2 = 30ml$

$(CO_2/H_2C_2$ $^{2-}$قلم الجزائر$^{3+}$ $(\,ox/red\,)$



V_{CO_2}

x_{max}

$t_{\frac{1}{2}}$

c_2

V $v = \frac{1}{6.V.V_M} \times \frac{dV_{CO_2}}{dt}$

$t = 25min$ $t = 0min$

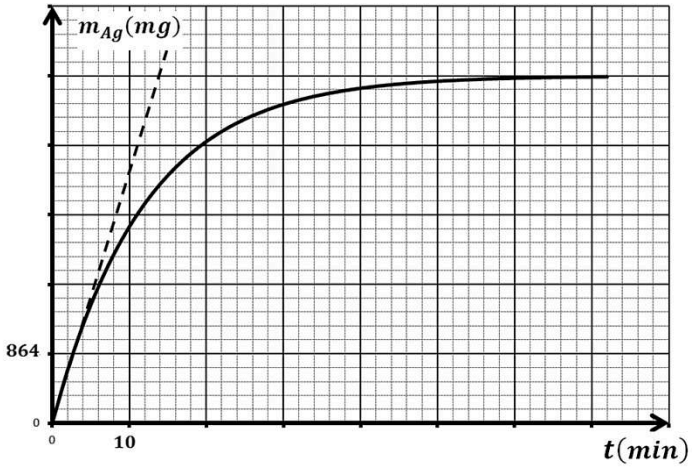
$V_M = 24\,L/mol$ $H_2C_2O_4$

$m = 3.175g$ $t = 0$

C_0 $(Ag^+ + NO_3^-)$ $V = 200mL$

$m_{Ag} = f(t)$

$Cu_{(s)} + 2Ag^+{}_{(aq)} = Cu^{2+}{}_{(aq)} + 2Ag_{(s)}$



(Ox/Red)

x_{max}

C_0

$t_{1/2}$

M_{Ag} $v_{Ag}(t) = \frac{1}{M_{Ag}} \times \frac{dm_{Ag}(t)}{dt}$

$t = 0$

$M_{Cu} = 63.5\ g.mol^{-1}$ $M_{Ag} = 108\ g.mol^{-1}$

$H_2C_2O_4{}_{(aq)}$

$V_1 = 100ml$ $(2K^+ + Cr_2O_7^{2-})$

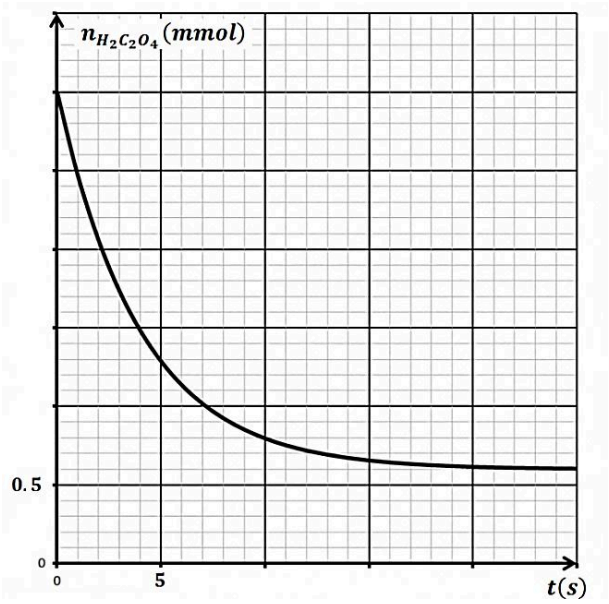
c_2 $V_2 = 100ml$ c_1

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$V_0 = 20ml$

$H_2C_2O_{4\,(aq)}$

V_0



$20ml$

CO_2 $H_2C_2O_4$ $Cr_2O_7{}^{2-}/Cr^{3+}$

$n_0(H_2C_2O_4)$

x_{max}

c_2

c_1

n_f $n_{1/2} = \frac{n_0+n_f}{2}$ $t = t_{1/2}$

$t_{1/2}$ n_0

$t = 8s$ v

$(H_3O^+ + Cl^-)$ Al

$$2Al_{(s)} + 6H_3O^+{}_{(aq)} = 2Al^{3+}{}_{(aq)} + 3H_{2\,(g)} + 6H_2O_{(l)}$$

$V = 100mL$ $t = 0$ m_0 Al

C

t

$t(min)$	0	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
$m(g)$	4.05	2.84	2.27	1.94	1.78	1.70	1.64	1.62	1.62

$m = m_0 - \frac{2M \times V_{H_2}}{3V_M}$ m

$m(t)$

$1cm \rightarrow 1\,min$; $1cm \rightarrow 0.5g$

C $n_0(H_3O^+)$ $n_0(Al)$

$m_{1/2} = \frac{m_0+m_f}{2}$ $t = t_{1/2}$

$t_{1/2}$ m_f

$t = 3min$ $v_V = -\frac{1}{2.V.M} \times \frac{dm}{dt}$

$M = 27\ g/mol$

$S_2O_8{}^{2-}$ I^-

$2I^-_{(aq)} + S_2O_8{}^{2-}_{(aq)} = I_{2(aq)} + 2SO_4{}^{2-}_{(aq)}$

$250mL$ c_1 $V_1 = 20mL$ $t = 0$

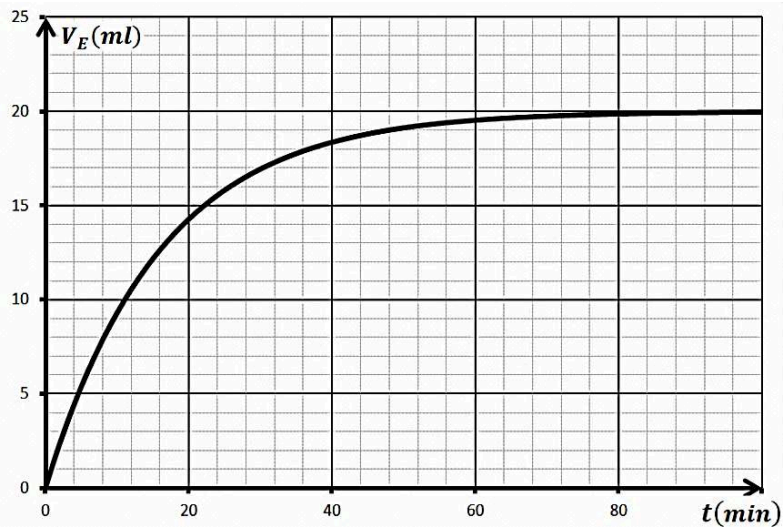
20 $c_2 = 0.2\ mol/L$ $V_2 = 80mL$

$150mL$ $5mL$

I_2

$c_0 = 0.025\ mol/L$ $\left(2Na^+_{(aq)} + S_2O_3{}^{2-}_{(aq)}\right)$

V_E



I_2/I^- $S_4O_6^{2-}/S_2O_3{}^{2-}$

$x = 10c_0V_E$ x

$S_2O_8{}^{2-}$ c_1

V V_E c_0

$t = 40$ $t = 20$

Cl_2

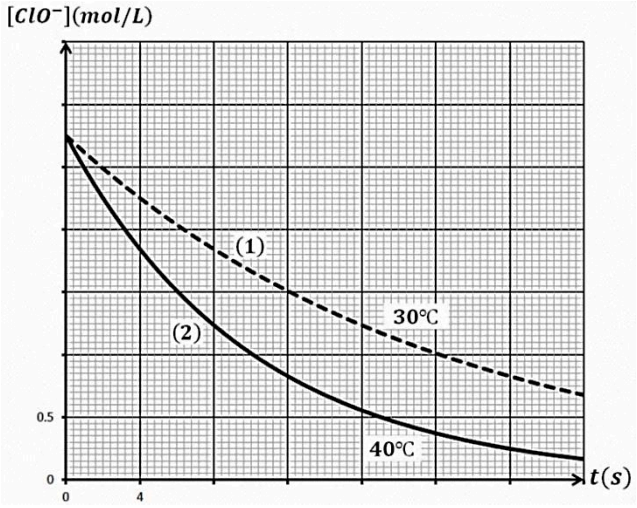
$(Na^+ + HO^-)$

$Cl_{2(g)} + 2HO^-_{(aq)} = ClO^-_{(aq)} + H_2O_{(l)}$

$2ClO^-_{(aq)} = 2\ Cl^-_{(aq)} + O_{2(g)}$ -

-

$$ClO^-_{(aq)} + Cl^-_{(aq)} + 2H_3O^+_{(aq)} = Cl_{2(g)} + H_2O_{(l)}$$



ClO^-

$t = 8s$ ClO^-

$\theta = 30°C$; $\theta = 40°C$

$$v_{vol} = -\frac{1}{2} \times \frac{d[ClO^-]}{dt}$$

$t = 0$

$\theta = 30°C$; $\theta = 40°C$

C_0 I_2

$Zn_{(S)}$

Zn^{2+}/Zn I_2/I^-

Zn $V = 50ml$ 20°C

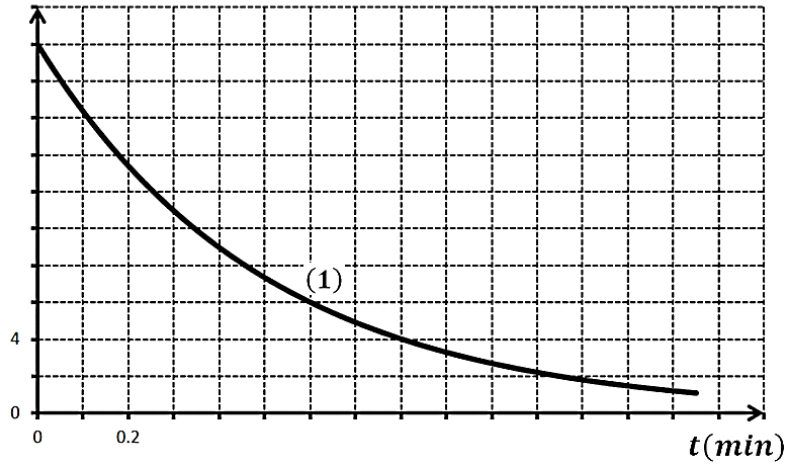
$[I_2] = f(t)$ t $[I_2]$

I_2

I_2

$100ml$ 20°C V

$[I_2](mmol/L)$



$[I_2] = (t)$ -

V

80°C

$[I_2] = h(t)$

$$(CH_3)_3 - C - Cl_{(aq)} + 2H_2O_{(l)} = (CH_3)_3 - C - OH_{(l)} + H_3O^+{}_{(l)} + Cl^-{}_{(l)}$$

$acétone$ $80\ ml$ $150\ ml$

$0{,}10\ mol/l$ $20\ ml$

$t(s)$	0	30	60	80	100	120	150	200
$\sigma(S/m)$	0	0.264	0.412	0.502	0.577	0.627	0 688	0.760

$t = 0s$

x σ

x

$t = 50\ s$

$t(\infty)$

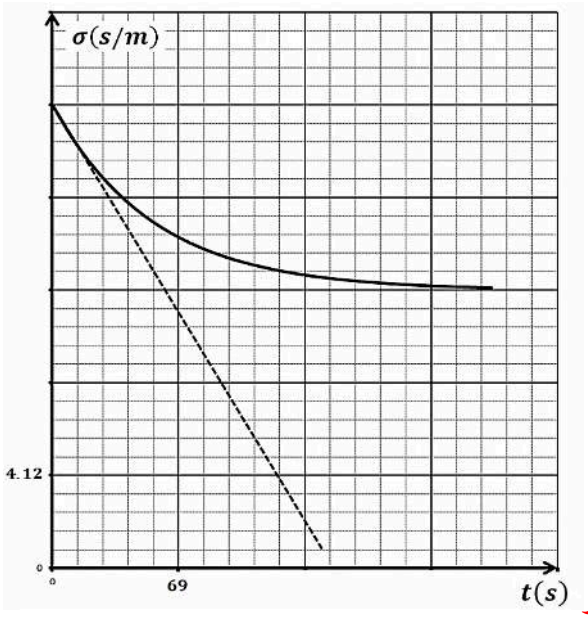
$\lambda(Cl^-) = 7{,}5\ mS.m^2/mol$, $\lambda(H_3O^+) = 35 mS.m^2/mol$

$(2Na^+ + S_2O_3{}^{2-})$

$V_1 = 480mL$ $t = 0$ $(H_3O^+ + Cl^-)$

$c_2 = 5\,mol/L$ $V_2 = 20mL$ $c_1 = 0.5\,mol/L$

$S_2O_3{}^{2-}{}_{(aq)} + 2H_3O^+{}_{(aq)} = S_{(S)} + SO_{2(g)} + 3H_2O_{(l)}$



$\sigma = f(t)$

t

$\sigma = 20.6 - 170x$

V $v_{vol} = -\frac{1}{170V} \times \frac{d\sigma}{dt}$

$t = 0$

$t_{\frac{1}{2}}$

قلم الجزائر

$c_0 = 2 \times 10^{-2} mol/l$ $I_{2(aq)}$ $V_0 = 250ml$

$m = 0.5g$ $Zn_{(s)}$

$Zn_{(s)} + I_{2(aq)} = Zn^{2+}{}_{(aq)} + 2I^{-}{}_{(aq)}$

σ

$t(\times 10^2 s)$	0	1	2	4	6	8	10	12	14	16
$\sigma(S/m)$	0	0.18	0.26	0.38	0.45	0.49	0.5	0.51	0.52	0.52
$x(mmol)$										

x σ

$x = f(t)$

$t_2 = 1000s$ $t_1 = 400s$

$\lambda_{I^-} = 7.7\, mS\,.m^2/mol$ $\lambda_{Zn^{2+}} = 10.56\, mS\,.m^2/mol$ $M(Zn) = 65.4\, g/mol$

$m = 36mg$

$V = 30\, ml$

$V_M = 24l/mol$ $M(Mg) = 24\, g/mol$

Mg^{2+}/Mg H^+/H_2

$t\ (min)$	0	2	4	6	8	10	12	14	16	18
$V_{H_2}\ (ml)$	0	12.0	19.2	25.2	28.8	32.4	34.8	36.0	37.2	37.2
$x(mol)$										

x

$x = f(t)$

$t = 0min$

$pH = 1$

$V_0 = 100ml$

$0.089g$ $C_0 = 0.01\,mol/l$ $(Na^+ + OH^-)$

$V_0 = 100ml$ $M = 88.11\,g/mol$ $C_4H_8O_2$

$C_4H_8O_2 + OH^- = C_2H_3O_2{}^- + C_2H_6O$

30°C

$t(min)$	0	5	9	13	20	27
$\sigma(S/m)$	0	0.210	0.192	0.178	0.160	0.148
$x(mmol)$						

$\lambda_{C_2H_3O_2{}^-} = 4.1mS.m^2/mol$, $\lambda_{Na^+} = 5mS.m^2/mol$, $\lambda_{OH^-} = 20mS.m^2/mol$

t = 0 σ_0 $x = C_0V_0 \times \frac{\sigma_0-\sigma}{\sigma_0-\sigma_f}$ x

$\sigma_f = 0.091\,S/m$

$x = f(t)$

$t = 10min$ $t = 5min$

$t = 20min$

$100ml$

40°C

40°C

$Zn_{(s)}$ $(H_3O^+ + Cl^-)$

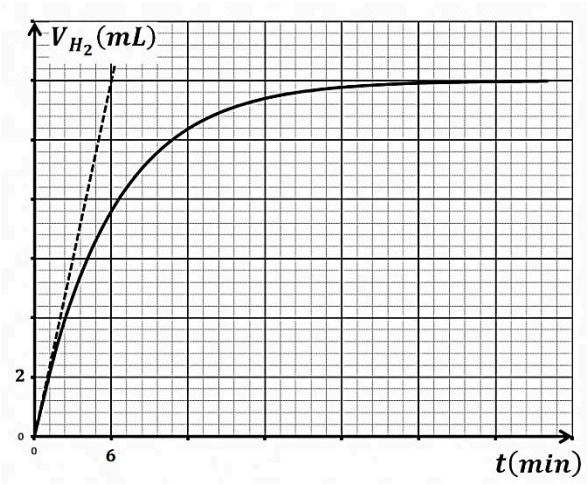
$V = 100mL$ $m = 0.654g$ $t = 0$

$C = 0.01mol/l$

$P = 1.013 \times 10^5 Pa$ $\theta = 20°\,C$

قلم الجزائر

Zn^{2+}/Zn H_3O^+/H_2



V $v_{vol} = \frac{P}{VRT} \times \frac{dV_{H_2}}{dt}$

$t = 0$

H_3O^+

$M(Zn) = 65.4\,g/mol$ $R = 8{,}314\,(SI)$ $PV = nRT$

$(H_3O^+ + Cl^-)$

Al^{3+}

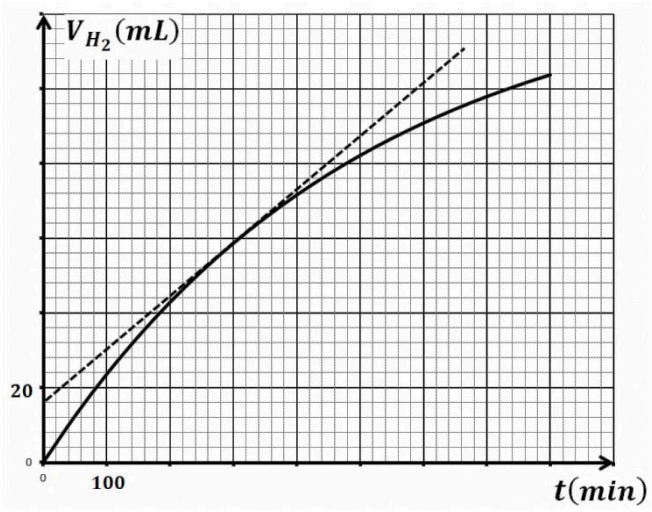
$V = 60mL$ $m = 0.81g$ $t = 0$

$c = 0.18\,mol/l$

$V_{H_2} = f(t)$

$2Al_{(s)} + 6H_3O^+{}_{(aq)} = 2Al^{3+}{}_{(aq)} + 3H_{2(g)} + 6H_2O_{(l)}$

(Ox/Red)



x_{max}

$x(t)$

$V_{H_2}(t)$

$V_f(H_2)$

$t_{1/2}$ $V_{H_2}(t_{1/2}) = \frac{V_f(H_2)}{2}$ $t_{1/2}$

$v = \frac{1}{3V_M} \times \frac{dV_{H_2}(t)}{dt}$ t

$t = 300s$

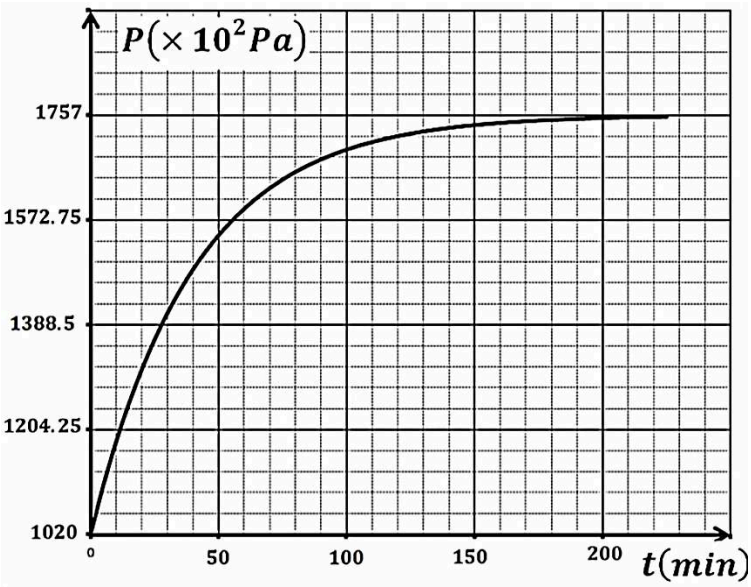
$V_M = 24L.mol^{-1}$ $M(Al) = 27g.mol^{-1}$

قلم الجزائر

25°C $(H_3O^+ + Cl^-)$ Zn

$C_0 = 0.4mol/l$ $V_0 = 75ml$ $m = 0.5g$

Zn^{2+}/Zn H_3O^+/H_2



$x = \frac{(P-P_0)V}{RT}$

$V = 250ml$ P_0

$P = \frac{P_f+P_0}{2}$ $t = t_{1/2}$

P_f $t_{1/2}$

$t = 0$

H_3O^+

$M(Zn) = 65.4\,g/mol$, $PV = nRT$, $R = 8{,}314\,(SI)$,

H_2O_2

$10l$ $(10V)$

$V_M = 22.4\,l/mol$ O_2

$2H_2O_2 = 2H_2O + O_2$

$c = 0.893\,mol/l$

$100ml$ V

-

$c_1 = 0.1\,mol/l$ V -

$20ml$ $(10V)$

$V_E = 38ml$ $c_0 = 0.02\,mol/l$ $(K^+ + MnO_4^-)$

MnO_4^-/Mn^{2+} $O_2/\,H_2O_2$

$$2H_2O_{2(aq)} = 2H_2O_{(l)} + O_{2(g)}$$

- $1l$ $20V$ S_0 $500ml$
  $V_M = 22.4\,l/mol$ $10l$
- $50ml$ $250ml$ $200ml$ $100ml$ $50ml$
  $250ml$ $10ml$ $5ml$ $1ml$
  $C' = 2 \times 10^{-3}\,mol/l$
- 98%
  (A, B, C, D)

S_0 $200ml$ S

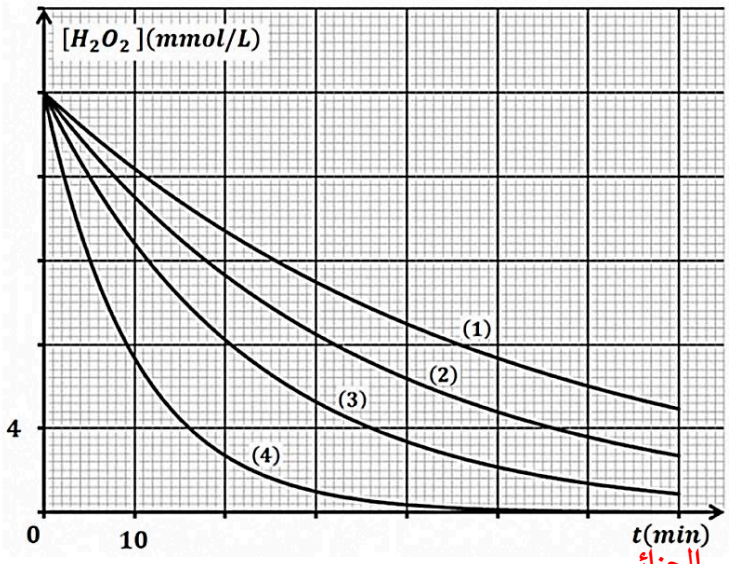
S

S S_0

S

رمز المجموعة	A	B	C	D
حجم الوسيط المضاف (mL)	1	5	0	2
حجم $H_2O_2(mL)$	49	45	50	48
حجم الوسط التفاعلي (mL)	50	50	50	50

$10ml$

- 

S

S_0

قلم الجزائر

H_2O_2

$10l$ $1l$ $(10V)$

$V_M = 22.4\,l/mol$ O_2

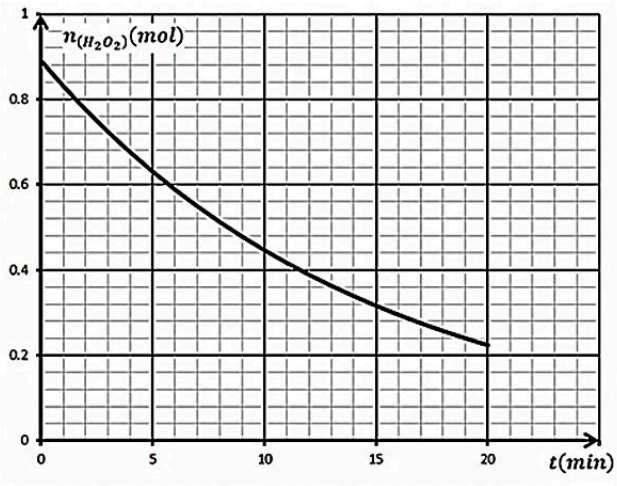
$2H_2O_{2(aq)} = 2H_2O_{(l)} + O_{2(g)}$

$n_{(H_2O_2)} = 0.89mol$

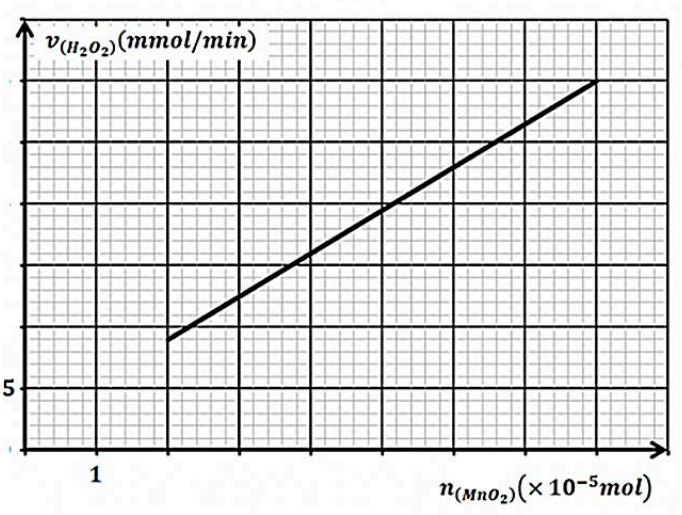
MnO_2 $t = 0$

$n_{(H_2O_2)}$

شكل-1



شكل-2



O_2 H_2O_2 $t = 10min$

$t = 10min$

MnO_2

$t = 10min$

H_2O_2

$2H_2O_{2(aq)} = 2H_2O_{(l)} + O_{2(g)}$

$V_0 = 10ml$

$t = 0$

$(2H_3O^+ + SO_4^-)$ t

$c = 0.1 mol/l$ $(2K^+ + Cr_2O_7^{2-})$

V_E

$$3H_2O_{2(aq)} + Cr_2O_7^{2-}{}_{(qa)} + 8\,H_3O^+{}_{(aq)} = 2Cr^{3+}{}_{(aq)} + 3O_{2(g)} + 15H_2O_{(l)}$$

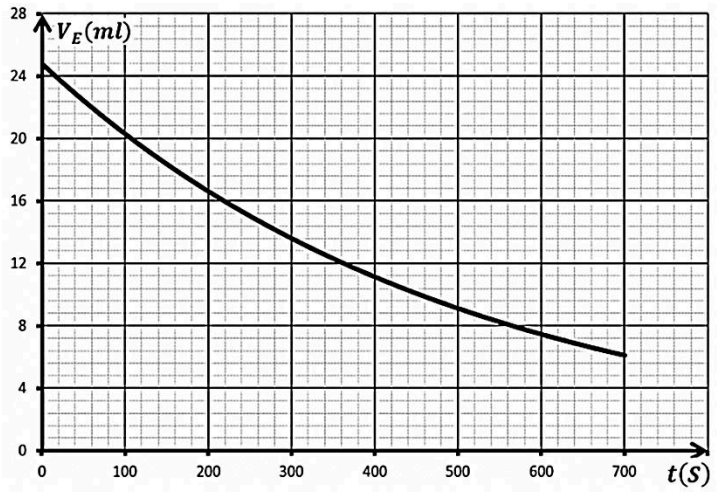
V_E

V_0 V_E c $[H_2O_2]$

$1l$ $10V$

O_2 $10l$

-



$t_{1/2}$

V_E $H_2O_{2(aq)}$

$t_2 = 600s$ $t_1 = 200s$

$V_M = 22.4\,L/mol$

$(H_3O^+ + Cl^-)_{aq}$ $CaCO_{3(s)}$

$$CaCO_{3(s)} + 2H_3O^+{}_{(aq)} = Ca^{2+}{}_{(aq)} + CO_{2(g)} + 3H_2O_{(l)}$$

- $c_0 = 0.1\,mol/L$
-
- $200ml$ $150ml$ $100ml$
  $20ml$ $10ml$ $5ml$
  $V = 200mL$ $c = 10\,mmol/L$

0.4g

σ

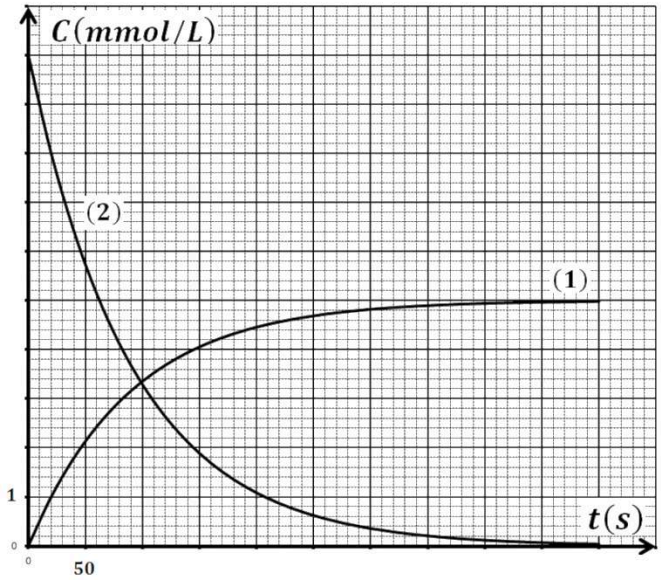
$t = 0$ σ_0

t

s/m σ $\sigma = 0.425 - 290x$

$[H_3O^+]$ $[Ca^{2+}]$

$t = 0$



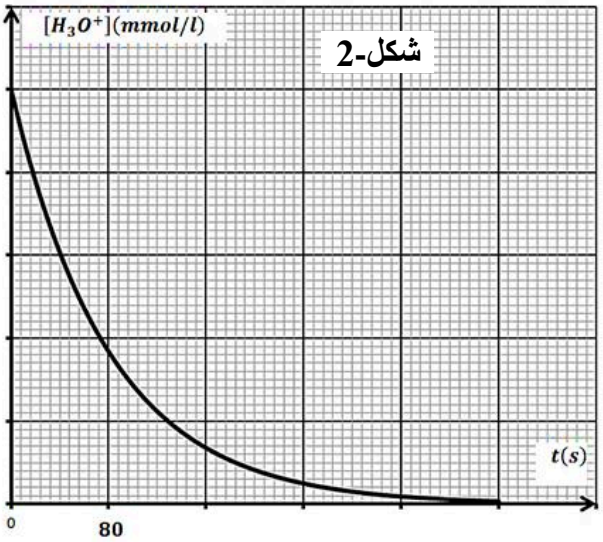
$C = 12\ g/mol$, $O = 16\ g/mol$, $Ca = 40g/mol$,
$\lambda(Cl^-) = 7{,}5\ mS.m^2/mol$, $\lambda(Ca^{2+}) = 12\ mS.m^2/mol$, $\lambda(H_3O^+) = 35mS.m^2/mol$

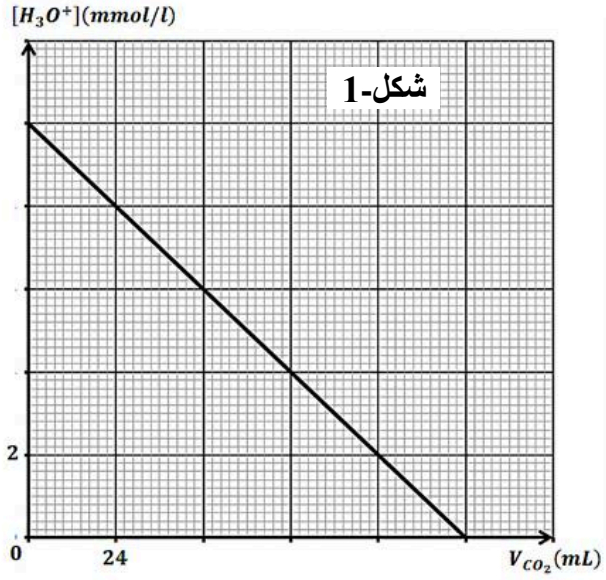
$(H_3O^+ + Cl^-)_{aq}$ $CaCO_{3(s)}$

$$CaCO_{3(s)} + 2H_3O^+_{(aq)} = Ca^{2+}_{(aq)} + CO_{2(g)} + 3H_2O_{(l)}$$

2g c V

V_{CO_2}





V_M $[H_3O^+] = c - \frac{2V_{CO_2}}{V \times V_M}$ ${H_3O^+}_{(aq)}$

V c

$[H_3O^+]$ $[H_3O^+] = f(t)$

$t = 80s$

$V_M = 24\,l/mol$ $M_{Ca} = 40\,g/mol$ $M_o = 16\,g/mol$ $M_C = 12\,g/mol$

$(Na^+ + OH^-)$ Cl_2

$${Cl_2}_{(g)} + 2{OH^-}_{(aq)} = {ClO^-}_{(aq)} + {Cl^-}_{(aq)} + {H_2O}_{(l)}$$

$(°Chl)$

$$°Chl = C_0.V_M$$

C_0 $V_M = 22.4L.mol^{-1}$

C_0 ClO^- 20°C (A)

$V_1 = 2mL$ C_1

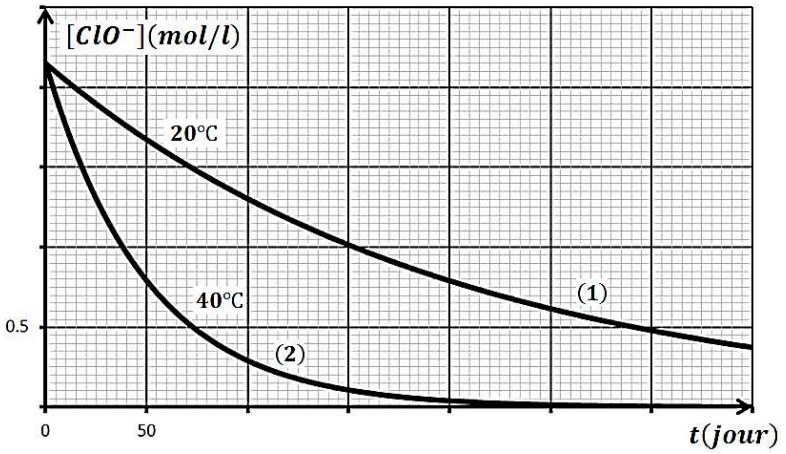
I_2 $(K^+ + I^-)$

$${ClO^-}_{(aq)} + 2{I^-}_{(aq)} + 2{H_3O^+}_{(aq)} = {I_2}_{(aq)} + {Cl^-}_{(aq)} + 3{H_2O}_{(l)}$$

${S_2O_3}^{2-}$ $\left(2Na^+ + {S_2O_3}^{2-}\right)$

$V_E = 20ml$ $C_2 = 0.1\,mol/l$

$\left({S_4O_6}^{2-}/{S_2O_3}^{2-}\right)$ (I_2/I^-) (Ox/Red)



$C_1 = \frac{C_2 \times V_E}{2V_1}$

$°Chl$ C_0 c_1

$${2ClO^-}_{(aq)} = 2{Cl^-}_{(aq)} + {O_2}_{(g)}$$

ClO^-

قلم الجزائر

40°C 20°C (A)

$t = 0$

(A) ClO^-

$t = 50jour$ ClO^-

$(Na^+ + OH^-)$ Cl_2

(Cl_2/Cl^-) (ClO^-/Cl_2) (Ox/Red)

$2ClO^-_{(aq)} = 2Cl^-_{(aq)} + O_{2(g)}$

S_1 $V_1 = 20ml$ S_0

S_1 $C_1 = 0.104mol/L$ ClO^-

Co^{2+} $t = 0$

P

$T = 296K$

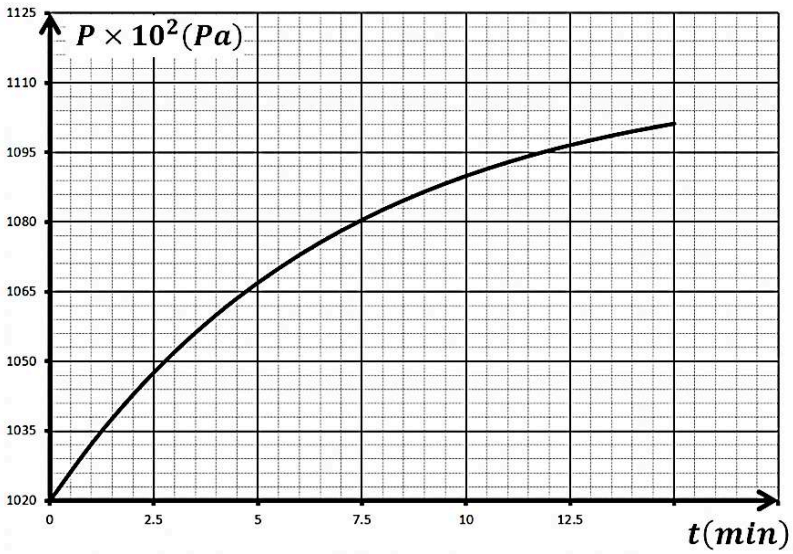
. $PV = nRT$, $R = 8{,}314\ (SI)$ $V_g = 275ml$

S_0 C_0 S_1

x_{max}

P_0 $x = \frac{(P-P_0)V_g}{RT}$

P_f $P_f = P_0 + \frac{RTx_{max}}{V_g}$ P_f



$P = \frac{P_f+P_0}{2}$ $t = t_{1/2}$

$t_{1/2}$

ClO^-

$v = \frac{2V_g}{RT} \times \frac{dP}{dt}$

$t = 5min$

Cl_2

S_0

$T = 296K$ $P_0 = 1.02 \times 10^5 P$

قلم الجزائر