

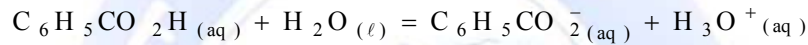
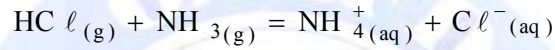
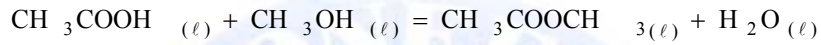
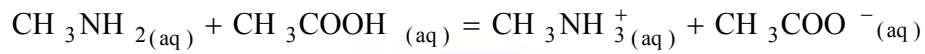
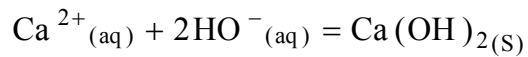


pH .1

.2

.3

★ 1



: . 1 ★ 2

pH		3,4		6,8		9,6
$[\text{H}_3\text{O}^{+}](\text{mol.L}^{-1})$	$5,0.10^{-2}$		$7,4.10^{-5}$		$2,6.10^{-2}$	

$[\text{H}_3\text{O}^{+}]$

pH . 2

★ 3

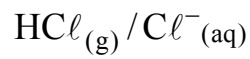
$\text{HC}\ell_{(\text{g})}$

. 1

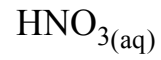
0,1 mL pH . 2
($22,4 \text{ L.mol}^{-1}$). 1L $\text{HC}\ell_{(\text{g})}$

1L $\text{HC}\ell_{(\text{g})}$. 3

pH = 2,0



★ 4



1. () .

: $\text{HNO}_{3(aq)} / \text{NO}_{3(aq)}^{-}$

2. pH $C = 0,10 \text{ mol.L}^{-1}$

3. 10 mL 90 mL

pH

★ 5

: pH $C = 0,10.10^{-3} \text{ mol.L}^{-1}$

- : pH = 3,9

- : pH = 3,0

- : pH = 6,2

- : pH = 3,0

1.

2.

100 mL

★★ 6

. $C_a = 1,0.10^{-3} \text{ mol.L}^{-1}$

.1

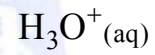


pH . 2

50 mL . 3



$C_b = 1,0 \cdot 10^{-3} \text{ mol L}^{-1}$



pH .

pH

★ 7



:

$C(\text{mol.L}^{-1})$	$2,0 \cdot 10^{-2}$	$1,1 \cdot 10^{-2}$	$5,0 \cdot 10^{-3}$	$1,0 \cdot 10^{-3}$
pH	2,95	3,10	3,25	3,60
$C(\text{mol.L}^{-1})$	$5,0 \cdot 10^{-4}$	$1,0 \cdot 10^{-4}$	$5,0 \cdot 10^{-5}$	$1,0 \cdot 10^{-5}$
pH	3,75	4,25	4,50	5,10

. 1

. (pH = 2,95) . 2

. .(-logC) pH . 3

: pH = f(-logC) . 4

$$1,0.10^{-4} \text{ mol.L}^{-1} < C < 2,0.10^{-2} \text{ mol.L}^{-1}$$

.2

★ 8

V=20,0 mL CH₂ClCOOH_(aq)
 . 2,37 pH . C = 10⁻² mol.L⁻¹
 . 1

. X_{max} . 2

. τ_f . X_f . 3

HI_(aq) S₀

★ 9

P = 28%

d = 1,26

. (S₀) . 1

V₁ = 500 mL (S₀) . 2

. C₁ = 0,05 mol.L⁻¹ S₁

. S₁

200 S_1 $V_1 = 5 \text{ mL}$. 3
mL

S_2 .

. 2,90 S_2 pH .

$\rho_{\text{eau}} = 1,0 \cdot 10^3 \text{ g.L}^{-1}$

★ ★ 10

1L 10^{-3} mol $\text{CH}_3\text{COOH}_{(\text{aq})}$

. 1

. $\sigma_1 = 4,9 \text{ mS.m}^{-1}$. 2

τ_f

100 mL 10 mL . 3

$[\text{CH}_3\text{COO}^-]$

$\sigma_2 = 1,2 \text{ mS.m}^{-1}$

$[\text{CH}_3\text{COO}^-]$

. 4



★ ★ 11

$\sigma = 0,19 \text{ mS.m}^{-1}$

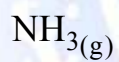
. 1

V x_f . 2

. 3

$\lambda_{\text{Ag}^+} = 6,2 \text{ mS.m}^2.\text{mol}^{-1}$:

$\lambda_{\text{Cl}^-} = 7,6 \text{ mS.m}^2.\text{mol}^{-1}$



S_1

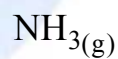
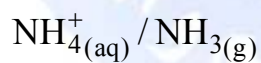
★ ★ 12

$\text{pH} = 11,1$

pH

$C = 0,10 \text{ mol.L}^{-1}$

. 1



. 2

V_2

S_2

. 3

$C_2 = 2,5.10^{-2} \text{ mol.L}^{-1}$

$= 100 \text{ mL}$

. S_1

10,8

S_2

pH

. 4

$$C_1 = 0,10 \text{ mol.L}^{-1}$$

$$\sigma_1 = 4,88.10^{-5} \text{ S.m}^{-1} :$$

$$\sigma_2 = 2,19.10^{-4} \text{ S.m}^{-1}$$

$$. 25^\circ\text{C}$$

.1

HA

S₂ S₁

$$: C = 10^{-2} \text{ mol.L}^{-1}$$

S₁ -CH₂ClCOOH_(aq)CHCl₂COOH_(aq) S₂ -

$$25^\circ\text{C}$$

$$. \sigma_2 = 0,330 \text{ mS.m}^{-1} \quad \sigma_1 = 0,167 \text{ mS.m}^{-1} :$$

.1

.2

.3

. 4

. 5

:25°C :

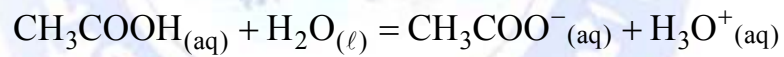
$$\lambda_{\text{H}_3\text{O}^+} = 35.10^{-3} \text{ S.m}^2.\text{mol}^{-1}$$

$$\lambda_{\text{CH}_2\text{ClCO}_2^-} = 4,22.10^{-3} \text{ S.m}^2.\text{mol}^{-1}$$

$$\lambda_{\text{CHCl}_2\text{CO}_2^-} = 3,83.10^{-3} \text{ S.m}^2.\text{mol}^{-1}$$

★ 15

:



25°C

$$\sigma = 1,6.10^{-2} \text{ S.m}^{-1} \quad C = 1,0.10^{-2} \text{ mol.L}^{-1}$$

. 1

$$[\text{CH}_3\text{COO}^-]_f \quad [\text{H}_3\text{O}^+]_f \quad \sigma \quad . 2$$

$$x_f = x_{\text{éq}} \quad . 3$$

.V

$$x_{\text{éq}} \quad \lambda_{\text{CH}_3\text{COO}^-} \quad \lambda_{\text{H}_3\text{O}^+} \quad \sigma \quad . 4$$

$$. [\text{CH}_3\text{COO}^-]_f \quad [\text{H}_3\text{O}^+]_f \quad .V$$

K



.5

$$\lambda_{\text{H}_3\text{O}^+} = 35,9 \cdot 10^{-3} \text{ S.m}^2.\text{mol}^{-1} :$$

$$\lambda_{\text{CH}_3\text{COO}^-} = 4,1 \cdot 10^{-3} \text{ S.m}^2.\text{mol}^{-1}$$

. 1 ★ 16

 σ

25°C

. 2

C (mol.L ⁻¹)	1.10 ⁻²	5.10 ⁻³	1.10 ⁻³
$\sigma(\mu\text{S.m}^{-1})$	100,4	70,4	33,3

. 3

C

. 4

$$V = 20 \text{ mL}$$

★ 17

$$C = 0,10 \text{ mol.L}^{-1}$$

$$m = 6,35 \text{ g}$$

.1

$$n_0(\text{Cu})$$

.2

$$(x_f = x_{\text{eq}})$$

)

K .3

$$x_{\text{éq}} = (1,0.10^{-3} ; - 4,8.10^{-11}) \quad V \quad x_{\text{éq}} \quad . 4$$

$$\tau \quad [Ag^+]_{\text{éq}} \quad . 5$$

$$M_{\text{Cu}} = 63,5 \text{ g} \cdot \text{mol}^{-1} \quad K = 2,2 :$$

$$V_1 = 30 \text{ mL}$$

★ 18



$$C_2 = 0,10 \text{ mol} \cdot \text{L}^{-1}$$

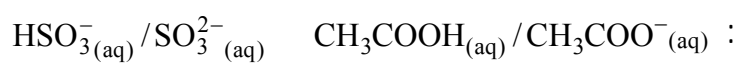
. 1

. 2

$$Q_{r,i} \quad . 3$$

$$Q_{r,f} \quad \tau \quad . 4$$

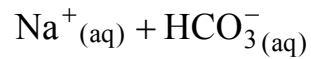
$$\tau_f \quad K = 251 \quad . 5$$



$$V_1 = 30 \text{ mL}$$

★ 19

$$C_1 = 0,15 \text{ mol.L}^{-1}$$



$$C_2 = 0,10$$

$$V_2 = 20 \text{ mL}$$

$$1 \text{ mol.L}^{-1}$$

.1

.2

$$Q_{ri}$$

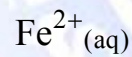
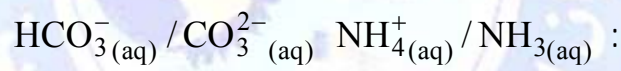
.3

$$Q_{r,f}$$

.4

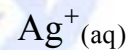
$$K = 7,9.10^{-2}$$

.5



★★ 20

K



$$V = 1 \text{ L}$$

$$= 3,2$$

$\text{Fe}^{2+}_{(\text{aq})} + \text{Ag}^+_{(\text{aq})} = \text{Fe}^{3+}_{(\text{aq})} + \text{Ag}_{(\text{s})}$				
1	1.10^{-2}	1.10^{-2}	1.10^{-2}	1.10^{-1}
2	1.10^{-1}	1.10^{-1}	5.10^{-3}	1.10^{-1}

$$\text{Ag}^+_{(\text{aq})} / \text{Ag}_{(\text{s})} : \quad . 1$$

$$\text{Fe}^{3+}_{(\text{aq})} / \text{Fe}^{2+}_{(\text{aq})}$$

$$Q_r \quad . 2$$

$$. 3$$

$$. 4$$

$$x_f \quad . 5$$

★ ★ ★ 21

$$. C_0$$

$$. 1$$

$$\tau \quad C_0 \quad [\text{CH}_3\text{COO}^-]_f \quad [\text{H}_3\text{O}^+]_f \quad . 2$$

$$\tau \quad C_0 \quad [\text{CH}_3\text{COO}^-]_f \quad . 3$$

$$. K_a = C_0 \frac{\tau^2}{1-\tau} : \quad . 4$$

$$\tau \quad C_0 \quad . 5$$

:

$C_0 \text{ (mol.L}^{-1}\text{)}$	1.10^{-2}	5.10^{-3}	1.10^{-3}	5.10^{-4}
τ	$4,0.10^{-2}$	$5,6.10^{-2}$	$12,5.10^{-2}$	$16,0.10^{-2}$

$X = \frac{1}{C_0}$				
$Y = \frac{\tau^2}{1-\tau}$				

$$\frac{\tau^2}{1-\tau} = f\left(\frac{1}{C_0}\right) \quad y = f(x) \quad .$$

.K .

S₀ 500 mL ★ ★ ★ 22

0,10 mol C₂H₅COOH_(aq)

) .

C = 2,0.10⁻³ V = 1,00 L S (S₀ .mol.L⁻¹

. 1 .

() .

.1000 mL 100 mL 50,0 mL :

. S₀ S

2,0.10⁻³ mol.L⁻¹ . 2

.S 1,0 L

. X_f = X_{éq}

σ . 3

. X_{éq} V

S 25°C . 4
 $\sigma = 6,20.10^{-5} \text{ S.m}^{-1}$

X_{éq}

25°C . 5
 . 6

— . 3

★ 23

V₁=200 mL S₁ —

C₁ = 5.10⁻³ mol.L⁻¹

V₂= V₁ S₂ —

.C₂ = C₁

. pH₂ = 2,6 pH₁ = 3,6 : pH

. 1

. 2

K_{a,2} K_{a,1} . 3

. 4

S

★ ★ 24

$$m = 0,305g$$

$$V = 500 \text{ mL}$$

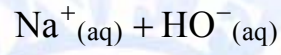


.S

. 1

$$V_a = 10 \text{ mL}$$

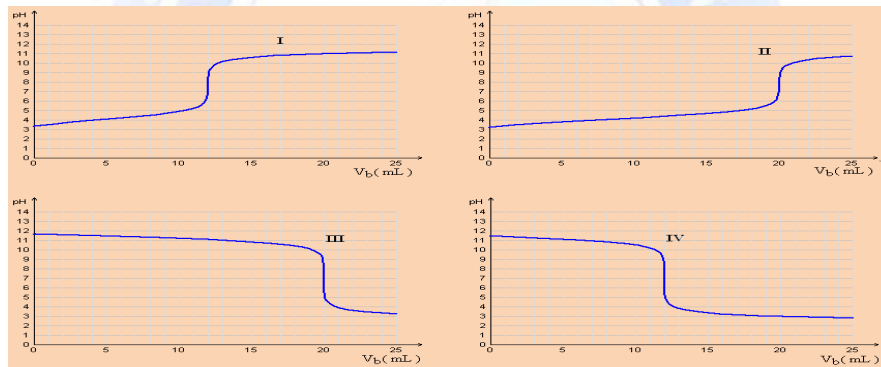
. 2



$$pH \quad V_b$$

$$C_b = 5.10^{-3} \text{ mol.L}^{-1}$$

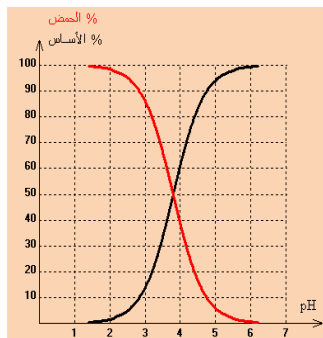
$$pH = f(V_b)$$



الوحدة 4: تطور حالة جملة كيميائية خلال تحول كيميائي نحو حالة التوازن

★ ★ 25

(Corrosif)



%

%

lu.dz

جميع الحقوق محفوظة ©

$$pH = \text{pK}_a + \log \frac{[\text{HCOO}^-]_{\text{aq}}}{[\text{HCOOH}]_{\text{aq}}}$$

1. $pH = \text{pK}_a$

2. $pH = 5$

3. pH

$[\text{HCOOH}]_{\text{eq}} = 2[\text{HCOO}^-]_{\text{eq}}$

pK_a pH pH

★ ★ 26

			3,1 – 4,4
			4,8 – 6,4
			5,2 – 6,8
			6,8 – 8,0
			8,2 – 10,0
			11,6 – 14,0

A,B,C

A –

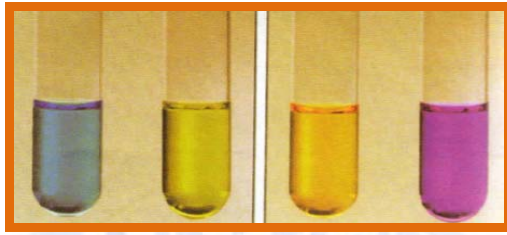
B –

C –

1.

. 2

pH



$C_1 =$

★ ★ 27

.25°C

pH = 2,4

0.10 mol.L⁻¹

.1

$V_a = 80$ mL

. 2

V_b

$C_1 = 2,5 \cdot 10^{-1}$ mol.L⁻¹

.

$V_{b,eq}$

.

. 3,8

pH

$$V_b = \frac{V_{b,eq}}{2}$$

$n(HO^-)$

<http://www.onefd.edu.dz>

جميع الحقوق محفوظة ©

$$25^{\circ}\text{C} \quad K_e = 10^{-14} :$$

$$V_a = 20 \text{ mL}$$

★ ★ 28

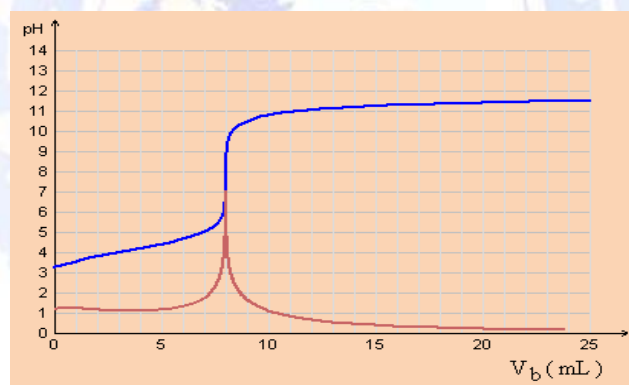
$$C_a$$



$$C_b = 10^{-1} \text{ mol.L}^{-1}$$

$$V_b$$

$$\frac{dpH}{dV_b} = g(V_b) \quad pH = f(V_b) :$$



.1

$$pH_E \quad V_{bE} \quad .2$$

$$C_a \quad C_a \quad V_a \quad C_b \quad V_{b,E} \quad .3$$

$V_b = 4$ pH pH = f(V_b) .4
 $[HO^-]$ mL
 n_{HO^-}
 $V_b = 4\text{mL}$. 5

★ ★ ★ 29

$C_6H_5COOH_{(aq)} / C_6H_5COO^-_{(aq)}$
 pK_a (AH/A⁻)
 $4,2$
 S_1 pH pH . 1
 $pH_1 = 3,1$ $C_1 = 0.10\text{mol.L}^{-1}$
 2
 K_A (AH/A⁻)
 S_2 pH . 3
 $C_2 = 10^{-2} \text{ mol.L}^{-1}$ $Na^+_{(aq)} + C_6H_5COO^-_{(aq)}$
 $pH_2 = 8,1$ 1
 4

	S ₁	.5
pH	. 5,2	pH
	.	
S ₁	pK _a	. 6
	.	
		. 7
	S ₁	.
		★ ★ ★ 30
pH	C ₀ =2,90.10 ⁻⁴ mol.L ⁻¹	
.(HIn/ In ⁻)		4,18
	HIn	.
		. 1
	HIn	.
	[H ₃ O ⁺]	. 2
	V = 100 mL	. 3
	HIn	.
	K _a	. 4
		. 5
	K= 1,95.10 ⁻⁵ :	

pK_a . 6

:

				pK _a
		3,1 – 4,4		3.7
		3,8 – 5,4		4.7
		6,0 – 7,6		7.0
		8,0 – 10,0		9.4

$$V_B = 20 \text{ mL}$$

★ ★ ★ 31

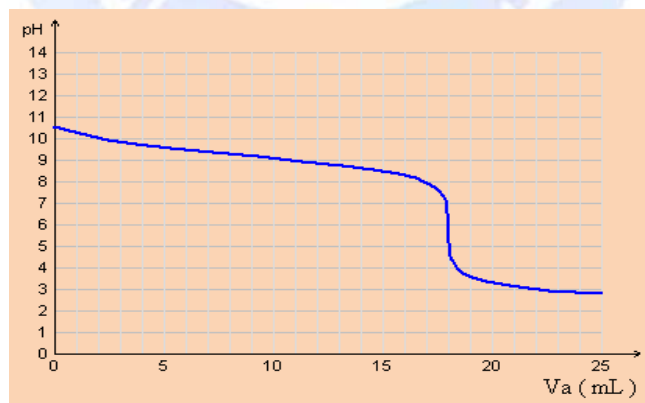
C_B

$$.C_A = 0,1.10^{-1} \text{ mol.L}^{-1}$$

V_A

: pH = f(V_A)

pH



. 1

K . 2

$E(v_{b,eq}, pH_{eq})$. 3

pH $pH = 2$: . 4

$pH = 9,2 = 5,2$

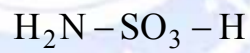
:

$$pK_a(NH_4^+_{(aq)} / NH_{3(aq)}) = 9,2$$

$$pK_a(H_3O^+_{(aq)} / H_2O_{(\ell)}) = 0$$

$$pK_a(H_2O_{(\ell)} / HO^-_{(aq)}) = 14$$

★ ★ ★ 32



.AH

. 1

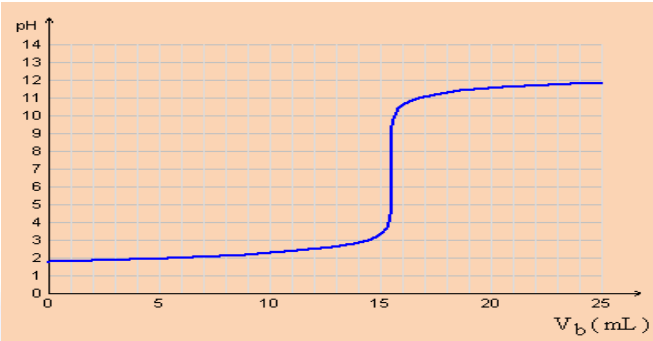
1,80 g . 2

200 mL

20 . C_a S

() S mL

pH $C_b = 0,10 \text{ mol.L}^{-1}$
80 mL)
:



pH	3,1 – 4,4	4,4 – 6,0	8,1 – 10,0

(déboucheur)

★★★ 33

:

$$\rho = 1,23 \text{ kg.L}^{-1}$$

. 20 %

$$M(\text{NaOH}) = 40 \text{ g.mol}^{-1}$$

:

.20mL 10mL 5mL :

.1000mL 500mL 100mL :

.25mL :

pH

. 1

.S

100

. 2

S

$$V_B = 20 \text{ mL}$$

. 3

pH

$$C_A = 0.10 \text{ mol.L}^{-1}$$

:

V_b (mL)	2	4	6	8	10	11	12	12.5
pH	12.7	12.6	12.5	12.3	12.0	11.6	10.8	10.0
V_b (mL)	13.5	14	15	16	17	20	22	25
pH	2.9	2.4	2.1	1.9	1.7	1.5	1.4	1.3

