td ACQ 2.2

(1h40 → 2h à 3h) 8h18

① $T_E = \frac{1}{f_E} = \frac{1}{12 f} = \frac{1}{12} T$ donc il faut 12 échantillons pour couvrir la période T du signal.

② $u_0 = 0$ $u_1 = 10 \sin \frac{2\pi}{12} = 10 \sin \frac{\pi}{6} = 5V$

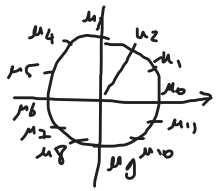
$u_2 = 10 \sin \frac{2\pi}{6} = 10 \sin\left(\frac{\pi}{3}\right) = 10 \frac{\sqrt{3}}{2} = 8,66\ V$

$u_3 = 10 \sin \frac{2\pi}{4} = 10 \sin \frac{\pi}{2} = 10V$

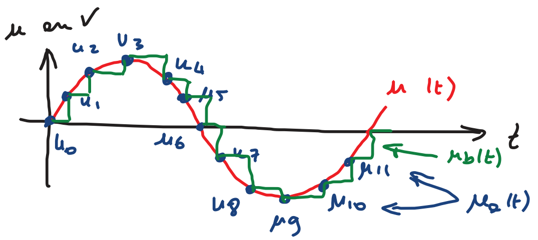
$u_4 = 8,66\ V$ $u_5 = 5V$

$u_6 = 0V$ $u_7 = -5V$ $u_8 = -8,66V$

$u_9 = -10V$ $u_{11} = -5V$



③



8h27

④ $U_b = \sqrt{\frac{1}{T} \underbrace{\int_0^T u_b^2(t)\, dt}_{\text{aire sous la courbe}}} = \sqrt{\frac{1}{T}\left(\sum_{i=0}^{N-1} u_i^2 \frac{T}{12}\right)}$

$\boxed{U_b = \sqrt{\frac{1}{12}\left(2 \cdot \cancel{u_0} + 2 u_3^2 + 4 u_2^2 + 4 u_1^2\right)}}$

$U_b = \sqrt{\frac{1}{12}\left(2 \cdot 10^2 + 4 \cdot 8,66^2 + 4 \cdot 5^2\right)}$ $\underline{U_b = 7,07\ V}$

$\boxed{U = \frac{\hat{U}}{\sqrt{2}}}$ $U = \frac{10}{\sqrt{2}}$ $\underline{U = 7,07V} \simeq U_b$ (échantillon suffisant pour ce critère).

8h33

⑤ $\boxed{q = \frac{V_{ref}}{2^n}}$ $q = \frac{5}{2^{10}}$ $\underline{q = 4,88\ mV}$

⑥

V_e	$N = \frac{V_e}{q}$	2^9 512	2^8 256	2^7 128	2^6 64	2^5 32	2^4 16	2^3 8	2^2 4	2^1 2	2^0 1	
1	204	0 reste	1 ↳	0 76	1 ↳	0 12	0	1 ↳	1 4 ↳	0 0	0	
2	409	0	1	1 153	1 25	0	1	1 9	0 1	0	1	0
3	614	1	1 102	0	1	1 38	0 6	0	1	1 2	0 0	
4	819	1	1 307	0 51	0	1	1 19	0 3	0	1	1 1	0
5	~~1024~~ 1023	1	1	1	1	1	1	1	1	1	1	

8h48

⑦ $\boxed{q = \frac{V_{pe}}{2^n - 1}}$ $q = \frac{5}{2^8}$ $\underline{q = 19,8\ mV}$ 9h42

⑧ Plus petit mot : 0

grand mot : $2^n - 1 = 255$

⑨ $V_i = q\, d_{10}$ où d_{10} = valeur décimal de bi

$b_1 = 0 \longrightarrow V_1 = 0V$

$d_2 = (255)_{10} \longrightarrow \underline{V_2 = 5\ V}$

⑩ $\boxed{N = 235_{(10)} = (\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 0\ )_2}$

128 64 32 16 8 4 2 1

↳ 107 ↘ 43

9h52

d

9h52

(11)

```
def binaire(M) :
    n = 0
    while 2**n < M :
        n = n+1
    b = " "
    R = M
    for i in range(n, -1, -1) :
        if 2**i >= R :
            R = R - 2**i
            b = b + "1"
        else :
            b = b + "0"
    return b
```

(12) b1 = binaire(M1)

(13) return "0b" + b

ou

initialisation par b = "0b" avant le while.

10h00

(14) ordonnée à l'origine ($H=0$) $V_{h0} = -3{,}5\,V$ 8h48

pente (sensibilité) $\boxed{a = \dfrac{V_{hmax} - V_{hmin}}{H_{max} - H_{min}}}$ $a = \dfrac{4{,}9 + 3{,}5}{30 - 0}$ $= 0{,}28\,V.mm^{-1}$

(15) $\boxed{q = \dfrac{V_{ref}}{2^n}}$ $q = \dfrac{5}{2^n}$ $q = 2{,}44\,mV$

8h55

(16) $\boxed{N = \dfrac{V_h}{q}}$

(17) $\boxed{N_{max} = \dfrac{V_{h\,max}}{q}}$ $N_{max} = \dfrac{4{,}9}{2{,}44.10^{-3}}$ $N_{max} = 2008$

	1024	512	256	128	64	32	16	8	4	2	1	
$(2008)_{10}$ = (	1	1	1	1	1	0	1	1	0	0	0	$)_2$
		984	472	216	88	24						

$\boxed{N_{min} = \dfrac{V_{hmin}}{q}}$ $N_{min} = \dfrac{-3{,}5}{0{,}00244}$ $N_{min} = -1435$

	1024	512	256	128	64	32	16	8	4	2	1	
$(-1435)_{10}$ = -(	1	0	1	1	0	0	1	1		1	1	$)_2$
		-411		-155	-27		11		3		1 0	

9h15

(18) $\boxed{H_{min} = \dfrac{V_{hmin} - V_0}{a}}$ $H_{min} = \dfrac{-5 + 3{,}5}{0{,}28}$ $H_{min} = -5{,}36\,mm$

$\boxed{H_{max} = \dfrac{V_{hmax} - V_0}{a}}$ $H_{max} = \dfrac{5 + 3{,}5}{0{,}28}$ $H_{max} = 30{,}4\,mm$

9h20

(19) $\Delta\theta = \dfrac{\theta_{max} - \theta_{min}}{2^n}$ $\Rightarrow$ $2^n = \dfrac{\theta_{max} - \theta_{min}}{\Delta\theta}$

$\left(n = \log_2(2^n) = \dfrac{\log(2^n)}{\log(2)}\right)$ $2^n = \dfrac{40 + 10}{1} = 50$

Donc avec $n = 6$ bits soit $2^6 = 64$ valeurs cela sera suffisant pour $\Delta\theta < 1°$.

(20) $\boxed{2^n = \frac{\theta_{max} - \theta_{min}}{\Delta\theta}}$ $2^n = \frac{50}{0,1} = \underline{500}$

$\Rightarrow$ $\underline{\underline{n = 9 \text{ bits}}}$ qui permet de coder 512 valeurs.

(21) $\boxed{q = \frac{V_{ref}}{2^n}}$ $q = \frac{10}{2^9}$ $q = \underline{19,5 \text{ mV}}$

(22) $S = \frac{\Delta V}{\Delta \theta}$ $\boxed{S = \frac{V}{\theta_{max} - \theta_{min}}}$ $S = \frac{10}{40+10}$ $\underline{S = 0,02 \ V°C^{-1}}$

9433

(23) $(\overset{256}{0}\,\overset{128}{1}\,\overset{64}{1}\,\overset{32}{1}\,\overset{16}{1}\,\overset{8}{0}\overset{4}{0}\overset{2}{0}\overset{1}{0})_2 = 128 + 64 + 32 + 16 = (240)_{10}$

$q = \frac{V}{N}$ et $S = \frac{V}{\theta - \theta_{min}} = \frac{q}{\Delta\theta}$

$\Rightarrow$ $\theta = \Delta\theta \cdot N - \theta_0$ $\theta = 0,1 \cdot 240 + 10$ $\underline{\theta = 34°C}$

(24)
```
def dec(b):
    n = len(b)
    s = 0
    for i in range(n, -1, -1):
        s = s + b[i] * 2 ** i
    return s
```

(25)
```
print(b1, "en base 10 vaut", dec(b1))
```

(26)
```
def temp(b):
    teta = 0.1 * dec(b1) + 10
    return teta
```

(27)
```
print("température associée à", b1, "vaut", temp(b1))
```

9442