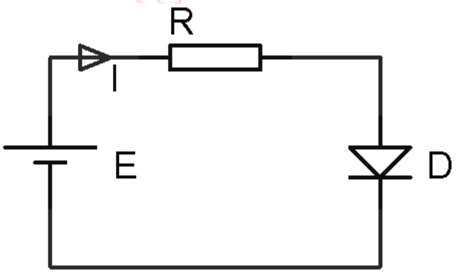
Diode

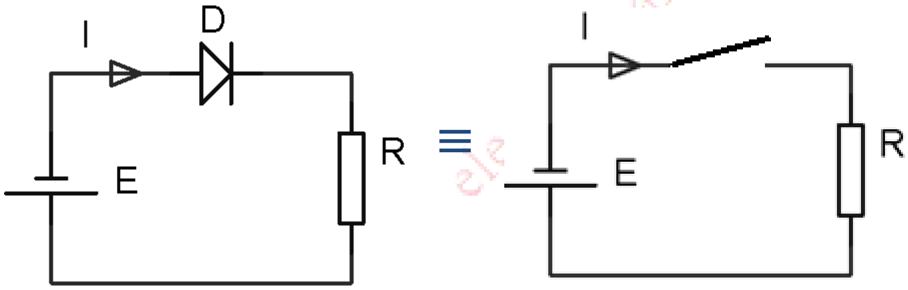
Exercice 1

a. La diode est passante. La loi de maille :



$$E = RI + V_D \Rightarrow I = \frac{E - V_D}{R} = \frac{10V - 0{,}6V}{1k\Omega} \Rightarrow \quad \boxed{I = 9{,}4mA}$$

b. La diode est bloquée

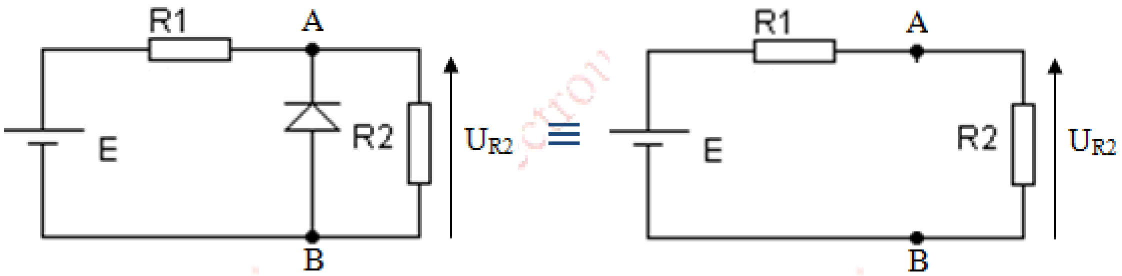


$\boxed{I = 0A}$

Exercice 2

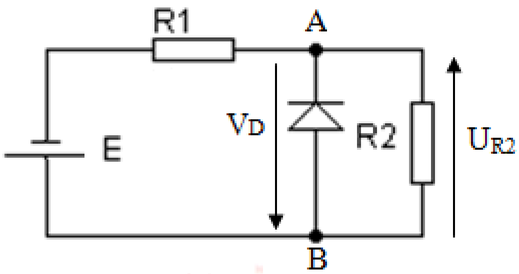
1. $E = +5V$

a. la diode n'est pas passante (polarisation inverse) :



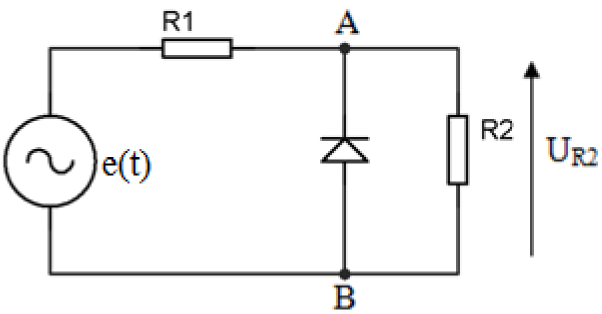
$U_{R2} = E \times R_2 / (R_1 + R_2) = 5V \times 1 / (1+1)$ $\boxed{U_{R2} = 2{,}5V}$

b. la diode est passante (polarisation directe) :



$U_{R2} = - V_D$ **$U_{R2} = - 0{,}6V$**

2. $e(t) = 5V \sin(2\pi t / T)$ avec $T = 20ms$



- Pour : **$e(t) \geq 0$**, la diode n'est pas passante et $U_{R2} = e(t) \times R_2 / (R_1 + R_2)$

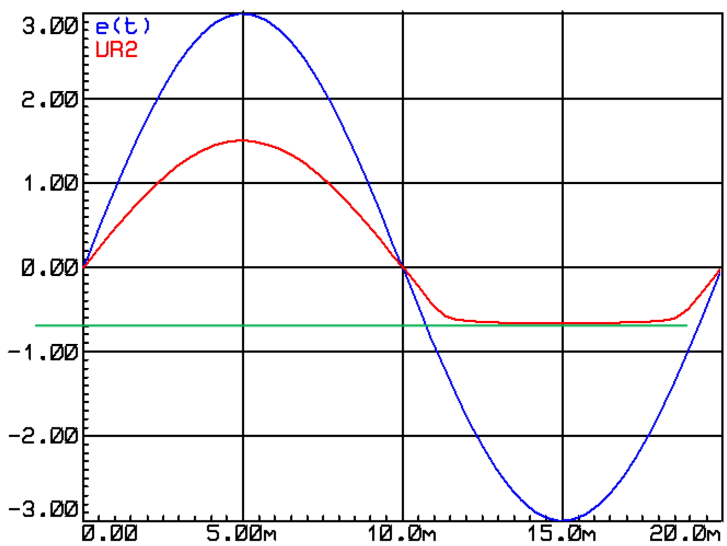
  $U_{R2} = 5V \sin(2\pi t / T) \times 1/(1+1)$ **$U_{R2} = 2{,}5V\sin(2\pi t / T)$**

- Pour : **$e(t) < -0{,}7\ V$**, la diode est passante

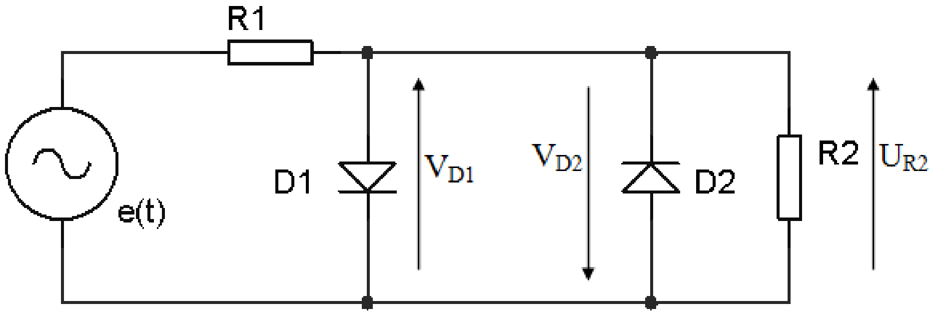
  $U_{R2} = - V_D$ **$U_{R2} = - 0{,}6V$**

- Pour : **$-0{,}7V \leq e(t) < 0$**, la diode n'est pas passante

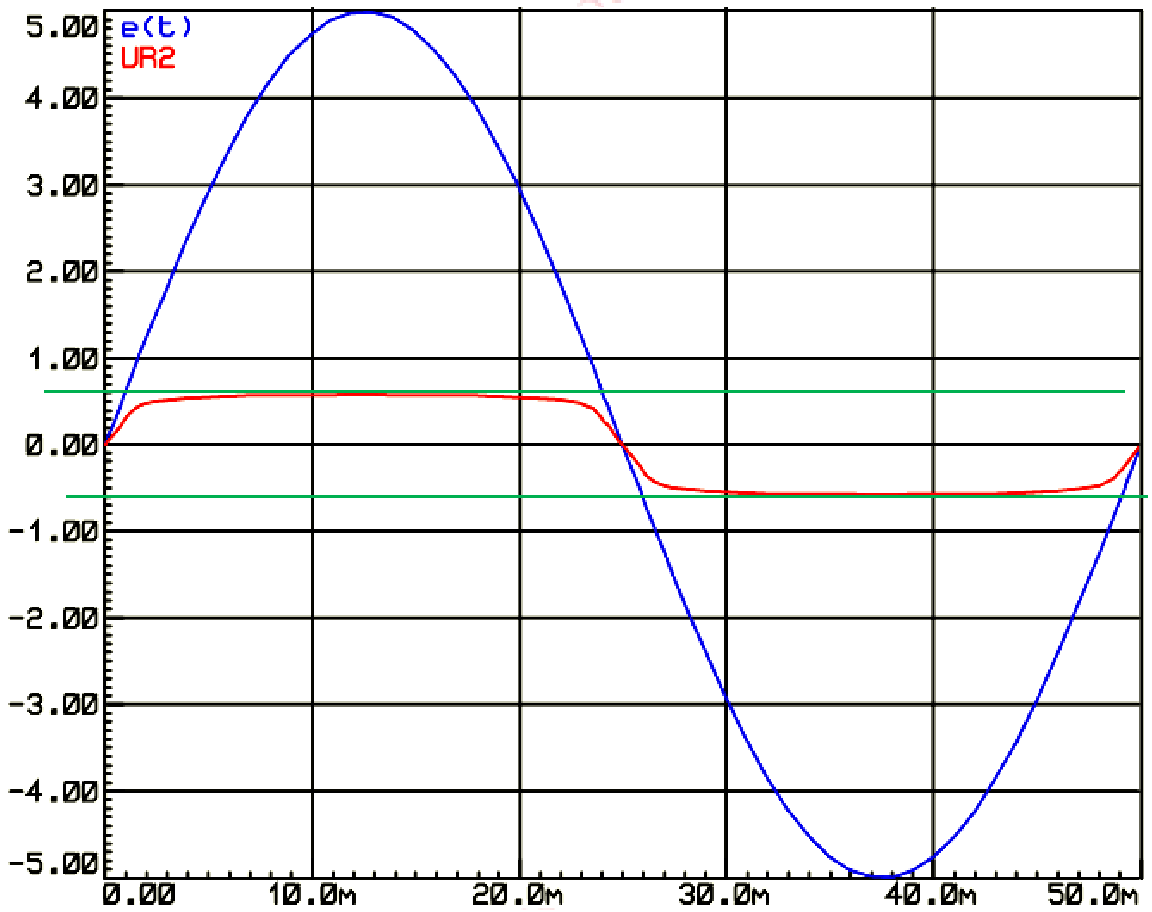
  $U_{R2} = e(t) \times R_2 / (R_1 + R_2)$ **$U_{R2} = 2{,}5V\sin(2\pi t / T)$**



Exercice 3

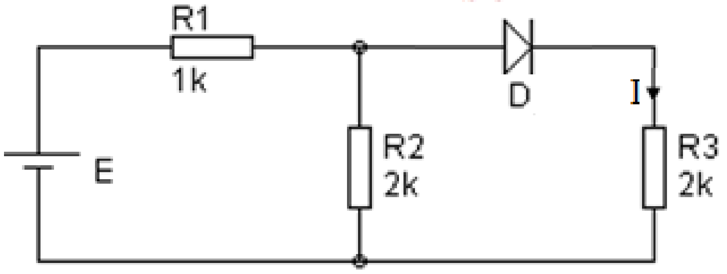


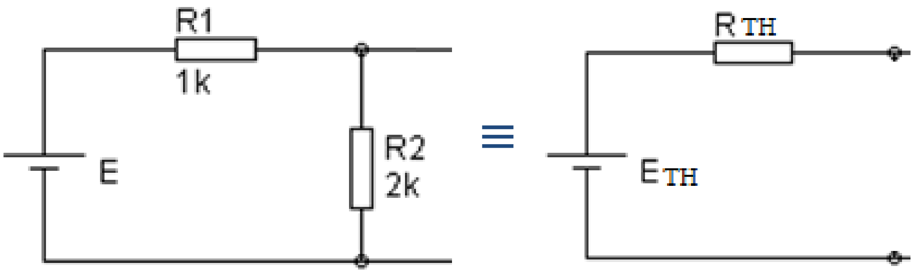
- Pour : **e(t) ≥ 0,6V**, la diode D1 est passante et la diode D2 est bloquée
  $U_{R2} = V_{D1}$ **U_{R2} = 0,6V**
- Pour : **e(t) <-0,6 V**, la diode D2 est passante et la diode D1 est bloquée
  $U_{R2} = - V_{D2}$ **U_{R2} = -0,6V**
- Pour : **-0,6V ≤ e(t) <0,6V**, les diodes ne sont pas passantes et
  $U_{R2} = e(t) \times R_2 /(R_1 + R_2)$ **U_{R2} = 2,5Vsin(2πt / T)**



Exercice 4

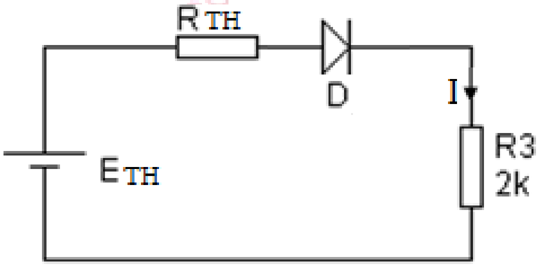
On utilise le théorème de Thévenin pour simplifier le schéma :





$$E_{TH} = \frac{R_2}{R_1 + R_2} E = \frac{1}{1+2} x5V = \frac{5}{3} V \quad \text{et} \quad R_{TH} = \frac{R_1 \text{ x } R_2}{R_1 + R_2} = \frac{1x2}{1+2} k\Omega = \frac{2}{3} k\Omega$$

1. E = 5V, la diode est passante ($E_{TH} > V_D = 0{,}6V$).



$I = (E_{TH} - V_D)/(R_{TH} + R_3) = (5V/3 - 0{,}6V) / (2/3 + 2)k\Omega$ **I = 0,64mA**

$U_{R3} = (E_{TH} - V_D) \text{ x } R_3 / (R_{TH} + R_3) = (5V/3 - 0{,}6V) \text{ x } 2 / (2/3 + 2)$ **U_{R3} = 1,28V**

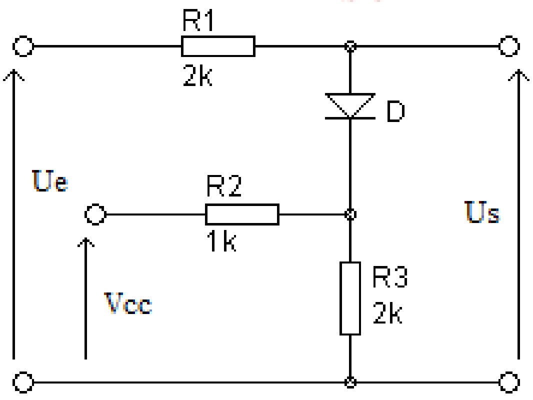
2. E = 1,5V, la diode n'est pas passante ($E_{TH} < V_D = 0{,}6V$)

U_{R3} = 0V

I = 0A

Exercice 5

1. lorsque la diode est bloquée, le courant $I_{R1} = 0$ (courant dans R_1) et $U_{R1} = 0V$



$Us = Ue - U_{R1}$

$Us = Ue$

2. $Ue = U_{R1} + Us = U_{R1} + V_D + U_{R3}$

$U_{R3} = Vcc \times R3/(R2 + R3) = 2Vcc / 3$

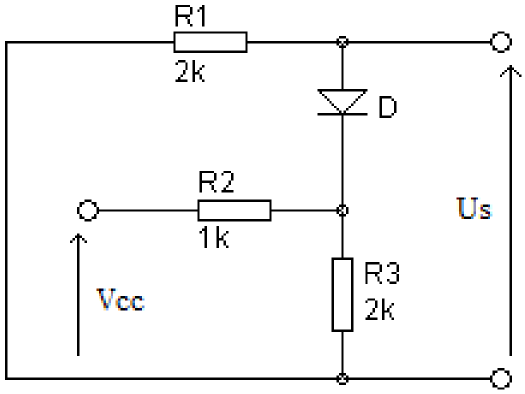
$Ue = U_{R1} + V_D + 2Vcc / 3$

La tension minimale d'entrée (U_{emin}), pour que la diode conduise, est obtenue lorsque le courant dans la diode D est négligeable $\Rightarrow U_{R1} = 0V$

$U_{emin} = V_D + 2Vcc / 3$

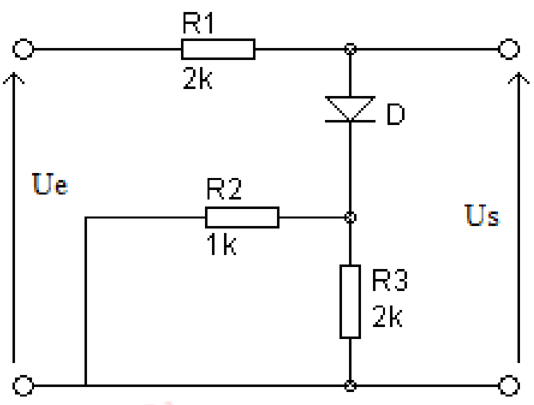
3. si $Ue = 10V$, $Vcc = 5V$ et $V_D = 0{,}6V$,

a. ($Ue = 0V$ et $Vcc = 5V$)



$U'_{R3} = 2Vcc / 3 \Rightarrow U'_{R3} = 10V / 3$

($Ue = 10V$ et $Vcc = 0V \Rightarrow R2//R3$)



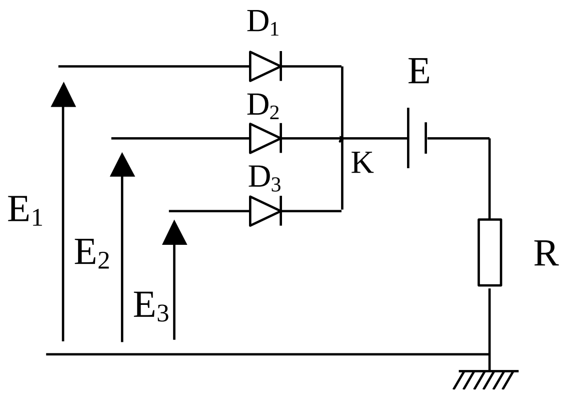
$U''_{R3} = (Ue - V_D) \times (R2//R3) / (R1 + R2//R3)$

$U''_{R3} = (10V - 0,6V) \times (2/3) / (2 + 2/3) \Rightarrow U''_{R3} = 9,4V / 4$

$U_{R3} = U'_{R3} + U''_{R3}$ **$U_{R3} = 5,68V$**

b. $Us = U_{R3} + V_D = 5,68V + 0,6V$ **$Us = 6,28V$**

Exercice 6



$E_1 = 30V$ $E_2 = 10V$ $E_3 = 15V$ $E = 10V$ $R = 20\Omega$

a) Lorsque D_1 conduit,

$V_K = E_1 - V_D = 30V - 0,6V = 29,4V$

$E_2 - V_K = 10V - 29,4V = -19,4$ $\Rightarrow$ D_2 est bloquée

$E_3 - V_K = 15V - 29{,}4V = -14{,}4 \quad \Rightarrow \quad D_3$ est bloquée

Donc, seule la diode D_1 est passante.

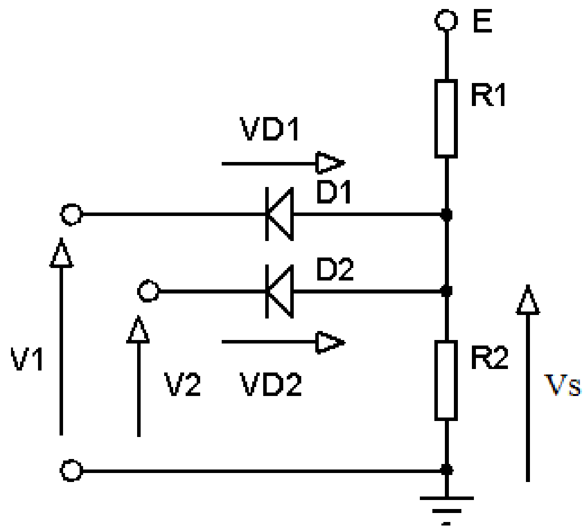
b) $I_R = (V_K - E) / R = 19{,}4V / 20\Omega = 0{,}97$ A

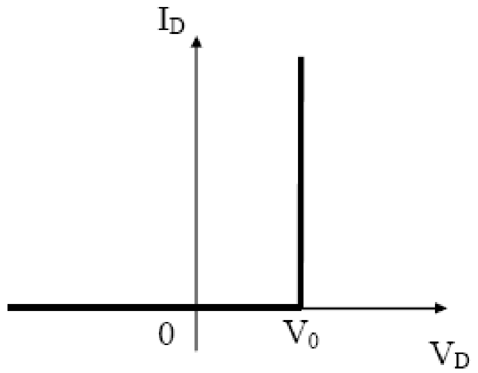
La diode D_1 conduit $\Rightarrow U_{D1} = 0{,}6V$, U_{D2} et U_{D3} aux bornes des diodes.

$U_{D2} = E2 - V_K$ **$U_{D2} = -19{,}4V$**

$U_{D3} = E3 - V_K$ **$U_{D3} = -14{,}4V$**

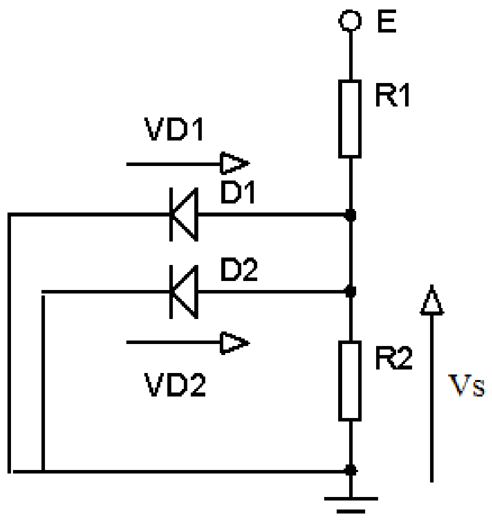
Exercice 7





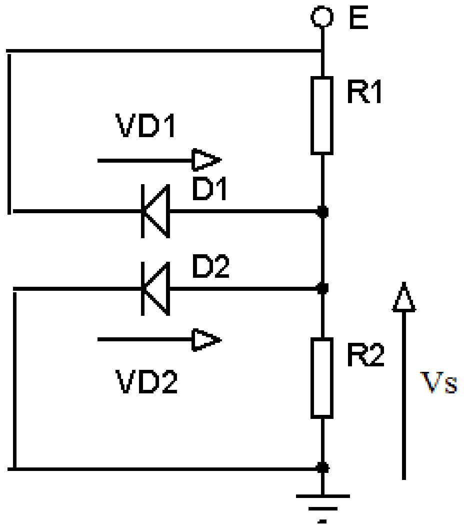
1)

a) $V_1 = 0V$ et $V_2 = 0V$,



Les 2 diodes conduisent : $V_s = V_{D1} = V_{D2} = 0{,}6V$

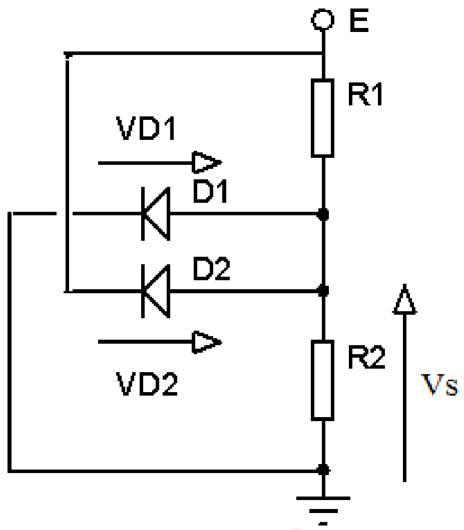
b) $V_1 = 5V$ et $V_2 = 0V$



D_2 conduit : $V_s = V_{D2} = 0{,}6V$

D_1 est bloquée : $V_{D1} = V_s – E = 0{,}6V - 5V = - 4{,}4V$

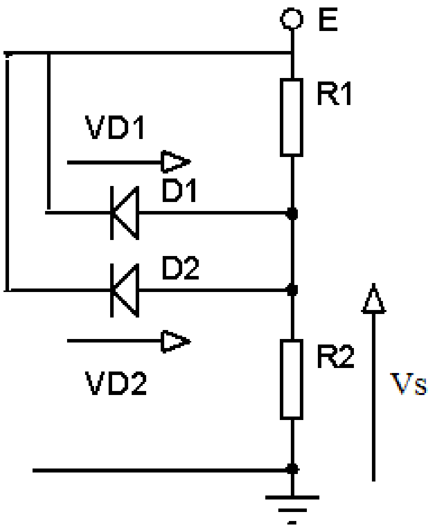
c) $V_1 = 0V$ et $V_2 = 5V$



D_1 conduit : $V_s = V_{D1} = 0{,}6V$

D_2 est bloquée : $V_{D2} = V_s – E = 0{,}6V - 5V = - 4{,}4V$

d) $V_1 = 5V$ et $V_2 = 5V$



D_1 et D_2 sont bloquée : $V_{D1} = V_{D2} = Vs - E$

$$Vs = U_{R2} = E \times \frac{R_2}{R_1 + R_2} = 5V \times \frac{100}{10 + 100} = 4{,}54V$$

$V_{D1} = V_{D2} = Vs - E = 4{,}54V - 5V = -0{,}46V$

2)

V_1	V_2	Vs
0V	0V	0,6V
0V	5V	0,6V
5V	0V	0,6V
5V	5V	4,54V

$\Rightarrow$

V1	V2	Vs
0	0	0
0	1	0
1	0	0
1	1	1

3) la fonction logique réalisée est le ET (AND) logique