ELECTRONICS TEST

Calculators and documents are not allowed. The points scale is given as an indication.
Answer exclusively on the item. If your run out of space use the back of the pages

EXERCISE 1 : LECTURE QUESTIONS (MCQ - 3 POINTS)

Select the correct answer

Q1. Doping increases conductivity of a semiconductor
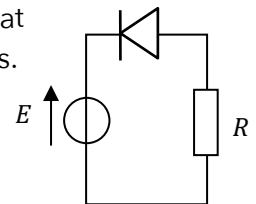
a- TRUE   b- FALSE

Q2. If we take silicon as a semiconductor element and dope it with an element that has one less valence electron than silicon, we have:

a- N-type doping   c- P-type doping

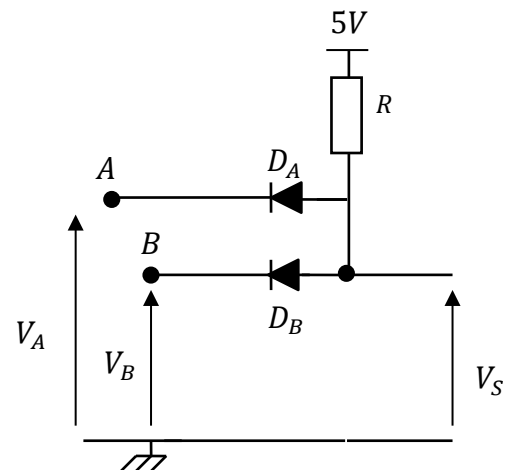b- No doping   d- NP-type doping

Q3. Consider the circuit opposite in which the diode is assumed ideal. What is the value of voltage V_{AK} across the diode if E = 10 V and R = 100 Ohms.

a- $10\,V$ c- $-10\,V$

b- $0\,V$ d- $0,7\,V$
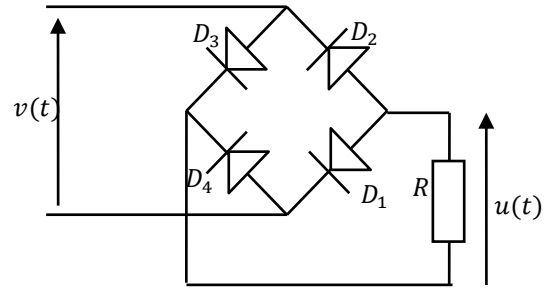
Q4. Consider the circuit opposite

What type of gate does this circuit realize ?

a- OR   c- NAND

b- AND   d- NOR

In the following circuit : $v(t) = V.\sqrt{2}.sin(\omega t)$.
(Q5&Q6)

Q5. What are conducting diodes if v(t) is negative.

      a- D_1 & D_3 c- D_3 & D_4

      b- D_2 & D_4 d- D_1 & D_2

Q6.   Select the correct answer

      a- $u(t) \leq 0\ \forall t$ c- $u(t) = 0$ if $v(t) \leq 0$

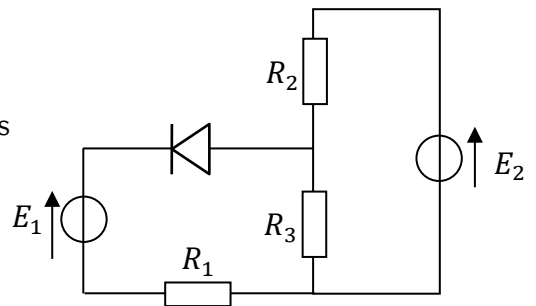   b- $u(t) \geq 0\ \forall t$ d- $u(t) = 0$ if $v(t) \geq 0$

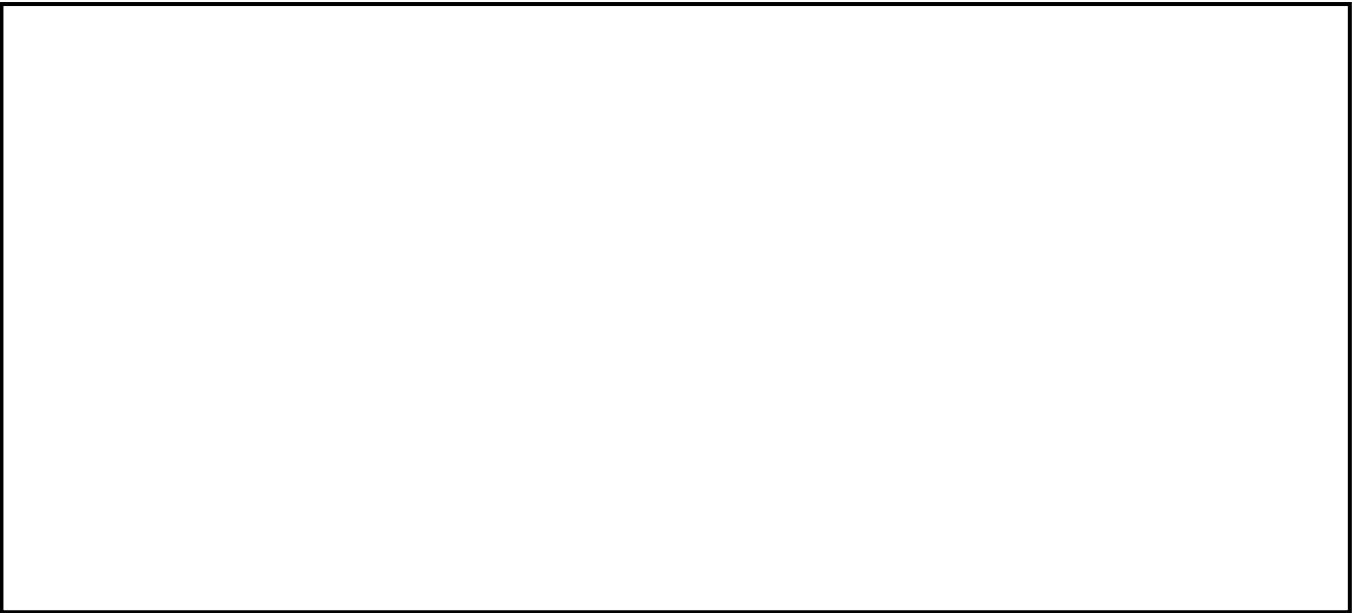## EXERCISE 2 : DIODES (5 points+1)

For the following questions, use proof by contradiction.

1. Consider the diagram opposite. Show that the diode is conducting

   We have $R_1 = 2k\Omega, R_2 = R_3 = 1k\Omega,$ $E_1 = 5V$
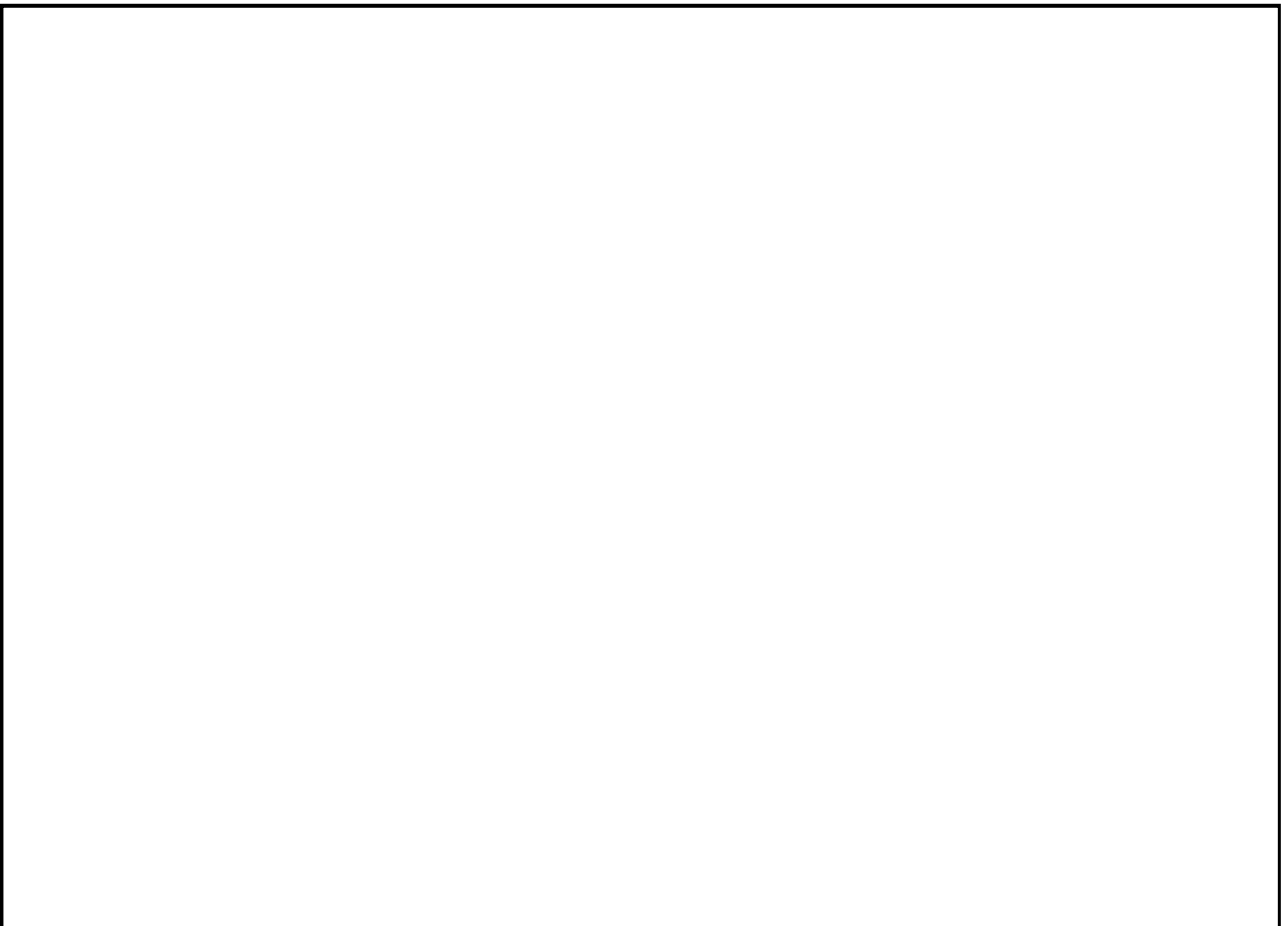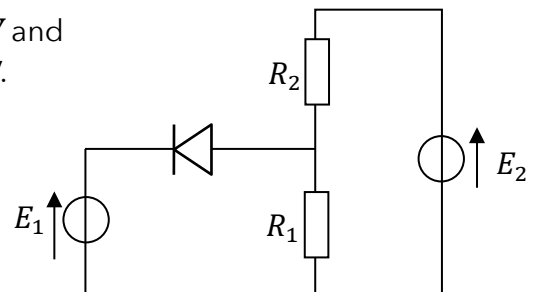 $E_2 = 20V$. The diode is assumed ideal (ideal model)

   BONUS : Determine then the current that traverses the diode.

2. Consider circuit opposite. $R_1 = R_2 = 1k\Omega$, $E_1 = 12V$ and $E_2 = 10V$. We use the threshold model with $V_0 = 0.6$ V.
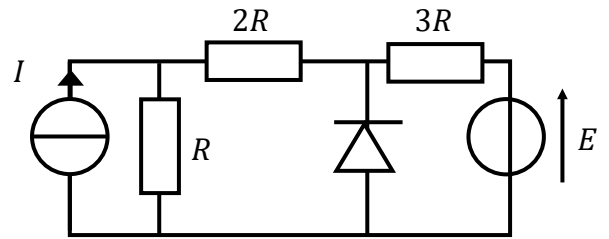
    Show that the diode is blocked.

Exercice 3 : Diodes (6 points)

Consider the following circuit

We'll use the threshold model for the diode.
We note V_0 the threshold voltage.

1. Determine the Thévenin generator seen by the diode

2. Determine the relation between E, R, I and V_0 so that the diode is conducting ?

EXERCISE 4 : ZENER DIODE (6 POINTS)

We consider the following diagram. V is a voltage that can take any real value. We want to plot the shape of the transfer characteristic i.e $U = f (V)$ by substituting the diode by its real model. We will denote V_0 the direct threshold voltage, r_D the internal resistance of the direct diode, V_Z the Zener threshold voltage and r_Z the internal resistance of the reverse diode.
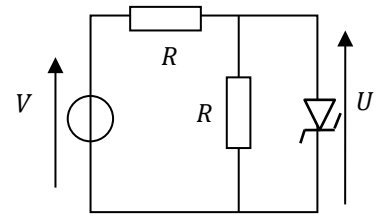
1. What is the expression of U when the Zener diode is blocked ? For which values of V are we in this case ?

2. What is the expression of U when the Zener diode is conducting in forward ?

3. What is the expression of U when the Zener diode is conducting in reverse ?

4. Plot the the transfer characteristic function $U = f(V)$.