EPITA / InfoS3 November 2022

NAME: …… Forename:..... Group:.....

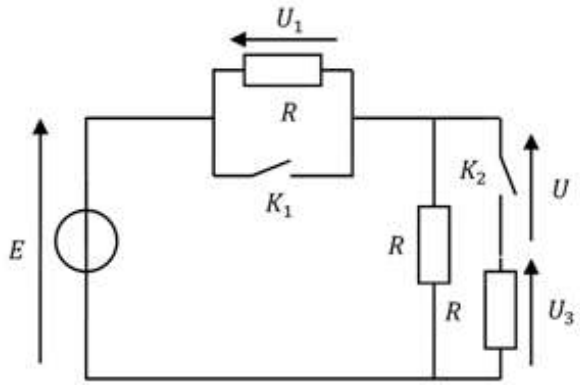
# Electronic **Control**

*Calculators and documents are not allowed. The scale is given as an indication.*

***Answers exclusively on the subject. If you run out of space, you can use the back of the pages.***

## Exercise 1. MCQ (4 points – No negative points)

Consider the circuit below:




**Q1.** What is the expression of $U$ if $K_1$ *and* $K_2$ are open?

a- $U = \frac{E}{2}$

b- $U = 0$

c- $U = E$

d- $U = \frac{E}{3}$

**Q2.** What is the expression of $U$ *if* $K_1$ is closed and $K_2$ is open ?

a- $U = \frac{E}{2}$

b- $U = 0$

c- $U = E$

d- $U = \frac{E}{3}$

**Q3.** In a semiconductor, the current is composed of:

a- Free electrons only

b- Electrons and holes moving in opposite directions

c- Electrons and holes moving in the same direction

d- Holes only.

**Q4.** In an intrinsic semiconductor, the number of free electrons is:

a- equal to the number of holes

b- greater than the number of holes

c- smaller than the number of holes

d- none of the previous cases

**Q5.** Doping increases the conductivity of the semiconductor.

a- TRUE

b- FALSE

**Q6.** What is thermogeneration

a- Heat release

b- The creation of Electrons/Holes pairs under the effect of temperature

c- This is another term for the Joule effect

d- The manufacture of temperature sensors

**Q7.** The silicon semiconductor element is used with 4 electrons in the valence band. If it is doped with aluminum, an element with 3 electrons in its valence band, what is the type of doping:

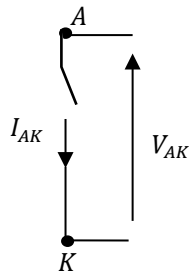
a- N Doping

b- P Doping

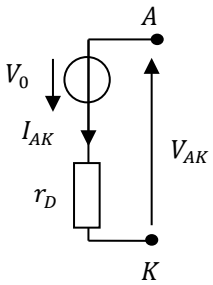
c- NP Doping

d- No doping

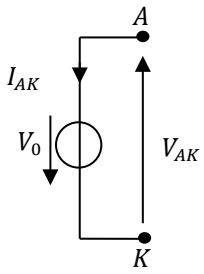
**Q8.** What replaces the blocked diode with if the real model (imperfect voltage source) is used?



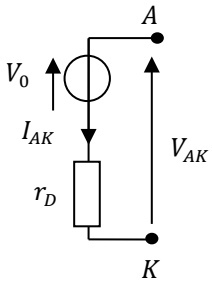

a-




b-



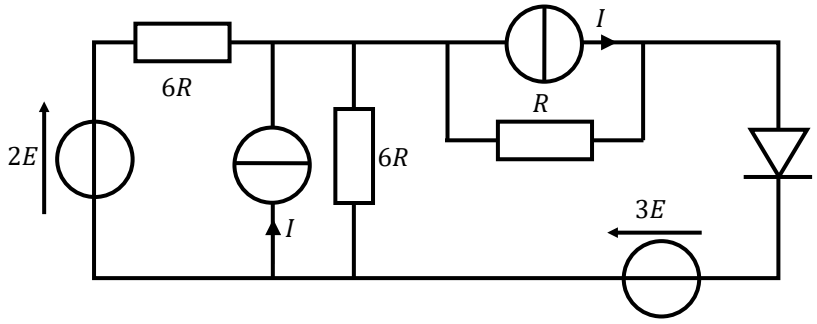

c-




d-

## Exercise 2. SUP +Diode revisions (5 points)

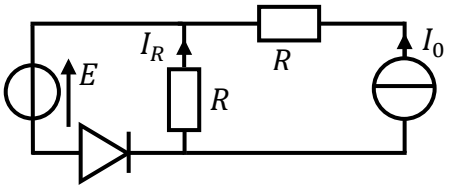
Consider the circuit below.




1. Determine the Thevenin generator seen by the diode.

2. Under what condition connecting $E$, $I$ and $R$ will the diode be passing? The threshold model (Ideal voltage source model) will be used.

## Exercise 3. Diodes (6 points)



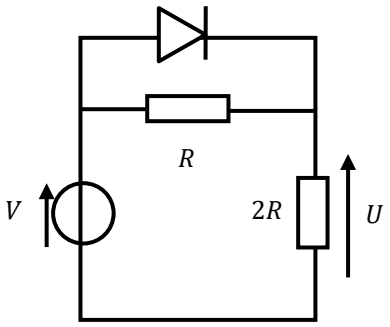

Consider the following diagram: We will model the diode using its threshold model (ideal voltage generator) with $V_0 = 0.7V$. **For the following 2 questions, you will use reasoning by the absurd.**

1. If $R = 1k\Omega,\ I_0 = 5\ mA\ and\ E = 5V,$ show that the diode is blocked. Then determine the intensity of the $I_R$ current that passes through the resistor.

2. If $R = 1\ k\Omega,\ I_0 = 10\ mA\ and\ E = 5\ V$ show that the diode is passing. Determine then the intensity of the $I_D$ current that passes through the diode.

## Exercise 4. Transfer characteristic (5 points+1)

Consider the following circuit:




We want to trace the characteristic $U = f(V)$.

We will use the threshold model (perfect voltage source) to model the diode; and we will call its threshold voltage $V_O$.

1. Give the expression of *U* if the diode is passing.

2. Give the expression of $U$ if the diode is blocked.

3. For what values of $V$ is the diode blocked?

4. Plot $U = f(V)$

**BONUS**: The voltage generator is now considered to be a sinusoidal voltage generator.

We give $V = e(t) = E.\sqrt{2}.\sin(\omega t)$. $E\sqrt{2} = 30\,V$. Plot the look of the curve $u(t)$ if the diode is ideal.