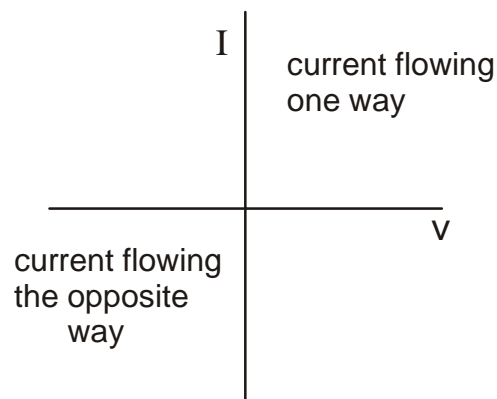


## Investigating Components having Non-Linear Characteristics

1. **Preparation:**
  - a) Read about diodes and voltage dependent resistors. You do NOT need to know HOW they work but just how they behave in circuits.
  - b) See expt 1EM for circuit diagram.
  - c) Parts 3 and 4 below.
  
2. Obtain results to plot the characteristics of
  - a) a 3.5v bulb
  - b) a voltage dependent resistor, v.d.r. (sometimes called a varistor)
  - c) a silicon diode
  
3. Using the same circuit as experiment 1EM, connect the component to be investigated *first one way then the opposite way*. Plot your results on axes as shown below. Use a 6v d.c. supply for the bulb and diode. Increase to 24v for the v.d.r.



### **IMPORTANT**

Set the potential divider to give *zero* voltage *before* connecting the component into the circuit, then increase the voltage very gradually.

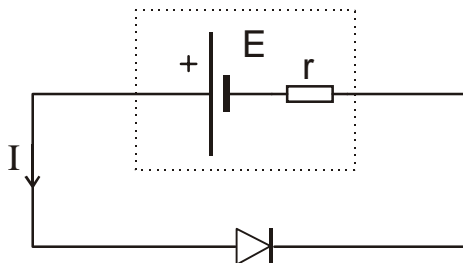
For the bulb you can safely go up to  $I_{\max} = 300 \text{ mA}$ .

For the diode,  $I_{\max} = 100 \text{ mA}$ .

For the v.d.r.,  $I_{\max} = 10 \text{ mA}$ .

#### 4. Using the Characteristics

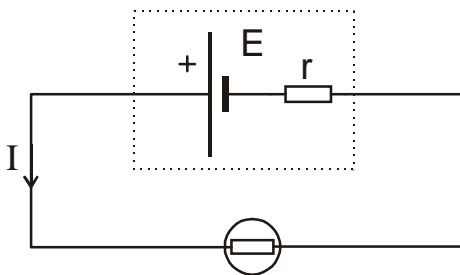
Consider the circuit shown below, in which  $E = 1.1 \text{ V}$  and  $r = 25 \Omega$ . (A diode connected as shown below is said to be “forward biased”.)



Try to calculate the current,  $I$  which flows in the circuit and the voltage,  $V$  across the diode.

It will soon become clear that you can *not* calculate these answers without knowing the detailed characteristics of the diode (make sure you understand *why* this is the case). Let us assume that the diode in this circuit is the one which you used in your experiment. If you plot the *characteristics of the battery* in this circuit on the same axes as the characteristics of the diode, you should see how to answer the questions.

Using the same method, consider the following circuit, in which the bulb is the one you used in your experiment,  $E = 4.5 \text{ V}$  and  $r = 15 \Omega$ .



Find the voltage across the bulb and the current flowing in the circuit.