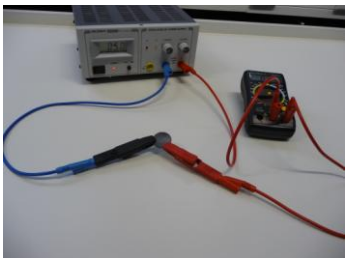
Does the supply of energy have an effect on the conductivity of semiconductors, metals and aqueous solutions?

At this station you can find out more about the electric conductivity of a piece of silicon, a piece of tungsten wire and an aqueous solution of zinc iodide at room temperature and at higher temperatures.
Carry out the experiments, note down your observations and answer the questions.



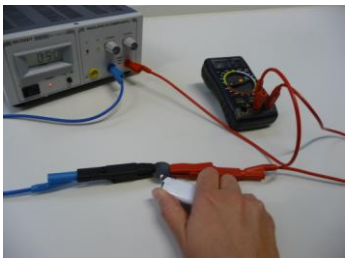


Fig.1 Set-up of E1. For E2 a piece of tungsten wire is used instead of the silicon plate.

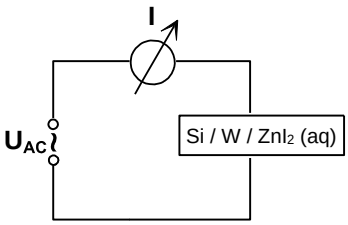


Fig.2 Circuit diagram of E1 –E3.

E1) Testing semiconductors: silicon Si

Set up the circuit as shown in Fig.1. Connect the silicon plate directly to the alligator clips.

a) Apply a voltage of 10 V (AC) and measure the electric current with a measuring device which can measure electric current in µA.

I = _____ µA

b) Continue measuring the electric current and move the flame of a pocket lighter close to the silicon plate. Remove the flame again and cool the wire by blowing at it. Repeat this procedure several times.

I = _____ µA

☞ Describe the changes in electric conductivity when the silicon plate is heated and cooled.

E2) Testing metals: tungsten W

Set up the circuit as shown in Fig.1. You can connect the tungsten wire directly to the alligator clips or use a light bulb (with the glass removed!) in a bulb socket.

a) Apply a voltage of 5 V (AC) and measure the electric current.

I = _____ mA

b) Continue measuring the electric current and move the flame of a pocket lighter close to the tungsten wire. Remove the flame again and cool the wire by blowing at it. Repeat this procedure several times.

I = _____ mA

☞ Describe the changes in electric conductivity when the tungsten wire is heated and cooled.

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E3) Testing aqueous solutions: zinc iodide solution ZnI_2 (aq)

Fill 100 mL zinc iodide solution c = 0.1 mol/L into a 250 mL beaker and set up the circuit as shown in Fig.3. Watch the colour of the solution and the carbon rods before the experiment.

a) Apply a voltage of 5 V (DC) and measure the electric current at room temperature.

I = _____ mA

b) Continue measuring the electric current and heat the solution with a burner up to 60 °C.

I = _____ mA

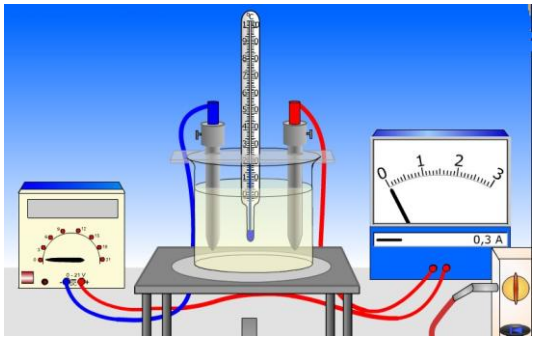

Fig. 3 Set-up of E3.

☞ Compare the look of the solution and the carbon rods before and after the experiment.

☞ Describe the changes in electric conductivity when the zinc iodide solution is heated.

☞ **Questions**

1) Based on your observations you can now complete the following table:

tested material	**conductivity at room temperature**	**change in conductivity at higher temperatures**	**visible changes in material**
semiconductor		☐ increase ☐ decrease	
metal		☐ increase ☐ decrease	
aqueous solution		☐ increase ☐ decrease	

2) In your group find an answer to the title question.

Words: *tungsten:* Wolfram; *silicon:* Silicium; *circuit diagram:* Schaltskizze; *circuit:* Stromkreis; *to apply a voltage:* eine Spannung anlegen; *bulb socket:* Lampenfassung; *carbon rod:* Graphit-Elektrode.

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