7. Electronics

At the beginning of teaching the modules about electronics repeat the relevant safety instructions ‘electricity’ to students.

Chapter 6 introduced the basics of electricity and diodes as comparatively simple to understand semiconducting components[1]. In the following, students will learn about two more semiconductors (LDR, transistor), a capacitor (which is a conductor) as key components in an electronic circuit. In a further step, students learn about two electronic circuits.

Note that the teaching of the module electronics builds upon this knowledge and the physics behind. As in the module on electricity: understanding the properties of the components and the electronic circuits allows linking the understanding gained in the experiments with the physics behind.

Also note that the experiments in this module 7 (electronics) are designed to be conducted with breadboards. As mentioned in the introduction to module 6, using breadboards for the experiments requires introducing and familiarizing students with it (see notes and information on breadboards in module 6). As an alternative to using breadboard, experiment 7.1 can also be conducted with crocodile clip cables (see experimentation instruction 7.1 (2) Light dependent resistors (with crocodile clips)).

The electronic circuits are exemplary of an endless number of devices and processes that use electronics. Not least, the development of transistor circuits is the foundation of computer technology. Circuits can be found all around us – in our homes, schools and businesses and are part and parcel of everyday life of most people in this world. Knowledge about the basics of electronics and its pervasiveness in everyday life and technology provide good stepping-stones to inform students about the vocational application.

In general, students may have different levels of confidence doing the modules about electronics, and probably about science respective physics in general. At the same time, once started, students commonly enjoy doing the hand-on experiments of the modules. Successfully setting up a circuit that works, or even building a dark detector, can be very enlightening and motivating to students and may even alleviate some of the reservations again sciences. Conversely, fiddling around with a circuit that does not work can be demotivating and reinforce insecurities.

If your students are doing the experiments in groupwork, make sure that each group will get the desired result. This may imply that you as the teacher need to go around in the classroom and check on each group, or that you ask students that have completed a task to help others struggling. It may also mean that you need to encourage your students to ask you for help if they are stuck. Either way, to ensure that you provide your students with a good learning experience, it is recommended that you conduct each experiment yourself and know about the pitfalls that go along with electronics. Common mistakes, and by far the majority of mistakes made when doing this kind of electronics and at this level, include using the wrong component or a component with a wrong value (especially resistors), installing LEDs or transistor the wrong way, and mixing up

[1] A semiconductor is a device which is neither an insulator nor a conductor. It is a substance, usually a solid chemical element or compound, that can conduct electricity under some conditions but not others, making it a good medium for the control of electrical current. In other words: They behave like a conductor in the right conditions.

positive and negative poles. If you introduce the experiments, highlight aforementioned mistakes as likely causes for non-functioning circuits. If students do not find the mistake themselves and circuits still are not working, check first for the errors mentioned.

If you've checked the errors and circuits are still not working, test the LED or transistor (if the components are included in the circuit). A LED or transistor can be damaged, especially when the resistor has too little resistance. Make sure that you know how to easily whether a transistor or LED is broken.

The experiments in the modules can be conducted with different materials, for example specifically developed experimental sets of breadboards. If you are using breadboards, and/or if you are introducing regular electronic components such as LEDs, transistors and electrolytic capacitors, you need to explain how to distinguish the various pins of the components.

If you are using different materials or output voltage, most likely you will need to adjust the values of the components. For example, the dark detector can just as well be build with an output voltage of 9V. In this case, you would need to adjust the values of the resistors. The Internet is a rich source to find circuits operating with different voltages.