

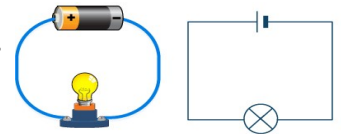
A system is a collection of connected things which perform a task.

In Design and Technology we use systems to explain how complex things work by breaking the task down into 3 basic parts:



Circuits

- Electronic systems are **circuits** that contain a sequence of electronic **components** that are connected by wires to a **power source**, eg battery or mains electricity.
- A circuit is made up of different components which can be **input, process or output** components.
- **Circuit diagrams** are used to show how a circuit works.
- **Symbols** are used to represent components
- **Voltage** from the power source pushes electrons around the circuit (**current**) from positive to negative.



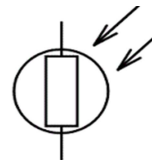
Input Components

Input devices give an **INPUT SIGNAL** to the system. They can be triggered manually, (like a light switch), or respond to environmental changes (light sensor, temperature sensor, pressure switch etc). Once triggered, an electrical signal is processed.

L.D.R.s



- Light dependent resistors are sensors that detect changes in light levels.
- Resistance increases in the dark, as it limits the current.
- Used for street lights that come on automatically.
- Can be altered so they are triggered when a certain light level is reached.
- Can be used as a light sensor or a dark sensor. Just swap it around with the VR.
- Inexpensive, but need to be carefully positioned.



Thermistors



- Thermistors are sensors that detect temperature changes.
- Resistance decreases as temperature increases (current increases).
- Can be used as a cold sensor or as a heat sensor.
- Used in air-conditioning systems and heating systems in cars, houses etc.
- Cheap but need to be carefully positioned.



Control Devices and Components

Control / Processing devices can be used to give an input signal to an electronic circuit, or respond to an input signal, and switch on the output.

Switches



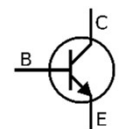
- Switches are used to complete or disconnect a circuit.
- There are many different types of switches available: toggle, slide, push, micro switches.
- May fail mechanically after a long time.



Transistors



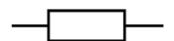
- The transistor is like a tiny electronic switch. It can turn current on and off.
- They respond to the input, and send an electrical signal to trigger the output.
- They improve the sensitivity of sensing circuits.
- Can be damaged by heat.
- It works by the sensor sending a signal to the base. Once a small voltage reaches the base, a larger voltage can pass through the collector and the emitter, turning on an output device.



Fixed Resistors



- Resistors come in wide range of values, which are colour-coded.
- Resistance is measured in Ohms
- They are used to control the flow of electricity in a circuit.
- They are also used to protect delicate output devices and control devices, by limiting the current.
- If the wrong value is used, components can be destroyed and the circuit will not work.



Name:

Date:


HW/CWK



ELECTRONIC SYSTEMS



CORE 1.6 **1**

1.	What 3 parts make up a system? i) _____ ii) _____ iii) _____	(1)
2.	Explain why you think symbols are used to represent components, rather than pictures. _____ _____	(1)
3.	What is an electronic circuit? _____ _____	(1)
4.	List 3 possible applications for a dark sensor. i. _____ ii. _____ iii. _____	(3)
5.	Which input component would you have as a fire detector? _____	(1)
6.	Name a suitable switch for a bedroom light. _____	(1)
7.	Name 2 purposes for a fixed resistor: i. _____ ii. _____	(2)
8.	Explain the purpose of a transistor, and how it works. _____ _____ _____ _____ _____	(4)
9.	Name a disadvantage of a transistor. _____ _____	(1)
10.	i) What is RESISTANCE measured in? _____ ii) Draw the symbol for this measurement: 	(2)

TOTAL MARKS: / 17

OUTPUT COMPONENTS

Output components (devices) are controlled by the system, and have particular functions eg lights, buzzers, computer screens etc.

BUZZER



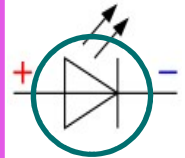
- Buzzers create sound.
- Buzzers are useful in sensing circuits. It gives people a warning if something requires attention. Burglar alarms, car alarm, microwaves, low battery on a device, smoke alarms, malfunction on a device.



L.E.D.



- An L.E.D. (light-emitting diode) gives out light when electricity is passed through it from positive to negative.
- LEDs come in a variety of colours and formats.
- Single LEDs can be small coloured indicator lights e.g. on a smoke alarm, watch light.
- They can also be used to light up rooms, make shop signs.
- They do not heat up like old bulbs, and are a fraction of the cost.

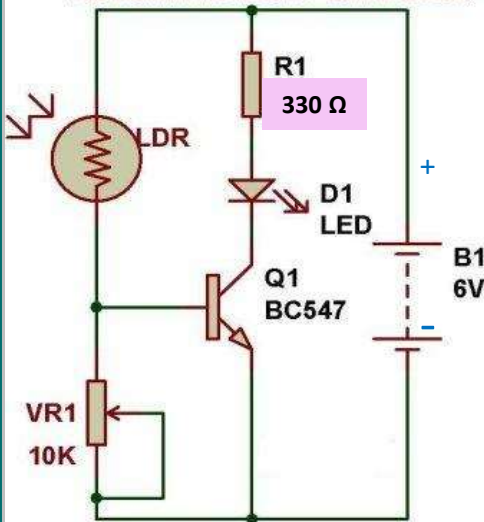


L.D.R.

TRANSISTOR

L.E.D.

AUTOMATIC LIGHT DETECTOR

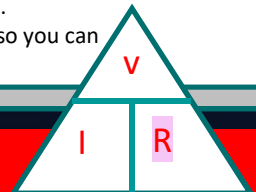


CIRCUIT ACTION

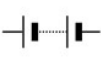
The 6V battery provides the power to this circuit.

The LDR and the Variable Resistor (VR1) make up the **INPUT** part of this system. Current always takes the path of least resistance, so if it is dark, the current cannot get past the LDR to get to the base leg of the transistor. Because there is no current going through the base collector, it means no current can reach the LED. The VR is used to set a particular light level. It can be set by the user.

The **TRANSISTOR** is the **PROCESS** part of this system. When light is detected by the LDR, it allows a small current to flow through to the base. When this happens, the transistor acts like a switch, and allows a bigger current to flow through from the collector to the emitter, thus allowing the **OUTPUT** (LED) to light up, as a complete circuit is created. The 330Ω RESISTOR (R1) is there to protect the LED from burning out. OHM's Law can be used to decide how big a resistor is needed. An LED can handle 0.02 Amps. Use the formula (triangle) to work out amps, volts and resistance. In this example, to find out Resistance, cover the R. Resistance will be V/I (amps). $R=6/0.02$ $R=300\Omega$. There is no resistor that is exactly 300Ω. The closest values of resistor available are 270 Ω and 330Ω , so you can choose either.



KEY TERMS

INPUT DEVICE	Something that can give an input signal to the system.
INPUT SIGNAL	Information given to the system by an input signal. e.g. changes in the environment (light levels, rain, movement).
OUTPUT DEVICE	Something that responds to an instruction from the system. e.g. noise of a buzzer , switching on of LED lights, movement of a motor.
OUTPUT SIGNAL	An instruction the system gives to an output device such as a buzzer or an LED
PROGRAM	A set of instructions the system controller has been given to make the circuit work as it should. If a transistor has been used there is no program, just a simple switching action due to the rise in voltage on the Base leg of the transistor above 0.6V. A central heating system is programmed.
RESISTANCE (R)	When the electric current flowing through a circuit is reduced or limited. Measured in ohms. Ω
COMPONENT	An individual piece of a system.
CIRCUIT	A linking together of several components together to perform a task. Electricity has to be able to flow through it.
VOLTAGE (V)	The amount of push that could make the electricity flow through a circuit. Bigger batteries have more push / pressure. Measured in Volts. 
CURRENT (I)	The flow of the electricity through the circuit. Measured in Amps. Current flows positive to negative.
SEMI-CONDUCTOR	A material that allows electricity to flow in certain conditions. It can behave as an insulator or a conductor. A transistor is a good example of a semi-conductor.





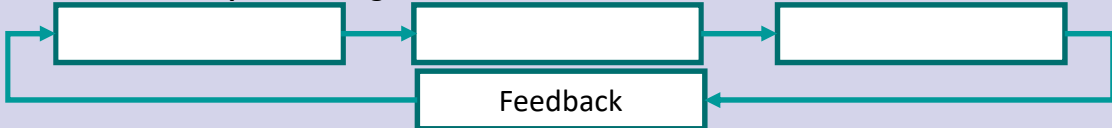


ELECTRONIC SYSTEMS



CORE 1.6

2

1.	Draw the symbol for a buzzer: 	Draw the symbol for an LED: 	(2)
2.	List 3 devices that might use a buzzer in their circuits: i. _____ ii. _____ iii. _____		(3)
3.	On an LED, how can you tell which is the negative leg if someone has cut the legs to the same size? _____		(1)
4.	List 3 devices that might use an LED in their circuits: i. _____ ii. _____ iii. _____		(3)
5.	Look carefully at the light detecting diagram. It detects <i>light</i> . How could you change the circuit so that it becomes a <i>heat</i> detector? _____		(1)
6.	Use Ohm's Law to find out the value of the resistor required to protect an LED, if the battery is 15V. Use a calculator if required. _____		(1)
7.	The circuit is missing a 1K ohm resistor which would protect the transistor. Which leg should it be connected to on the transistor, to protect it from a sudden surge of current? Circle your answer: <div style="display: flex; justify-content: space-around; text-align: center;"> Base emitter collector </div>		(1)
8.	Draw the symbol for the transistor, and label the 3 legs: 		(4)
9.	Name a semi-conductor and then explain what a semi-conductor is. Name: _____ What a semi-conductor is: _____		(2)
10.	Apart from a central-heating system, name an electronic system which might be "programmed." _____ Present this as simple building blocks: 		(4)