

# AQA GCSE

Design and  
Technology 8552

6

## Systems approach to designing

Unit 2  
Energy, materials,  
systems and devices



PG ONLINE

# Objectives

- Understand the principles of electronic systems
- Use systems diagrams and flowcharts to analyse and solve a given problem
- Understand the use of open and closed loop systems and subsystems
- Recognise and understand common electronic input and output components

# What is an electronic system?

- An electronic system is a series of parts or components that control a task or activity
  - Many products contain electronic systems
- Think about a security light:
  - What is the input?
  - What is the output?
  - How does the system make a decision to operate?



# Subsystems

- Subsystems or subtasks are events or tasks that happen within a system
- A car's systems include:
  - Steering
  - Braking
  - Electrical
  - Power and drive
  - Entertainment
  - Navigation
  - Safety and many more



# Systems diagram

- Explaining how a system works can be confusing so a simple block diagram is used
  - Separate inputs, processes, decisions and outputs are placed in individual boxes
  - They are linked with arrows to create a system or subsystem
  - The arrows show the direction (flow) within the system



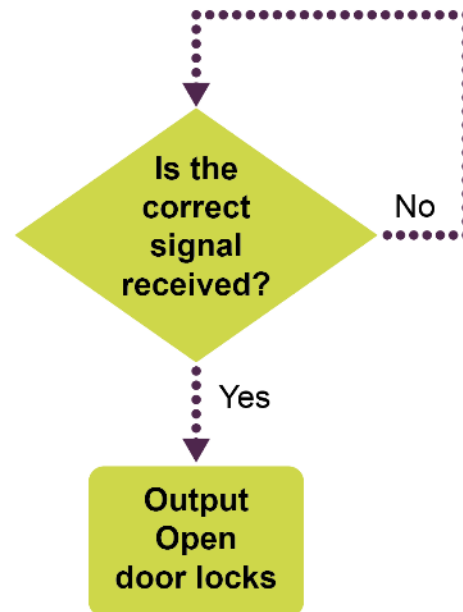
# Open loop systems

- Open loop systems **do not** make decisions based on feedback
  - A toaster heats bread for a set period of time
  - It cannot predict the perfect coloured toast
  - Why can't toasters get toast right every time?



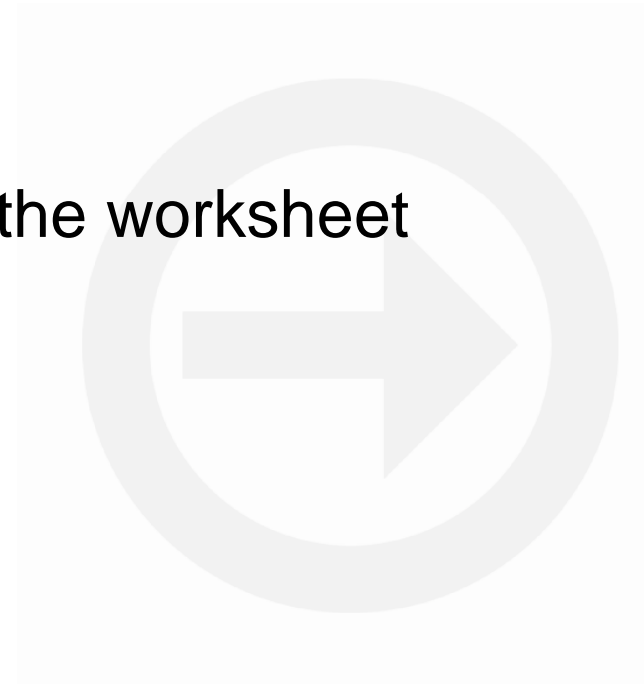
# Closed loop systems

- Feedback is used to make a decision
  - Diamond boxes represent decisions
  - How does a car know when to let you in?



# Worksheet 6





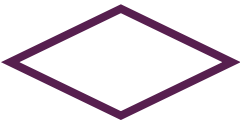
- Complete **Tasks 1** and **2** of the worksheet





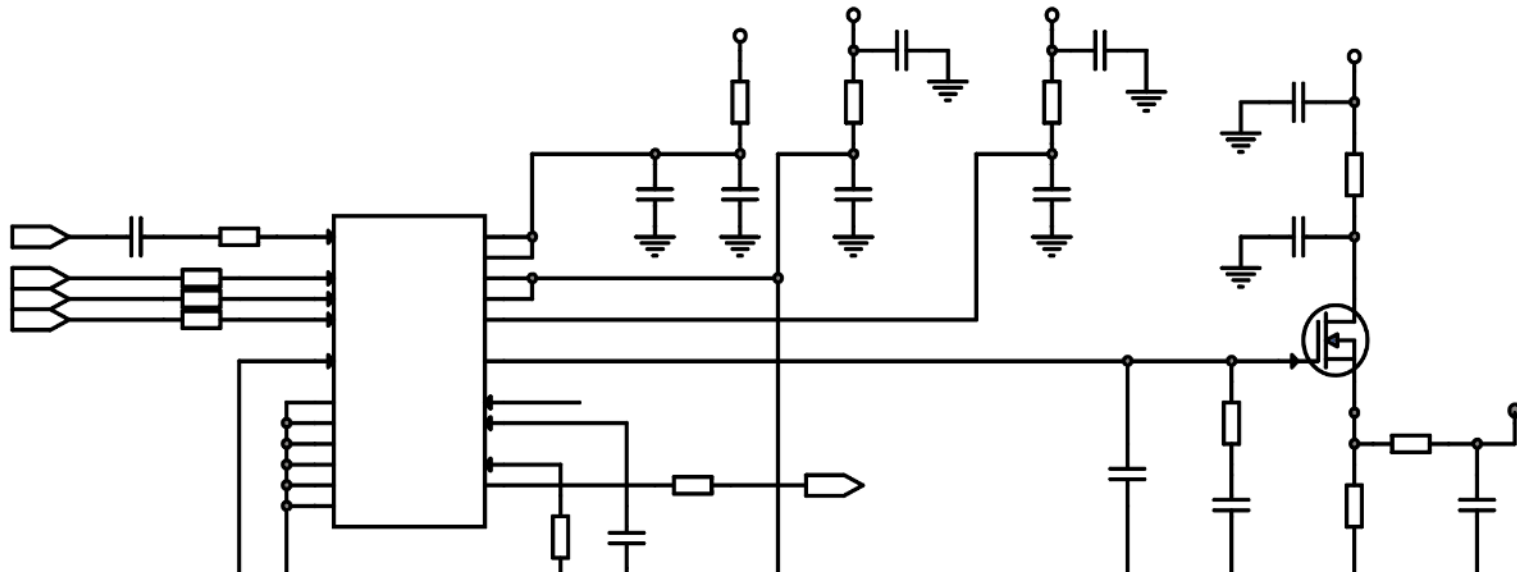
# Flowcharts

- Flowcharts are a more detailed way to graphically represent systems
  - They can also be used when programming microcontrollers
  - The common symbols include:

Start / End	Arrows	Input / Output	Process	Decision
				

# Circuits and symbols

- Specific symbols are used to represent components in an electronic circuit
  - Circuit symbols are connected in a particular way to assist understanding in a clear layout
  - It is known as a schematic diagram and is a visual representation of the circuit but **not** a real-life diagram



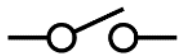
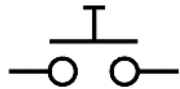

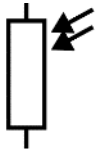
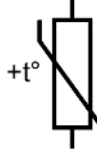
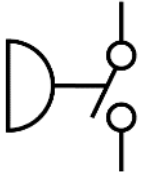
# Input components

- Systems and devices are triggered either manually or automatically using switches and sensors
  - Switches are a common form of input
  - Sensors can detect heat, light, movement and sound etc.



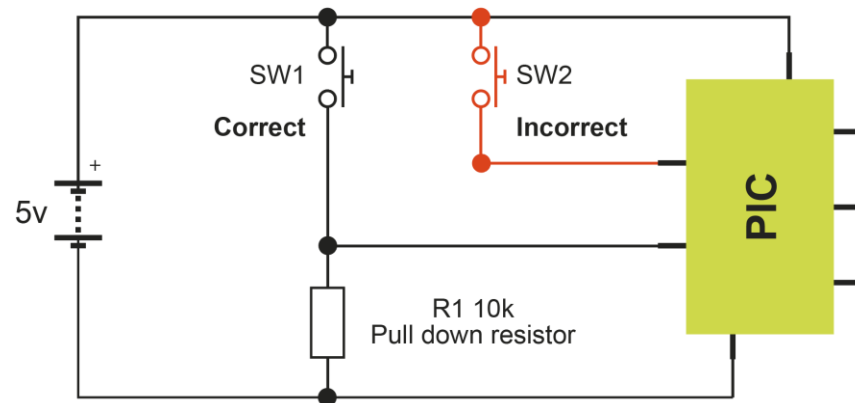
# Inputs

- Here are the circuit symbols for some input components used in electronic circuits
  - What does it mean if a component has polarity?
  - Which input component detects sound?

<b>Toggle (latching)</b>	<b>Push to make (PTM) Normally open</b>	<b>Push to break (PTB) Normally closed</b>	<b>Light dependent resistor (LDR)</b>	<b>Thermistor</b>	<b>Pressure switch</b>
					

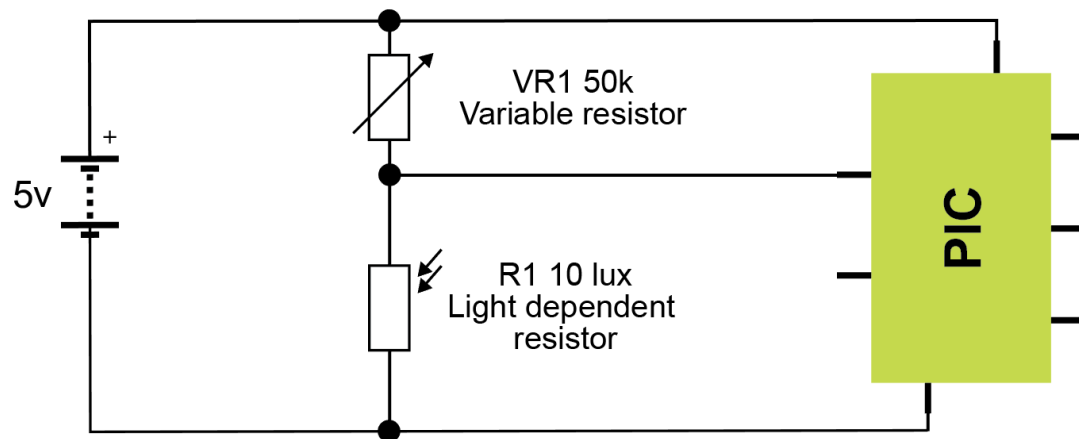
# Connecting inputs

- Most input components, especially sensors, work best in a potential divider
  - The input is connected to both the positive and negative of the power supply through appropriate components
  - It helps to provide a consistent signal to an input pin
  - A resistor is used to **pull-up** or **pull-down** an input pin to avoid it floating, which can cause erratic errors



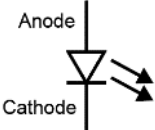

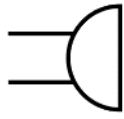
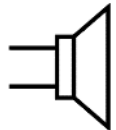
# Using analogue inputs

- Analogue components give out varying signals
  - A potential divider is used to provide the desired voltage in response to changing environmental conditions
  - For example, a street lamp needs to be turned on at dusk
  - The dark detector below uses a variable resistor which allows the sensitivity of the device to be adjusted



# Output components

- Output components change electrical energy into light, sound, heat, movement and so on
  - Some output components require lots of energy to operate, e.g. motors and heating elements
  - Why are LEDs becoming a much more popular light source than traditional lamps?

Light emitting diode (LED)	Lamp	Buzzer	Speaker
			

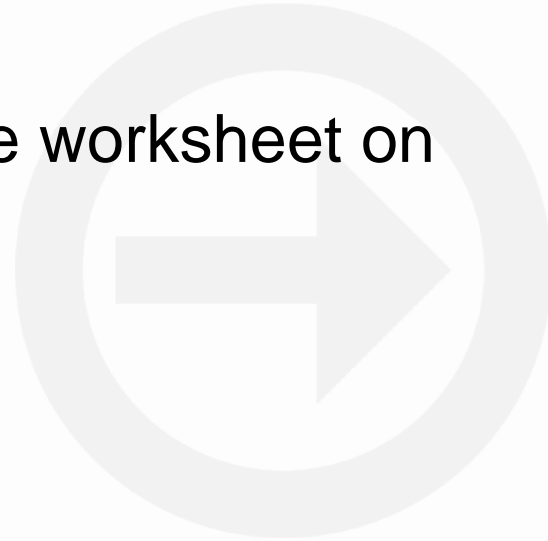
# Using high-power outputs

- Some output components require more power than the processing components in the circuit can provide
  - Transducer drivers are used to increase the power available
  - These include transistors such as a Darlington pair or field-effect transistors, and operational amplifiers
  - Relays can be used to operate a high-powered circuit with a low-powered trigger
- Which household appliances and electronic devices use the most power and why?



# Worksheet 6

- Complete **Tasks 3** and **4** of the worksheet on components and flowcharts



# Plenary

- Explain the difference between an open and closed loop system
- How is a decision made using a flowchart?
- What do transducer drivers do in a circuit?
- **Challenge:**
  - From where you are now, write a flowchart that gives logical instructions of how to get to your next lesson
  - Use decisions to help you travel the correct distance, rather than guessing how far to travel in one direction

## **Copyright**

© 2017 PG Online Limited

The contents of this unit are protected by copyright.

This unit and all the worksheets, PowerPoint presentations, teaching guides and other associated files distributed with it are supplied to you by PG Online Limited under licence and may be used and copied by you only in accordance with the terms of the licence. Except as expressly permitted by the licence, no part of the materials distributed with this unit may be used, reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic or otherwise, without the prior written permission of PG Online Limited.

## **Licence agreement**

This is a legal agreement between you, the end user, and PG Online Limited. This unit and all the worksheets, PowerPoint presentations, teaching guides and other associated files distributed with it is licensed, not sold, to you by PG Online Limited for use under the terms of the licence.

The materials distributed with this unit may be freely copied and used by members of a single institution on a single site only. You are not permitted to share in any way any of the materials or part of the materials with any third party, including users on another site or individuals who are members of a separate institution. You acknowledge that the materials must remain with you, the licencing institution, and no part of the materials may be transferred to another institution. You also agree not to procure, authorise, encourage, facilitate or enable any third party to reproduce these materials in whole or in part without the prior permission of PG Online Limited.