Unit 2
Energy, Systems, Materials & Devices

GCSE Design & Technology

Name: _____

Teacher: _____

D&T Group: _____

Tutor Group: _____

Subject: Design & Technology

Progress band target: _____

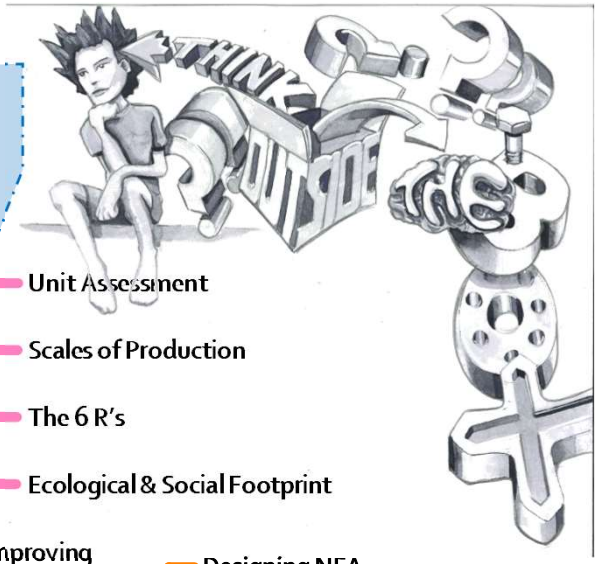
This is the target for the end of Year 11. Targets will become more specific as you move up the year groups.

Your work will be marked as:

Below / On / Above / Well Above

the path to this target.

Your Learning Map....



- 1
  - Industry & Enterprise
  - Sustainability and the Environment
  - People, Culture and Society
  - Production Techniques and Systems
  - Informing Design Decisions
  - Unit Assessment
- 2
  - Unit Assessment
  - Mechanical Devices
  - Electronic Systems Processing
  - Systems Approach to Designing
  - Composite Materials and Technical Textiles
  - Smart Materials
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- 3
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  - Unit Assessment
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  - Unit Assessment
  - Scales of Production
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  - Ecological & Social Footprint
  - Improving Functionality
  - Forces & Stresses
- 5
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  - Working with Timbers *or* Paper & Boards
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- E

GCSE Design & Technology
New & Emerging Technologies
Energy, Systems, Materials & Devices
Materials
Common Specialist Technical Principles
Papers & Boards or Timber Based Materials
NEA Project – 50% of GCSE

Energy Generation – Information Sheet

GCSE Design & Technology

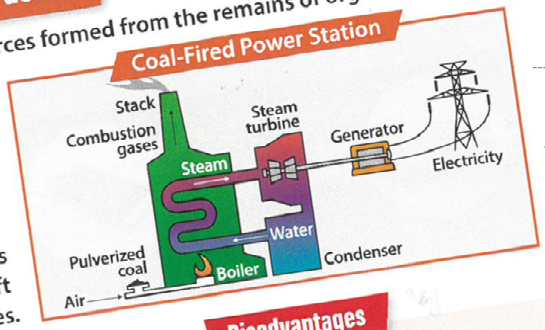
Fossil Fuels

Fossil fuels are non-renewable natural resources formed from the remains of organisms.

The three main types of fossil fuel are coal, oil and gas. To produce electricity, fossil fuels are usually burned in power stations.

Traditionally, the UK's energy mix has consisted mainly of fossil fuels. However, declining reserves and links to climate change have led to a big shift away from fossil fuels towards renewable sources.

Coal-Fired Power Station



Advantages

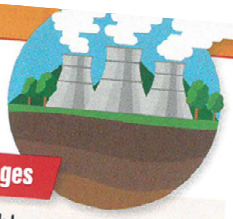
- Generate large amounts of cheap energy
- Provide a reliable supply of energy

Disadvantages

- Release greenhouse gases, which cause pollution and contribute to global warming
- Will eventually run out

Nuclear Power

Nuclear power stations work in a similar way to other power stations, but heat is generated by splitting uranium atoms in nuclear reactors.



Advantages

- Very efficient – generates a lot of electricity
- Produces far less greenhouse gases than fossil fuels

Disadvantages

- Depends on a non-renewable resource (uranium)
- Produces dangerous radioactive waste products that are difficult to dispose of
- High set-up and decommissioning costs

Renewable Energy

Renewable energy is non-finite, making it the most sustainable form of energy. However, there are several issues concerning its reliability, efficiency and initial set-up costs.

	Use	Advantages	Disadvantages
Wind	Generators in wind turbines convert the wind's kinetic energy into electricity.	Wind produces no greenhouse gases. Once turbines have been set up, energy is cheap.	Set-up costs are high. Turbines are considered unsightly and cause noise pollution.
Solar	Solar panels are used to convert the Sun's energy into electricity.	Solar energy produces no greenhouse gases. Once panels have been set up, energy is cheap.	No electricity is generated when there is no sunlight. Solar panels are expensive.
Tidal	Turbines convert kinetic energy in water currents and tides into electricity.	Tides are guaranteed, predictable and produce no greenhouse gases.	Tidal barrages are costly to build and can disrupt ecosystems.
Hydro-electric	As trapped water is released from dams, its kinetic energy turns electric turbines.	Once set up, HEP is cheap. Reservoirs provide a water supply during shortages.	Set-up costs are high. When dams are built, habitats are often destroyed.
Biomass	Organic material, such as animal waste or crops, are burned for energy or processed into biofuel.	Biomass is affordable and renewable if resources are replaced (e.g. trees are replanted).	Burning biomass releases CO_2. Also, using wood for fuel can lead to deforestation.

Task 1 (*Protractor required*)

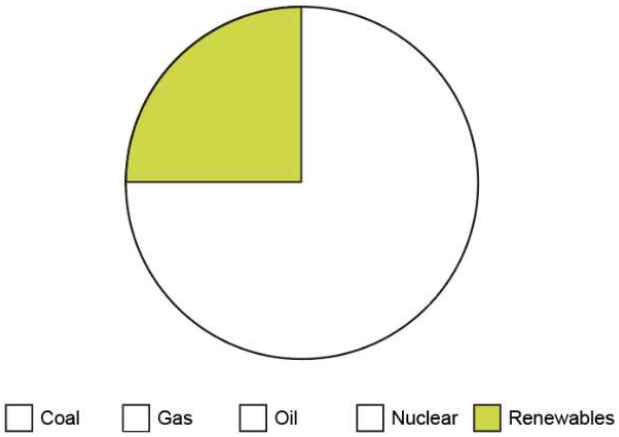
Electricity generated in the UK in the 2nd quarter of 2016 was from a mix of different sources:

Coal 6% **Gas 45%** **Oil 2%**

Nuclear 22% **Renewables 25%**

1. What percentage of energy was generated by fossil fuels? _____
2. What fraction of the electricity generated was from renewables? _____
3. Complete the pie chart to visually express the different energy sources listed.

Sources of UK electricity generation 2016



4. Why is it desirable for a nation to provide electricity from a variety of different sources?

Task 2

Nuclear power remains a controversial form of power generation. Discuss the arguments for and against its use being increased as a way to reduce reliance on fossil fuels?

Energy Generation – Homework 1

GCSE Design & Technology

1. Which of the following statements about fossil fuels is **false**? [1]
   - ◊ Fossil fuels are burned to create heat, which fires steam-driven turbines
   - ◊ Fossil fuels include gas, oil and coal
   - ◊ Fossil fuels produce no CO_2 when burned
   - ◊ Fossil fuels cannot be replaced as fast as they are being used

2. Name **three** different renewable energy sources. [3]

3. The National Grid is the network of power cables that connect power sources to supply electricity to businesses and homes in the UK.

   Discuss how the National Grid ensures a consistent supply of power on a cold and still winter's evening and justify why demand might be high at this point? [5]

4. Explain how fossil fuels are used to produce electricity. [3]

5. Explain how shale gas is produced by fracking (hydraulic fracturing). [3]

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Below / On / Above / Well above
your minimum target path

Total 15 marks

Demand for energy fluctuates. Therefore, energy storage systems are needed to store electricity until it is required.

Kinetic Pumped Storage Systems

Kinetic pumped storage systems are used to manage energy supply.

When demand for energy is low (e.g. at night), excess energy produced by power stations is used to pump water from a low reservoir to a high reservoir.

When energy demand peaks (e.g. at breakfast time), water stored in the higher reservoir is released through turbines to generate extra electricity. The water is then pumped back to the higher reservoir when energy demand drops again.

Batteries

Batteries store energy in a chemical form and convert it to electrical energy when needed.

Ordinary dry-cell batteries are non-rechargeable. As the reactants inside them are consumed in chemical reactions, the output from these batteries gradually falls. Once all the reactants have been consumed, these batteries go 'flat' and cannot supply electrical energy anymore.

Alkaline Batteries

Alkaline batteries are usually disposable and cannot be reused once flat. They leak less than other types of battery and last a long time.

Because they cannot be recharged, they are best used in devices that do not use much power (e.g. clocks and smoke detectors). Their output gradually falls over time.

Rechargeable Batteries

Rechargeable batteries can be recharged and reused so they are better for the environment than alkaline batteries.

Charging a battery reverses the chemical reaction that occurred when it was used. These batteries maintain a constant output until they go flat and are best suited to high-powered items (e.g. car batteries and mobile phones).

Batteries contain toxic chemicals that can harm the environment. Therefore, it is important that they are recycled or disposed of correctly.

Task 1

The rechargeable batteries in mobile phones can contain various chemicals and metals. The phone converts this stored chemical energy into other forms of energy in order for it to operate.

Explain which forms of energy a smartphone can emit during daily use. Give examples where possible.

Task 2

Answer the following questions or complete the statements

Statement / Question	Answer
Pneumatic systems move compressed _____ to create movement.	
Batteries store which type of energy?	
Fluid or oil pumped around a system under pressure is known as what?	
Why do alkaline cells usually last longer than traditional lead-acid varieties?	
Draw the circuit symbol for a cell and a battery.	
What energy is stored in a candle and what is it converted to when it is burned?	
Justify the best times to pump water back up to an upper reservoir at a kinetic pumped hydroelectric power station.	

Energy Storage– Homework 2	**GCSE Design & Technology**

1. Which **one** of the following is a type of kinetic energy? [1]
   - ◊ Mechanical
   - ◊ Sound
   - ◊ Chemical
   - ◊ Nuclear

2. Name **three** simple methods of storing energy that can be found in most homes or in a design and technology workshop? [3]

3. Explain the difference between **potential** and **kinetic** energy, giving **one** example for each. [4]

4. Describe how flywheels can be used to store surplus energy and smooth erratic energy generation from some renewable sources. [6]

5. Describe the use of energy storage systems, including kinetic pumped storage systems, to use surplus energy to help smooth peak supply and balance the demand on the National Grid.

   You may use a diagram to aid your answer. [4]

6. Standard alkaline battery cells are 1.5V.

   (a) State the voltage of a rechargeable cell. [1]

   (b) How many rechargeable cells would be required in a 12V battery? [1]

Total 20 marks

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Modern Materials

New materials with useful properties are constantly being developed to meet specific applications. They are developed through inventing or improving processes.

Graphene

A single layer of carbon atoms.

Properties
- transparent
- very strong and light
- excellent conductor of heat and electricity

Uses
- protective equipment and clothing
- can be mixed with paint to protect materials from corrosion
- ideal material for use in solar cells due to its transparency and conductive properties

Metal Foams

Metals are injected with air whilst in a liquid state.

Properties
- lightweight
- strong under compression, so absorb energy well
- low thermal conductivity

Uses
- prosthetics (artificial body parts)
- ideal for use in soundproofing and crash protection in vehicles due to its ability to absorb energy

Titanium

A metal that has historically been difficult to extract, refine and process.

Properties
- high strength-to-weight ratio
- corrosion-resistant
- can withstand extreme temperatures
- expensive

Uses
- prosthetics (artificial body parts)
- ideal for use in aircraft and spacecraft, due to its resistance to corrosion and high strength-to-weight ratio
- often alloyed with other metals

Modern materials are also developed through altering existing materials.

Coated Metals

Properties of metals can be improved by adding a coating of another material, often to increase strength and resistance to corrosion. Examples include, nickel-plated steel, polymer-coated aluminium and galvanised steel (applying a protective zinc coating).

Liquid Crystal Displays (LCDs)

LCDs are flat panel displays that use liquid crystals to control light emission and create an image. When voltage is applied to liquid crystals, they change shape and allow different levels of light to pass through, thereby creating an image.

Nanomaterials

Nanomaterials contain particles less than 100 nanometres in size and have different properties to larger particles of the same material. They have a large surface-area-to-volume ratio, which can improve properties such as strength, conductivity and reactivity.

Modern Materials– Worksheet 3	GCSE Design & Technology

Imagine that you work for a company that designs and develops products to be used by the National Health Service (NHS). The company want to come up with ideas for how the following modern materials could be used or even combined to make realistic products or services. You can list existing products and uses that you know of as well as any new ideas.

Complete the table by filling in potential uses for the following modern materials.

Modern material		Proposed use in the NHS
	Biodegradable polymers	
	Flexible MDF	
	Titanium	
	Fibre optics	
	LCD screens	
Combined materials:		

Modern Materials– Homework 3

GCSE Design & Technology

1. Which **one** of the following statements is **false**? [1]
   - ◊ Nanomaterials are between 1 and 1000 nanometres in size
   - ◊ Graphene is a carbon lattice structure one atom thick
   - ◊ Biodegradable polymers are made from petrochemical resources
   - ◊ Information is transmitted down fibre optic cables using pulses of light

2. Name **three** different modern materials and describe **one** use for each. [6]

3. Explain why LCD screens are appropriate for use in a battery powered metronome? [3]

4. Explain why biodegradable polymers are considered to be CO_2 neutral. [3]

5. How might metal foams be beneficial to patients receiving orthopaedic implants?[2]

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Total 15 marks

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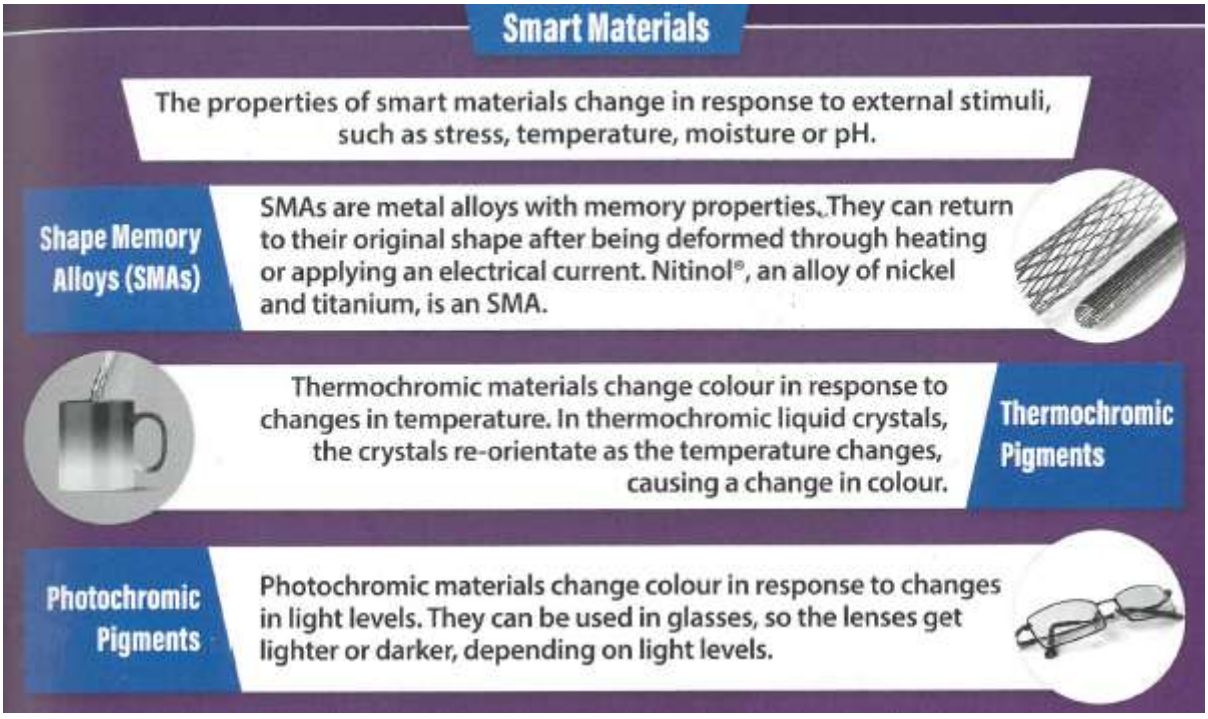
Smart Materials
The properties of smart materials change in response to external stimuli, such as stress, temperature, moisture or pH.
Shape Memory Alloys (SMAs)
SMAs are metal alloys with memory properties. They can return to their original shape after being deformed through heating or applying an electrical current. Nitinol®, an alloy of nickel and titanium, is an SMA.
Thermochromic materials change colour in response to changes in temperature. In thermochromic liquid crystals, the crystals re-orientate as the temperature changes, causing a change in colour.
Thermochromic Pigments
Photochromic Pigments
Photochromic materials change colour in response to changes in light levels. They can be used in glasses, so the lenses get lighter or darker, depending on light levels.

Task 1

For each of the following stimuli, list the appropriate smart material(s)

Stimulus	Smart material(s)
Sound	
UV light	
Pressure / movement	
Electricity	
Heat	
PH levels	
Stress / fractures	

Task 2

Explain how smart materials can be used by manufacturers to improve health and safety for children's products and goods.

Smart Materials– Homework 4	**GCSE Design & Technology**

1. Which **one** of the following smart materials **does not** react to electricity? [1]
   - ◊ Shape memory alloy
   - ◊ Quantum tunnelling compound
   - ◊ Thermochromic pigment
   - ◊ Piezoelectric material

2. Which smart material can be both a conductor and an insulator? [1]

3. Explain **one** disadvantage of using photochromic particles with self-darkening glasses. [2]

4. Describe how self-healing polymers could be useful in the construction of plastic frames for glasses and sunglasses. [2]

5. Use the following key words to create a short paragraph that explains the process that self-healing concrete undergoes when activated. [3]

Water – bacteria – stress – calcium carbonate – spheres – food – cracks

6. The following question is about the shape memory alloy, nitinol.

(a) Nitinol is an alloy of nickel and which other metal? [1]

(b) How is a shape 'set' in to the memory of nitinol? [2]

(c) A piece of Nitinol has a shape 'set' in its memory.

Explain what stimulus is required to return the material to its 'set' shape, once deformed. [1]

(d) Name and briefly describe **one** commercial use of nitinol. [2]

Total 15 marks

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your minimum target path

RAS:

Composite Materials

Composite materials are made from two or more materials, often ones with contrasting properties. Combining the properties of two different materials can lead to the development of new and improved materials. Concrete is one of the most common composite materials.

Glass reinforced plastic (GRP) combines glass fibres with a thermosetting plastic to create a lightweight, strong and resistant material that is used in boat hulls and car bodies.

Carbon reinforced plastic (CRP) combines carbon fibres with a thermosetting plastic. It is more rigid, stronger and lighter than GRP, but it is also more expensive and brittle.

Technical Textiles

Some textiles are manufactured for functionality rather than aesthetics.

Kevlar® is a strong synthetic textile with a high tensile strength-to-weight ratio. It is often used in protective armour.

Conductive textiles conduct electricity. Metal fibres are either spun into the fabric or metal-based powders are impregnated into the fabric.

Fire-resistant fabrics, such as Nomex® have flame resistance built into their chemical structures to protect the wearer.

Microfibres are made of extremely fine synthetic fibres. They are breathable and durable, so are often used in sports clothing. They can also be **microencapsulated** to incorporate tiny capsules that are capable of holding substances such as scents, therapeutic oils and insecticides. Over time, the capsules rupture, releasing the contents.

Task 1

(a) Explain why carbon fibre reinforced plastic (CRP) is used in sports equipment, motorsport vehicles and safety equipment such as helmets.

(b) Why is a release agent applied to a mould or former before it is used for shaping GRP products?

(c) What does the term 'cure' mean when working with reinforced plastics?

(d) What are the health and safety precautions you should take when using resins that contain high levels of volatile organic compounds?

Task 2

GRP and CRP are frequently used for batch produced products such as boat hulls. Why do you think they are not often used for mass produced or one-off products?

Task 3

Label and annotate the picture of the police officer in full riot gear, explaining which elements of the uniform and protective equipment could benefit from composite materials or technical textiles. Justify each of your responses.

Composite Materials & Technical Textiles – Homework 5

GCSE Design & Technology

1. Which **one** of the following is a type of Aramid fibre? [1]
   - ◊ Cotton
   - ◊ Stainless steel thread
   - ◊ Gore-Tex®
   - ◊ Kevlar®

2. What is meant by a 'composite' material? [2]

3. Put the following steps, for forming a single layer glass reinforced plastic component, in the correct order. Draw lines between the steps. [8]

Step 1	Apply resin and work evenly into matting
Step 2	Clamp in position and leave to cure
Step 3	Apply GRP matting
Step 4	Trim and finish workpiece
Step 5	Prepare mould
Step 6	Apply gel coat
Step 7	Apply release agent
Step 8	Release the workpiece from the mould

4. Explain how a Gore-Tex® membrane works. [3]

5. Gasses, liquids and solids can be microencapsulated in a fabric.

   Give **two** applications of microencapsulation within a technical textile [2]

6. Discuss the environmental concerns regarding microfibre products such as the cleaning glove shown below. [4]

Total 20 marks

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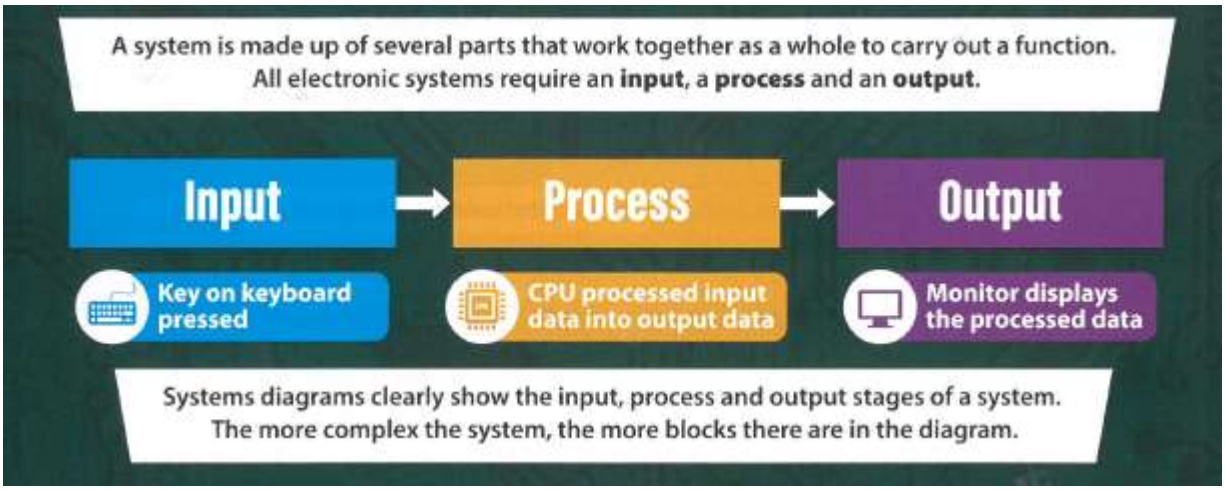
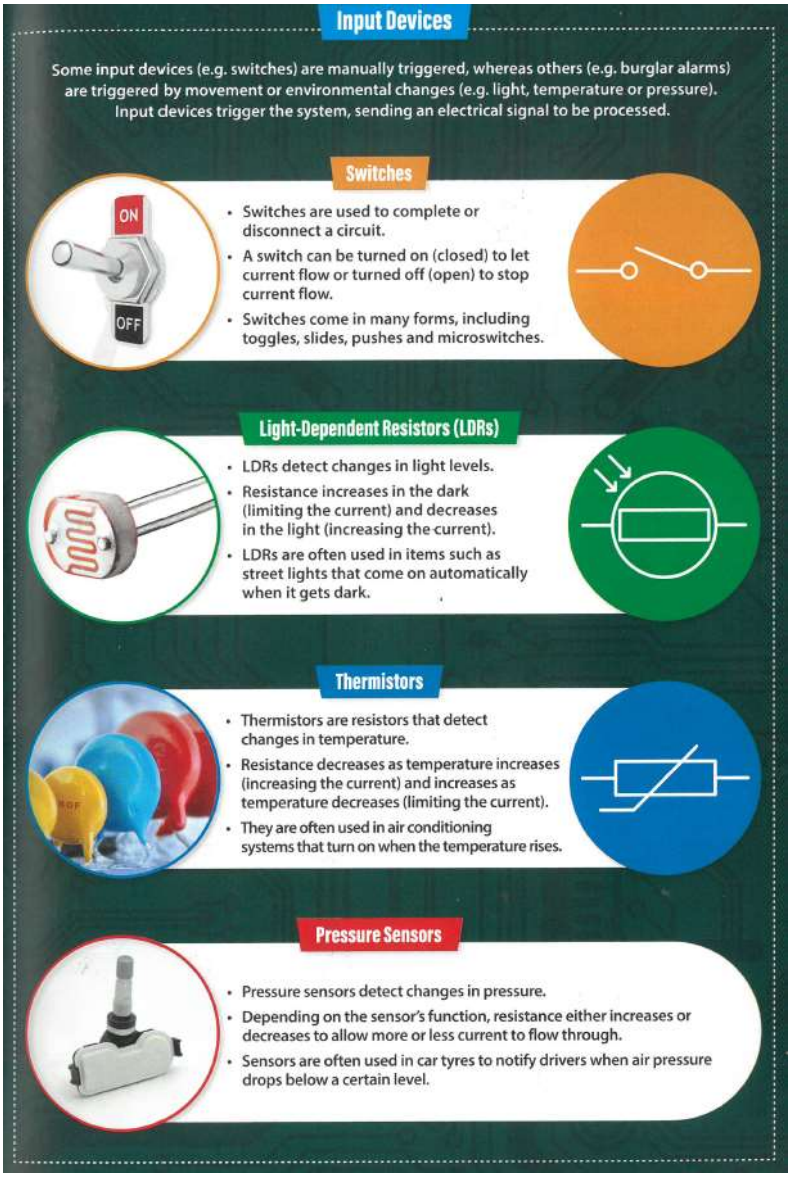

A system is made up of several parts that work together as a whole to carry out a function.
All electronic systems require an input, a process and an output.
Input
Process
Output
Key on keyboard pressed
CPU processed input data into output data
Monitor displays the processed data
Systems diagrams clearly show the input, process and output stages of a system.
The more complex the system, the more blocks there are in the diagram.


Input Devices
Some input devices (e.g. switches) are manually triggered, whereas others (e.g. burglar alarms) are triggered by movement or environmental changes (e.g. light, temperature or pressure). Input devices trigger the system, sending an electrical signal to be processed.
Switches
ON
OFF
Switches are used to complete or disconnect a circuit.
A switch can be turned on (closed) to let current flow or turned off (open) to stop current flow.
Switches come in many forms, including toggles, slides, pushes and microswitches.
Light-Dependent Resistors (LDRs)
LDRs detect changes in light levels.
Resistance increases in the dark (limiting the current) and decreases in the light (increasing the current).
LDRs are often used in items such as street lights that come on automatically when it gets dark.
Thermistors
Thermistors are resistors that detect changes in temperature.
Resistance decreases as temperature increases (increasing the current) and increases as temperature decreases (limiting the current).
They are often used in air conditioning systems that turn on when the temperature rises.
Pressure Sensors
Pressure sensors detect changes in pressure.
Depending on the sensor's function, resistance either increases or decreases to allow more or less current to flow through.
Sensors are often used in car tyres to notify drivers when air pressure drops below a certain level.

Process Devices

Process devices process the electronic signals received from an input to determine an output action. Most processes in electronic systems are carried out by **integrated circuits (ICs)** that can perform multiple tasks, thus reducing the number of components needed in a circuit.

Microcontrollers

A **microcontroller** is a type of IC that is programmed to perform specific tasks in a wide variety of electronic devices. It contains memory, programmable input/output peripherals and a processor all on one chip – it is essentially a tiny computer.

Microcontrollers are adaptable and can be programmed to perform different tasks. The program is then stored in the microcontroller's memory.

Programs are written in a special programming language. Alternatively, a flowchart can be used and then translated by special software into coded commands for the microcontroller. Common programming languages include embedded C, Python, BASIC and Scratch.

Microcontrollers are often used as **timers** and **counters** in embedded systems to measure elapsed time or to count or time external events.

Timers

Timers are often used to add a time delay. They do this by creating a pulse of voltage after a certain period of time to trigger an output. An example includes a microwave timer.

Counters

Counters count the number of pulses of voltage created by an input device and display this as an output. An example includes a pedometer, which counts each step a person takes.

Output Devices

Output devices transfer electrical energy into a response depending on the device's function.

Buzzers

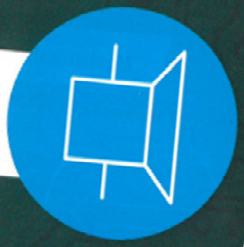
- Buzzers use electrical energy to create sound energy.
- Most use a piezo transducer, which converts electrical current into mechanical movement, to create sound.

Example: car alarm

Speakers

- Speakers use electrical energy to create sound energy.

Example: speakers on a mobile phone



Lamps

- Lamps convert electrical energy into light energy.

Example: house lights

Task 1

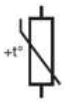
Imagine you are designing a toy robot. List the subsystems that would need to be developed for it to be a quality engaging and entertaining product.

Task 2

1. Draw a basic system diagram, using the simple block method, explaining how a press switch activated, motorised door works.

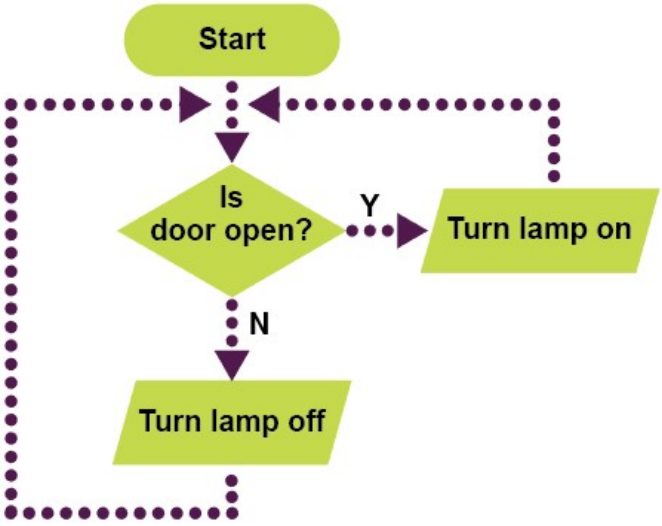
Task 3

1. Match the correct symbols, names and descriptions for the following input and output components.

		**Speaker**		**Changes its resistance as light levels change**		**Input**
		**LDR**		**Momentary connection**		
		**LED**		**Emits sound**		
		**Push to make switch**		**Changes its resistance as heat levels change**		**Output**
		**Toggle switch**		**Emits light**		
		**Thermistor**		**Latches a connection on**		

Task 4

The flowchart below shows the input, process and output of a fridge light system to turn a light on and off in response to the door being opened and closed.



(a) Draw a flowchart to describe the function of an energy-saving light that switches on as someone approaches. The lamp should turn off after 10 seconds unless retriggered.

(b) Draw a complete flowchart system for a traffic light controlled pedestrian crossing.

Extension exercise: Add subsystems to illustrate the flashing light and audible beep.

Systems Approach to Designing – Homework 6

GCSE Design & Technology

1. Which **one** of the following components is used to detect light levels? [1]
   - ◊ LED
   - ◊ Thermistor
   - ◊ LDR
   - ◊ Resistor

2. Which **one** of the following is an output component? [1]
   - ◊ Speaker
   - ◊ PTM switch
   - ◊ Pressure pad
   - ◊ Microphone

3. Explain the functional difference between a closed loop system and an open loop system. [2]

4. This question is about connecting components together in a circuit.

   (a) What is the name for the style of circuit drawn below? [1]

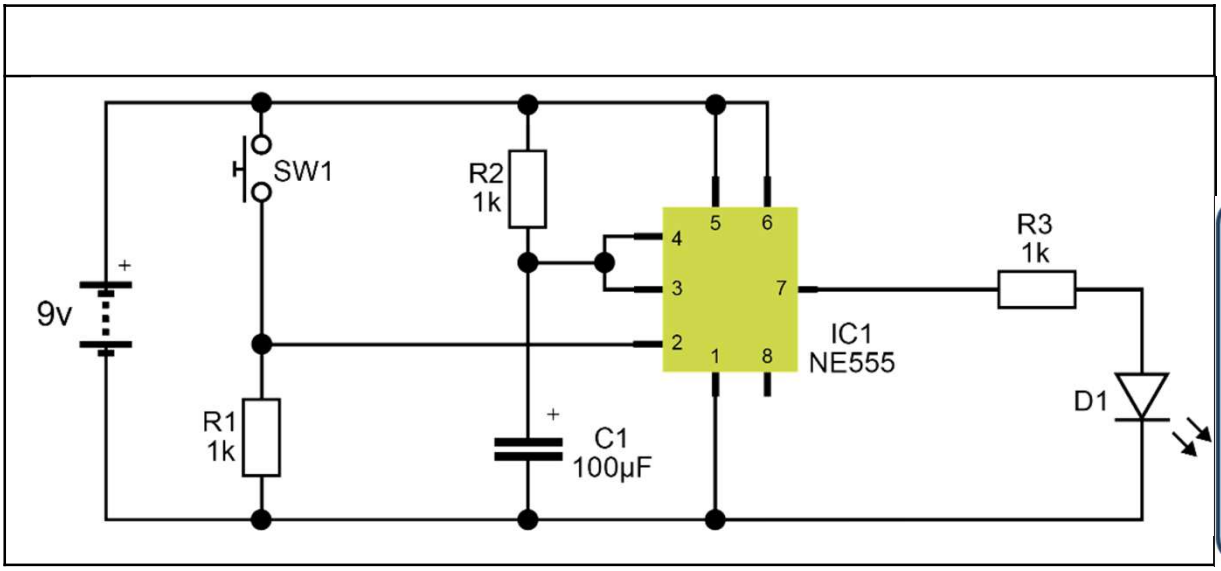
   (b) Which electronic component is labelled **SW1**? [1]

   (c) Which electronic component is labelled **D1**? [1]

   (d) Explain the function of resistor **R1**. [2]

e) Split the timing circuit below into **three** blocks by drawing two vertical lines across it.

Label each of the blocks, stating whether it is the **input**, **output** or **process**. [3]



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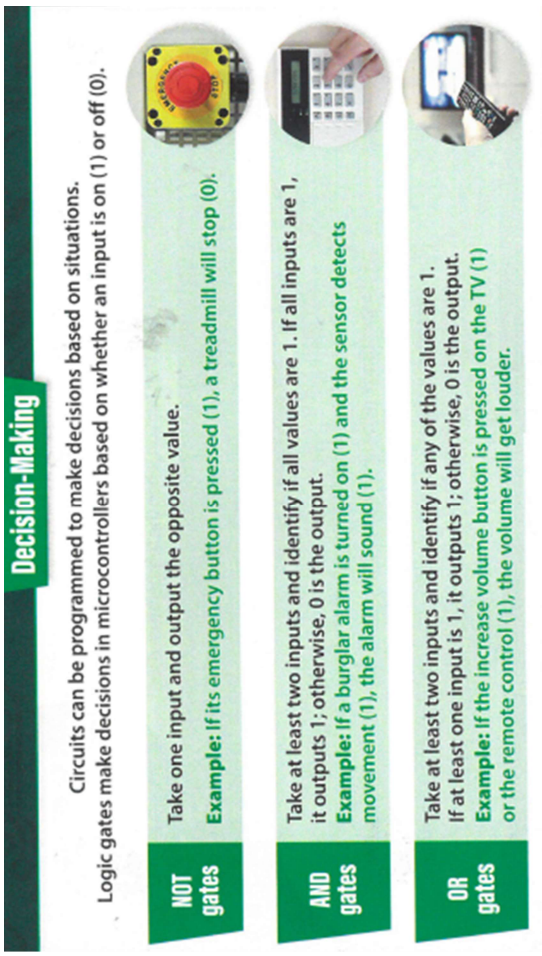


Task 1

Fill in the table stating whether each input component gives a digital or analogue signal and justify your reasoning.

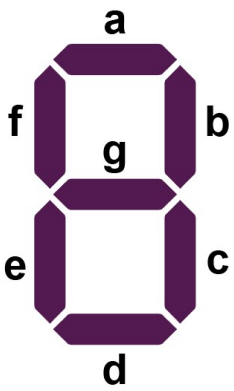
Input component	Analogue or digital	Justification of answer
Microphone		
Toggle switch		
Thermistor		
Light dependent resistor		
Push-to-make switch		

Task 2

Counting circuits frequently use 7-segment displays to visually output numbers. To connect a 7-segment display, each segment (an individual LED) is wired to a separate output of the IC that is controlling it. The pins are labelled a to g as per the picture below. Each number displayed, from 0 to 9, can be represented by a series of zeros (0 = segment off) and ones (1 = segment on).

Complete the following table by filling in the corresponding 0s and 1s to ensure the correct segments light up. The first has been completed as an example

Number	a	b	c	d	e	f	g
0	1	1	1	1	1	1	0
1							
2							
3							
4							
5							
6							
7							
8							



1. Which **one** of the following components will give a digital signal? [1]

   ◊ Microphone

   ◊ Light dependent resistor

   ◊ Toggle switch

   ◊ Thermistor

2. Using notes **and** sketches, explain the characteristics of the following types of signal. [4]

Analogue:	**Digital:**

3. Explain how a microcontroller can be programmed. [2]

4. A digital egg timer uses an input, process and output.

   (a) Suggest an appropriate input component. [1]

   (b) Suggest an appropriate output component. [1]

   (c) Circle the most appropriate device below to be used for the timing process. [1]

   Monostable

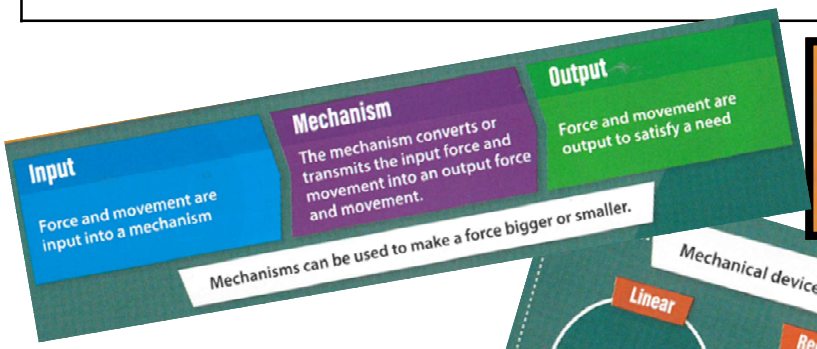
   Astable

This work is **Below / On / Above / Well above** your minimum target path

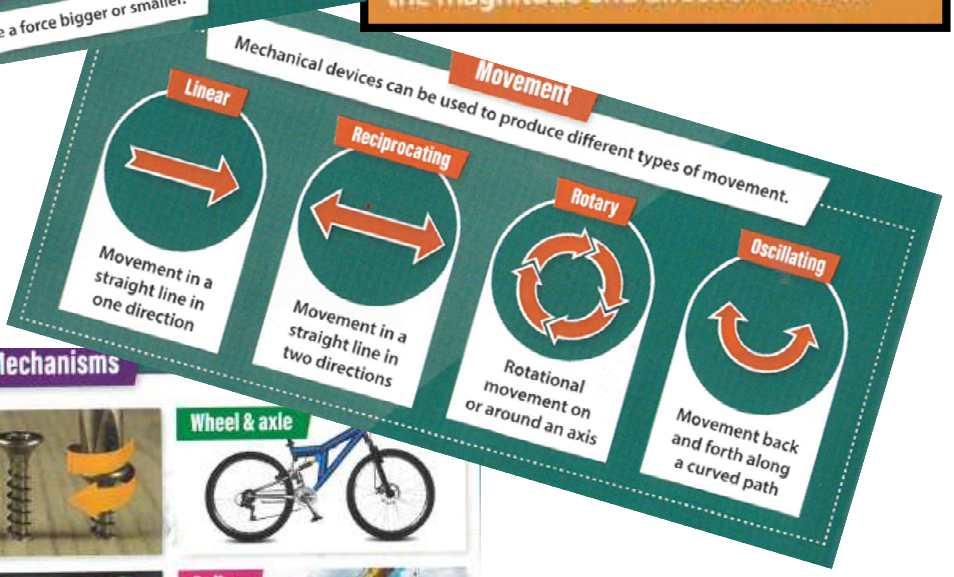
Total 10 marks

Mechanical Devices – Information Sheet

GCSE Design & Technology



Mechanical devices change an input force and movement into a desired output force and movement. They can change the magnitude and direction of force.



Mechanical advantage (MA) is a measure of the force amplification achieved by using a mechanism.

The mechanical advantage measures the ratio of the input force (effort) to the output force (load).

$$MA = \frac{\text{Load}}{\text{Effort}}$$

The best resource for looking at all the different mechanisms and the types of motion is via our schools access to the Focus E-Learning Platform in the internet. To access this use the following information:

Website: www.focuselearning.co.uk
Username: student@sheringhamhigh3028
Password: 2zmjb4w0q

Then use the link to "Focus on Mechanisms"

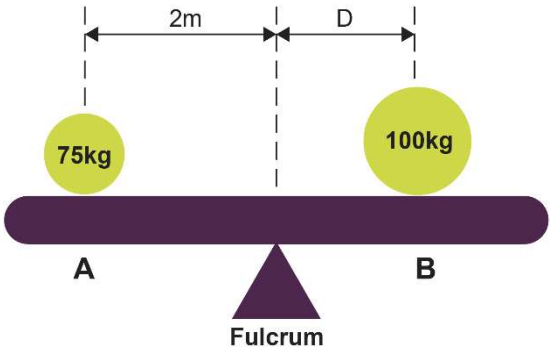
You can then look up the following mechanisms:
Gears, Cams & Followers, Pulleys & Belts, Levers & Linkages

Task 1

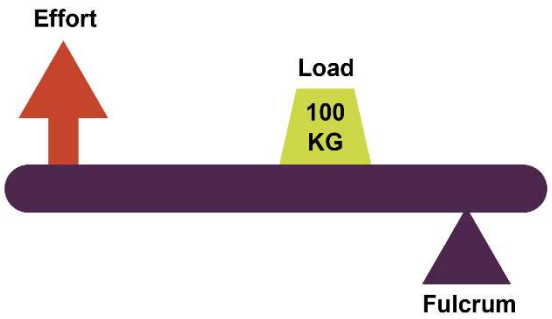
Complete the following questions:

1. Calculate the mechanical advantage (MA) of a mechanism if the load is 200N and the effort is 50N?

2. If person A has a mass of 75kg and is seated 2 metres from the fulcrum, how far should person B sit away if they have a mass of 100kg for the seesaw to be balanced?



3. What class of lever is pictured below?



4. Which class of lever applies to the pliers pictured below?

5. Study the picture of the car interior below. List and link the relevant motions found for the different controls. Example: The volume control on the radio is rotary.

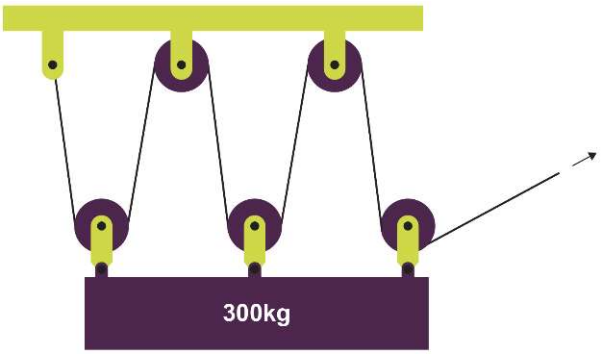
Task 2

1. Explain how pulleys and belts are used to drive mechanisms. Where possible refer to specific features and materials.

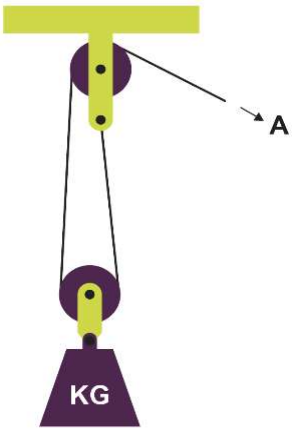
2. Name the lifting system being used in the picture below and describe how it is capable of assisting with the lifting of heavy objects.

3. A pulley system reduces the effort required to lift a load, at the expense of the pulling distance required to raise it.

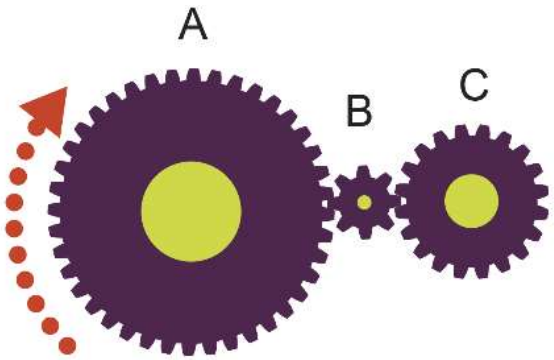
(a) How much effort is required to lift the weight pictured in the diagram below:



(b) How far must the rope be pulled in direction **A** in the diagram below to raise the load by 1.5M?



4. A gear train is made up of two or more cogwheels or gears.



(a) Name the type of gear pictured as gear B. _____

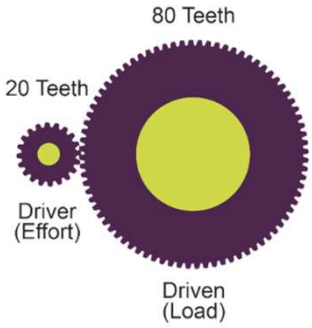
(b) (i) Explain the function of gear **B**.

(ii) Gear **A** rotates in a clockwise direction.
Which direction will gear **C** turn when gear **A** is turned? _____

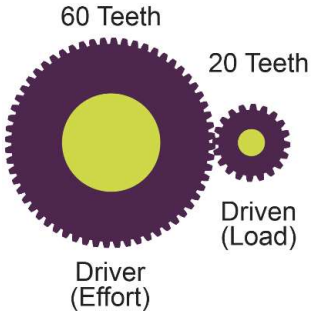
(c) Does the size of gear **B** affect the ratio between gears **A** and **C**? _____

5. For the following simple gear trains, work out the gear ratio (velocity ratio).

(a)



(b)



Homework 8: Mechanical devices

1. Which **one** of the following motions describes travel along a straight path? [1]

   ◊ Reciprocating motion
   ◊ Linear motion
   ◊ Rotary motion
   ◊ Oscillating motion

2. Which type of motion best describes the movement of a washing machine drum?[1]

3. Which class of lever best describes the action of lifting a wheeled suitcase? [1]

4. What is meant by the term equilibrium when applied to levers? [1]

5. Give **two** functions of a linkage. [2]

6. A crank and slider converts one motion into another. State **both** motions. [2]

7. For each of the following statements, state the type of cam described.

   (a) A round cam with a hole for the camshaft positioned off centre. [1]

   (b) A cam with a long dwell, a slow rise and a sudden drop. [1]

   (c) A cam designed to have no dwell period. [1]

   (d) A cam with a long dwell and a rapid rise and fall. [1]

8. Which type of follower is the most accurate but most prone to wear? [1]

9. Explain the use of an idler gear? [2]

Total 15 marks

This work is
Below / On / Above / Well above
your minimum target path

Attach your assessment on these pages to keep safe!

Attach your assessment on these pages to keep safe!