EXAM PRACTICE 1 - MATERIALS 1

Material	Info / Advantages	Typical Uses
Wool (Natural Fibre)	An animal / protein fibre, from the fleeces of sheep, Warm, Soft, Absorbent, Crease resistant.	Felt, Flannel, Gabardine, Jumpers, Suits, Dresses, Carpets.
Polyester (Synthetic Fibre)	Produced from coal and oil. Strong, Durable, Elastic, Crease Resistant.	Sportswear.
Foil Lined Board (230-420 gsm)	Made by laminating aluminium foil to one side of cardboard, solid white board or duplex board. Can keep moisture in/out.	Drinks cartons, Ready meal lids.
Layout/Tracing paper (50-90 gsm)	Relatively hard and translucent. Cheap.	Working Drawings / Tracing for designers
Aluminium (Non-Ferrous Metal)	Lighter than steel, but not as strong. Light, Malleable, Can be shaped easily.	Drinks cans, Cooking pans, Food Packaging.

EXAM PRACTICE 2 - MATERIALS 2

Material	Advantages	Disadvantages
Pine (Soft wood)	Very durable, Easy to work, Quite cheap as it grows quickly enough to be forested, Reasonably strong, Lightweight.	Can warp, Crack and splinter more than some other woods
Plywood (Manufactured)	Flat and structurally strong, Surface looks like wood, Resistant to warping / cracking / twisting, Can be shaped unlike timbers.	Quite expensive, Edges can look rather rough, Susceptible to water damage if wrong grade is used.
Acrylic (Thermoplastic)	Tough, Easy to cut, Easily finished, Easily cleaned, Available in a range of colours, Widely available, Can be shaped using heat.	Brittle, Breaks easily if dropped, Relatively expensive.
UF (Thermosetting plastic)	Rigid, Hard, Heat resistant, Excellent electrical insulation	Can break easily if dropped, Brittle, Can not be shaped more than once as it is a thermosetting plastic.
Cast Iron (Ferrous Metal)	Affordable, Hard skin, Good in compression, Self Lubricating, Magnetic.	Rusts, A lower melting point than other Ferrous metals.

EXAM PRACTICE 3 – SCALES OF MANUFACTURE

Type	Characteristics	Example
One-off production	Only one product is made at a time. Every product is different so it is labour intensive. Products may be made by hand or a combination of hand and machine methods. **Usually high quality.**	Expensive watches, Yachts, Specialist furniture.
Batch production	A set number of identical products are made. Batch production may also be labour intensive, but jigs and templates are used to aid production. Batches of the product can be made as often as required. The machines can be easily changed to produce a batch of a different product. **Most products are made in batches.**	School chairs, Baked goods, Clothing, Computer chips, Electrical goods, Very expensive rare sports cars.
Mass production	Identical products are made, usually on a production line. Mass production often involves the assembly of a number of sub-assemblies of individual components. Parts may be bought from other companies.	I phone, Common cars – Ford Fiesta, Lego, Socks.
Continuous Production	When many thousands of identical products are made. The difference between this and mass production is that the production line is kept running 24 hours a day, seven days a week to maximise production and eliminate the extra costs of starting and stopping the production process. The process is highly automated and few workers are required.	Sheet material, Nuts & Bolts, Biros, Newspapers.

EXAM PRACTICE 4 – ELECTRONIC SYSTEMS AND PROGRAMMABLE COMPONENTS

What is a Microcontroller (Programmable Interface Controller):

- Microcontrollers are widely used in everyday items such as washing machines, remote controls, microwave ovens, mobile phones and vending machines. A modern car can contain around 40 of them.

- They are a type of integrated circuit and range in size from 8 to 40 pins. They can be programmed to respond to one or more inputs and to control one or more outputs.

Benefits of using a Microcontroller:

- Microcontrollers are versatile because they have the ability to control numerous inputs and outputs simultaneously.
- Microcontrollers can run multiple programs simultaneously and include interrupts / override features. Microcontrollers are small in size and can reduce the number of components required and therefore size of control systems can be reduced / miniaturised.
- Many microcontrollers run off low voltage supplies (3v – 4.5v) making them energy efficient / more environmentally friendly and are also reusable.
- Microcontrollers can be updated with new software to de-bug and improve performance and are reusable once a product has reached the end of its useful life.

How do you programme a Microcontroller:

Stage 1: Compose a program (could be in the form of lines of code or in flowchart form, could include CAD).

Stage 2: Run / test the program to see if it works as required / or download onto a Micro controller IC or circuit board.

Stage 3: Run / test the system to see if it works and / or edit program and repeat for new program. or Place microcontroller IC into control system and run.

EXAM PRACTICE 4 – ELECTRONIC SYSTEMS AND PROGRAMMABLE COMPONENTS

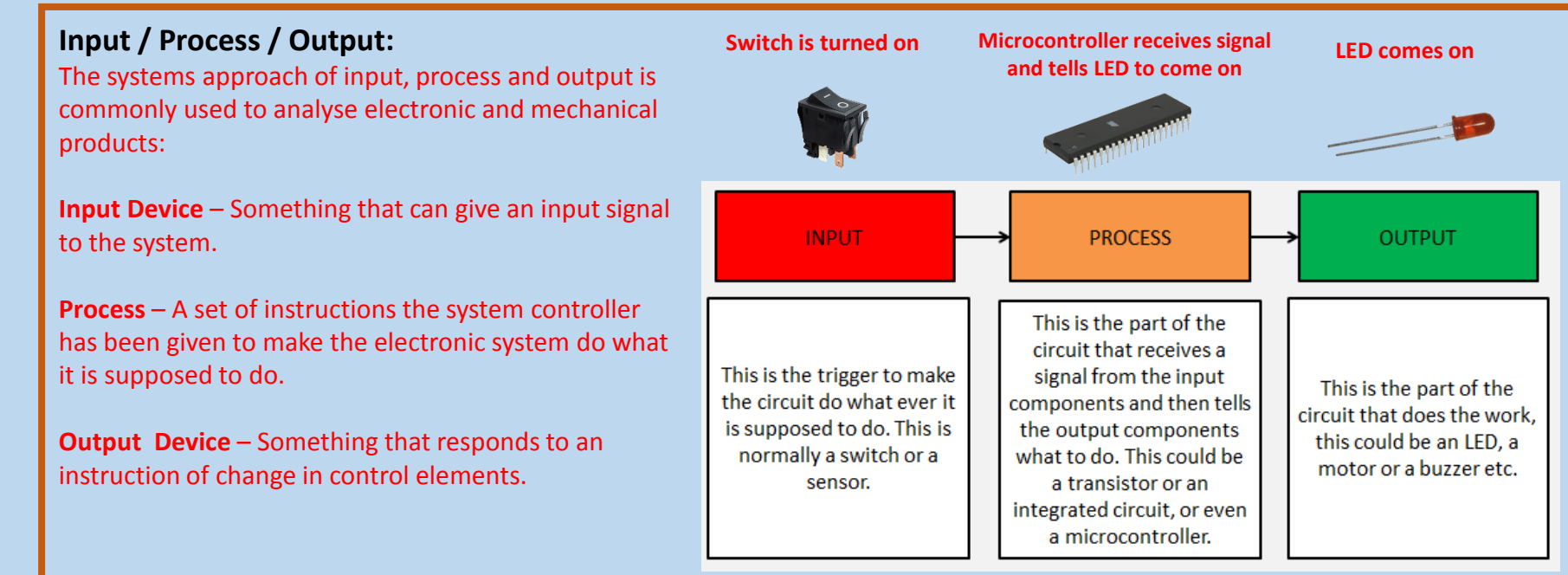
Input / Process / Output:

The systems approach of input, process and output is commonly used to analyse electronic and mechanical products:

Input Device – Something that can give an input signal to the system.

Process – A set of instructions the system controller has been given to make the electronic system do what it is supposed to do.

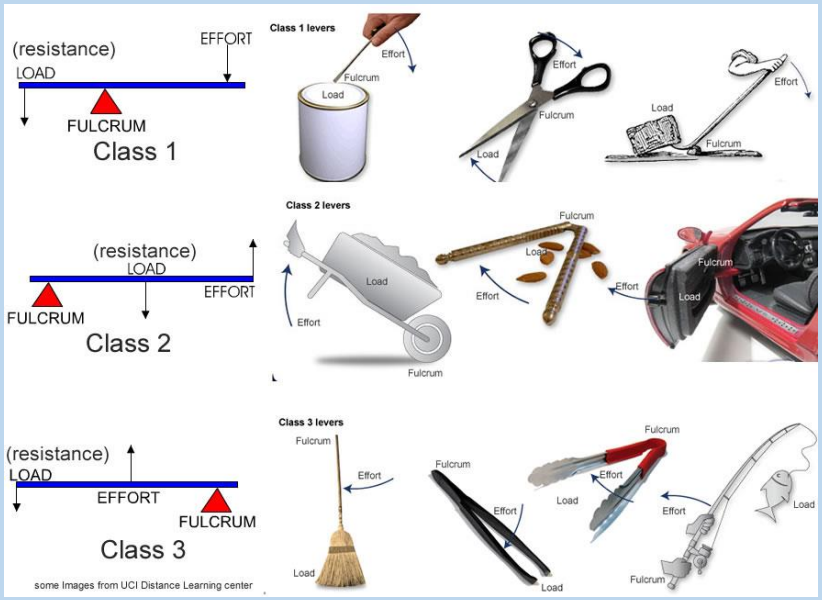
Output Device – Something that responds to an instruction of change in control elements.



EXAM PRACTICE 5 – MECHANISMS/LEVERS/PULLEYS

Levers

A lever is the simplest kind of mechanism. There are three different types of lever. Common examples of each type are the crowbar, the wheelbarrow and the pair of tweezers.
All **levers** are one of three types, usually called **classes**. The class of a lever depends on the relative position of the load, effort and fulcrum:
The **load** is the object you are trying to move.
The **effort** is the force applied to move the load.
The **fulcrum** (or **pivot**) is the point where the load is pivoted.



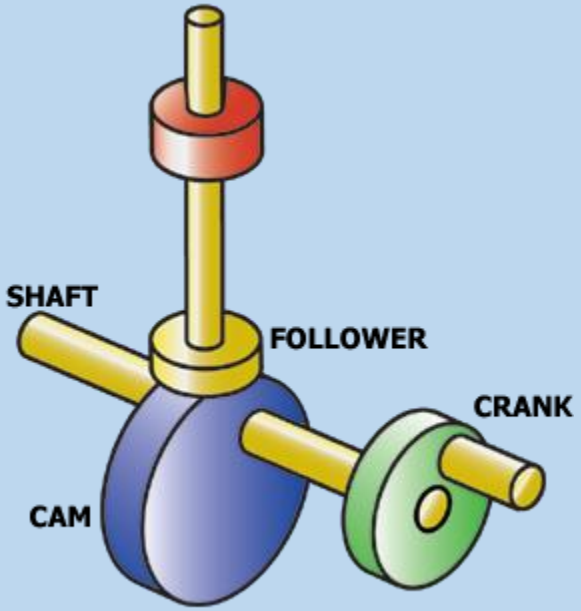
EXAM PRACTICE 5 – MECHANISMS/LEVERS/PULLEYS

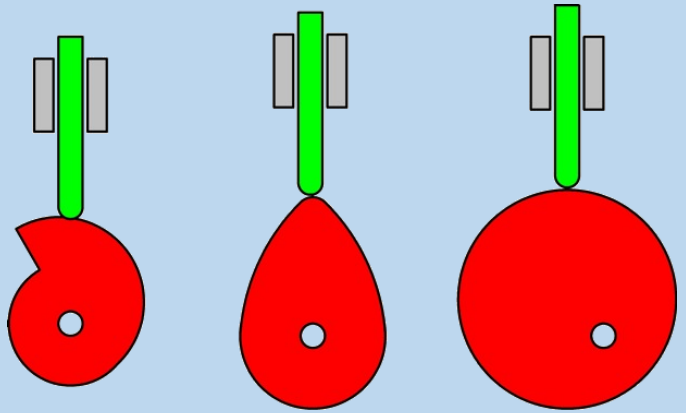
CAMS

A cam is a shaped piece of metal or plastic fixed to a rotating shaft. A **cam mechanism** has three parts: **cam**, **slide** and **follower**.

The cam shaft rotates continually, turning the cam. The follower is a rod that rests on the edge of the turning cam. The follower is free to move up and down, but is prevented from moving from side to side by a slide or guide, so the follower can only do three things:

Rise (move up)
Fall (move down) or
Dwell (remain stationary)



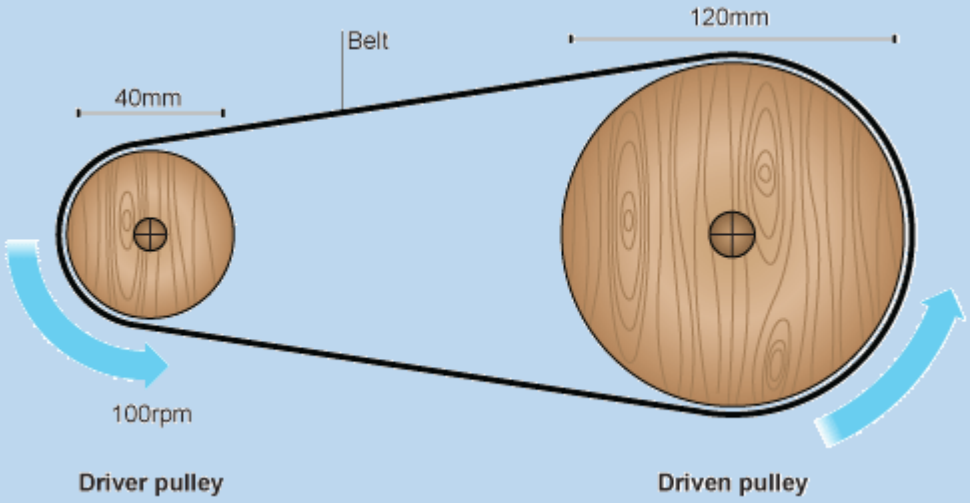


EXAM PRACTICE 5 – MECHANISMS/LEVERS/PULLEYS

Pulleys & Belts

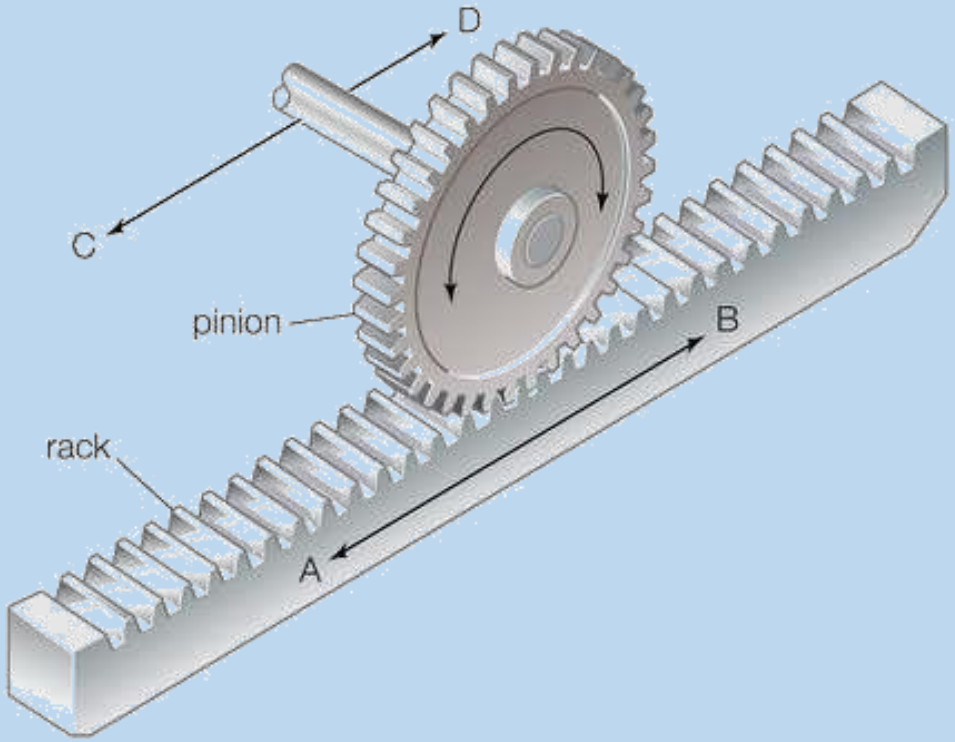
Pulleys are used to change the speed, direction of rotation, or turning force or **torque**.

A **pulley system** consists of two **pulley wheels** each on a shaft, connected by a **belt**. This transmits rotary motion and force from the input, or driver shaft, to the output, or driven shaft.



Rack and Pinion

A **rack-and-pinion** changes **rotary motion to reciprocating motion**. A crank, link and slider could also be used for this. A cam-and-follower will change reciprocating to rotary motion.



EXAM PRACTICE 5 – MECHANISMS/LEVERS/PULLEYS

Equation	Explanation	Calculation
Mechanical Advantage	Class 1 and class 2 levers both provide **mechanical advantage**. This means that they allow you to move a large output load with a small effort. Load and effort are **forces** and are measured in Newtons (N).	Mechanical advantage (N) = load ÷ effort
Velocity Ratio for Levers	The mechanical advantage gained with class-one levers and class-two levers makes it seem like you are getting something for nothing: moving a large load with a small effort. The catch is that to make the effort smaller, you have to move a greater distance.	Velocity Ratio (MM) = distance moved by effort ÷ distance moved by load
Velocity Ratio for a Pulley System	If the pulley wheels are different sizes, the smaller one will spin faster than the larger one. The difference in speed is called the **velocity ratio**.	Velocity ratio = diameter of the driven pulley ÷ diameter of the driver pulley
Output speed of a Pulley System	If you know the velocity ratio and the input speed of a pulley system, you can calculate the output speed.	Output speed (RPM) = input speed ÷ velocity ratio