

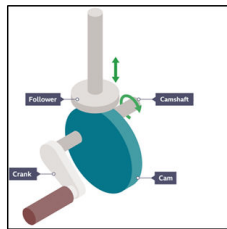
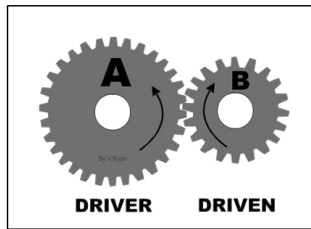
Name:

Date:

Year 9

### Knowledge organiser 1: Resistant Materials

| Physical property   | Usage example  |
|---|--|
| <b>Density</b> - amount of matter a material has to its volume                                      | Low-density foams, eg low density polyethylene (LDPE), can be used as low-weight, shock absorbing packaging materials to protect fragile items                           |
| <b>Absorbency</b> - ability to retain heat, light or water in a structure                           | Paper towels are absorbent and are used to soak up liquid spills or dry wet hands  |
| <b>Conductivity</b> - ability of heat (thermal) or an electric charge (electrical) to pass through  | Wooden handles are used on saucepans as they are poor thermal (heat) conductors, and copper is used for wires in power cables as they are good electrical conductors     |
| <b>Corrosive resistance</b> - ability to withstand chemicals, water and weather conditions, eg snow | Glass is used in external windows as it maintains its transparency for a long time in most weather conditions  |
| <b>Flammability</b> - ability to ignite (catch on fire) or combust (burn)                           | Specially engineered ceramics are used in brake pads for high-performance motorbikes as they have low flammability, and can be used in places where high-friction occurs |

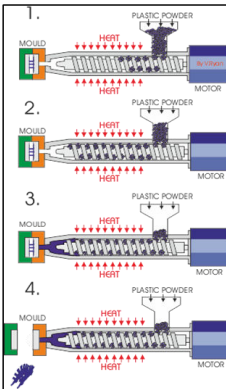


The gears shown below are called spur gears because they mesh together. Gear 'A' is called the 'driver' because this is turned by a motor. As gear 'A' turns it meshes with gear 'B' and it begins to turn as well. Gear 'B' is called the 'driven' gear.

To find out more:

<https://www.bbc.co.uk/bitesize/guides/zh4g4qt/revision/1>

### Injection moulding



### Injection moulding

Injection moulding is used in industry to produce most **mass-produced** polymer parts using the following process:

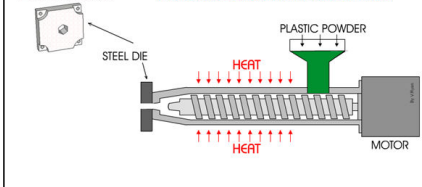
1. granular plastic is held in a hopper
2. it is moved via an **Archimedeian screw** along a heated tube, called the heating chamber
3. once the polymer has been melted, it is pushed **into a mould** with a **hydraulic ram** - the use of the hydraulic ram ensures just enough material is injected into the mould each time
4. the mould is then cooled so that the moulded plastic can be removed

### Extrusion

Extrusion works in a very similar way to injection moulding:

1. granular plastic is held in a hopper
2. it is moved by Archimedeian screw along a heated tube, called the heating chamber
3. once the polymer has been melted it is pushed **through a die mould**, which will form the shape of the extrusion
4. because there is no hydraulic ram in this process, molten plastic can be fed through the die continuously

### Extrusion



**Thermosetting:** Also called 'thermoset'. Can only be formed once as it cannot be reheated and therefore cannot be recycled.

**Thermofforming:** Also called 'thermoplastic'. Can be reformed when heated, and therefore can often be recycled.

### Scales of production

#### Prototype and one-off production

In one-off production an individual item is designed and made to meet a client's specification. At this level both time and material costs are high, and a high level of design and manufacturing skills is required. An example of a one-off product is a specialist powered wheelchair for a user with specific disabilities, which may require skills like the **soldering** of switches to allow for operation of the controls for specific movements.

#### Batch production

Batch production is where many items of the same product are produced. It will involve the use of some **automation** to reduce labour costs and will require the design engineer to consider how materials can be used efficiently and how samples can be tested to ensure quality. An example of a batch produced product would be the **etching** of a printed circuit board (PCB) for a small team of specialist racing drones.

#### Mass production

Manufacturing in huge numbers is categorised as mass production. This level of production involves standardised production methods, **production lines** and the extensive use of automation. Because of the high set-up costs, mass production systems tend to be inflexible. An example of a mass produced item would be a polyethylene terephthalate (PET) drinks bottle made using a blow moulding system.