

Design and Technology in Our World

- Electric vs petrol cars: cost comparison and sustainability
- Non-renewable energy sources
- Market pull and hybrid cars
- Global manufacturing impacts

Global manufacturing - How It Works:

- A company designs a product (e.g. a phone) in one country.
- The parts are made in several other countries (e.g. screens in South Korea, chips in Taiwan).
- The product is assembled in another country (e.g. China).
- Then it's shipped and sold all over the world.

Non-renewable energy - Main Types:

1. Coal

1. A black rock burned for heat and electricity.
2. Made from ancient plants buried and compressed over time.

2. Oil (Petroleum)

1. A thick liquid used for fuel (like petrol and diesel).
2. Found underground and used in cars, planes, and plastics.

3. Natural Gas

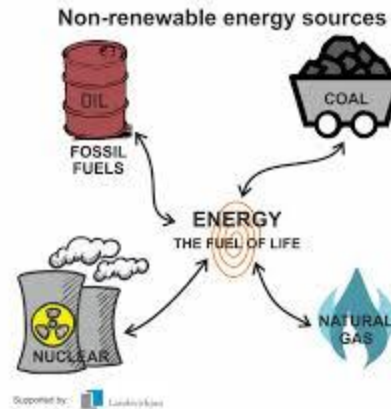
1. A gas used for heating and cooking.
2. Often found with oil and burns cleaner than coal.

4. Nuclear Energy

1. Uses uranium, a metal found in rocks.
2. Produces lots of energy but creates radioactive waste.

Why They're a Problem:

- Limited supply** – once used, they're gone.
- Pollution** – burning them releases greenhouse gases.
- Climate change** – contributes to global warming.



Market Pull

This happens when **customers or users** ask for something new or better.

- The **demand comes from the market.**
- Companies respond by creating products to meet that need.

Example:

People want eco-friendly clothing → textile companies develop sustainable fabrics.

Technology Push

This happens when **new technology is developed first**, and then companies find ways to use it.

- The **innovation comes from scientists or engineers.**
- Products are created based on what the technology can do, even if people didn't ask for it yet.

Example:

A new fabric is invented that changes colour in sunlight → fashion brands start using it in clothing.

Materials Technology

- Smart materials: photochromic, thermochromic, quantum tunnelling composite
- Shape Memory Alloys (SMA)
- Glass Reinforced Plastic (GRP): properties and sustainability

Photochromic

Materials that **change colour when exposed to light**, especially sunlight (UV light)

- Example:** Sunglasses that darken in the sun and go clear indoors.
- Use in textiles:** Fabrics that change colour outdoors.



Thermochromic

Materials that **change colour with heat**.

- Example:** A mug that changes design when hot water is added.
- Use in textiles:** T-shirts or clothing that change colour with body heat or temperature.



Quantum Tunnelling

A **very advanced science concept** where particles pass through barriers they normally shouldn't.

- In textiles, it's used in **smart materials** like pressure-sensitive fabrics.
- Example:** A fabric that lights up or changes when touched.



Composite Materials

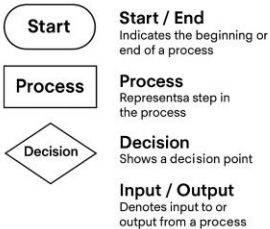
Made by **combining two or more materials** to make something stronger or better.

- Each part keeps its own properties, but together they're more useful.
- Example:** Fibreglass (glass + plastic), or carbon fibre (strong and light).
- Use in textiles:** Protective clothing, sportswear, or fashion with added strength or flexibility.

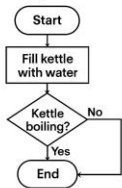
Electronic Systems & Mechanical Devices

- Components of a flashing bike light
- Parking sensors: flowchart and feedback
- Gear mechanisms: gear ratio, rack and pinion

Flowchart Symbols



Example: Turning on a kettle



Electrical Circuit Components



How to Work It Out:

Step 1: Count the Teeth

- Count the number of teeth on each gear.

Step 2: Use the Formula

Gear Ratio = Teeth on Driven Gear ÷ Teeth on Driver Gear

- **Driver Gear:** The gear that turns first (input).
- **Driven Gear:** The gear that is turned by the driver (output).

Example:

- Driver gear has **10 teeth**
 - Driven gear has **30 teeth**
- Gear Ratio = 30 ÷ 10 = 3:1**

This means:

- The driver gear turns **3 times** to make the driven gear turn **once**.
- You get **more force**, but **less speed**.

Reverse Example:

- Driver gear has **30 teeth**
 - Driven gear has **10 teeth**
- Gear Ratio = 10 ÷ 30 = 1:3**

This means:

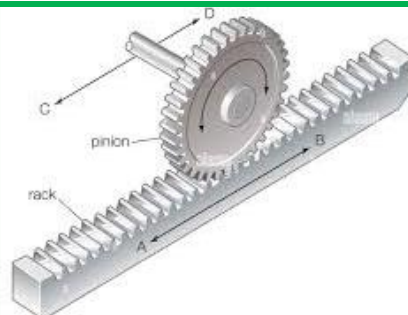
- The driver gear turns **once** to make the driven gear turn **3 times**.
- You get **more speed**, but **less force**.

Rack and Pinion - How It Works:

- When the **pinion** turns, its teeth grip the teeth on the **rack**.
- This makes the **rack move in a straight line**.
- It's like turning a wheel to slide something forward or backward.

Where You See It:

- **Steering systems** in cars – turning the steering wheel moves the wheels left or right.
- **Machinery** – to move parts precisely.
- **Railways** – in mountain trains to grip steep tracks.



Materials

- Recycled paper packaging: safety and fibre strength
- Beech wood toothbrush: properties and tree characteristics
- PVC coated nylon bag: properties, target market, and comparison with knitted fabric
- Non-ferrous metals in jewellery: properties and examples

Common Non-Ferrous Metals in Jewellery:

Gold

1. Soft, shiny, and doesn't tarnish.
2. Used in rings, necklaces, and luxury items.

Silver

1. Bright and shiny, but can tarnish over time.
2. Popular for earrings, bracelets, and pendants.

Copper

1. Reddish-brown and easy to shape.
2. Sometimes used in handmade or boho-style jewellery.

Platinum

1. Very strong and doesn't tarnish.
2. Used in high-end rings and watches.

Titanium

1. Lightweight, strong, and hypoallergenic.
2. Great for modern or men's jewellery.

Aluminium

1. Very light and doesn't rust.
2. Used in costume jewellery and colourful designs.

PVC – Polyvinyl Chloride

PVC is a **type of plastic** that is:

- **Strong and durable**
- **Water-resistant**
- **Lightweight**
- Can be **flexible or rigid**, depending on how it's made

Hard woods-

e.g Oak, Beech wood are strong, hard, fine-textured hardwood that are easily bent by steaming and takes an excellent finish, making it suitable for furniture, flooring,.

Paper and Packaging Revision Notes

- Paper is often measured by its **weight per square metre**, which helps determine its thickness and strength. This is known as **gsm** (grams per square metre), and it's important when choosing paper for printing, packaging, or crafting.
- When paper is recycled, the fibres become **shorter and weaker** each time. This affects the quality and strength of recycled paper, which is why it's often used for things like newspaper or cardboard rather than high-quality printing.
- Designers must think carefully about **safety** when creating packaging. This includes using **non-toxic materials**, avoiding **sharp edges**, and ensuring the product is **securely enclosed** to prevent damage or injury. Clear **warnings or instructions** may also be added to help users handle the product safely.

Anthropometrics

- About **body measurements**
- Helps designers know **how big or small people are**
- Used to make sure things **fit properly**

Example:

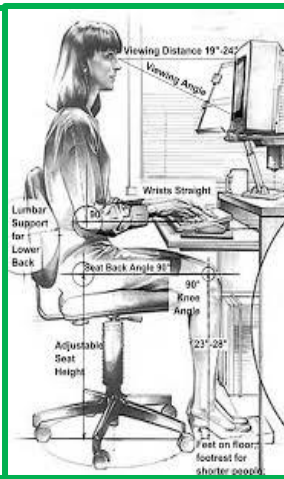
Making a chair the right height for a pupil.

Ergonomics

- About **comfort and ease of use**
- Helps designers make things **safe and comfortable**
- Used to reduce **strain or injury**

Example:

Designing a chair that supports your back while sitting.



Product Analysis

- Material selection and evaluation
- Anthropometrics and ergonomics
- Disassembly and design brief
- Logo design and area calculation

Tie-Dye – Resist Dyeing Made Easy

Tie-dye is a fun and colourful way to dye fabric using a **resist technique**. This means you **block parts of the fabric** so the dye can't reach them.

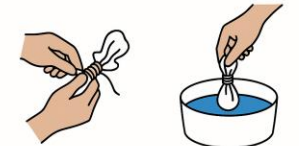
Steps:

1. **Twist or fold the fabric** into shapes.
2. **Tie it tightly** with string or rubber bands.
3. **Apply dye** to the fabric.
4. The tied areas **resist the dye** and stay lighter or white.
5. **Untie and reveal** the pattern!

Why It Works:

- The tied parts **stop the dye** from soaking in.
- This creates **unique patterns** like spirals, stripes, or circles.

Tie-Dye (Resist Method)



TIE

DYE



UNTIE



TIE-DYE

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Designing Responsibly – Key Revision Points

Ethical and Environmentally Friendly Production

- **Fair working conditions:** Designers should choose manufacturers that treat workers fairly, pay fair wages, and provide safe environments.
- **Sustainable materials:** Use organic cotton, recycled fabrics, or low-impact dyes to reduce harm to the planet.
- **Waste reduction:** Design with minimal fabric waste and consider packaging that's recyclable or reusable.
- **Local sourcing:** Reduces transport emissions and supports local economies.
- **Transparency:** Brands should be open about where and how products are made.

Why Testing and Evaluating Matter

- **Checks quality:** Ensures the product works well and lasts.
- **Improves safety:** Identifies any risks or faults before the product is sold.
- **Refines design:** Helps improve comfort, fit, or function based on feedback.
- **Saves money:** Fixing problems early avoids costly mistakes later.
- **Meets user needs:** Makes sure the product is suitable for the target audience.

ACCESSFM

A – Aesthetics What does it look like? Is it stylish, colourful, modern?

C – Cost How much does it cost to make or buy?

C – Client Who is it for? What does the target user need or want?

E – Environment Is it eco-friendly? Can it be recycled or reused?

S – Size How big or small is it? Does it fit the user or space?

S – Safety Is it safe to use? Are there any risks?

F – Function What does it do? Does it work well?

M – Materials What is it made from? Are the materials suitable and sustainable?

Batik – Resist Dyeing Made Easy

Batik is a method where **hot wax** is used to **block dye** from reaching parts of the fabric.

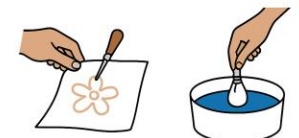
Steps:

1. **Draw a pattern** on fabric using **hot wax**.
2. **Dip the fabric in dye** – the waxed areas **resist the dye**.
3. **Let it dry**, then **remove the wax** (usually by heating or ironing between paper).
4. The waxed areas stay **lighter**, creating a **pattern**.

Why It's Used:

- Creates **detailed and colourful designs**
- Each piece is **unique**
- Popular in **traditional textiles** (especially in Indonesia and Africa)

Batik (Resist Method)



WAX

DYE



REMOVE WAX



BATIK

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