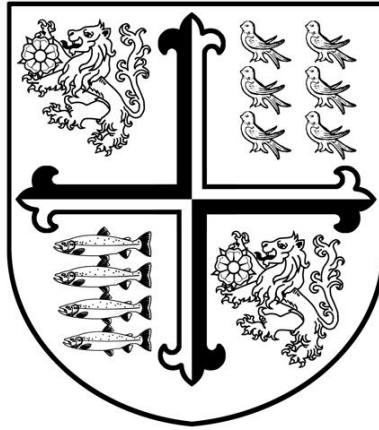




Year 11

GCSE Design Technology Exam Preparation

Exam Board: Edexcel

Exam date information:

1 exam

1 hour 45 mins

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Year 11 Design Technology Revision

Half Term 1

During year 11, you are going back through year 9 content, recalling and revising it. You will cover topics 1.17 through to 1.15.

If you **RED** or **AMBER** sections, make a note of the specific bits which you are struggling with.

Topics	Key Concepts	R	A	G
1.17 Communication techniques	<i>Being able to use/draw, reference and explain the reasons to use the following techniques:</i> a) Freehand sketching (2D and/or 3D) b) Annotated sketches c) Cut and paste techniques d) Digital photography/media e) 3D models f) Isometric and oblique projection g) Perspective drawing h) Orthographic and exploded views i) Assembly drawings j) System and schematic diagrams			
1.16 Design strategies	<i>Have knowledge of the following design strategies and why they're used (pros and cons):</i> a) Collaboration b) User-centred design c) Systems thinking			
1.15 Designers and design companies	<i>Knowing the work and styles of past and present designers and design companies for:</i> a) Alessi b) Apple c) Heatherwick Studio d) Joe Casely-Hayford e) Pixar f) Raymond Loewy g) Tesla h) Zaha Hadid <i>Being able to analyse a product, using the following specification criteria:</i> a) Form b) Function c) Client and user requirements d) Performance requirements e) Materials and components/systems f) Scale of production and cost g) Sustainability h) Aesthetics i) Marketability j) Consideration of innovation			

Revision Questions:

1.17 Communication techniques

1. What is one advantage of using freehand sketching when developing early design ideas?
2. What two key types of information should be included when annotating a design sketch?
3. How can cut and paste techniques help when developing design concepts?
4. Give one way digital photography can be used to support design development.
5. Why are 3D models useful when communicating a design idea to a client or user?
6. What is the main purpose of using isometric projection in design drawings?
7. How does perspective drawing improve the realism of a design idea?
8. What is the difference between an orthographic drawing and an exploded view?
9. What is shown in an assembly drawing and why is it important?
10. What is a system or schematic diagram used to represent in design and technology?

1.16 Design strategies

1. What does collaboration mean in design?
2. Give one example of a person you might collaborate with in a design team.
3. What is user-centred design?
4. Give one way designers find out what users need.
5. What is meant by 'systems thinking'?
6. Who is the main user of systems thinking and why do they use it?

1.15 Designers and design companies

1. What type of products is Alessi best known for?
2. Give one characteristic of Alessi's design style.
3. Name one key feature often associated with Apple product design.
4. Who is a famous designer associated with Apple?
5. What type of design work does Heatherwick Studio produce?
6. What industry is Joe Casely-Hayford known for?
7. What is the style in which Joe Casely-Hayford designs?
8. What design shape is Raymond Loewy well known for?
9. Why are Tesla cars so successful?
10. What was Zaha Hadid famous for designing?

6 mark question

Compare how Apple and Alessi use design to meet user needs. Refer to specific examples in your answer. (6 marks)

Half Term 2

Continuing with year 9 content revision.

If you **RED** or **AMBER** sections, make a note of the specific bits which you are struggling with.

Topics	Key Concepts	R	A	G
1.14 Influences when designing and making	<i>Understanding how the following factors will influence a designer when developing a product:</i> a) Social, ethnic and economic groups b) Fair trade c) Carbon offsetting d) Product disassembly and disposal e) Green Designs f) Recycling and reusing materials or products g) Human capability h) Cost of materials i) Manufacturing capability j) Environmental impact – life cycle analysis (LCA).			
1.13 Material properties	<i>Understanding why materials are chosen for their purpose, including the following information:</i> a) Properties of materials b) Advantages and disadvantages of materials c) Justification of the choice of materials			
1.12 Woods and timbers	<i>To know about different woods and timbers that can be used for products and be able to apply that knowledge and understanding to be able to discriminate between them and select appropriately:</i> a) Hardwoods: oak, mahogany, beech, balsa b) Softwoods: pine, cedar c) Manufactured boards: plywood, medium density fibreboard (MDF) d) Understanding properties that woods have such as hardness, toughness, durability			

Revision Questions:

1.14 Influences when designing and making

1. Why do designers consider different social and economic groups when designing products?
2. Give one example of how a product might be adapted for the elderly.
3. What does "fair trade" mean?
4. What is carbon offsetting?
5. Why is it important for products to be easy to disassemble?
6. What is meant by "green design"?
7. Give one benefit of recycling materials.
8. What is meant by human capability in design?
9. How does the cost of materials affect product design?
10. What is a life cycle analysis (LCA)?

1.13 Material properties

Define the following terms:

1. Toughness
2. Hard
3. Malleable
4. Ductile
5. Stable
6. Stiff
7. Compressive strength
8. Tensile strength

1.12 Woods and timbers

1. Compare the properties of oak and balsa, giving one difference in strength and density.
2. Why is beech commonly used for furniture rather than balsa? Give two reasons.
3. Explain why pine is widely used in construction despite being less durable than some hardwoods.
4. Give one property of cedar that makes it suitable for outdoor use.
5. Explain how plywood is constructed and why this makes it strong.
6. Compare MDF with natural wood, giving one advantage and one disadvantage.

Half Term 3

Continuing with year 9 content revision.

If you **RED** or **AMBER** sections, make a note of the specific bits which you are struggling with.

Topics	Key Concepts	R	A	G
1.11 Textiles and fibres	<i>To know about different textiles and fibres that can be used for products and be able to apply that knowledge and understanding to be able to discriminate between them and select appropriately:</i> a) Natural: cotton and wool b) Synthetic: polyester and acrylic c) Woven: calico and denim d) Non-woven: felt and bonded fibres e) Knitted: warp knit and weft knit f) Understanding properties that textiles have such as elasticity, resilience, durability			
1.10 Polymers	<i>To know about different polymers that can be used for products and be able to apply that knowledge and understanding to be able to discriminate between them and select appropriately:</i> a) Thermoforming: acrylic HIPS, biopol b) Thermosetting: urea formaldehyde, polyester resin c) Understanding properties that polymers have such as insulation of heat and electricity, toughness			
1.09 Papers and boards	<i>To know about different papers and boards that can be used for products and be able to apply that knowledge and understanding to be able to discriminate between them and select appropriately:</i> a) Papers: copier, cartridge, tracing b) Boards: corrugated, folding boxboard, solid white board c) Understanding properties that papers and boards have such as flexibility, printability and biodegradability			

Revision Questions:

1.11 Textiles and fibres

1. Explain why cotton is suitable for summer clothing but not ideal for waterproof garments.
2. Describe the main use of wool and why it is used for that purpose.
3. Explain one advantage of polyester over cotton for outdoor clothing.
4. Compare acrylic with wool, giving one similarity and one difference.
5. Compare calico and denim in terms of strength and typical uses
6. Explain how the interlacing of warp and weft threads affects the properties of woven fabrics.
7. Explain why felt does not fray when cut.
8. Describe one advantage and one disadvantage of bonded fabrics.
9. Compare warp knit and weft knit fabrics in terms of stretch and structure.
10. Explain why knitted fabrics are suitable for garments that need flexibility.

1.10 Polymers

1. Explain why acrylic is commonly used as a glass substitute.
2. Give one reason why HIPS is suitable for packaging products.
3. What is one environmental advantage of using biopol?
4. Describe what happens to thermoforming polymers when they are heated.
5. Give one property of urea formaldehyde that makes it useful for electrical fittings.
6. Explain why polyester resin is used in products such as boat hulls.

1.09 Papers and boards

1. Explain why copier paper is suitable for everyday printing tasks.
2. Give one reason why cartridge paper is preferred for drawing and sketching.
3. Describe one key property of tracing paper and explain its use.
4. Compare copier paper and tracing paper, giving one difference in their properties.
5. Explain how the structure of corrugated board increases its strength.
6. Give one reason why folding boxboard is commonly used for packaging.
7. Describe one property of solid white board that makes it suitable for high-quality packaging.
8. Compare corrugated board and solid white board, giving one difference in their uses.

Half Term 4

Continuing with year 9 content revision.

If you **RED** or **AMBER** sections, make a note of the specific bits which you are struggling with.

Topics	Key Concepts	R	A	G
1.08 Metals	<i>To know about different metals that can be used for products and be able to apply that knowledge and understanding to be able to discriminate between them and select appropriately:</i> a) Ferrous: mild steel, stainless steel, cast iron b) Non-ferrous: copper, aluminium, brass c) Understanding properties that metals have such as ductility, malleability, hardness			
1.07 Programming	<i>Understanding the different components to a flowchart and being able to apply this knowledge to make a simple programme:</i> a) How to make use of flowcharts b) How to switch outputs on/off in relation to inputs and decisions c) How to use simple routines to control outputs with delays, loops and counts			
1.06 Electronic components	<i>Know the different electronic component functions and their advantages:</i> a) Sensors and their input to a circuit: light-dependent resistors (LDRs), thermistors b) Control devices and components: switches, transistors, resistors c) Outputs: buzzers, light-emitting diodes (LEDs)			

Revision Questions:

1.08 Metals

1. Explain why mild steel is widely used in construction, despite being prone to corrosion.
2. Give one property of stainless steel and explain a use of it.
3. Compare cast iron with mild steel, giving one difference in properties and one difference in typical use.
4. Explain how the properties of copper make it suitable for both plumbing and electrical uses.
5. Explain why aluminium is often used in aircraft manufacture instead of steel.
6. Compare brass with copper, giving one advantage and one typical application.

1.07 Programming

1. Produce a flowchart for making a cup of tea. The tea bag should go in before the milk and the person may want sugar.

1.06 Electronic components

1. What does an LDR do in a circuit?
2. How does a thermistor respond to changes in temperature?
3. What is the function of a switch in a circuit?
4. What is the purpose of a resistor in a circuit?
5. Give one advantage of using LEDs as an output.
6. When might a buzzer be used in a product?

Final revision prior to the exam

This document continues with year 9 revision.

Continue to **RED** or **AMBER** sections, make a note of the specific bits which you are struggling with and then keep going back to them to revise them further!

Topics	Key Concepts	R	A	G
1.05 Mechanical devices	<i>Knowing the different types of movement and mechanical devices, alongside how to calculate speeds etc:</i> a) Types of movement: linear, reciprocation, rotary, oscillation b) Classification of levers: class 1, 2 and 3 c) Calculations related to mechanical advantage (MA), velocity ratio (VR), load, effort and efficiency d) Linkages: bell crank, reverse motion linkages e) Cams: pear, eccentric, drop f) Followers: roller, knife, flat g) Pulleys and belts: V-belt, velocity ratio (VR), input and output speeds h) Crank and sliders i) Gear types: simple, compound gear train, idler, revolutions per minute (RPM) calculations, bevel gears, rack and pinion			
1.04 Modern materials	<i>Knowing how to distinguish between modern materials; knowing their applications, advantages and disadvantages of the following:</i> a) Smart and modern materials: shape-memory alloys (SMAs), nanomaterials, reactive glass, piezoelectric materials, temperature-responsive polymers, conductive inks b) Composites: concrete, plywood, GFRP, CFRP, reinforced polymers, robotic materials c) Technical textiles: agro, geo, construction, sports, protective, domestic, environmentally friendly			

Topics	Key Concepts	R	A	G
1.03 Energy sources	<i>Knowing the processes and uses of different power sources; their applications, pros and cons:</i> a) Sources, advantages and disadvantages of energy: fossil fuels, biodiesel and biomass, tidal, wind, solar, hydroelectric b) Powering systems: batteries and cells, solar cells, mains electricity, wind power c) Factors to consider when choosing appropriate energy sources to make products and power systems: portability, environmental impact, power output, system connections, cost			
1.02 Evaluating new and emerging technologies	<i>Knowing how to evaluate design decisions against topics such as:</i> a) New and emerging technologies against: budget, timescale, who the product is for, materials, manufacturing capabilities b) How potential future scenarios can occur and impact: natural disasters, medical advances, travel, global warming, communication c) Ethical perspectives: where it was made, who was it made by, who will it benefit, Fair Trade d) Environmental perspectives: materials, carbon footprint, energy usage during a life cycle analysis (LCA)			
1.01 New and emerging technologies	<i>Understanding how the following is affected by new and emerging technologies; both advantages and disadvantages:</i> a) Industry: unemployment, workforce skills, demographic movement, science and technology parks b) Enterprise: crowd funding, privately owned businesses, not-for-profit c) Sustainability d) People: workforce, children, apprenticeships, wages, disabled e) Culture: population movement around the EU, social segregation f) Society: changes in shift patterns, remote working, video conferencing, Internet of Things (IoT) g) Environment: pollution, waste, transportation, packaging h) Quantity production: one-off, batch, mass, continuous, JIT, lean, standardised parts and components			

Revision Questions:

1.05 Mechanical devices

1. What is meant by linear motion?
2. Give one example of a product that uses reciprocating motion.
3. What is the difference between rotary motion and oscillating motion?
4. What is a class 1 lever?
5. Give one example of a class 2 lever.
6. Explain how a class 3 lever differs from a class 1 lever.
7. Calculate the mechanical advantage if the load is 60 N and the effort is 20 N.
8. Calculate the velocity ratio if the effort arm is 50 cm and the load arm is 10 cm.
9. A system has a load of 100 N and an effort of 25 N. What is the MA?
10. A machine has an MA of 4 and a VR of 5. Calculate the efficiency (%).
11. What is the purpose of a bell crank linkage?
12. What does a reverse motion linkage do?
13. What type of motion does a cam produce?
14. Name one difference between a pear cam and an eccentric cam.
15. Give one advantage of a roller follower over a knife-edge follower.
16. What is the function of a V-belt in a pulley system?
17. A pulley system has an input speed of 200 rpm and a VR of 2. What is the output speed?
18. What type of motion does a crank and slider mechanism convert?
19. What is the purpose of an idler gear in a gear train?
20. A gear rotates at 120 rpm and drives a second gear at a VR of 3. What is the output speed?

1.04 Modern materials

Smart and modern materials

1. What happens to a shape-memory alloy when it is heated?
2. Give one example of a product that uses SMAs.
3. Why are nanomaterials stronger than their larger-scale equivalents?
4. What does reactive (photochromic) glass do when exposed to sunlight?
5. What happens when pressure is applied to a piezoelectric material?
6. How do temperature-responsive polymers react to changes in temperature?
7. What is a key property of conductive inks?
8. Give one use of conductive ink in products.

Composite materials

1. Explain one advantage and one disadvantage of using concrete in construction.
2. What is meant by *reinforced concrete*, and why is reinforcement added?
3. Describe how plywood is manufactured.
4. State one reason why plywood is stronger than solid wood of the same thickness.
5. Give two properties of GFRP.
6. Explain why CFRP is commonly used in high-performance products such as sports equipment or vehicles.
7. What is a reinforced polymer?
8. What are robotic materials, and give one example of how they might be used.

Technical textiles

1. Identify one function of agrotextiles used in farming.
2. What is the purpose of geotextiles in construction or civil engineering?
3. State two requirements materials must meet when used in the construction industry.
4. Explain why lightweight materials are important in sports product design.
5. Give one property required of materials used for protective equipment and explain why it is important.
6. Where will you find domestic textiles in use? Give an example.
7. What is meant by an environmentally friendly material, and give one example.

1.03 Energy sources

1. State one advantage and one disadvantage of using fossil fuels for energy production.
2. Explain why fossil fuels are considered a non-renewable energy source.
3. Give one advantage of using biomass as an energy source.
4. Identify one environmental disadvantage of burning biomass.
5. Describe how tidal energy generates electricity.
6. Explain one limitation of using wind power.
7. State two advantages of solar energy.
8. Explain how hydroelectric power stations generate electricity.
9. State one advantage and one disadvantage of using mains electricity in products.

1.02 Evaluating new and emerging technologies

1. Explain how medical advances could influence the development of new products.
2. State one impact of global warming on materials or product design.
3. Why is it important to consider where a product is made?
4. What is Fair Trade, and how does it benefit producers?
5. Identify one factor considered in a life cycle analysis (LCA) and explain its importance.

1.01 New and emerging technologies

1. What is meant by crowdfunding as a type of enterprise?
2. How does a not-for-profit organisation differ from a privately owned business?
3. What is meant by sustainability in a business context?
4. Why are apprenticeships important for the workforce?
5. How can businesses support disabled employees in the workplace?
6. What is meant by population movement around the EU, and how can it affect culture?
7. How has remote working changed traditional shift patterns?
8. What is the difference between batch production and mass production?

Answers to all of the revision Qs

1.17 Communication techniques

1. It is quick and flexible, allowing lots of ideas to be generated and explored rapidly.
2. Materials, dimensions, sizes, functionality, parts that can't be seen etc.
3. They allow designers to combine existing images or ideas to quickly create new concepts and explore different styles.
4. It can be used to record research, existing products, or stages of model development for reference.
5. They allow the client to see and understand the shape, size, and form of the design more clearly. They help clearly check aesthetics and functionality.
6. To show a 3D representation of a design without perspective distortion.
7. It shows depth and distance, making the design look more realistic as it would appear in real life.
8. An orthographic drawing shows separate 2D views (front, side, top), while an exploded view shows how parts fit together by separating them.
9. It shows how all parts fit together and is important for guiding the construction or manufacturing process.
10. It represents how a system works, showing inputs, processes, and outputs using symbols.

1.16 Design strategies

1. Working together with others to design a product.
2. A product designer, engineer, anyone in manufacturing etc.
3. Designing a product based on the needs and wants of the user.
4. Conducting surveys, interviews, or observations.
5. The process of using flowcharts to show a process/programme in a design.
6. Mostly engineers. They use it to break down a complex product into small, manageable chunks.

1.15 Designers and design companies

1. Kitchenware and household products.
2. Creative, decorative, and often playful design style.
3. Minimalist design (simple, sleek appearance).
4. Jonathan Ive.
5. Architecture, product design, and large-scale structures, as well as smaller products i.e. perfume bottles.
6. Fashion design.
7. Mixing cultural influences from Africa with typical British tailored pieces.
8. Teardrop shape (for aerodynamics).
9. Powerful electric cars which don't compromise on form or function.
10. Futuristic architecture (buildings with flowing, curved shapes).

6 mark question

Apple and Alessi both design products to meet user needs, but they do this in different ways.

Apple focuses on creating products that are simple to use and visually appealing. For example, the iPhone has a minimalist design with an easy-to-use touchscreen interface, which meets user needs for functionality and ease of use. Apple also ensures products work well together, improving the user experience.

Alessi, on the other hand, focuses more on creative and decorative design. For example, their kettles and kitchenware often have unusual shapes or playful features, making them attractive and enjoyable to use. This meets user needs by making everyday products more exciting and aesthetically pleasing.

Both companies consider the user, but Apple prioritises function and usability, while Alessi places more emphasis on style and emotional appeal.

Level 3 (5–6 marks)

- Clear comparison of two designers/companies
- Uses relevant and accurate examples
- Explains how design meets user needs
- Shows good understanding with developed points

Level 2 (3–4 marks)

- Some comparison made
- Basic examples included
- Some explanation of user needs
- May lack detail or clarity

Level 1 (1–2 marks)

- Limited knowledge shown
- Simple statements about designers/companies
- Little or no link to user needs
- No real comparison

1.14 Influences when designing and making

1. To ensure products are suitable, inclusive, and affordable for different users.
2. Designing a product with larger text, larger buttons, less complexity etc.
3. Ensuring workers are paid fairly and work in safe conditions.
4. Reducing carbon emissions by funding activities like planting trees.
5. So parts can be repaired, reused, or recycled more easily. It also helps with transportation and activities like moving house.
6. Designing products to minimise environmental impact.
7. It reduces waste sent to landfill and is therefore better for the environment.
8. What users are physically and mentally able to do.
9. Expensive materials increase the final product price. Dependent on the product, this may not be viable or feasible to do.
10. Assessing the environmental impact/carbon emissions of a product from the very start to the end of the products life (disposal).

1.13 Material properties

1. Ability to withstand sudden shock/stress.
2. Ability to withstand indentation, scratching, penetration of the surface.
3. (metals only) Being deformed in all directions with fracturing.
4. (metals only) Being able to be drawn out and twisted into wiring.
5. Ability to keep its shape.
6. Resists bending.
7. Withstanding being squashed.
8. Withstanding being stretched/pulled apart.

1.12 Woods and timbers

1. Oak is very strong and dense, making it durable and suitable for construction, whereas balsa is very low in density and much weaker, making it ideal for lightweight models but not structural use.
2. Beech is stronger and more durable than balsa, making it suitable for furniture. It also has a fine, even grain, which gives a good finish, unlike balsa which is soft and easily damaged.
3. Pine is widely used because it is inexpensive, readily available, and easy to work with, even though it is less durable than many hardwoods.
4. Cedar is naturally resistant to moisture and decay, making it suitable for outdoor use.
5. Plywood is made by gluing layers (veneers) of wood together with the grain at right angles. This cross-graining increases its strength, stability, and resistance to warping.

6. One advantage of MDF is that it has a smooth surface with no grain, making it easy to machine and finish. However, a disadvantage is that it is weaker than natural wood and can be damaged by moisture.

1.11 Textiles and fibres

1. Cotton is suitable for summer clothing because it is breathable and absorbent, allowing sweat to evaporate and keep the body cool. However, it is not waterproof as it absorbs water easily and takes a long time to dry.
2. Used for jumpers and warm clothing as it is a good heat insulator.
3. Polyester is more suitable for outdoor clothing because it is water-resistant and dries quickly, unlike cotton which absorbs moisture.
4. Acrylic is similar to wool in that it is warm and lightweight. However, it is synthetic and less breathable than wool.
5. Calico is lightweight and less durable, making it suitable for items like test garments or craft work. Denim is much stronger and more durable due to its twill weave, making it ideal for jeans and workwear.
6. The interlacing of warp and weft threads creates a strong and stable fabric with little stretch. This structure increases durability but reduces flexibility.
7. Felt does not fray because it is made by matting fibres together rather than weaving them, so there are no threads to come undone.
8. One advantage is that bonded fabrics are quick and cheap to produce. A disadvantage is that they are often weak and not very durable.
9. Weft knit fabrics are stretchy in all directions and can unravel easily, whereas warp knit fabrics are more stable, less stretchy, and do not ladder as easily.
10. Knitted fabrics are suitable for flexible garments because their looped structure allows them to stretch and move with the body, improving comfort.

1.10 Polymers

1. Acrylic is transparent and has a glass-like appearance, but it is lighter and more impact-resistant than glass, making it safer and less likely to shatter.
2. HIPS is lightweight, easy to form, and has good impact resistance, making it suitable for protective packaging.
3. Biopol is biodegradable, so it can break down naturally in the environment, reducing plastic waste.
4. When heated, thermoforming polymers soften and can be moulded into shape. When cooled, they harden again and keep their new form.
5. Urea formaldehyde is a good electrical insulator and is heat-resistant.
6. Polyester resin is strong, lightweight, and can be reinforced with fibres such as fibreglass.

1.09 Papers and boards

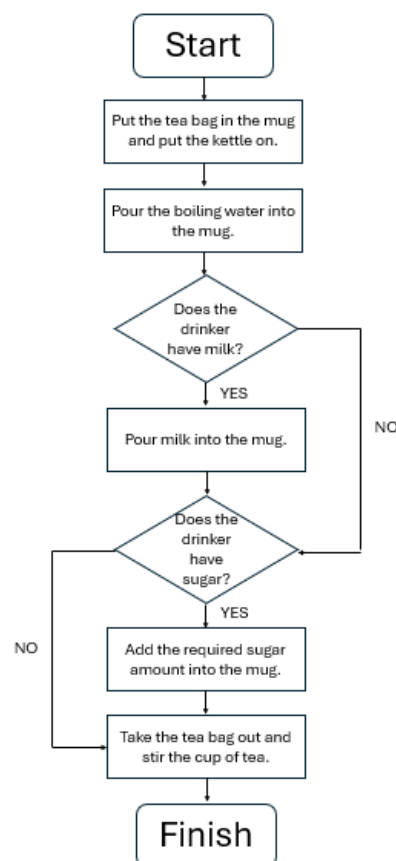
1. Copier paper is smooth, lightweight, and allows ink or toner to transfer clearly without smudging, making it suitable for high-volume everyday printing.
2. Cartridge paper is thicker and more absorbent than standard paper, which makes it suitable for drawing as it can handle different media such as pencil, ink, or light paint.
3. Tracing paper is translucent, allowing light to pass through it so designs underneath can be seen clearly, making it useful for copying drawings.
4. Copier paper is opaque and designed for printing, whereas tracing paper is translucent and designed for copying images.
5. Corrugated board has a fluted layer sandwiched between flat layers, which increases stiffness and strength while remaining lightweight.
6. Folding boxboard is lightweight, easy to cut and crease, and has a smooth surface for printing, making it ideal for packaging such as cartons.
7. Solid white board has a high-quality, smooth white surface which allows for high-quality printing and an attractive finish for premium packaging.

8. Corrugated board is mainly used for protective packaging like boxes due to its strength, whereas solid white board is used for retail packaging where appearance and print quality are important.

1.08 Metals

1. Mild steel is widely used in construction because it is strong, tough, and relatively inexpensive.
2. Stainless steel is corrosion-resistant, which makes it useful for products like cutlery and kitchen equipment where resistance to rust and hygiene are important.
3. Cast iron is hard and resistant to compression but brittle, whereas mild steel is tougher and more flexible. Cast iron is often used for items like manhole covers or cookware, while mild steel is used for structural supports.
4. Copper is an excellent conductor of electricity, making it ideal for wiring, and it is also resistant to corrosion, making it suitable for plumbing pipes.
5. Aluminium is used in aircraft manufacture because it is lightweight and has a good strength-to-weight ratio, which reduces fuel use compared to heavier steel.
6. Brass has better corrosion resistance than copper and is harder, making it more durable. It is commonly used for fittings such as door handles or musical instruments.

1.07 Programming



1.06 Electronic components

1. An LDR changes its resistance depending on light intensity.
2. A thermistor changes its resistance with temperature. As temperature increases, its resistance decreases.
3. A switch is used to open or close a circuit, allowing current to flow or stopping it.
4. A resistor limits the flow of current in a circuit, preventing components from being damaged.
5. LEDs use very little energy and have a long lifespan, making them efficient outputs.
6. A buzzer is used to produce sound as a warning or alert, for example in alarms or timers.

1.05 Mechanical devices

1. Motion in a straight line (e.g. a drawer opening).
2. A piston in an engine, sewing machine needle (moves back and forth in a straight line).
3. Rotary = continuous circular movement (e.g. wheel), oscillating = back-and-forth motion along an arc (e.g. pendulum).
4. The fulcrum is between the effort and the load (e.g. seesaw).
5. A wheelbarrow (load is between fulcrum and effort).
6. Effort is between fulcrum and load, unlike class 1 where pivot is in the middle.
7. $MA = \text{Load} / \text{Effort} = 60/20 = 3$
8. $VR = \text{Effort} / \text{Load} = 50/10 = 5$
9. $MA = 100/25 = 4$
10. $\text{Efficiency} = MA / VR \times 100 = 4/5 \times 100\% = 80\%$
11. Changes the direction of movement (usually by 90°).
12. Makes two parts move in opposite directions.
13. Converts rotary motion into reciprocating or oscillating motion.
14. Pear = has a dwell (stays still for part of rotation), eccentric = no dwell, continuous motion.
15. Reduces friction and wear compared to a knife-edge follower.
16. Transfers rotary motion between pulleys and provides better grip to reduce slipping.
17. $\text{Output speed} = \text{input speed} / VR = 200/2 = 100\text{rpm}$.
18. Converts rotary motion into reciprocating motion.
19. Changes direction of rotation without changing speed or gear ratio.
20. $\text{Output speed} = \text{input speed} / VR = 120/3 = 40\text{rpm}$.

1.04 Modern materials

Smart and modern materials

1. When heated, a shape-memory alloy returns to its original (pre-set) shape after being deformed.
2. SMAs are used in products such as orthodontic braces, spectacles or self-opening vents.
3. Nanomaterials are stronger because their particles are extremely small, which increases surface area and improves strength and durability.
4. Reactive (photochromic) glass darkens when exposed to sunlight and becomes clear again when the light level decreases.
5. When pressure is applied, piezoelectric materials generate a small electrical charge.
6. These polymers change colour when the temperature changes.
7. Conductive inks allow electricity to flow, meaning they can conduct electrical current.
8. Conductive inks are used in printed electronics, such as circuits in smart packaging or flexible keyboards.

Composite materials

1. *Advantage:* Very strong in compression, making it ideal for structural use.
Disadvantage: Weak in tension, so it can crack without reinforcement.
2. Reinforced concrete is concrete with steel bars or mesh embedded inside it.
The reinforcement is added to improve tensile strength and prevent cracking.
3. Plywood is made by gluing together thin layers (veneers) of wood with the grain of each layer at right angles to the next.
4. It is stronger because the cross-grain layers distribute loads evenly and reduce the chances of splitting.
5. Lightweight, High strength, corrosion resistant, durable, low cost compared to CFRP.
6. CFRP is used because it has a very high strength-to-weight ratio, making products strong but lightweight, which improves performance.
7. Cotton fabrics mixed with a polymer resin to make inflammable laminated plastic sheets.

8. Robotic materials are materials that can sense and respond to their environment. Uses: plane wings, prosthetics.

Technical textiles

1. Agrotextiles are used to protect crops, for example by controlling sunlight, temperature, or pests.
2. Geotextiles are used to separate, filter, reinforce, or drain soil, helping prevent erosion and improve stability.
3. High strength, Durability, waterproof (Materials must withstand loads and environmental conditions over time).
4. Lightweight materials reduce the effort needed to move equipment, improving speed and performance for the user.
5. Property: Impact resistance: it protects the user by absorbing or reducing forces from impacts (e.g. helmets). Heat resistance: to protect firefighters when entering burning buildings. Chemical resistance: to protect those working with toxic waste/chemicals etc.
6. Found in the household. Vary, can range from flooring, to furnishings, cushions to curtains etc.
7. An environmentally friendly material has minimal negative impact on the environment (e.g. biodegradable or recyclable). Examples include bamboo, flax, cotton, hemp.

1.03 Energy sources

1. *Advantage:* Reliable and can generate large amounts of energy.
Disadvantage: Produces carbon dioxide, contributing to climate change.
2. They are non-renewable because they take millions of years to form and cannot be replaced within a human timescale.
3. Biomass is renewable because it comes from plants or organic matter that can be regrown.
4. Burning biomass releases carbon dioxide and can contribute to air pollution if not managed sustainably.
5. Tidal energy uses the movement of water caused by tides to turn turbines, which generate electricity.
6. Wind power is unreliable because it depends on wind availability, which is not constant.
7. Renewable energy source, produces no pollution during use, abundant in hot countries.
8. Water stored behind a dam is released to flow through turbines, which spin generators to produce electricity.
9. *Advantage:* Provides a constant and reliable power supply.
Disadvantage: Requires connection to a power source (not portable) and can be dangerous if mishandled.

1.02 Evaluating new and emerging technologies

1. Medical advances can lead to new products such as prosthetics or wearable health devices that improve quality of life and monitor health.
2. Designers may use more sustainable and environmentally friendly materials and processes.
3. It is important because products made in different countries may involve poor working conditions or low wages, so designers must consider ethical sourcing.
4. Fair Trade ensures producers receive fair wages and safe working conditions, improving their quality of life and supporting sustainable practices.
5. Factor: Energy use. Importance: Reducing energy use during a product's life cycle lowers environmental impact and carbon emissions.

1.01 New and emerging technologies

1. Crowdfunding is raising small amounts of money from many people, usually online, to fund a business or project.
2. A not-for-profit organisation reinvests profits into its causes, while a privately owned business aims to make profit for its owners.
3. Sustainability means operating in a way that meets present needs without harming future resources or the environment.
4. They provide practical training and skills development, helping people gain employment.
5. By making reasonable adjustments such as accessible facilities, adapted equipment, and flexible working arrangements.
6. It refers to people moving between EU countries, which can increase cultural diversity and exchange of ideas.
7. It allows more flexible working hours and reduces the need for fixed shifts or commuting.
8. Batch production makes items in groups, while mass production produces large quantities continuously.