



MATERIALS DESIGN AND TECHNOLOGY

ATAR course examination 2023

Marking key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

Section One: Short answer

15% (30 Marks)

Question 1

(10 marks)

- (a) Describe the role of client values and beliefs in the design process. (3 marks)

Description	Marks
Describes the role of client values and beliefs in the design process	3
Outlines the role of client values and beliefs in the design process	2
Makes a general statement about the role of client values and beliefs in the design process	1
Total	3
Answers could include: Client values and beliefs inform what the designer creates, the design features, the materials sourced, the budget for the project, the timeline, any environmental considerations and other factors, so that the end product is satisfactory to the client and will not be rejected and end up in landfill. Accept other relevant answers.	

- (b) Outline **two** factors that influence the development of trends in product design. (4 marks)

Description	Marks
For each factor (2 x 2 marks)	
Outlines a factor that influences the development of trends in product design	2
Makes a general statement about a factor that influences the development of trends in product design	1
Total	4
Answers could include: <ul style="list-style-type: none"> • consumer demand for new materials/styles/products influences designers to innovate, create and produce • media, social media and social influencers cause trends that drive changes in consumer behaviour and tastes • advances in technology create trends: new methods of production create innovative products with new aesthetics, efficiency and functions cause consumers to demand new products • changes in lifestyle choices create trends and cause new designs to be produced to meet demands • designers create trends based on availability of materials, productibility of designs and desirability of user features. Accept other relevant answers.	

- (c) Concern for the environment is a current social trend. Name **one** traditional product that has been altered to fit this trend and outline how it has been changed. (3 marks)

Description	Marks
Names a traditional product that has been altered to fit this trend	1
Subtotal	1
Outlines how the traditional product has been changed to fit this trend	2
Makes a general statement about how the traditional product has been changed to fit this trend	1
Subtotal	2
Total	3
Answers could include: <ul style="list-style-type: none"> • cars, trucks: changed fuel type from fossil fuel to electric for less carbon emissions • bikes/scooters: made electric so that more people can use them for a greater range of activities • drinking vessels: portable, re-usable drink bottles • clothing: recycled, upcycled garments and components • energy production: from fossil fuel to renewable solar/wind/wave energy systems • textiles: organic fibres, recycled fabrics, plastics converted to fabrics • food: organic, locally produced • packaging: biodegradable, recycled • eating utensils: biodegradable • cleaning products: organic/Earth-friendly. Accept other relevant answers.	

Question 2

(8 marks)

Outline how **two** elements and **two** principles of design have been used in the artwork on the wheat silos shown below.

Description	Marks
For each element/principle (4 x 2 marks)	
Outlines an element/principle of design in the artwork on the wheat silos	2
Makes a general statement about an element/principle of design in the artwork on the wheat silos	1
Total	8
Answers could include: <ul style="list-style-type: none"> • elements: line, colour, shape, form, tone • principles: rhythm, dominance, radiation, proportion, repetition, harmony, balance, texture, gradation, contrast, unity • line has been used to outline the triangular and circular shapes that form the solid part of the design. Open lines form the wheat stalk shapes coming from the solid triangle shapes that depict the ground • a limited colour pallet and repetition of the two subjects in the images, the wheat and the people, create harmony in the artwork • the contrasts in the shapes and colours of the design create a bold image that suits the harsh landscape and bright light • the artwork is sized large to fit the proportions of the silos, so that it makes a bold statement and can be seen from a long distance away. Accept other relevant answers.	

Question 3

(12 marks)

- (a) Outline how **four** design fundamentals were used to design the electric bicycle pictured above. (8 marks)

Description	Marks
For each design fundamental (4 x 2 marks)	
Outlines how the design fundamental was used to design the electric bicycle pictured	2
Makes a general statement about how a design fundamental was used to design the electric bicycle pictured	1
Total	8
Answers could include: <ul style="list-style-type: none"> • aesthetics: the colours are very appealing, bright and fun. The bike looks solid and safe • function: two carry baskets for more storage and carrying capacity, large comfortable seat, mud guards, headlight • safety: red colour, disc brakes, fat tyres, baskets are low for good balance • anthropometric data: heights and widths of frame, seat and handlebars, size of grips and brake handles • ergonomics: large comfortable seat, height of seat, height of handlebars • environmental impacts and considerations: no fossil fuel used, less parking space needed, less resources used to produce than a car, target market feel they are reducing their environmental impact • sustainability issues: less resources used to produce the bicycle than a car. Accept other relevant answers.	

- (b) Explain the role of performance criteria in the design process of a product. (4 marks)

Description	Marks
Explains the role of performance criteria in the design process of a product	4
Describes the role of performance criteria in the design process of a product	3
Outlines the role of performance criteria in the design process of a product	2
Makes a general statement about performance criteria	1
Total	4
Answers could include: <ul style="list-style-type: none"> • to evaluate the successful use of each of the design fundamentals to meet the criteria set out in the design brief by the client • to assess whether the final product meets safety standards for manufacturers and end users • to assess whether the product fits with the values and beliefs of the client and the developer • to assess the accuracy of costings and timelines • to make recommendations and establish changes for future models of the product and future production processes. Accept other relevant answers.	

Section Two: Extended answer

25% (39 Marks)

Question 4

(11 marks)

- (a) List **four** items that are included in a risk assessment document for a piece of new equipment. (4 marks)

Description	Marks
For each item (4 x 1 mark)	
Lists an item that is included in a risk assessment document for a piece of new equipment	1
Total	4
Answers could include: supplier' contact information, equipment type, date, location, users of the equipment, purpose of equipment, description of how the equipment is used, does the operator require a licence or competency, workplace conditions (access, lighting, thermal conditions), training procedure, PPE.	
Accept other relevant answers.	

- (b) Identify **three** actions that can be taken if a hazard cannot be fixed or eliminated. (3 marks)

Description	Marks
For each action (3 x 1 mark)	
Identifies an action that can be taken if a hazard cannot be fixed or eliminated	1
Total	3
Answers could include: <ul style="list-style-type: none"> • provide education/training for safe operation • replace it with a less harmful/toxic item • separate it using barriers or screens • modify it with guards or new systems for users • have safety rules • provide PPE. 	
Accept other relevant answers.	

Question 4 (continued)

(c) Explain how the use of ergonomics can impact the safety of a workplace. (4 marks)

Description	Marks
Explains how the use of ergonomics can impact the safety of a workplace	4
Describes how the use of ergonomics can impact the safety of a workplace	3
Outlines how the use of ergonomics can impact the safety of a workplace	2
Makes a general statement about how the use of ergonomics can impact the safety of a workplace	1
Total	4
<p>Answers could include:</p> <ul style="list-style-type: none"> • injury risk reduction: employers can reduce the risk of musculoskeletal disorders (MSDs) and other injuries caused by poor posture, repetitive motion, and other physical stresses. Also, by designing workstations and equipment to fit the size and range of motion of workers, employers can reduce the risk of repetitive motion injuries, such as carpal tunnel syndrome and injuries to the muscles, tendons, ligaments, nerves, and joints caused by repetitive motions, awkward postures, or forceful exertions. By providing ergonomic chairs and adjustable desks, employers can reduce the risk of back pain and other injuries caused by prolonged sitting or standing • improved posture: ergonomic design can improve posture, reducing the strain on the muscles and joints of the body. By promoting good posture, employers can reduce the risk of back pain, neck pain, and other discomforts that can lead to workplace injuries • reduced fatigue: ergonomic design can reduce physical and mental fatigue by optimising work processes and reducing the effort required to perform tasks. This can help employees to stay alert and focused, reducing the risk of accidents and errors that can lead to workplace injuries • increased productivity: ergonomic design can also increase productivity by reducing the time and effort required to complete tasks. For example, using ergonomic tools and equipment can make it easier and more efficient to perform tasks, reducing the risk of injury and improving overall productivity. Job satisfaction may also increase as a result • improved safety culture: by prioritising ergonomic design, employers can demonstrate a commitment to workplace safety, which can create a culture of safety among employees. This can promote safety awareness and encourage employees to take an active role in promoting safety in the workplace. 	
Accept other relevant answers.	

Question 5

(9 marks)

- (a) Using the results from the graph below, identify and explain which material would be the most suitable for the seal of the swimming goggles. (5 marks)

Description	Marks
Identifies Material C	1
Subtotal	1
Explains which material would be the most suitable for the seal of the swimming goggles	4
Describes which material would be the most suitable for the seal of the swimming goggles	3
Outlines which material would be the most suitable for the seal of the swimming goggles	2
Makes a general statement about material for the seal of the swimming goggles	1
Subtotal	4
Total	5
<p>Answers could include:</p> <p>Material C would be the most suitable for the seal because once you compare its properties against the other materials it is overall the best material. Its durability is slightly lower than Materials B and D, only rating 5 against a 7 and a 9, but when compared to their strength ratings, Material C is much better. Being worn on the head and during activities, the goggles are going to be exposed to a lot of impacts so it's important to have a material that has high impact ratings. It also out-scores the other materials with elasticity. This is important as it means the materials won't fail over a prolonged period of wear. Its tear resistance is also one of the highest scoring, getting a 7, the same as Material D. The high strength rating also works in the material's favour allowing it to be bent and stretched around the head again and again without failure. It's for these reasons that Material C would be the best choice.</p> <p>Accept other relevant answers.</p>	

Question 5 (continued)

- (b) Outline **two** factors, other than material properties, that can influence the selection of materials for products. (4 marks)

Description	Marks
For each factor (2 x 2 marks)	
Outlines a factor, other than material properties, that can influence the selection of materials for products	2
Makes a general statement about a factor, other than material properties, that can influence the selection of materials for products	1
Total	4
<p>Answers could include:</p> <ul style="list-style-type: none"> • cost of materials influences selection as it impacts the price of the product for both manufacturers and consumers and suitability for price ranges of target markets • the manufacturability of the material influences selection as the type of material used for a product must fit machinery and processes available • the environmental impact of a material influences selection as manufacturers must meet legal requirements to minimise negative impacts • availability of materials influences selection as producers need to meet timelines and consider cost of transport from distant suppliers • safety of a material is important for the welfare of manufacturers, in meeting OSH standards, and for the safety of consumers it must meet legal requirements, and to maintain sales and profitability for the producer • target market demands in aesthetics, function, price, safety, timeframes and ethical considerations influence what producers select for products. <p>Accept other relevant answers.</p>	

Question 6

(13 marks)

- (a) Outline **three** impacts on the environment that designers aim to minimise when designing a product. (6 marks)

Description	Marks
For each environmental impact (3 x 2 marks)	
Outlines an impact on the environment that designers aim to minimise when designing a product	2
Makes a general statement about an impact on the environment that designers aim to minimise when designing a product	1
Total	6
Answers could include: <ul style="list-style-type: none"> • amount of waste going to landfill • overuse of resources causing depletion of finite resources • use of energy that causes air pollution and greenhouse gases • the amount of transport needed to minimise air pollution • type and quantity of packaging required for the product • production of toxic waste that may contaminate soil and water sources. Accept other relevant answers.	

- (b) Identify **three** ways manufacturers can reduce waste during production. (3 marks)

Description	Marks
For each way (3 x 1 mark)	
Identifies a way manufacturers can reduce waste during production	1
Total	3
Answers could include: <ul style="list-style-type: none"> • source sustainable, recyclable materials • calculate and buy accurately • test processes in the planning stage • make prototypes • manufacture to safety and legal requirements • manufacture waste into something else (bi-products) • re-use left over scraps • upcycle/redesign unsold products • make high-quality products that need replacing less frequently/long-life products. Accept other relevant answers.	

Question 6 (continued)

- (c) Explain how designers can plan to minimise waste at the end of a product’s life cycle. (4 marks)

Description	Marks
Explains how designers can plan to minimise waste at the end of a product’s life cycle	4
Describes how designers can plan to minimise waste at the end of a product’s life cycle	3
Outlines how designers can plan to minimise waste at the end of a product’s life cycle	2
Makes a general statement about minimising waste	1
Total	4
<p>Answers could include:</p> <ul style="list-style-type: none"> • research consumer needs: to avoid creating products that are undesirable, unsafe or redundant. Products that are poorly targeted or designed may end up in landfill • use eco-friendly materials: designers can choose materials that are renewable, biodegradable, or recyclable. They can also consider materials that have a lower environmental impact in their production and disposal • design for durability: designers can create products that are built to last, with sturdy materials and components that are designed to withstand wear and tear. This can reduce frequent replacements and extend the life of the product. • design for recyclability: designers can create products that are easy to disassemble and separate into their constituent materials for recycling. This may involve using fewer different materials in the product design or designing for modularity so that parts can be easily replaced or upgraded • encourage repair and re-use: designers can encourage repair and re-use of products by designing them with replaceable parts, clear instructions for repairs, and promoting repair services • consider end-of-life options: designers can consider the end-of-life options for their products and design them to be easily disassembled for recycling or to be repurposed into other products. They can also explore alternative disposal methods, such as composting or incineration, that have less impact on the environment. 	
Accept other relevant answers.	

Question 7

(6 marks)

Discuss an ethical issue faced by designers choosing to manufacture products offshore, rather than locally.

Description	Marks
Discusses in detail an ethical issue faced by designers choosing to manufacture products offshore rather than locally	6
Discusses an ethical issue faced by designers choosing to manufacture products offshore rather than locally	5
Explains an ethical issue faced by designers choosing to manufacture products offshore rather than locally	4
Describes an ethical issue faced by designers choosing to manufacture products offshore rather than locally	3
Outlines an ethical issue faced by designers choosing to manufacture products offshore rather than locally	2
Makes a general statement about an ethical issue faced by designers choosing to manufacture products offshore rather than locally	1
Total	6
<p>Answers could include:</p> <p>Safety, health and wellbeing of the population:</p> <ul style="list-style-type: none"> workers in Australia are protected by workplace safety legislation to ensure safe work environments, reduce accidents, and support the good health of workers strict product standards in Australia mean high safety and quality of materials strict standards in Australia mean high safety of production processes compensation and insurances protect the lifestyle of injured workers. <p>Fair work:</p> <ul style="list-style-type: none"> legislated employment conditions, minimum age, pay and leave entitlements protect workers discrimination laws protect workers against age, gender and racial bias. <p>Protection of the environment to maintain lifestyle and health:</p> <ul style="list-style-type: none"> in Australia the environmental impact of manufacturing is considered: materials and processes are regulated to reduce pollution high-quality products need less frequent replacement which is better for consumers and minimises environmental impact less transport kilometres on products causes less air pollution and better human health local production helps consumers who want to reduce impact on the environment to protect living conditions and health. <p>Economic stability and growth:</p> <ul style="list-style-type: none"> local production supports Australian employment levels local production keeps money in Australia for a healthy economy local production maintains and improves education and training standards leading to improved standard of living. 	
Accept other relevant answers.	

Section Three: Wood context

60% (80 Marks)

Question 8

(19 marks)

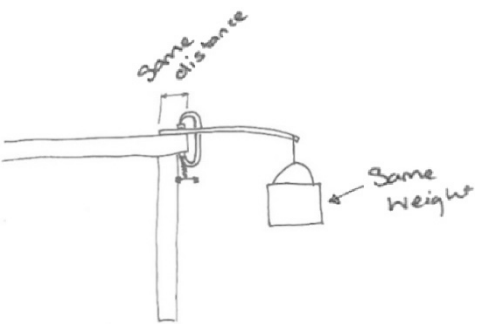
- (a) Name a suitable timber and its classification for the laminated armrests. (2 marks)

Description	Marks
Names a suitable timber	1
Names the classification of the chosen timber	1
Total	2
Answers could include: <ul style="list-style-type: none"> • Suitable timber: pine (other softwoods may apply) • Classification: softwood • Suitable timber: plywood • Classification: man-made boards 	
Accept other relevant answers.	

- (b) Outline **three** properties you consider to be important when selecting timber for the armrests. (6 marks)

Description	Marks
For each property (3 x 2 marks)	
Outlines a property considered to be important when selecting timber for the armrests	2
Makes a general statement about selecting timber for the armrests	1
Total	6
Answers could include: <ul style="list-style-type: none"> • strength: timber that has high strength-to-weight ratio, which means that it is strong and lightweight at the same time • durability: timber that can be naturally resistant to decay, insects, and fire, depending on the species of tree and the growing conditions • dimensional stability: timber that has the ability to expand and contract depending on the moisture content in the environment • workability: timber that is relatively easy to work with using simple tools, such as saws and drills • elasticity: timber that can be bent/manipulated into shape. 	
Accept other relevant answers.	

- (c) Describe the process for testing **one** property of timber that you could carry out in a school workshop. Use a sketch to support your answer. (5 marks)

Description	Marks
Description	
Describes the process for testing a property of timber that you could carry out in a school workshop	3
Outlines the process for testing a property of timber that you could carry out in a school workshop	2
Makes a general statement about a process for testing timber	1
Subtotal	3
Sketch	
Uses a sketch to support answer	2
Uses a partial sketch to support answer	1
Subtotal	2
Total	5
<p>Answers could include:</p> <p>Property: stiffness/elasticity</p> <ol style="list-style-type: none"> 1. Select several different samples of timbers to test. 2. Machine timbers to the same dimensions. 3. Clamp one end of the timber strip to the bench. 4. Suspend weight from the other end. 5. Measure the sag. 6. Repeat this for each material sample. 7. Record data in a table to compare the results. 	
Accept other relevant answers.	

- (d) Outline **three** factors that are necessary to ensure accurate results when carrying out tests on timber. (6 marks)

Description	Marks
For each factor (3 x 2 marks)	
Outlines a factor that is necessary to ensure accurate results when carrying out tests	2
Makes a general statement about carrying out tests	1
Total	6
<p>Answers could include:</p> <ul style="list-style-type: none"> • use dependable, correct assessment tools in good condition • keep a control sample • take multiple measurements • use a standard system of measurement • record data accurately • control variables as much as possible • repeat the test to ensure reliability • analyse results systematically. 	
Accept other relevant answers.	

Question 9

(9 marks)

- (a) Identify **two** common methods used for the conversion of timber. (2 marks)

Description	Marks
For each method (2 x 1 mark)	
Identifies a common method used for the conversion of timber	1
Total	2
Answers could include: <ul style="list-style-type: none"> • live sawing (through and through) • quarter sawn (radial sawing) • back sawing (tangential, plain) Accept other relevant answers.	

- (b) With reference to **one** of the methods identified in part (a), outline **two** characteristics of timber converted this way. (4 marks)

Description	Marks
For each characteristic (2 x 2 marks)	
Outlines a characteristic of timber converted this way	2
Makes a general statement about a characteristic of timber converted this way	1
Total	4
Answers could include: <p>Live sawing (through and through)</p> <ul style="list-style-type: none"> • stability: the varying width of the boards means that any movement or distortion is less likely to affect the overall structure of the timber • strength: through and through sawn timber is often stronger than other sawing methods because the growth rings are perpendicular to the face of the board • grain patterns: typically a distinct and varied grain pattern that is influenced by the angle at which the log is cut, giving the timber a unique and natural appearance. <p>Quarter sawn (radial sawing)</p> <ul style="list-style-type: none"> • straight and uniform grain: quarter sawn timber is characterised by a straight and uniform grain pattern, which gives it a distinct appearance • increased stability: because of its straight and uniform grain, quarter sawn timber is more stable than other types of sawn timber. This means that it is less likely to warp or twist over time • greater durability: quarter sawn timber is more durable than other types of sawn timber because the growth rings are more perpendicular to the surface of the board, making it less likely to split or crack • attractive figure: quarter sawn timber often has a distinctive figure or pattern, which can add visual interest and appeal to furniture, flooring, and other applications • resistance to moisture: because of its straight and uniform grain, quarter sawn timber is less prone to moisture uptake and can resist rot and decay better than other types of sawn timber. <p>Back sawing (tangential, plain)</p> <ul style="list-style-type: none"> • knots: this method produces timber with more knots compared to other methods • grain patterns: the grain patterns are generally more visible and pronounced compared to other methods • appearance: the appearance of the timber is usually straighter and more uniform • stability: timber sawn with the tangential method tends to have more movement and shrinkage compared to other methods. Accept other relevant answers.	

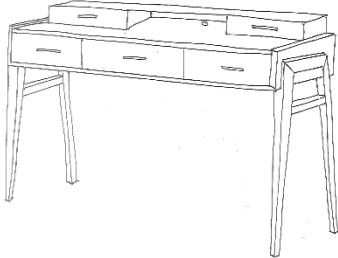
(c) On the image below, draw an end view of a log sawn using a common method for the conversion of timber. Name the method below. (3 marks)

Description	Marks
Draws precisely an end view of a log sawn with the named method	3
Draws an end view of a log sawn with the named method	2
Limited information	1
Total	3
Answers could include:	
<p>For copyright reasons this image cannot be reproduced in the online version of this document but may be viewed at the following link https://www.cochranslumber.com/milling-through-the-different-cuts-of-flooring/sawing-diagram/</p>	
Accept other relevant answers.	

Question 10

(14 marks)

Draw a final design solution on the page opposite, with **five** annotations, based on the client's feedback and using the design brief below. The design will be presented to the client, and it should reflect the rapid concept sketches shown below.

Description	Marks
Sketch	
Drawing shows a high level of detail of all features specified by client	4
Drawing shows features specified by client	3
Drawing shows some features specified by client	2
Limited drawing with few features specified by client	1
Subtotal	4
For each annotation (5 x 2 marks)	
Annotation is fully justified using appropriate terminology	2
Limited annotation	1
Subtotal	10
Total	14
Answers could include:	
<p>Annotations should address the client's wants:</p> <ul style="list-style-type: none"> • tapered legs • three drawers • drawer handles • drawers on top for charging • a rail on the legs • dark timber. 	
Accept other relevant answers.	

Question 11

(12 marks)

- (a) State **two** reasons why finishes are applied to timber products. (2 marks)

Description	Marks
For each reason (2 x 1 mark)	
States a reason why finishes are applied to timber products	1
Total	2
Answers could include: <ul style="list-style-type: none"> • to enhance appearance • to protect from the environment • prevent timber movement • reduce stains. Accept other relevant answers.	

- (b) Recommend **two** finishes for the table on the boat pictured below and justify each of your selections. (4 marks)

Description	Marks
For each finish (2 x 2 marks)	
Recommends a finish for the table on the boat and justifies its selection	2
Recommends a finish	1
Total	4
Answers could include: <ul style="list-style-type: none"> • marine varnish: provides excellent protection against moisture, UV rays, saltwater, and other environmental factors that can damage wood surfaces on boats and other marine equipment • epoxy: a two-part system that can be used to protect and strengthen the wood on a boat. It can be used as a sealer or as a coating and provides excellent protection against moisture and UV rays. It is available in different gloss levels and can be tinted to different colours • furniture oil: a popular finish for wood on boats because it enhances the natural beauty of the wood and provides some protection against moisture and UV rays. It penetrates the wood fibres and dries to a matte finish. Accept other relevant answers.	

- (c) Outline **three** ways that applying finishes will affect the usability of the table in part (b).
(6 marks)

Description	Marks
For each way (3 x 2 marks)	
Outlines a way that applying finishes will affect the usability of the product	2
Makes a general statement about a way that applying finishes will affect the usability of the product	1
Total	6
<p>Answers could include:</p> <ul style="list-style-type: none"> • improved durability: applying a finish can help protect a product from wear and tear, moisture, and other environmental factors that can cause it to deteriorate over time • enhanced aesthetics: applying a finish can improve the appearance of a product by adding colour, shine, texture, or other decorative elements • reduced friction: some finishes, such as wax or oil, can reduce friction between moving parts and make a product easier to use • increased slipperiness: some finishes, such as varnish or polyurethane, can make a product more slippery • chemical toxicity: some finishes can release toxic chemicals or fumes that can pose health risks to users. 	
Accept other relevant answers.	

Question 12

(16 marks)

- (a) Outline **three** ways to reduce the production time when making the chopping boards. (6 marks)

Description	Marks
For each way (3 x 2 marks)	
Outlines a way to reduce production time when making chopping boards	2
Lists a way to reduce production time when making chopping boards	1
Total	6
Answers could include: <ul style="list-style-type: none"> • make the project in mass so that large numbers of the same component are made at the same time and while materials and equipment are ready • use of jigs and templates to cut and make multiple numbers exactly the same, reducing repetitive measuring, errors in size and shape and variations in boards • use of computer numerical control (CNC) to cut out handle recess reduces time and handling of boards • ensure accurate gluing of boards to reduce sanding • assemble all materials prior to starting work to avoid time lost in having to stop and start production to fetch things • check all equipment is clean and serviceable to avoid breakdowns and needing to stop work to clean equipment that isn't working efficiently. 	
Accept other relevant answers.	

- (b) Identify a technique that could be used with a router to shape the handle recess. (1 mark)

Description	Marks
Identifies the technique of using a jig/template	1
Total	1
Accept other relevant answers.	

- (c) Explain how to carry out the technique identified in part (b). (4 marks)

Description	Marks
Explains how to carry out the technique identified in part (b)	4
Describes how to carry out the technique identified in part (b)	3
Outlines how to carry out the technique identified in part (b)	2
Lists some steps in the technique identified in part (b)	1
Total	4
Answers could include: <ol style="list-style-type: none"> 1. Create or obtain a template for the shape or pattern you want to cut with the router. The template can be made of plywood, MDF, or other materials that can be easily cut and shaped. 2. Cut the template out using a jigsaw or other cutting tool. Make sure the template is smooth and accurate, as any imperfections will be transferred to the final cut. 3. Attach the template to the workpiece using double-sided tape or clamps. Make sure the template is securely fastened and will not move during the routing process. 4. Install a pattern cutter router bit for the desired cut. Make sure the bit is securely fastened and adjusted to the correct depth. Or use a collar on the router. 5. Turn on the router and use the template as a guide to route the workpiece. Keep the router base plate flush against the template at all times and move the router in a clockwise direction to prevent the bit from pulling away from the workpiece. 6. Once the routing is complete, remove the template from the workpiece. 	
Accept other relevant answers.	

- (d) The handle on the chopping board is connected to the timber using threaded rod; two holes are drilled into the timber and then the threaded rod is glued in. Identify a suitable adhesive for this process and state **two** of its relevant characteristics. (3 marks)

Description	Marks
Identifies epoxy	
Subtotal	1
For each characteristic (2 x 1 mark)	
States a relevant characteristic	1
Subtotal	2
Total	3
Answers could include: <ul style="list-style-type: none"> • excellent bonding strength and can bond a wide range of materials • highly resistant to water, chemicals, heat, impact and vibration • can be used for a wide range of applications • relatively long curing time, which allows for adjustment • clear or translucent appearance, making it ideal when aesthetics are important • generally safe to use, when used in a well-ventilated area with appropriate protective gear. 	
Accept other relevant answers.	

- (e) Outline an appropriate decoration for the chopping board that could be used to elevate its aesthetic appeal. (2 marks)

Description	Marks
Outlines an appropriate decoration for the chopping board	2
Makes a general statement about an appropriate decoration for the chopping board	1
Total	2
Answers could include: <ul style="list-style-type: none"> • laser cut names into each gift • route a curve near the edge to catch liquids • inlay veneers in a relevant theme • route a decorative edge. 	
Accept other relevant answers.	

Question 13

(10 marks)

Discuss **two** environmental impacts of 'fast furniture'.

Description	Marks
For each environmental impact (2 x 5 marks)	
Discusses an environmental impact of 'fast furniture'	5
Explains an environmental impact of 'fast furniture'	4
Describes an environmental impact of 'fast furniture'	3
Outlines an environmental impact of 'fast furniture'	2
Makes a general statement about the environmental impacts of 'fast furniture'	1
Total	10
<p>Answers could include:</p> <ul style="list-style-type: none"> • deforestation: relies heavily on wood and wood-based materials such as particleboard, MDF, and plywood. This puts a strain on forests as they are being cleared for wood sourcing, leading to deforestation, habitat loss, and soil degradation • greenhouse gas emissions: the production of fast furniture requires significant amounts of energy, particularly in the form of fossil fuels • landfills: fast furniture is typically made from synthetic materials that are not biodegradable, such as plastics, foam, and metal. When these items are discarded, they often end up in landfills • chemical pollution: the production of fast furniture often involves the use of toxic chemicals such as formaldehyde, flame retardants, and volatile organic compounds (VOCs). These chemicals can leach into the environment and contaminate soil and water, posing a threat to human health and wildlife • resource depletion: the production of fast furniture relies on the extraction of natural resources such as wood, metal, and petroleum-based products. As these resources become depleted, the cost of production may increase, and future generations may face scarcity and reduced access to these resources • water pollution: the production of fast furniture often involves the use of chemicals that can contaminate water sources, such as rivers and lakes • energy consumption: the production, transportation, and disposal of fast furniture require significant amounts of energy, contributing to the depletion of fossil fuels and exacerbating climate change • air pollution: the manufacturing process of fast furniture releases airborne pollutants such as particulate matter and volatile organic compounds, which can harm human health and contribute to smog and air pollution • biodiversity loss: the destruction of natural habitats and deforestation due to fast furniture production can result in the loss of biodiversity and the extinction of plant and animal species • social inequality: the fast furniture industry often relies on exploitative labour practices, such as low wages and unsafe working conditions, leading to social inequality and human rights violations. 	
Accept other relevant answers.	

Section Three: Metal context

60% (80 Marks)

Question 14

(19 marks)

- (a) Name a suitable metal that could be used to make the metal frame of the chair and state a characteristic of that metal. (2 marks)

Description	Marks
Names a suitable metal	1
States a characteristic of that metal	1
Total	2
Answers could include: <ul style="list-style-type: none"> aluminium: lightweight, durable, highly resistant to corrosion and rust low carbon steel (mild steel): strong, durable, resistant to corrosion and rust, easy to work with. 	
Accept other relevant answers.	

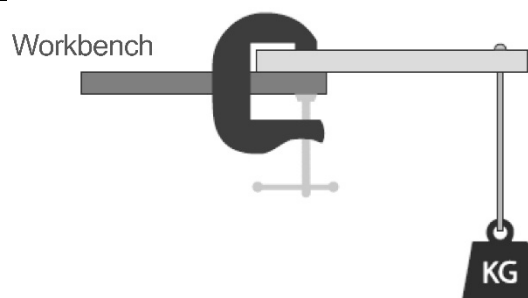
- (b) The performance of the frame is very important as the chair suspends the user above the ground. Outline **three** properties you consider to be important when selecting metal for the frame. (6 marks)

Description	Marks
For each property (3 x 2 marks)	
Outlines a property considered important for the metal frame	2
Makes a general statement about a property considered important for the metal frame	1
Total	6
Answers could include: <ul style="list-style-type: none"> static bend strength: relates to a material's ability to withstand deforming/failure under prolonged stress. As the frame will support a user's weight, it is important that it doesn't fail and possibly injure the user <div style="border: 1px dashed gray; padding: 5px; text-align: center; margin: 10px 0;"> For copyright reasons this text cannot be reproduced in the online version of the document </div> <ul style="list-style-type: none"> tensile strength: refers to the maximum amount of stress a material can withstand while being stretched or pulled without breaking. This means that the material will be able to take the weight being applied when a user sits on the chair without bending hardness: the property of a material that allows it to resist permanent distortion, penetration, indentation, and scratching. Therefore, hardness is important from an engineering point of view because resistance to wear by either friction or erosion from steam, oil, and water generally increases with hardness. 	
Accept other relevant answers.	

Question 14 (continued)

- (c) Describe the process for testing **one** property of metal that you could carry out in a school workshop. Use a sketch to support your answer. (5 marks)

Description	Marks
Description	
Describes the process for testing a property of metal that you could carry out in a school workshop	3
Outlines the process for testing a property of metal that you could carry out in a school workshop	2
Makes a general statement about a process for testing metal	1
Subtotal	3
Sketch	
Uses a sketch to support answer	2
Uses a partial sketch to support answer	1
Subtotal	2
Total	5
<p>Answers could include:</p> <p>Property: Static bend</p> <p>Set up:</p> <ul style="list-style-type: none"> • cut material samples all the same size • mark the centre of each piece • set up your jig/testing technique. <p>How the test is carried out:</p> <ol style="list-style-type: none"> 8. Select several different samples of timbers to test. 9. Machine metals to the same dimensions. 10. Clamp one end of the metal strip to the bench. 11. Suspend weight from the other end. 12. Measure the sag. 13. Repeat this for each material sample. 14. Record data in a table to compare the results. <p>Accept other relevant answers.</p>	



- (d) Outline **three** factors that are necessary to ensure accurate results when carrying out tests on metal. (6 marks)

Description	Marks
For each factor (3 x 2 marks)	
Outlines a factor that is necessary to ensure accurate results when carrying out tests	2
Makes a general statement about carrying out tests	1
Total	6
<p>Answers could include:</p> <ul style="list-style-type: none"> • use dependable, correct assessment tools in good condition • keep a control sample • take multiple measurements • use a standard system of measurement • record data accurately • control variables as much as possible • repeat the test to ensure reliability • analyse results systematically. <p>Accept other relevant answers.</p>	

Question 15

(9 marks)

- (a) Outline the difference between a pure metal and an alloy. (2 marks)

Description	Marks
Outlines the difference between a pure metal and an alloy	2
Makes a general statement about the difference between a pure metal and an alloy	1
Total	2
Answers could include: <ul style="list-style-type: none"> a pure metal is composed of only one type of atom. Pure metals have uniform physical and chemical properties throughout the material an alloy is a mixture of two or more metals or a metal and a non-metal. Alloys are created by combining different metals to achieve desirable properties, such as increased strength, durability, or resistance to corrosion. Accept other relevant answers.	

- (b) Explain the difference between low, medium and high carbon steels. (4 marks)

Description	Marks
Explains the difference between low, medium and high carbon steels	4
Describes the difference between low, medium and high carbon steels	3
Outlines the difference between low, medium and high carbon steels	2
Makes a general statement about different types of steel	1
Total	4
Answers could include: <ul style="list-style-type: none"> low carbon steel typically contains less than 0.3% carbon, making it relatively soft and ductile. This type of steel is commonly used in applications that require good formability and weldability, such as car body panels, wire products, and structural components medium carbon steel typically contains between 0.3% to 0.6% carbon, making it stronger and harder than low carbon steel. This type of steel is commonly used in applications that require higher strength and wear resistance, such as gears, shafts, and axles high carbon steel typically contains between 0.6% to 1.4% carbon, making it very hard and brittle. This type of steel is commonly used in applications that require high strength and hardness, such as cutting tools, knives, and springs. Accept other relevant answers.	

Question 15 (continued)

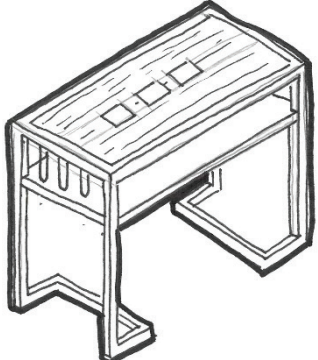
(c) Identify a metal innovation and outline **two** characteristics of this material. (3 marks)

Description	Marks
Identification	
Identifies a metal material innovation	1
Subtotal	1
For each characteristic (2 x 1 mark)	
Identifies a characteristic of identified metal innovation	1
Subtotal	2
Total	3
<p>Answers could include:</p> <p>Light weight metals, e.g. titanium</p> <ul style="list-style-type: none"> • high strength-to-weight ratio: titanium has a high strength-to-weight ratio, which makes it ideal for applications where low weight and high strength are important • excellent corrosion resistance: titanium is highly resistant to corrosion, making it ideal for use in harsh environments • excellent biocompatibility: titanium is biocompatible, meaning it does not react with human tissues, making it suitable for medical implants • excellent formability: titanium is easily shaped and formed, making it ideal for complex designs and shapes • high melting point: titanium has a high melting point, making it suitable for high-temperature applications • lightweight and durable: titanium is lightweight and durable, making it ideal for use in applications where weight and durability are important. <p>Specialty alloys, e.g. inconel</p> <ul style="list-style-type: none"> • high-temperature resistance: inconel retains its strength at high temperatures, making it suitable for use in high-temperature applications, such as gas turbine engines • corrosion resistance: inconel is highly resistant to corrosion, making it ideal for use in harsh environments, such as chemical processing and marine applications • high strength: inconel has high strength at elevated temperatures, making it ideal for use in high-stress applications • good formability: inconel can be easily shaped and formed, making it suitable for complex designs and shapes • excellent weldability: inconel can be easily welded, making it suitable for use in applications that require joining • low coefficient of thermal expansion: inconel has a low coefficient of thermal expansion, which means it does not expand or contract significantly with temperature changes, making it ideal for use in high-temperature applications. <p>Composites, e.g. aluminium oxynitride (ALON)</p> <ul style="list-style-type: none"> • transparency: ALON is highly transparent in the visible and infrared spectrum, making it suitable for use in optical applications • hardness: ALON is a very hard material and has a high level of scratch resistance, making it ideal for use in protective windows, such as bulletproof glass • high strength: ALON has a high level of strength and toughness, making it resistant to impact, pressure, and thermal shock • thermal stability: ALON has a high thermal conductivity and is stable at high temperatures, making it ideal for use in high-temperature applications • corrosion resistance: ALON is resistant to corrosion and chemical attack, making it suitable for use in harsh environments • lightweight: ALON is a lightweight material, making it suitable for use in applications where weight is a concern, such as aerospace and defence industries. <p>Accept other relevant answers.</p>	

Question 16

(14 marks)

Draw a final design solution on the page opposite, with **five** annotations, based on the client's feedback and using the design brief below. The design will be presented to the client, and it should reflect the rapid concept sketches shown below.

Description	Marks
Sketch	
Drawing shows a high level of detail of all features specified by client	4
Drawing shows features specified by client	3
Drawing shows some features specified by client	2
Limited drawing with few features specified by client	1
Subtotal	4
For each annotation (5 x 2 marks)	
Annotation is fully justified using appropriate terminology	2
Limited annotation	1
Subtotal	10
Total	14
<p>Answers could include:</p> <p>Annotations should address the client's wants:</p> <ul style="list-style-type: none"> • thin frame • recessed tabletop • inlay design on the top • shelf underneath the top • additional vertical supports. 	
	
Accept other relevant answers.	

Question 17

(12 marks)

- (a) State **two** reasons why finishes are applied to metal products. (2 marks)

Description	Marks
For each reason (2 x 1 mark)	
States a reason why finishes are applied to metal products	1
Total	2
Answers could include: <ul style="list-style-type: none"> • to enhance appearance • to protect from the environment. Accept other relevant answers.	

- (b) Recommend **two** finishes for a newly manufactured steel toolbox and justify each of your selections. (4 marks)

Description	Marks
For each finish (2 x 2 marks)	
Recommends a finish for the toolbox and justifies its selection	2
Recommends a finish	1
Total	4
Answers could include: <ul style="list-style-type: none"> • painting: a common finishing method used for metal surfaces, especially for decorative or protective purposes. It provides a durable, smooth finish that can be customised with a wide variety of colours and finishes. Painting can also protect metal surfaces from corrosion and weathering • galvanising: a process of coating metal with a layer of zinc to protect it from rust and corrosion. Galvanising is often used for outdoor applications where the metal is exposed to moisture and other harsh environmental conditions. It also provides a strong, durable finish that can withstand heavy use • lacquering: a process of applying a clear coating over a metal surface to protect it from oxidation, tarnishing, and other forms of corrosion. It can also be used for decorative purposes, as it can enhance the appearance of the metal and create a glossy, polished finish • enamelling: a process of applying a glass-like coating to a metal surface to provide a durable and attractive finish. Enamel coatings are resistant to abrasion, corrosion, and chemicals, and they can be customised with a wide range of colours and designs • tin plating: a process of coating a metal surface with a layer of tin to protect it from corrosion and enhance its appearance. Tin plating is often used for decorative purposes and can provide a bright, shiny finish that is resistant to tarnishing and oxidation • electroplating: electroplating is a process of coating a metal surface with a thin layer of another metal, such as gold, silver, or nickel. Electroplating can be used for decorative purposes, to improve the electrical conductivity of a metal, or to protect it from corrosion and wear • powder coatings: involve applying a dry powder to a metal surface and then baking it to create a durable, hard-wearing finish. Powder coatings can be customised with a wide range of colours and finishes, and they are resistant to scratches, chips, and fading. They are often used in industrial applications where durability is essential. Accept other relevant answers.	

- (c) Outline **three** ways that applying finishes will affect the usability of the toolbox in part (b).
(6 marks)

Description	Marks
For each way (3 x 2 marks)	
Outlines a way that applying finishes will affect the usability of the product	2
Makes a general statement about a way that applying finishes will affect the usability of the product	1
Total	6
<p>Answers could include:</p> <ul style="list-style-type: none"> • protection: one of the primary reasons for applying finishes is to protect the product from damage caused by exposure to environmental elements, such as water, dust, sunlight, or chemicals. The protection provided by the finish can extend the lifespan of the product, making it more usable for a more extended period • aesthetics: applying finishes can enhance the visual appeal of a product, making it more aesthetically pleasing and attractive to users. By improving the product's aesthetics, finishes can increase its value and usability • functionality: finishes can also impact the usability of a product by altering its functional properties • durability: applying a finish can make a product more durable by adding an additional layer of protection. This can help prevent wear and tear, scratches, and other damage, thereby extending the product's lifespan and increasing its usability • cleanliness: applying finishes that are easy to clean and maintain can improve the product's usability by reducing the time and effort required for cleaning • health and safety: some finishes can impact the health and safety of users, either positively or negatively. For instance, applying finishes that contain harmful chemicals or volatile organic compounds (VOCs) can pose health risks to users and the environment, reducing the product's usability • cost: applying finishes can add to the cost of production, making the product more expensive. This can impact the product's usability by making it less accessible to certain groups of consumers who may not be able to afford it. 	
Accept other relevant answers.	

Question 18

(16 marks)

(a) Outline **three** ways to reduce the production time when making the candle holders.

(6 marks)

Description	Marks
For each way (3 x 2 marks)	
Outlines a way to reduce production time when making candle holders	2
Lists a way to reduce production time when making the candle holders	1
Total	6
Answers could include: <ul style="list-style-type: none"> • produce a detailed and accurate production plan • cut all materials to size at the same time • use jigs to ensure bends and twists are consistent • set up work area for most efficient work process • create a detailed and accurate working drawing • use a production line to make individual parts in batches. 	
Accept other relevant answers.	

(b) Identify a technique that could be used to shape the scrolls on the candle holder.

(1 mark)

Description	Marks
Identifies a technique that could be used to shape the scrolls	1
Total	1
Answers could include: <ul style="list-style-type: none"> • scroll-bending jig • produce a jig. 	
Accept other relevant answers.	

(c) Explain how to carry out the technique identified in part (b).

(4 marks)

Description	Marks
Explains how to carry out the technique identified in part (b)	4
Describes how to carry out the technique identified in part (b)	3
Outlines how to carry out the technique identified in part (b)	2
Lists some steps in the technique identified in part (b)	1
Total	4
<p>Answers could include:</p> <p>Scroll:</p> <ol style="list-style-type: none"> 1. Select the type of metal you want to use for the scroll. 2. Decide on the size and shape of the scroll you want to produce. Draw a template or pattern of the scroll on paper. 3. Cut a piece of metal to the desired length using a metal cutting tool, such as a hacksaw. The length of the metal should be slightly longer than the desired size of the scroll. 4. Using a pencil or marker, mark the metal where you want to bend it to create the scroll. Make sure the marks are spaced evenly along the length of the metal. 5. Using a bending tool, such as pliers or a bending machine, bend the metal along the marks to create the scroll. Work carefully to ensure that the bends are smooth and even. 6. Once the basic scroll shape is created, you can further shape it using a hammer or other shaping tools to create more complex curves or details. 7. Once the scroll is shaped, use sandpaper or a metal file to smooth out any rough edges or imperfections. Apply a finish to the scroll, such as paint, powder coating, or polishing, to protect it from rust and corrosion. <p>Accept other relevant answers.</p>	

Question 18 (continued)

- (d) Describe an appropriate non-permanent joining method to attach the candle discs to the scrolled arms. (3 marks)

Description	Marks
Describes an appropriate non-permanent joining method to attach the candle discs to the scrolled arms	3
Outlines an appropriate non-permanent joining method to attach the candle discs to the scrolled arms	2
Makes a general statement about an appropriate joining method to attach the candle discs to the scrolled arms	1
Total	3
<p>Answers could include:</p> <ul style="list-style-type: none"> • screws: screws are a common non-permanent joining technique used in a wide range of applications. They are easy to install and remove, and they provide a secure and reliable connection that can be adjusted as needed. Screws are also versatile and can be used with a variety of materials, e.g. wood, metal and plastic • nut and bolt: these connections are another common non-permanent joining technique. They provide a strong and reliable connection that can be easily assembled and disassembled using basic hand tools. Nut and bolt connections are also adjustable and can be tightened or loosened as needed, making them suitable for applications that require frequent adjustments or maintenance • pop rivet: a non-permanent joining technique that uses a special tool to insert a rivet into two or more materials. The rivet expands inside the materials, creating a secure and tight connection. Pop rivets are easy to install and remove and are commonly used in applications where access to the back of the joint is limited. They are also suitable for applications that require a flush or low-profile connection, as the rivet head sits flush with the surface of the material. <p>Accept other relevant answers.</p>	

- (e) Outline an appropriate decoration for the candle holder that could be used to elevate its aesthetic appeal. (2 marks)

Description	Marks
Outlines an appropriate decoration for the candle holder	2
Makes a general statement about an appropriate decoration for the candle holder	1
Total	2
<p>Answers could include:</p> <ul style="list-style-type: none"> • polishing: a common decoration technique for metal that involves using abrasives or buffing compounds to create a smooth, reflective surface on the metal • plating: involves applying a thin layer of one metal onto the surface of another metal. Plating can be used to create decorative finishes, such as gold or silver plating, or to improve the durability or corrosion resistance of a metal surface • etching: involves using chemicals or acid to remove a portion of the metal surface to create a design/pattern. Etching can be used to create intricate designs/text on metal surfaces and can be done by hand or with computer-controlled equipment • engraving: involves cutting or incising a design or text into the surface of the metal using a sharp tool. Engraving can be used to create detailed designs or text on metal surfaces, and can be done by hand or with computer-controlled equipment • anodising: an electrochemical process that involves creating a thin, oxide layer on the surface of the metal to create a coloured or decorative finish. Anodising can be used to create a range of colours and finishes and is commonly used on aluminium surfaces. <p>Accept other relevant answers.</p>	

Question 19

(10 marks)

Discuss **two** environmental impacts of 'fast furniture'.

Description	Marks
For each environmental impact (2 x 5 marks)	
Discusses an environmental impact of 'fast furniture'	5
Explains an environmental impact of 'fast furniture'	4
Describes an environmental impact of 'fast furniture'	3
Outlines an environmental impact of 'fast furniture'	2
Makes a general statement about the environmental impact of 'fast furniture'	1
Total	10
<p>Answers could include:</p> <ul style="list-style-type: none"> • waste generation: the rapid turnover of furniture in the market results in a significant amount of waste generation. As furniture becomes cheaper and more disposable, it is often discarded after a short period of use. This leads to increased landfill waste and consumption of resources, such as wood, metals, and plastics • depletion of natural resources: fast furniture relies heavily on the use of natural resources, such as timber, minerals, and oil-based materials. The increased demand for furniture and the short life cycle of these products results in the depletion of these resources. This, in turn, increases the environmental impact of manufacturing and transportation of furniture, contributing to the depletion of resources for future generations • increased carbon footprint: fast furniture has a significant impact on the carbon footprint of the furniture industry. The production, transportation, and disposal of furniture contribute to greenhouse gas emissions, which exacerbate climate change. The short life cycle of furniture further compounds this problem by increasing the frequency of production and transportation of new furniture • decreased quality and durability: fast furniture is often made with lower-quality materials and construction techniques. This results in furniture that is less durable and more prone to damage and wear. The lower quality of furniture means that it needs to be replaced more frequently, resulting in increased waste and resource depletion • chemical pollution: fast furniture is often treated with chemicals to make it flame-resistant, stain-resistant, or waterproof. These chemicals can leach into the environment, polluting water and soil, and posing a health hazard to humans and wildlife • loss of biodiversity: the demand for fast furniture puts pressure on the world's forests, leading to deforestation and habitat loss for wildlife. This loss of biodiversity can have a cascading effect on ecosystems and could lead to the extinction of species that rely on these habitats. 	
Accept other relevant answers.	

Section Three: Textiles context

60% (80 marks)

Question 20

(19 marks)

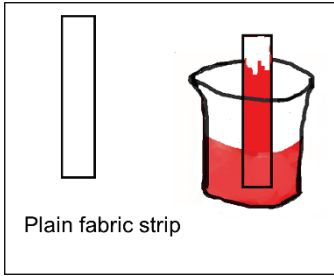
- (a) Name a suitable fibre and a suitable fabric structure for the cushion cover. (2 marks)

Description	Marks
Fibre: cotton, linen, polyester, nylon	1
Fabric structure: woven	1
Total	2
Accept other relevant answers.	

- (b) Outline **three** properties you consider to be important when selecting a fabric for the cushion cover. (6 marks)

Description	Marks
For each property (3 x 2 marks)	
Outlines a property considered to be important when selecting a fabric for the cushion	2
Makes a general statement about selecting a fabric for the cushion	1
Total	6
Answers could include: <ul style="list-style-type: none"> • durability/resilience: to ensure a long-life span in the outdoor conditions and reduce the need to replace frequently which is more sustainable and better for the environment • sun-resistance: to prevent fabric being weakened by the sun and from fading out colours that decrease aesthetic appeal • strength: to prevent tearing and rotting in the outdoor conditions • colour fastness: to resist bleeding from the rain or liquids, to maintain the appearance at a high standard for longer and reduce the need to replace frequently • abrasion resistance: to resist damage from regular wear and tear • shrink resistance: to prevent misshapen and badly fitting covers caused by being wet. 	
Accept other relevant answers.	

- (c) Describe the process for testing **one** property of fabric that you could carry out in a school workroom. Use a sketch to support your answer. (5 marks)

Description	Marks
Description	
Describes the process for testing one property of fabric that you could carry out in a school workroom	3
Outlines the process for testing one property of fabric that you could carry out in a school workroom	2
Makes a general statement about a process for testing fabric	1
Subtotal	3
Sketch	
Uses a sketch to support answer	2
Uses a partial sketch to support answer	1
Subtotal	2
Total	5
<p>Answers could include:</p> <p>Strength: Requirements – 1 piece of each fabric measuring 10 cm x 10 cm</p> <ol style="list-style-type: none"> 1. Remove one warp yarn from each fabric sample. 2. Pull the yarn until it breaks. Does it break easily or with difficulty? 3. Slightly tear the fabric sample when dry. Does it tear easily or with difficulty? 4. Wet the fabric sample. Slightly tear the sample. Was it easier to tear the sample when wet or dry? 5. Record results. <p>Water absorbency: Requirements – 1 piece of each fabric measuring 5 cm wide x 30 cm long</p> <ol style="list-style-type: none"> 1. Take a strip of each fabric type. 2. Place one end (about 3 cm) in a glass of coloured water. 3. Leave the samples in the water for 5 minutes. 4. Remove the samples. Measure how far along the strip the water has absorbed. 5. Record results. <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>Plain fabric strip</p> </div> </div> <p>Abrasion: Requirements – 1 piece of each fabric measuring 10 cm x 10 cm</p> <ol style="list-style-type: none"> 1. Rub each dry fabric sample with a piece of fine sandpaper, three times. 2. Repeat procedure in step 1. Note appearance of fabric and record results. 3. Repeat again and record results. 4. Wet samples and repeat steps 1 to 3. 5. Record results. 	
Accept other relevant answers.	

Question 20 (continued)

- (d) Outline **three** factors that are necessary to ensure accurate results when carrying out tests on textiles. (6 marks)

Description	Marks
For each factor (3 x 2 marks)	
Outlines a factor that is necessary to ensure accurate results when carrying out tests	2
Makes a general statement about carrying out tests	1
Total	6
<p>Answers could include:</p> <ul style="list-style-type: none"> • use dependable, correct assessment tools in good condition • keep a control sample • take multiple measurements • use a standard system of measurement • record data accurately • control variables as much as possible • repeat the test to ensure reliability • analyse results systematically. 	
Accept other relevant answers.	

Question 21

(9 marks)

(a) Name **two** regenerated fibres.

(2 marks)

Description	Marks
Any two of	
<ul style="list-style-type: none"> • rayon • viscose • acetate • lyocell 	1–2
Total	2
Accept other relevant answers.	

(b) Explain the difference between regenerated and synthetic fibres.

(4 marks)

Description	Marks
Explains the difference between regenerated and synthetic fibres	4
Describes the difference between regenerated and synthetic fibres	3
Outlines the difference between regenerated and synthetic fibres	2
Makes a general statement about regenerated and/or synthetic fibres	1
Total	4
Answers could include:	
<p>Regenerated fibres are partially man-made using naturally occurring organic materials, such as cellulose and wood pulp that are chemically treated and processed to become fibre structures. These fibres are used to make rayon, viscose and acetate fabrics.</p> <p>Synthetic fibres are completely man-made from petroleum products and chemicals and have no organic materials. These fibres are used to make polyester and nylon.</p>	
Accept other relevant answers.	

(c) In the box below draw and label a weft knit fabric structure.

(3 marks)

Description	Marks
Correctly draws a weft knit structure	1
Wale correctly labelled	1
Course correctly labelled	1
Total	3
Answers could include:	
<div style="border: 1px dashed gray; padding: 20px; width: fit-content; margin: 0 auto;"> <p>For copyright reasons this image cannot be reproduced in the online version of the document</p> </div>	

Question 22

(14 marks)

Draw a final design solution on the page opposite, with **five** annotations, based on the client's feedback and using the design brief below. The design will be presented to the client, and it should reflect the rapid concept sketches shown below.

Description	Marks
Sketch	
Drawing shows a high level of detail of all features specified by client	4
Drawing shows features specified by client	3
Drawing shows some features specified by client	2
Limited drawing with few features specified by client	1
Subtotal	4
For each annotation (5 x 2 marks)	
Annotation is fully justified using appropriate terminology	2
Limited annotation	1
Subtotal	10
Total	14
<p>Answers could include:</p> <p>Annotations should address the client's wants:</p> <ul style="list-style-type: none"> • the overall design of the corset should have a medieval aesthetic • must be comfortable to sit, eat and dance in for the event • must have a narrow ruffle or frill around the neckline • the corset must have eight panels: four front and four back • the corset must work with a full skirt that is gathered at the waist • the corset should curve down at the front to a V point. <div style="border: 1px dashed gray; padding: 10px; margin-top: 20px;"> <p>For copyright reasons this image cannot be reproduced in the online version of the document</p> </div>	
Accept other relevant answers.	

Question 23

(12 marks)

- (a) State **two** reasons why finishes are applied to textile products. (2 marks)

Description	Marks
For each reason (2 x 1 mark)	
States a reason why finishes are applied to textile products	1
Total	2
Answers could include: <ul style="list-style-type: none"> • to enhance appearance • to protect from the environment • to enhance dimensional stability. Accept other relevant answers.	

- (b) Recommend **two** finishes for the child's backpack pictured below and justify each of your selections. (4 marks)

Description	Marks
For each finish (2 x 2 marks)	
Recommends a finish for the child's backpack	2
Recommends a finish	1
Total	4
Answers could include: <ul style="list-style-type: none"> • fluoro chemistry: waterproofing/water-repelling so that contents are not damaged, if the bag gets wet • anti-microbial: to resist mould and bacteria growing on the bag causing health issues • stain repellent, scotch guard: to keep the bag clean and looking good, to reduce cleaning and prolong its life • mercerising: to enhance appearance with lustre that will appeal to the target market • sanforising: for shrink resistance to maintain the function and aesthetics of the bag, if it gets wet and prolong its life. Accept other relevant answers.	

Question 23 (continued)

- (c) Outline **three** ways that applying finishes will affect the usability of the backpack in part (b). (6 marks)

Description	Marks
For each way (3 x 2 marks)	
Outlines a way that applying finishes will affect the usability of the product	2
Makes a general statement about a way that applying finishes will affect the usability of the product	1
Total	6
<p>Answers could include:</p> <ul style="list-style-type: none"> • improves the usability by increasing strength • increases the longevity through colour fastness, shrink resistance and reduced microbial attacks which reduces the need to replace the product • protection from damage caused by exposure to environmental elements such as water, dust, sunlight or chemicals can extend the lifespan of the product, reducing the need to replace the product as frequently • improves the care by reducing the amount of washing needed • aesthetics: applying finishes can enhance the visual appeal of a product, making it more aesthetically pleasing and attractive to users. By improving the product's aesthetics, finishes can increase its value and usability. Looks good for longer which reduces the need to replace the product • durability: applying a finish can make a product more durable by adding an additional layer of protection. This can help prevent wear and tear, scratches, and other damage, thereby extending the product's lifespan and increasing its usability • health and safety: some finishes can impact the health and safety of users, either positively or negatively. For instance, applying finishes that contain harmful chemicals or volatile organic compounds (VOCs) can pose health risks to users and the environment, reducing the product's usability • cost: applying finishes can add to the cost of production, making the product more expensive. This can impact the product's usability by making it less accessible to certain groups of consumers who may not be able to afford it. 	
Accept other relevant answers.	

Question 24

(16 marks)

- (a) Outline
- three**
- ways to reduce the production time when making the aprons. (6 marks)

Description	Marks
For each way (3 x 2 marks)	
Outlines a way to reduce the production time when making the aprons	2
Lists a way to reduce production time when making the aprons	1
Total	6
Answers could include:	
<ul style="list-style-type: none"> • assemble all components at the start of the project • cut out pattern accurately to ensure all pieces are cut correctly, eliminating recutting • lay-up multiple layers of fabric and cut many aprons at the same time • use a production line method to batch sew all of the same parts on all aprons • do the finishing on all aprons together at the end of the sewing. 	
Accept other relevant answers.	

- (b) Identify a technique that could be used to shape the aprons into the waistline. (1 mark)

Description	Marks
Any one of	
<ul style="list-style-type: none"> • darts • gathering • tucks • pleats 	1
Total	1
Accept other relevant answers.	

Question 24 (continued)

(c) Explain how to carry out the technique identified in part (b). (4 marks)

Description	Marks
Explains how to carry out the technique identified in part (b)	4
Describes how to carry out the technique identified in part (b)	3
Outlines how to carry out the technique identified in part (b)	2
Lists some steps in the technique identified in part (b)	1
Total	4
<p>Answers could include:</p> <p>Darts</p> <ol style="list-style-type: none"> 1. Transfer the markings from the pattern. 2. Fold the dart in half lengthways matching the dots. 3. Pin the centre and both ends of the dart. 4. Using a regular straight stitch length start at the raw edge, backstitch, sew along the line to the point. 5. Sew right to the edge of the fabric. Backstitch at the point. 6. Press a horizontal dart towards the hem, or a vertical dart towards the centre of the garment. 7. If the fabric is very bulky cut away excess fabric in large darts. <p>Gathering</p> <ol style="list-style-type: none"> 1. On the right side of the fabric, stitch two parallel rows of straight stitch just inside the seam allowance leaving a long tail, 10 cm, at either end. Do not backstitch at ends. 2. Make first row of stitching 7–8 mm from the raw edge. 3. Make second row of stitching 16mm from the raw edge. 4. At one end hold both bobbin thread tails together and gently pull the thread and slide the fabric along the thread. 5. Go halfway along the fabric, then repeat from the other end to the desired width of the pattern piece. 6. Pin to the other pattern piece. 7. Stitch between the rows of gathering with a regular straight stitch length, securing at both ends with a backstitch. <p>Accept other relevant answers.</p>	

(d) State **three** reasons for using interfacing around the neckline of the apron. (3 marks)

Description	Marks
For each reason (3 x 1 mark)	
States a reason for using interfacing around the neckline of the apron	1
Total	3
<p>Answers could include:</p> <ul style="list-style-type: none"> • to stabilise the neckline • to stop the neckline stretching • to make it easier to neaten the neckline • to strengthen the neckline. <p>Accept other relevant answers.</p>	

- (e) Outline an appropriate decoration for the apron that could be used to elevate its aesthetic appeal. (2 marks)

Description	Marks
Outlines an appropriate decoration for the apron	2
Makes a general statement about an appropriate decoration for the apron	1
Total	2
<p>Answers could include:</p> <ul style="list-style-type: none"> • applique is a process of stitching layers of fabric onto a base fabric to create pictures and patterns, and is machine washable which is appropriate for an apron • frills are layers of gathered fabric added to give volume and create pretty features, and are machine washable which is appropriate for an apron • embroidery is adding a pattern made with threads to a fabric using machine or hand stitching and can be machine washable depending on the threads used, which is appropriate for an apron • trims (ribbon, lace, buttons etc.) can be added to embellish any area of an item and can be machine washable depending on the trims used, which is appropriate for an apron • gathers, pleats and tucks are methods of manipulating the base fabric to create features and are machine washable which is appropriate for an apron • prints are dyed or applied inks to create pictures and patterns and are usually machine washable which is appropriate for an apron. 	
Accept other relevant answers.	

Question 25

(10 marks)

Discuss **two** environmental impacts of 'fast fashion'.

Description	Marks
For each environmental impact (2 x 5 marks)	
Discusses an environmental impact of 'fast fashion'	5
Explains an environmental impact of 'fast fashion'	4
Describes an environmental impact of 'fast fashion'	3
Outlines an environmental impact of 'fast fashion'	2
Makes a general statement about the environmental impacts of 'fast fashion'	1
Total	10
<p>Answers could include:</p> <p>Global consumption of clothing every year is estimated to be 400% more than twenty years ago – around 80 billion new items – leading to the occurrence of 'fast fashion'. Our clothing has half the life span as previously and 60% of garments produced every year go to landfill or are incinerated.</p> <p>Impacts of 'fast fashion' are:</p> <ul style="list-style-type: none"> • depletion of non-renewable resources • emission of greenhouse gases: generating 10% of the world's carbon emissions the fashion industry is the second-largest industrial polluter. Textiles are incinerated at disposal • massive water use: the fashion industry is the second largest consumer of water: fibre production, yarn preparation, dyeing, finishing. Fibre production uses the most freshwater in growing cotton • massive energy use: mostly from fossil fuels. Fibre production, yarn preparation, dyeing and finishing are energy intensive • growing landfills: clothing/textiles use increasing space in landfills, synthetic fibres (polyester, nylon and acrylic) take hundreds of years to biodegrade • water pollution: dyeing and treating fabric causes 20% of global wastewater. 8,000 synthetic chemicals are used in processing and dyeing fabric. Millions of litres of contaminated water go to waterways causing many public health hazards. Production processes release particulate matter and acids like hydrogen chloride • soil contamination: pesticides used for growing cotton which makes up 50% of clothing • microfibres from clothing production and laundering are making their way into the oceans and the food chain • making plastic fibres into textiles is a fossil fuel energy intensive process • biodiversity loss: the destruction of natural habitats and deforestation for fibre production can result in the loss of biodiversity and the extinction of plant and animal species. <p>Accept other relevant answers.</p>	

ACKNOWLEDGEMENTS

- Question 9(c)** Left and middle image from: Cochrans Lumber. (n.d.). [Illustration of patterns of sawing different cuts of wood]. Retrieved September, 2023, from <https://www.cochranslumber.com/milling-through-the-different-cuts-of-flooring/sawing-diagram/>
Right image from: Lucas Mill. (n.d.). [Illustration of pattern of sawing log]. Retrieved September, 2023, from <https://forestryforum.com/board/index.php?topic=60602.80>
- Question 14(b)** Dot point 2 from: Baker Steel Trading. (n.d.). *Uses For Mild Steel: Physical Properties of Mild Steel*. Retrieved September, 2023, from <https://www.bakersteeltrading.co.uk/WHAT-CAN-MILD-STEEL-BE-USED-FOR/>
Dot point 4 from: Morrison, T. (2021). *The Importance of Hardness Testing: What is Hardness in Metals?* Retrieved September, 2023, from <https://www.heatreat.net/blogs/tom-morrison/2021/12/16/the-importance-of-hardness-testing>
- Question 21(c)** Adapted from: Wikipedia (n.d.). *Knit Schematic* [Illustration]. Retrieved September, 2023, from https://en.wikipedia.org/wiki/Knitted_fabric#/media/File:Knit-schematic.png
- Question 22** Adapted from: Butterick. (n.d.). *Butterick Pattern B4669 Laced Corsets with Peplum Variations* [Pattern]. Retrieved September, 2023, from https://simplicity.com/search.php?search_query=B4669

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