Government of **Western Australia**
School Curriculum and Standards Authority

MATERIALS DESIGN AND TECHNOLOGY

ATAR course examination 2016

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.

2016/64130

Section One: Short answer **15% (35 Marks)**

Question 1 **(15 marks)**

Define each of the following stages of the design process and give **two** examples of what would need to be provided in a portfolio at each of the stages.

Description	Marks
5 stages defined x 1 mark each	
Defining a stage	1–5
2 examples per stage x 5 stages	
Give an appropriate example	1–10
Total	**15**

Answers could include:

Design proposal/Statement of intent
During this stage a designer will work on finding out what restraints are in the form of looking at the client's wants and needs. Using this information, they will be able to create a statement of intent.

Examples are:
- considerations
- outline of the design brief
- client or product requirements (if not for a specific client)
- performance criteria related to the needs, values and beliefs of the end user
- location/environment.

Research
The designer will research a range of area, including materials, finishes, joining techniques, etc. and will then use this information to decide on what is best or best suited for their project.

Examples are:
- needs of the client
- materials investigation and/or testing
- research into a relevant theme
- investigation into components, notions, fixtures, fastenings and other items
- investigation into finishes
- environmental and ethical assessment
- relevant fundamentals of design to the product (functionality, safety needs, ergonomics, aesthetics)
- market research.

Development of ideas and concepts
The designer will start off by creating initial concepts/sketches and then with the help of their client will develop a chosen design or designs into a final solution

Examples are:
- thumbnails/rapid concept sketches
- developed colour sketches, by hand or digitally represented
- annotations
- evaluation and comparison of different ideas and concepts using the fundamentals of design
- client and/or market feedback on designs
- final justification of chosen design.

Production plan
In this stage the designer will plan for the production of the product, this work can include the production of working drawings, costing list, cutting lists and production plans.

Examples are:
- working drawings
- measurements
- materials lists
- costings
- production plan/flow chart
- risk management plan/safety procedures
- Gantt chart.

Final evaluation
Using the statement of intent the designer will evaluate the success of the final product against the restriction they set at the beginning of the design process. They can interview the client also to gain their feedback.

Examples are:
- evaluation of quality of the product's construction
- evaluation against the design proposal and design brief
- aesthetic evaluation
- functional evaluation
- ergonomic evaluation
- evaluation against the production proposal
- client feedback
- modifications identified.

Note: List is not exhaustive.

Question 2 **(8 marks)**

Finishes are used for a variety of reasons, one of which is protecting materials from the elements.

(a) Identify **one** finish that protects a material from the elements. Describe how this finish is applied and how it serves to protect the given material. (3 marks)

Description	Marks
Identifies a suitable finish	1
Describes how the finish is applied	1
Describes how the finish protects the material	1
Total	**3**

Answers could include:

Example 1:
Water-based polyurethane
Ensure the surfaces have been sanded up to 240 grit, Apply a very thin coat of polyurethane with a fine brush, foam pad or cloth. Allow 2 hours to dry and then re-apply. It may need several more coats.
This finish protects the timber by creating a thin film between the wood and the elements.

Example 2:
Spray paint
Ensure the surfaces are clean and free of rust and grease. Firstly, apply a coat of primer, this will grip that material and will also grip the next layer of paint. Spray a thin coat of paint onto the surface and slowly build up to an even coat.
This finish protects the timber by creating a thin film between the metal and the elements.

Example 3:
Scotchguard/waterproofing finish
Application: In domestic use a spray is applied, whereas in industry application of a coating of various waterproofing materials. Protection: Treatments either make the fabric resistant to water or completely waterproof. Generally sprays like Scotchguard can only render fabrics water resistant.

Note: List is not exhaustive.

(b) Describe an instance in which the finish identified in part (a) might **not** be effective. (2 marks)

Description	Marks
Describes an instance when the finish may not be suitable	2
States an instance when the finish may not be suitable	1
Total	**2**

Answers could include:

Water-based polyurethane
It lacks durability when compared to oil based polyurethane, is susceptible to heat and chemical damage. This would not be a good finish for a timber kitchen bench

Spray paint
It lacks durability when compared to finishes like powder coating and is susceptible chemical damage. This would not be a suitable finish for a bike frame

Scotch Guard
Domestic applications do not render fabrics completely waterproof so fabrics are not suitable for raincoats or water activities
Fabrics which are already water resistant, such as nylon, might not benefit from added chemicals from sprays, only completely impermeable waterproof coatings such as PVC.

Note: List is not exhaustive.

(c) Describe the possible environmental impacts that may be caused during manufacturing, applying and disposing of the finish. (3 marks)

Description	Marks
Appropriate description of one to three environmental impacts.	1–3
Total	**3**

Answers from the manufacturing, application of the finish and disposal of the product could include:

- production of the finish may involve release or creation of carbon emissions
- waste from production of the finish may damage local waterways and the ecosystem of plants, organisms and fish or animals
- application of the finish may release carbon emissions, by spray being released into the environment or chemicals from heat treated coatings being applied
- the material may require additional or less environmentally friendly care in cleaning
- the material may no longer be fully biodegradable or parts of the material may not break down in landfill.

Note: List is not exhaustive.

Question 3 **(12 marks)**

Using **three** design fundamentals, analyse **each** of the products shown below.

Description	Marks
2 products x 6 marks each (3 design fundamentals for each product x 2 marks for each design fundamental analysed)	
Analysis of an appropriate design fundamental relating to the product	2
Outline of an appropriate design fundamental relating to the product	1
subtotal for each design fundamental	**2**
subtotal each product	**6**
Total	**12**

Answers could include:

Product 1: Handheld vacuum
Any three of the following fundamentals:

Function
It is clear to see that the vacuum cleaner has been designed to be portable and run off battery power. These features will allow the user to use this product in most environments without relying on a fixed power source

Aesthetics
This vacuum has a small, compact and sleek design which is matched with the choices of colour. The colours make the product standout and the grey/silver gives off the feeling of a metallic material has been used

Ergonomics
Looking at the design it looks as if the vacuum has been designed to be used by one hand. This means that the product is more than likely light and won't cause the user too much stress when they use it

Safety
The design is small and compact and all internal parts look to be well concealed and protected with the plastic casing. There doesn't look to be any places that the user is likely to trap fingers, etc.

Cost
Looking at the overall appearance of this design it is clear to see that the product has been built/made to a very high standard. Along with the fact that the product is portable and doesn't use traditional vacuum bags I think that the product isn't cheap although in the long term the cost is cheaper.

Anthropometrics
It is clear to see that anthropometrics has been given great consideration with this vacuum. The handle is big and 'chunky' that would give the user a larger area to grip and would allow more control. The button is also very big and would be easy to press.

Product 2: Shape sorter toy
Any three of the following fundamentals:

Function
It is clear to see that this is a toy designed for a small child that is designed to help develop their cognitive skills. This is achieved by the children placing the correct shapes into their matching holes

Aesthetics
The colours used in this toy are bright and eye catching and are designed to grab the attention of the children that will use it

Ergonomics
The main box of this toy is big and bulky which will make it easy for young children to manipulate/move around. The coloured pieces are much smaller and will easily fit in the child's hand

Safety
This toy will be likely used by young children who have a tendency to put things in their mouth, smaller pieces are big enough that they won't be choking hazards. The material used looks to be a durable hardwood, this means that the material will be able to take a lot of knocks without breaking a part

Cost
The toy looks to be well made with all materials looking to be of a good quality, This quality matched with the colours makes me think that this toy would be around $30 to buy

Anthropometrics
It is clear to see that anthropometrics has been given great consideration with this toy. The smaller pieces look to have been designed with a small child's hand in mind as the pieces would need to fit in their hands easily so they can be manipulated.

Section Two: Extended answer **25% (37 Marks)**

Question 4 **(6 marks)**

The blender pictured above is designed to make smoothies and juices. Since its release, many other similar blenders have been developed. Discuss the relationship between product innovation, lifestyle choices and consumer demand in the development and sale of this type of product.

Description	Marks
Comprehensive discussion showing understanding of the relationship between product innovation, lifestyle choices and consumer demand in relationship to the example given, with comprehensive justifications	6
Discussion showing good understanding of the relationship between product innovation, lifestyle choices and consumer demand in relationship to the example given, with justifications	5
Discussion showing some understanding of the relationship between product innovation, lifestyle choices and/or consumer demand in relationship to the example given, with some justifications	4
Discussion showing some understanding of the relationship between either product innovation, lifestyle choices and/or consumer demand in relationship to the example given	3
Limited discussion on relationship between product innovation, lifestyle choices and consumer demand in relationship to the example given	2
Discussion on relationship between product innovation, lifestyle choices and consumer demand either does not show understanding of the relationship or does not refer to the example given	1
Total	**6**

Answers could include:

Fresh juices have been increasing in popularity on café menus. Much like the development of the Nespresso coffee pod machine, consumer demand was for the innovation of a product to make juices more easily than using a traditional blender at home. With busy schedules, people often only want to make a single serve juice for themselves when it suits them, rather than a large batch for the family, so getting out the large blender and then cleaning it afterwards was too much of a chore for a single serve. Busy lives mean that lifestyle choices dictate that time-poor people want a fast, easy to use and clean option that is healthy and can be consumed on the go, as most modern juice machines like the this blender come with cups and lids, meaning the smoothies can be made the night before and stored in the fridge, or made before walking out the door.

Another lifestyle choice of many young people and professionals, is to live in smaller apartments with little bench space in the kitchen. The blender takes up little more space than a soda bottle, meaning it can easily be tucked away when not in use. Consumer demand therefore dictates that smaller, more powerful items that are useful in the kitchen are developed. Another example of this is the stick blender, an example of using a small item rather than a big, cumbersome blender to blitz large quantities of soups and sauces. At the opposite end, many blender type products also have a smaller cup and different blending tools useful for making small quantities of sauces, dressings and pastes, much less labour intensively than using a mortar and pestle.

Note: List is not exhaustive.

Question 5 **(12 marks)**

The Whale Tail in Esperance was unveiled in 2014 and was designed and created by artists Jason Wooldridge and Cindy Poole.

With reference to the image, identify and outline how **three** principles and **three** elements of design have been used successfully in this sculpture.

Description	Marks
Correct identification of one to three principles and one to three elements	1–6
Relevant outline of one to three principles	1–3
Relevant outline of one to three elements	1–3
Total	**12**

Answers could include:

Elements of design	
Colour	A number of natural colours have been used in this design, from the natural colours of the timbers, to the cold and dark colours of the metal, to the intercut glass work
Line	There is strong use of line in this design, from the lines used in the main part of the tail. The curved sections of metal give the feeling of movement
Tone	Tone is visible in the different sections of timber that have been used and in the different pieces of glass work that are in the piece
Shape	The different materials have been shaped to give the sculpture more dimension. The timber is shaped to give the main section 3-dimensional feel
Texture	Different textures have been used in the tail
Form	The hollows in the tail create an open space allowing the background to flow into the foreground
Principles of design	
Contrast	The contrast between the two natural materials works well In the design
Dominance	The warm natural colours of the centre piece allow it to stand out against the rest of the darker tones and colours used
Balance	For the huge scale of this sculpture and that it is sitting off on an angle, it is very well balanced. The metal strip down the centre helps with this
Repetition	The repetition in the wood grain of the body of the tail extend upwards creating more height
Gradation	The gradation of the tones in the wood emphasise the smooth shape of the tail.
Rhythm	The rhythm is repeated in the fins on the tail so one's eye is drawn from one side to the other
Radiation	
Harmony	
Proportion	
Note: List is not exhaustive.	

Question 6 **(6 marks)**

Explain what a prototype is and why it is important to make one before producing a product. State **four** examples of how a designer could use a prototype to check the effectiveness of the design.

Description	Marks
Detailed explanation of what a prototype is and why it is important	2
Limited explanation of what a prototype is and why it is important	1
subtotal	**2**
States one to four examples	1–4
Total	**6**

Answers could include:

A prototype is an early sample, model, or release of a product built to test a concept or process or to act as a thing to be replicated or learned from.

Points of effectiveness answers could include:

- clients/users can be actively involved in the development
- provides a better understanding of the system being developed
- errors can be detected much earlier
- material choices can be tested
- ergonomics can be evaluated
- aesthetics can be evaluated
- joining methods can be assessed
- anthropometrics can be assessed
- quicker user feedback is available leading to better solutions
- missing functionality can be identified easily
- confusing or difficult functions can be identified
- testing product lifespan.

Note: List is not exhaustive.

Question 7 **(13 marks)**

The diagram below shows the main stages of a product life cycle assessment tool or plan.

(a) Define what a product life cycle assessment tool or plan is and explain how it can benefit a designer. (3 marks)

Description	Marks
Detailed explanation supporting what a product life cycle assessment tool or plan is and how it can benefit the designer	3
Satisfactory explanation of what a product life cycle assessment tool or plan is and how it can benefit the designer	2
Limited explanation of what a product life cycle assessment tool or plan is and how it can benefit the designer	1
Total	**3**
Answers could include: A product life cycle assessment tool or plan is a technique used to assess environmental impacts associated with all the stages of a product's life from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling. The assessment can help avoid environmental concerns by evaluating the potential impacts associated with identified inputs and releases of a material and product and to help make a more informed decision when selecting a material.	
Note: List is not exhaustive.	

Question 7 (continued)

(b) For each stage, give **two** examples of considerations that a designer may take into account when designing a new product. (10 marks)

Description	Marks
2 examples x 1 mark each x 5 stages	
One to 10 examples given	1–10
Total	**10**

Answers could include:

Material extraction/growth/harvesting
What machinery is needed to extract/grow/harvest the material
Are there any potential risks to the environment?
Pollution (air/soil/sound)
Converting raw material into usable materials
Transportation

Production
Energy consumption
Conservation of materials
Recycling
Prevention of pollution

Transportation
Packaging – is it simple to open? Are there a lot of parts?
Effective distribution – Where does it have to go? How does it have to travel?
Fuel use
Pollution from delivery vehicles (CO^2 emissions)
How many delivery vehicles?

Use
Is it easy to use?
Is it safe to use?
Is it energy saving?
Can it be reused?
Is it easy to repair if damaged?
Life expectancy?

Disposal
Easily recycled?
Amount of harmful substances in the environment?
Can it be broken down to salvage parts?
Easy to disassemble?
Life expectancy?
Can the recycling rate be improved?

Note: List is not exhaustive.

Section Three: Wood context **60% (67 Marks)**

Question 8 **(15 marks)**

(a) Name the materials test and explain the steps needed to complete this type of test. (5 marks)

Description	Marks
Names a strength/elasticity test	1
Comprehensive explanation of material test that could be used to test a material's properties	4
Detailed explanation of material test that could be used to test a material's properties	3
Satisfactory explanation of material test that could be used to test a material's properties	2
Limited explanation of material test that could be used to test a material's properties	1
Total	**5**

Answers could include:

- each sample is machined and cut to the same size
- recording sheet is ready to note the load limits of each sample
- clamp the first sample to the bench, lining up the 100 mm line with the bench edge
- steadily apply weight to the hook until failure
- use ruler to measure flex in the material
- record the max weight before failure happened.

Note: List is not exhaustive.

(b) The reliability of a materials test is important. Give **two** examples of what can affect a materials test and **two** examples of what the consequences of an inaccurate test might be. (4 marks)

Description	Marks
One to two examples of what can affect a materials test	1–2
One to two examples of what the consequences might be of an inaccurate test	1–2
Total	**4**

Answers could include:

What can affect a test:
- sample sizes being different
- inconsistent testing method
- inconsistent overhang of sample
- the way the weight is applied
- samples may not be securely held and could move/break free

Consequences:
- wrong material selection for a project based on incorrect information
- material failure under stress

Note: List is not exhaustive.

Question 8 (continued)

(c) (i) If the material being tested in part (a) performed well, identify the material and a suitable use for it. (1 mark)

Description	Marks
A suitable use identified	1
Total	**1**
Answers could include: A material that tests well would be good for projects such as table legs, rails, etc.	

(ii) If the identified material performed poorly, give a suitable use for the material. (1 mark)

Description	Marks
A suitable use identified	1
Total	**1**
Answers will be varied – accept all reasonable answers.	

(d) Identify and explain a manipulation technique you could use to give shape to the material identified in part (c)(i). (4 marks)

Description	Marks
Identifies a suitable manipulation technique	1
Detailed explanation of how to carry out the manipulation on the material or how the process works	3
Satisfactory explanation of how to carry out the manipulation on the material or how the process works	2
Limited explanation of how to carry out the manipulation on the material or how the process works	1
Total	**4**
Answers could include: **Laminating timber** Timber lamination can be used to manipulate timber into a curved shape. Before starting it is important to have a former/jig to hold your materials while the glue dries. The material should be cut into strips. Once materials have been cut to size and laid out in order, the faces should be covered in glue and placed together. The materials should then be clamped in the former/jig and allowed to dry. Note: Explanation may also include a description of how the process works.	
Note: List is not exhaustive.	

Question 9 **(10 marks)**

(a) Identify **four** differences in the cellular structure of hardwoods and softwoods. (4 marks)

Description	Marks
Identifies one to four correct differences	1–4
Total	**4**
Answers could include: • most hardwoods have thicker cell walls • hardwoods often have higher densities than softwoods • hardwoods have vessels where as Softwoods do not • hardwoods have pores ranging in size and shape • hardwoods have a more complex structure than softwoods and are often much slower growing as a result	
Note: List is not exhaustive.	

(b) Identify **three** characteristics of softwood trees. (3 marks)

Description	Marks
Identifies one to three correct characteristics	1–3
Total	**3**
Answers could include: • generally evergreen and have easily recognisable needle-like leaves • cone bearing trees (conifers) • generally softer and less dense than hardwoods • fast growing • easy workability	
Note: List is not exhaustive.	

(c) Give **three** advantages of using a softwood for furniture production. (3 marks)

Description	Marks
Gives one to three appropriate advantages	1–3
Total	**3**
Answers could include: • plantation timber • cheaper • easier to work and shape • less wear on tools • lighter than most hardwoods • readily available • waste materials can be recycled • reduced environmental impact	
Note: List is not exhaustive.	

Question 10 **(12 marks)**

(a) Give **three** possible reasons why the accident could have occurred. (3 marks)

Description	Marks
Gives one to three appropriate reasons	1–3
Total	**3**
Answers could include: • student wasn't trained on how to operate the machine • not paying attention • work wasn't held securely • router piece wasn't secure • no supervision	
Note: List is not exhaustive.	

(b) After the investigation was completed, the Occupational Safety and Health officer developed a risk management plan for the workshop. What was the purpose of the risk management plan? (2 marks)

Description	Marks
Explanation of the purpose of a risk management plan	2
Limited explanation of the purpose of a risk management plan	1
Total	**2**
Answers could include: A risk management plan is a document that a project manager prepares to foresee risks, estimate impacts, and define first aid, procedural and legal responses to issues.	
Note: List is not exhaustive.	

(c) Identify **three** proactive measures that could be introduced that would better prepare students for using workshop machinery. (3 marks)

Description	Marks
Identifies one to three appropriate proactive measures	1–3
Total	**3**
Answers could include: • increase training for students • introduce a spotter/buddy system for when students are using machinery • new students must take part in compulsory health and safety training • increase signage on the workshop, Safe Operating Procedures (SOPs), etc • complete Worksafe Certificate • student made aware of risk management plans • location of material safety data sheets (MSDS) certificates.	
Note: List is not exhaustive.	

(d) Identify **four** safety checks that should be carried out by a student before using the machine pictured at the start of this question. (4 marks)

Description	Marks
Identifies one to four correct safety checks	1–4
Total	**4**
Answers could include: • check power cord • check casing for any damage • check to see if router bit is securely held • check to see if router bit is sharp • work area is clear of obstruction • power cord isn't in the path of the cutter • work piece is securely held.	
Note: List is not exhaustive.	

Question 11 **(18 marks)**

In the space provided, sketch the final project that you designed and manufactured this year. Identify the key features and, with the use of annotation, justify your choices for:

- materials
- manufacturing techniques used
- joining methods
- finish
- historical, social and cultural sources of design inspiration
- client/end user needs
- design features/decoration.

Sketching (4 marks)
Annotation (14 marks)

Description	Marks
Maximum 4 marks for sketch	
Exceptional drawing showing high level of detail	4
Detailed drawing showing good detail	3
Satisfactory drawing showing some detail	2
Limited drawing with minimal detail	1
subtotal	**4**
7 x key features (bullet points from question) x 2 marks each	
Annotations are fully justified using appropriate terminology	2
Annotations identified with little justification	1
subtotal	**14**
Total	**18**

Answers must include the following features – annotations may vary:

Materials
Jarrah used as it is very durable and will with stand marks and dents

Manufacturing techniques
Legs have tapered ends produced using plane, great care needs to be taken to make sure all parts are the same

Joining methods
Domino joints used in leg and rail, no visible joint and have a high strength rating

Finish
Danish oil used as it soaks into the grain and creates a protective layer on the surface

Cultural/social/historical influences
Due to client's beliefs recycled timber was used in the production of the top

Client/end user needs
Client has asked for a hard wearing material as it is in a high traffic area. Jarrah would be suitable

Design features
Inlay used in the table top shows good contrast between the dark jarrah and the lighter tones of the rock maple.

Note: Complete list of examples not supplied as the responses will be too varied.

Question 12 **(12 marks)**

The globalisation of computer-aided drawing (CAD)/computer numerical control (CNC) technologies has had huge effects on the furniture-making industry. It has not only changed the manufacturing processes but also the way in which furniture is designed.

Consider this statement, describe **three** forms of CAD or CNC and outline the impacts they have had in the furniture-making industry.

Description	Marks
3 forms of CAD/CNC x 4 marks each.	
Detailed description of CAD/CNC and outlines their impacts on the furniture industry	4
Satisfactory description of CAD/CNC and outlines their impacts on the furniture industry	3
Basic description of CAD/CNC and outlines their impacts on the furniture industry	2
Limited description of CAD/CNC and outlines their impacts on the furniture industry	1
subtotal	**4**
Total	**12**

Answers could include:

CNC router
A CNC router is a computer controlled cutting machine related to the hand held router used for cutting various hard materials, such as wood, composites, aluminium, steel, plastics, and foams. It uses different profile cutters for cutting and shaping flat sheet material
The CNC router has both positive and negative effects on the furniture industry.

Laser cutter
Laser cutting is a technology that uses a laser to cut materials and is typically used for industrial manufacturing applications, but is also starting to be used by schools, small businesses, and hobbyists. Laser cutting works by directing the output of a high-power laser most commonly through optics. A laser cutter can cut through woods, plastics, thin metals, leather, foam, suede, cotton, felt, etc.

CAD
A computerised drawing package which allows manufacturers/designers to produce 2D and 3D images at a much faster rate. Images can be altered, edited and rendered multiple times. Files may be saved, exported and emailed.

Below are the positive and negative impacts of the CNC router, laser cutter and CAD:

Positive
- reduces the number of workers needed
- reduced need for skilled labour
- Very accurate
- fast
- can operate 24 hours
- cheaper production costs
- consistent production
- cheaper final product cost.

Negative
- loss of jobs
- increases training and upskilling required
- decreased labour force
- decrease in individuality of furniture designs
- furniture mass-production reduces design options for customers.

Note: List is not exhaustive.

Section Three: Metal Context **60% (67 Marks)**

Question 13 **(15 marks)**

(a) Name the materials test and explain the steps needed to complete this type of test. (5 marks)

Description	Marks
Names a strength/elasticity test	1
Comprehensive explanation of material test that could be used to test a material's properties	4
Detailed explanation of material test that could be used to test a material's properties	3
Satisfactory explanation of material test that could be used to test a material's properties	2
Limited explanation of material test that could be used to test a material's properties	1
Total	**5**
Answers could include: • each sample is machined and cut to the same size • recording sheet is ready to note the load limits of each sample • clamp the first sample to the bench, lining up the 100 mm line with the bench edge • steadily apply weight to the hook until failure • use ruler to measure the flex in the material • record the max weight before failure happened.	
Note: List is not exhaustive.	

(b) The reliability of a materials test is important. Give **two** examples of what can affect a materials test and **two** examples what the consequences of an inaccurate test might be. (4 marks)

Description	Marks
Gives one to two examples of what can affect a materials test	1–2
Gives one to two examples of what the consequences might be of an inaccurate test	1–2
Total	**4**
Answers could include: What can affect a test: • sample sizes being different • inconsistent testing method • inconsistent overhang of sample • the way the weight is applied • samples may not be securely held and could move/break free Consequences: • wrong material selection for a project based on incorrect information • material failure under stress	
Note: List is not exhaustive.	

(c) (i) If the material being tested in part (a) performed well, identify a suitable use for it. (1 mark)

Description	Marks
A suitable use identified	1
Total	**1**
Answers could include: A material that tests well, i.e. was strong, would be good for projects such as table legs, rails, etc.	

(ii) If the identified material performed poorly, give a suitable use for the material. (1 mark)

Description	Marks
A suitable use identified	1
Total	**1**
Answers will be varied – accept all reasonable answers.	

(d) Identify and explain a manipulation technique you could use to give shape to the material identified in part (c)(i). (4 marks)

Description	Marks
Identifies a suitable manipulation	1
Detailed explanation of how to carry out the manipulation on the material or how the process works	3
Satisfactory explanation of how to carry out the manipulation on the material or how the process works	2
Limited explanation of how to carry out the manipulation on the material or how the process works	1
Total	**4**
Answers could include: Curving legs using a roll bender A roll bender is a mechanical jig having three rollers used to form a metal bar into a circular arc. Two outer rollers, usually fixed, cradle the bottom of the material while the inner roller, whose position is adjustable, presses on the topside of the material. The material to be shaped is suspended between the rollers. By increasing the pressure of the top wheel and rolling the material through the material is forced through the three rollers and this creates a roll. The process should be continued until the set shape is achieved. Note: Explanation may also include a description of how the process works.	
Note: List is not exhaustive.	

Question 14 **(10 marks)**

(a) Identify **four** differences between the characteristics of ferrous and non ferrous metals. (4 marks)

Description	Marks
Identifies one to four correct differences	1–4
Total	**4**
Answers could include: Ferrous metals • used for their tensile strength and durability • high carbon content • prone to rusting • magnetic Non ferrous metals • more malleable • lighter • good aesthetic • high resistance to rusting • non magnetic.	
Note: List is not exhaustive.	

(b) Identify **three** properties of alloys. (3 marks)

Description	Marks
Identifies one to three correct properties of an alloy	1–3
Total	**3**
Answers could include: • low weight • high conductivity • non magnetic • resistant to corrosion.	
Note: List is not exhaustive.	

(c) Give **three** advantages of using aluminium over steel. (3 marks)

Description	Marks
Gives one to three appropriate advantages	1–3
Total	**3**
Answers could include: • weighs less • better malleability • better formability • better corrosion resistance • thermal conductivity • waste materials can be recycled • reduced environmental impact.	
Note: List is not exhaustive.	

Question 15 **(12 marks)**

(a) Give **three** possible reasons why the accident could have occurred. (3 marks)

Description	Marks
Gives one to three appropriate reasons	1–3
Total	**3**
Answers could include: • student wasn't trained on how to operate the machine • not paying attention • work wasn't held securely • disk wasn't secure • no supervision	
Note: List is not exhaustive.	

(b) After the investigation was completed, the Occupational Safety and Health officer developed a risk management plan for the workshop. What was the purpose of the risk management plan? (2 marks)

Description	Marks
Explanation of the purpose of a risk management plan	2
Limited explanation of the purpose of a risk management plan	1
Total	**2**
Answers could include: A risk management plan is a document that a project manager prepares to foresee risks, estimate impacts, and define first aid, procedural and legal responses to issues.	
Note: List is not exhaustive.	

Question 15 (continued)

(c) Identify **three** proactive measures that could be introduced that would better prepare students for using workshop machinery. (3 marks)

Description	Marks
Identifies one to three appropriate proactive measures	1–3
Total	**3**
Answers could include: • increase training for students • introduce a spotter/buddy system for when students are using machinery • new students must take part in compulsory health and safety training. • increase signage on the workshop, SOP's, etc • student made aware of risk management plans • location of material safety data sheets (MSDS) certificates..	
Note: List is not exhaustive.	

(d) Identify **four** safety checks that should be carried out by a student before using the machine pictured at the start of this question. (4 marks)

Description	Marks
Identifies one to four correct safety checks	1–4
Total	**4**
Answers could include: • check power cord • check casing for any damage • check to see if disc is securely held • check disc is in good working order, no cracks, etc. • work area is clear of obstruction • power cord isn't in the path of the cutter • work piece is securely held.	
Note: List is not exhaustive.	

Question 16 **(18 marks)**

In the space provided, sketch the final project that you designed and manufactured this year. Identify the key features and, with the use of annotation, justify your choices for:

- materials
- manufacturing techniques used
- joining methods
- finish
- historical, social and cultural sources of design inspiration
- client/end user needs
- design features/decoration.

Sketching (4 marks)
Annotation (14 marks)

Description	Marks
Maximum 4 marks for sketch.	
Exceptional drawing showing high level of detail	4
Good drawing showing good detail	3
Satisfactory drawing showing some detail	2
Limited drawing with minimal drawing	1
subtotal	**4**
7 x key features (bullet points from question) x 2 marks each	
Annotations are fully justified using appropriate terminology	2
Annotations identified with little justification	1
subtotal	**14**
Total	**18**

Answers must include the following features – annotations may vary:

Materials
Aluminium is ideal for the outdoors as it weathers well and withstands a range of temperatures

Manufacturing techniques
Legs were shaped using a roller, this technique will ensure all legs have the same arc

Joining methods
Parts held together using nut and bolt this means it can come apart and allow for easy transportation

Finish
Powder Coated finish provides a tough, durable skin that is easy to maintain

Cultural/social/historical
Due to client's beliefs, recycled materials were used in the production of the frame

Client/end user needs
Client requested that the furniture be easily moved. Aluminium being lightweight would be suitable

Design features
The intricate scroll work between the legs and rails are a feature that stands out against the rest of the structure.

Note: Complete list of examples not supplied as the responses will be too varied.

Question 17 **(12 marks)**

The globalisation of computer-aided drawing (CAD)/computer numerical control (CNC) technologies has had huge effects on the furniture-making industry. It has not only changed the manufacturing processes but also the way in which furniture is designed.

Consider this statement, describe **three** forms of CAD or CNC and outline the impacts they have had in the furniture-making industry.

Description	Marks
3 forms of CAD/CNC x 4 marks each	
Detailed description of CAD/CNC and outlines the impacts on the furniture industry	4
Satisfactory description of CAD/CNC and outlines the impacts on the furniture industry	3
Basic description of CAD/CNC and outlines the impacts on the furniture industry	2
Limited description of CAD/CNC and outlines the impacts on the furniture industry	1
subtotal	**4**
Total	**12**

Answers could include:

CNC
A CNC router is a computer controlled cutting machine related to the hand held router used for cutting various hard materials, such as wood, composites, aluminium, steel, plastics, and foams. It uses different profile cutters for cutting and shaping flat sheet material
The CNC router has both positive and negative effects on the furniture industry.

A CNC laser cutting is a technology that uses a laser to cut materials and is typically used for industrial manufacturing applications, but is also starting to be used by schools, small businesses, and hobbyists. Laser cutting works by directing the output of a high-power laser most commonly through optics. A laser cutter can cut through woods, plastics, thin metals, leather, foam, suede, cotton, felt, etc.

CAD
A computerised drawing package which allows manufacturers/designers to produce 2D and 3D images at a much faster rate. Images can be altered, edited and rendered multiple times. Files may be saved, exported and emailed.

Below are the positive and negative impacts of the CNC router, laser cutter and CAD:

Positive
- reduces the number of workers needed
- reduced need for skilled labour
- very accurate
- fast
- can operate 24 hours
- cheaper production costs
- consistent production
- cheaper final product cost

Negative
- loss of jobs
- increases training and upskilling required
- decreased labour force
- decrease in individuality of furniture designs
- furniture mass production reduces design options for customers.

Note: List is not exhaustive.

Section Three: Textiles context **60% (67 Marks)**

Question 18 **(15 marks)**

(a) Name the materials test and explain the steps needed to complete this type of test. (5 marks)

Description	Marks
Names a strength/elasticity test	1
Comprehensive explanation of material test that could be used to test a material's properties	4
Detailed explanation of material test that could be used to test a material's properties	3
Limited explanation of material test that could be used to test a material's properties	2
Superficial explanation of material test that could be used to test a material's properties	1
Total	**5**
Answers could include: • each sample is machined and cut to the same size • recording sheet is ready to note the load limits of each sample • steadily apply weight to the hook until failure • use ruler to measure flex in the material • record the max weight before failure happened.	
Note: List is not exhaustive.	

(b) The reliability of a materials test is important. Give **two** examples of what can affect a materials test and **two** examples what the consequences of an inaccurate test might be. (4 marks)

Description	Marks
Gives one to two examples of what can affect a materials test	1–2
Gives one to two examples of what the consequences of an inaccurate test might be	1–2
Total	**4**
Answers could include: What can affect a test: • sample sizes being different • inconsistent testing method • inconsistent overhang of sample • the way the weight is applied • samples may not be securely held and could move/break free Consequences: • wrong material selection for a project based on incorrect information • material failure under stress	
Note: List is not exhaustive.	

Question 18 (continued)

(c) (i) If the material being tested in part (a) performed well, identify the material and a suitable use for it. (1 mark)

Description	Marks
A suitable use identified	1
Total	**1**
Answers could include: A material that tests well would be good for projects such as active wear and comfort garments, e.g. thermals etc.	

(ii) If the identified material performed poorly, give a suitable use for the material. (1 mark)

Description	Marks
An suitable use identified	1
Total	**1**
Answers will be varied – accept all reasonable answers.	

(d) Identify and explain a manipulation technique you could use to give shape to the material identified in part (c)(i). (4 marks)

Description	Marks
Identifies a suitable manipulation	1
Detailed explanation of how to carry out the manipulation on the material or how the process works	3
Satisfactory explanation of how to carry out the manipulation on the material or how the process works	2
Limited explanation of how to carry out the manipulation on the material or how the process works	1
Total	**4**
Explanation may include: For each pleat, you need three marks: two fold lines and a placement line. Fold lines towards placement lines. Then hold in place with a pin and secure with a baste stitch across the top. If needed, you can stitch across the top Types of pleats are: • bias • crystal • goret • knife. Note: Explanation may also include a description of how the process works.	
Note: List is not exhaustive.	

Question 19 **(9 marks)**

(a) Identify **four** differences between cellulosic and protein fibres. (4 marks)

Description	Marks
Identifies one to four differences	1–4
Total	**4**

Answers could include:

- protein fibres are more susceptible to shrinking
- moths are attracted to protein fibres such as wool or silk
- cellulose fibres attract mould and mildew when left damp for long periods
- cellulose fibres are much more prone to wrinkling, but can also be ironed at higher temperatures
- cellulosic fibres are highly flammable, whereas protein fibres tend to singe, like human hair
- protein fibres are somewhat elastic, whereas cellulosic fibres are not
- cellulosic fibres are generally stronger than protein fibres
- protein fibres are more absorbent and have more ability to wick sweat from the skin
- cellulosic fibres breathe, making them more suitable for warm weather
- protein fibres are very good insulators, making them excellent for wearing in cold weather

Note: List is not exhaustive.

(b) Identify **three** characteristics of manufactured fibres. (3 marks)

Description	Marks
Identifies one to three correct characteristics	1–3
Total	**3**

Answers could include:

Both reference to regenerated and synthetic accepted:

- not absorbent (synthetic), partially absorbent (regenerated)
- wrinkle easily (regenerated), do not generally need to be ironed (synthetic)
- resistant to moths and mildew
- minimal flammability (regenerated), are not flammable (they generally melt)
- some breathing (regenerated), these fibres do not breathe, so are not good in hot weather
- (regenerated) partially biodegradable, synthetic fibres are not biodegradable
- (regenerated) shrink

Note: List is not exhaustive.

(c) Give **three** advantages of using a fibre blend. (3 marks)

Description	Marks
Gives one to three appropriate advantages	1–3
Total	**3**
Answers could include: • can increase comfort • blending fibres can make them easier to care for • elasticity may be increased to improve fit • addition of a natural fibre allows the garment to breathe and/or absorb sweat	
Note: List is not exhaustive.	

Question 20 **(12 marks)**

(a) Give **three** possible reasons why the accident could have occurred. (3 marks)

Description	Marks
Gives one to three appropriate reasons	1–3
Total	**3**
Answers could include: • student wasn't trained on how to operate the machine • not paying attention • work wasn't held securely • needle wasn't secure • machine was not properly serviced • no supervision • not wearing the correct PPE	
Note: List is not exhaustive.	

(b) After the investigation was completed, the Occupational Safety and Health Officer developed a risk management plan for the workshop. What was the purpose of the risk management plan? (2 marks)

Description	Marks
Explanation of the purpose of a risk management plan	2
Limited explanation of the purpose of a risk management plan	1
Total	**2**
Answers could include: A risk management plan is a document that a project manager prepares to foresee risks, estimate impacts, and define first aid, procedural and legal responses to issues	
Note: List is not exhaustive.	

(c) Identify **three** proactive measures that could be introduced that would better prepare students for using workshop machinery. (3 marks)

Description	Marks
Identifies one to three appropriate proactive measures	1–3
Total	**3**
Answers could include: • increase and revise training for students • ensure an assistant is available to supervise students when using machinery • new students must take part in compulsory health and safety training. • increase signage on the workshop, and ensure students know where the instruction manuals are located • student made aware of risk management plans • location of material safety data sheets (MSDS) certificates.	
Note: List is not exhaustive.	

(d) Identify **four** safety checks that should be carried out by a student before using the machine pictured at the start of this question. (4 marks)

Description	Marks
Identifies one to four correct safety checks	1–4
Total	**4**
Answers could include: • check power cord • check casing for any damage • check to see if needle is secured • check to see if needles in plate are secure • work area is clear of obstruction • power cord isn't in the path of the cutter	
Note: List is not exhaustive.	

Question 21 **(18 marks)**

In the space provided, sketch the final project that you designed and manufactured this year. Identify the key features and, with the use of annotation, justify your choices for:

- materials
- manufacturing techniques used
- joining methods
- finish
- historical, social and cultural sources of design inspiration
- client/end user needs
- design features/decoration.

Sketching (4 marks)
Annotation (14 marks)

Description	Marks
Maximum 4 marks for sketch.	
Exceptional drawing showing high level of detail	4
Good drawing showing good detail	3
Satisfactory drawing showing some detail	2
Limited drawing with minimal drawing	1
subtotal	**4**
7 x key features (bullet points from question) x 2 marks each	
Annotations are fully justified using appropriate terminology	2
Annotations identified with little justification	1
subtotal	**14**
Total	**18**

Answers must include the following features – annotations may vary:

Materials
Nylon/lycra is used as it is stretchy and fast drying

Manufacturing techniques
Twin needle hems are used to allow for stretching

Joining methods
Flat seams are used for ergonomics and increased performance and speed

Finish
An anti-pilling finish was considered to avoid the fabric pilling with abrasion and wear

Cultural/social/historical
The Australian cultural influences and historical garments worn by the Australian team were considered, including the use of green and gold

Client/end user needs
Client wants a modern design for their garment. This has been achieved by using modern colours/textures

Design features
The team logo was redesigned and embroidered onto each garment.

Note: Complete list of examples not supplied as the responses will be too varied.

Question 22 **(12 marks)**

The globalisation of computer-aided drawing (CAD)/computer numerical control (CNC) technologies has had huge effects on the garment-construction industry. It has not only changed the manufacturing processes but also the way in which garments are designed.

Consider this statement, describe **three** forms of CAD/CNC and outline the impacts they have had on the garment-construction industry.

Description	Marks
3 x forms of CAD/CNC x 4 marks each	
Detailed description of CAD/CNC and outlines the impacts on the garment construction industry	4
Satisfactory description of CAD/CNC and outlines the impacts on the garment construction industry	3
Basic description of CAD/CNC and outlines the impacts on the garment construction industry	2
Limited description of CAD/CNC and outlines the impacts on the garment construction industry	1
subtotal	**4**
Total	**12**

Answers could include:

CNC sewing machine
A CNC sewing machine is an embroidery machine which is used to create patterns on textiles. It is used commercially for branding and advertising on a range of materials. It can do automatic threading.

Laser cutter
Laser cutting is a technology that uses a laser to cut materials and is typically used for industrial manufacturing applications, but is also starting to be used by schools, small businesses, and hobbyists. Laser cutting works by directing the output of a high-power laser most commonly through optics. A laser cutter can cut through woods, plastics, thin metals, leather, foam, suede, cotton, felt, etc.

CAD
A computerised drawing package which allows manufacturers/designers to produce 2D and 3D images at a much faster rate. Images can be altered, edited and rendered multiple times. Files may be saved, exported and emailed.

Below are the positive and negative impacts of the CNC sewing machine, laser cutter and CAD:

Positive
- reduces the number of workers needed
- reduced need for skilled labour
- very accurate
- fast
- can operate 24 hours
- cheaper production costs
- consistent production
- cheaper final product cost.

Negative
- loss of jobs
- increases training and upskilling required
- decreased labour force
- decrease in individuality of furniture designs
- furniture mass-production reduces design options for customers.

Note: List is not exhaustive.

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