



ATAR course examination, 2021

Question/Answer booklet

MATERIALS DESIGN AND TECHNOLOGY

Section Three

Please place your student identification label in this box

WA student number: In figures

--	--	--	--	--	--	--	--

In words

Time suggested for this section

Suggested working time for this section: ninety minutes

Materials required for this section

To be provided by the supervisor

This Question/Answer booklet

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: up to three calculators, which do not have the capacity to create or store programmes or text, are permitted in this ATAR course examination

Place a tick (✓) in one of the following boxes to indicate your examination context

Wood

Metal

Textiles

Number of additional answer booklets used (if applicable):

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of the examination

The Materials Design and Technology ATAR course examination consists of a written component and a practical (portfolio) component.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of written examination
Section One Short answer	3	3	20	32	15
Section Two Extended answer	4	4	40	36	25
Section Three Candidates to choose one of the following contexts: Wood Metal Textiles	6	6	90	77	60
Total					100

Instructions to candidates

- The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2021: Part II Examinations*. Sitting this examination implies that you agree to abide by these rules.
- Write your answers in this Question/Answer booklet.
- Answer the questions according to the following instructions.

Section Three: Answer all of the questions within your context: Wood, Metal or Textiles.
- You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.
- Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Section Three: Sectionalised and extended answer**60% (77 Marks)**

You are required to choose **one** of the following options, according to the context you have studied in 2021.

Tick one of the boxes below to indicate your choice of context.

Context	✓	Question	Pages
Wood	<input type="checkbox"/>	8–13	4–17
Metal	<input type="checkbox"/>	14–19	18–31
Textiles	<input type="checkbox"/>	20–25	32–45

Now turn to the relevant pages and answer the questions for the context you have studied.

Section Three: Wood context

60% (77 Marks)

This section contains **six** questions. Answer **all** questions.

Suggested working time: 90 minutes.

Question 8

(11 marks)

- (a) In the table below, name each of the timber conversion processes and list **one** advantage and **one** disadvantage for each process. (9 marks)

	Advantage	Disadvantage
<div style="border: 1px dashed gray; padding: 5px; margin-bottom: 5px;"> For copyright reasons this image cannot be reproduced in the online version of this document. </div> Process name:		
<div style="border: 1px dashed gray; padding: 5px; margin-bottom: 5px;"> For copyright reasons this image cannot be reproduced in the online version of this document. </div> Process name:		
<div style="border: 1px dashed gray; padding: 5px; margin-bottom: 5px;"> For copyright reasons this image cannot be reproduced in the online version of this document. </div> Process name:		

- (b) Outline the connection between a timber’s structure, properties and end use in its selection for a manufactured product. (2 marks)

Question 9

(22 marks)

The image below is a prototype for a phone charger with passive speaker. The product is designed to passively amplify music from the phone in a compact format that is portable and convenient.

The prototype was evaluated by the designer and the following issues were identified:

- the device is prone to fall over when larger phones are inserted in the prototype
- the slot restricts access to the main menu button because the phone sits too deeply in the slot
- no source of design inspiration evident to appeal to a specific target market (historical, social, cultural, political).



- (a) In the space below, create **three** annotated rapid concept sketches. Each sketch must address **one** of the design issues described on page 6. (12 marks)

Concept sketch one: preventing the device from falling over

Concept sketch two: access to the main menu button is not restricted

Concept sketch three: design inspiration to appeal to a specific target market

This page has been left blank intentionally

See next page

Question 10

(12 marks)

The image below is a painted and lacquered chair, named 'Red and Blue Chair'. It is a reproduction of the famous Gerrit Thomas Rietveld chair designed in 1918. The seat and back were made from plywood and the frame was made from standard sizes of beechwood timber, that were readily available to the designer at the time of construction.



Beechwood is a European hardwood timber.

- (a) Define what is meant by the term 'hardwood'. (1 mark)

Plywood is a man-made board.

- (b) Define what is a man-made material, and state **two** advantages of its use for the Red and Blue Chair. (3 marks)

Definition: _____

One: _____

Two: _____

A finishing process is applied to enhance the chair.

- (c) (i) Describe the process used to prepare the chair for applying the paint and lacquer. (2 marks)

- (ii) Describe how the paint and lacquer were used to enhance the timber. (2 marks)

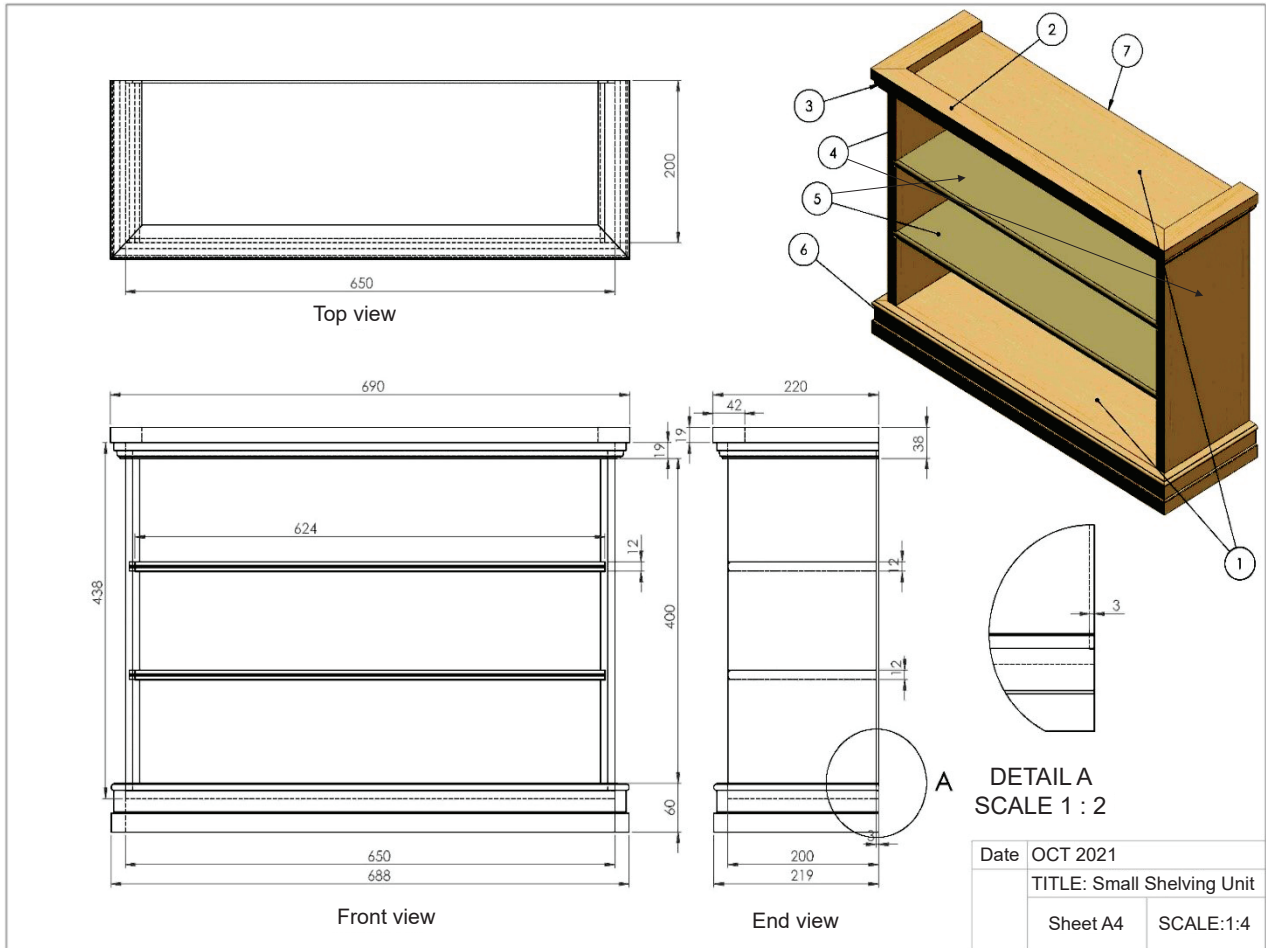
- (d) Considering the end use of the chair, describe how the finishes might protect the chair. (2 marks)

- (e) Identify and justify an appropriate adhesive that might be used in the construction process, using appropriate workshop terminology. (2 marks)

Question 11

(10 marks)

The basic shelving unit pictured below is designed as an inexpensive item of furniture that can be manufactured cheaply and used to organise small items.



Parts List

Part number	Part name	Material description
1	Carcass top and bottom	18 mm MDF pine veneer
2	Plain moulding	42 x 19 dressed pine
3	Ogee moulding	19 x 19 dressed pine
4	Sides of carcass	18 mm MDF pine veneer
5	Shelves	12 mm plain MDF
6	Colonial skirting	60 x 19 dressed pine
7	Backing board	3 mm plain MDF

Price List

Manufactured board	
Material	\$/m ²
18 mm MDF pine veneer	\$36.20
12 mm plain MDF	\$10.85
3 mm plain MDF	\$ 3.60

Dressed pine	
Material	Cost per \$/Lm
19 x 19	\$1.80
42 x 19	\$2.50
60 x 19	\$6.20

Using the drawings, parts and price lists, complete the costing table for making **one** shelving unit. Round costs to the nearest cent. All sizes to be in millimetres (mm).

Part name	Material description	Number required	Length	Width	Cost (\$/m ²) or (\$/Lm)	Total m ² rounded to two decimal places	Cost
Carcass top and bottom	18 mm MDF pine veneer	2	650 mm	200 mm	\$36.20		
Plain moulding	42 x 19 dressed pine	1	1200 mm	n/a	\$ 2.50	n/a	
Ogee moulding	19 x 19 dressed pine	1	1200 mm	n/a	\$ 1.80	n/a	
Sides of carcass	18 mm MDF pine veneer		400 mm	200 mm	\$36.20	0.16	
Shelves	12 mm plain MDF	2	624 mm	200 mm	\$10.85		\$ 2.71
Colonial skirting	60 x 19 dressed pine	1	1200 mm	n/a	\$ 6.20	n/a	
Backing board	3 mm plain MDF	1	630 mm	420 mm	\$ 3.60	0.26	
Total cost							

See next page

Question 12

(14 marks)

The image below is a chair designed and manufactured in Western Australia from local timber, and hardware and fabric from overseas.

	<p>Origin: designed and manufactured in Western Australia.</p> <p>Made from sustainably-sourced, recycled Jarrah.</p> <p>Stainless steel hardware components sourced from USA.</p> <p>Bamboo upholstery fabric made in China.</p> <p>Size: 1850 L x 650 W x 650 H</p> <p>Packaging: in-store and click and collect, recycled corrugated cardboard, biodegradable packaging peanuts made in Victoria.</p> <p>Marketing: online, in-store.</p>
---	---

- (a) Define the term 'globalisation'. (2 marks)

- (b) Review the specifications of the chair above and outline **three** impacts of globalisation affecting its production. (6 marks)

One: _____

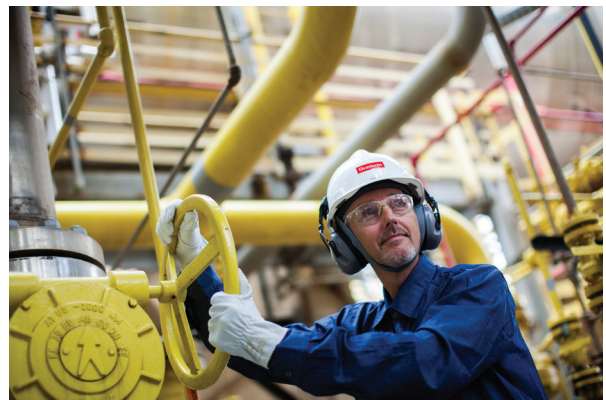
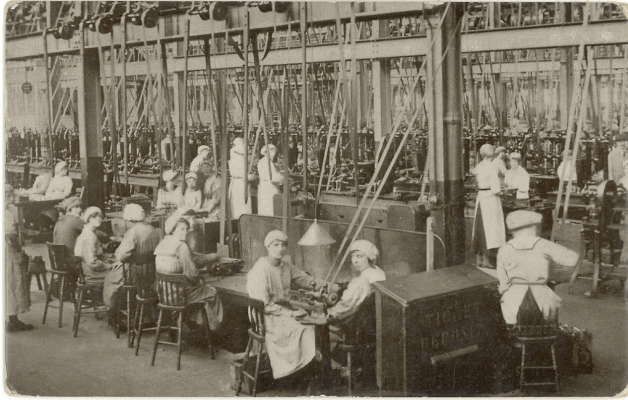
Two: _____

Three: _____

(c) Discuss how green design principles can be incorporated into the design and production of the chair. (6 marks)

Question 13

(8 marks)



Throughout history, humans have been a key element in manufacturing processes, both as creators of those processes and as workers in industry. As manufacturing processes involve increasing levels of automation, it is important to note that human skills are essential in the successful production of goods and will continue to be needed in the future.

Discuss how human factors have affected the development of manufacturing processes.

See next page

Section Three: Metal context

60% (77 Marks)


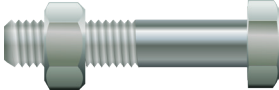

This section contains **six** questions. Answer **all** questions.

Suggested working time: 90 minutes.

Question 14

(11 marks)

- (a) In the table below, name each of the metal fasteners and list **one** advantage and **one** disadvantage for each fastener. (9 marks)

	Advantage	Disadvantage
 Fastener name:		
 Fastener name:		
 Fastener name:		

- (b) Define galvanising and state a reason why a fastener might need to be galvanised. (2 marks)

Question 15

(22 marks)

The shoe rack shown below was evaluated by the designer as the basis for a new design.

The design brief for the new model required that the shoe rack:

- hold a greater number of pairs of shoes
- secure the shoes more firmly on the rack
- include a source of design inspiration to appeal to a specific target market (historical, social, cultural, political).

For copyright reasons this image cannot be reproduced in the online version of this document but may be viewed at the link listed on the acknowledgements page.

- (a) In the space below, create **three** annotated rapid concept sketches. Each sketch must address **one** of the design issues described on page 20. (12 marks)

Concept sketch one: hold a greater number of pairs of shoes

Concept sketch two: secure the shoes more firmly

Concept sketch three: design inspiration to appeal to a specific target market

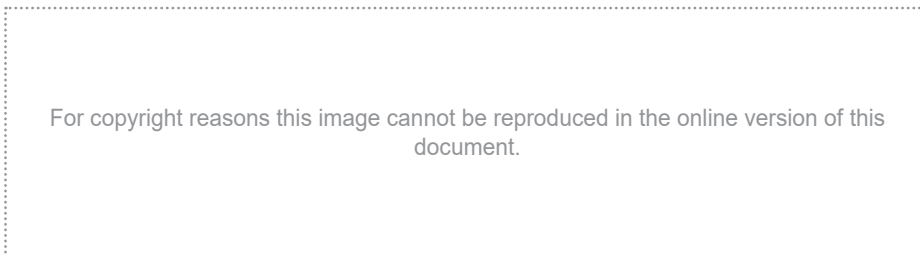
This page has been left blank intentionally

See next page

Question 16

(12 marks)

The image below is a screwdriver made in a school workshop. It has two separate parts which are joined together with a threaded connection. The blade is made out of high carbon steel, the handle out of brass.



High carbon steel is a ferrous metal.

- (a) Define what is meant by the term 'ferrous'. (1 mark)

Brass is an alloy.

- (b) Define the term 'alloy' and state **two** advantages of using an alloy. (3 marks)

Definition: _____

One: _____

Two: _____

The screwdriver blade was hardened and then tempered in the school workshop.

- (c) (i) Describe the process of hardening the screwdriver blade. (2 marks)

- (ii) Describe the resulting physical changes to the metal after tempering. (2 marks)

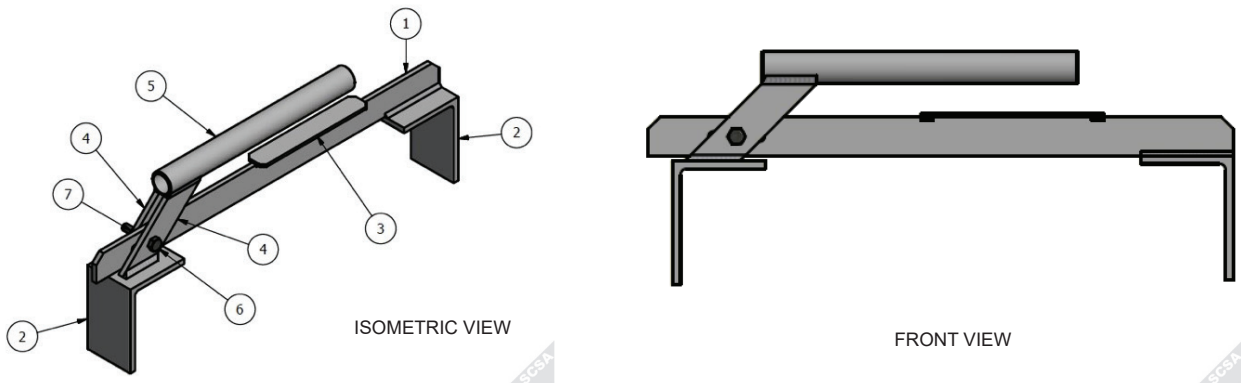
- (d) Describe the process you would use to cut the internal thread in the handle, using appropriate workshop terminology. (2 marks)

- (e) Describe the process you would use to cut the external thread on the blade, using appropriate workshop terminology. (2 marks)

Question 17

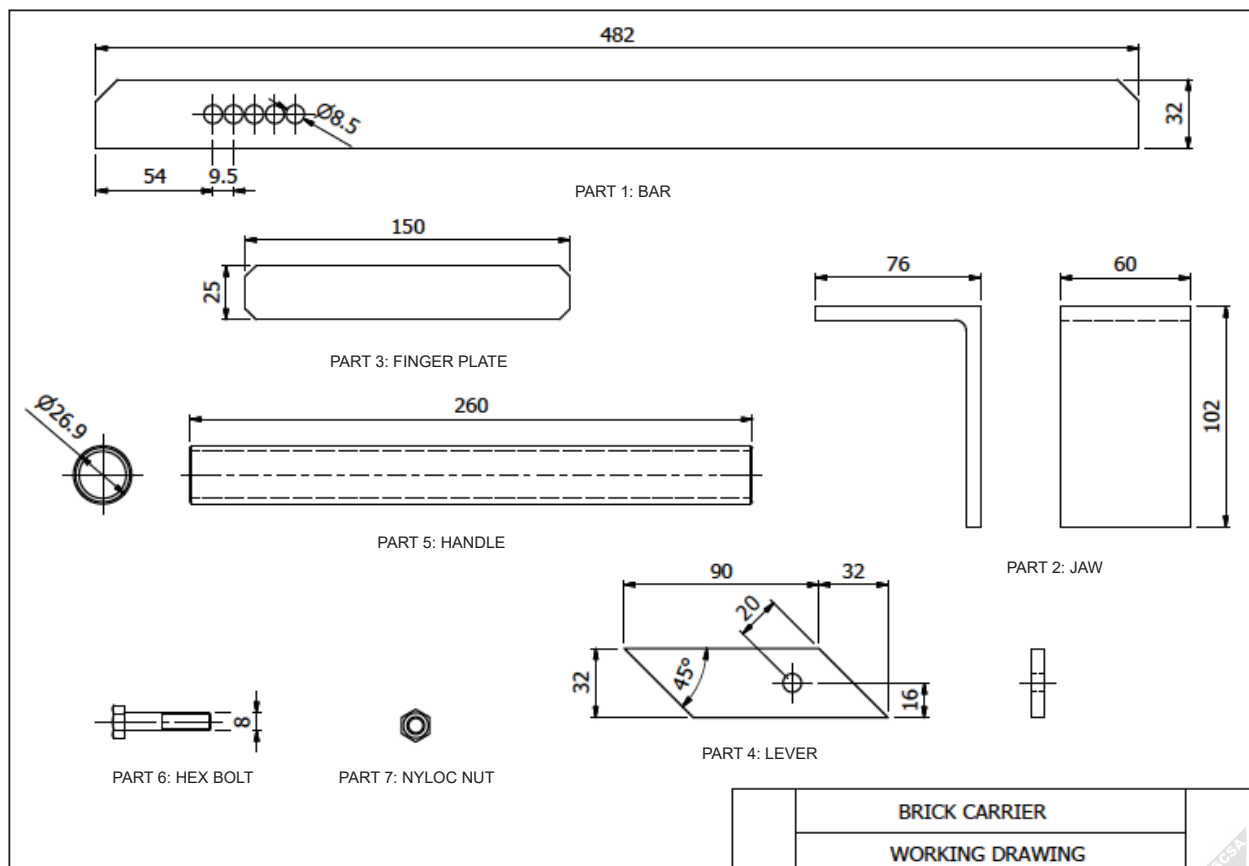
(10 marks)

The image below is of a brick carrier.



Parts List

Part number	Quantity	Part name	Material dimension
1	1	Bar	32 x 6 Mild steel flatbar
2	2	Jaw	102 x 76 x 6.5 Unequal angle
3	1	Finger plate	25 x 3 Mild steel flatbar
4	2	Lever	32 x 6 Mild steel flatbar
5	1	Handle	DIA 26.9 x 2.6 Steel pipe
6	1	Hexagon head bolt	M8 x 40
7	1	Hexagon nyloc nut	M8



See next page

Price List

Mild steel flatbar	
Size (mm)	Cost PLM
25 x 3	\$11.72
25 x 5	\$18.62
25 x 6	\$21.29
25 x 8	\$31.15
32 x 3	\$14.70
32 x 5	\$22.61
32 x 6	\$27.14
32 x 8	\$36.17

Using the drawings, parts and price lists, complete the costing table for making a **single** brick carrier. Round costs to the nearest cent. All sizes to be in millimetres (mm).

Part name	Material description	Number required	Length required (mm)	Cost (\$/m)	Cost
Bar	32 x 6 Mild steel flatbar	1		\$27.14	
Jaw	102 x 76 x 6.5 Unequal angle			\$110.00	\$13.20
Finger plate	25 x 3 Mild steel flatbar	1	150		
Lever	32 x 6 Mild steel flatbar	2		\$27.14	
Handle	DIA 26.9 x 2.6 Steel pipe	1		\$ 6.43	
Hexagon head bolt	N/A	1	N/A	\$0.20	\$ 0.20
Hexagon nyloc nut	N/A	1	N/A	\$0.20	\$ 0.20

See next page

Question 18

(14 marks)

The image below is a coffee table designed in Western Australia and manufactured offshore from materials sourced overseas.

<p style="text-align: center;">For copyright reasons this image cannot be reproduced in the online version of this document but may be viewed at the link listed on the acknowledgements page.</p>	<p>Origin: designed and sold in Western Australia.</p> <p>Made from 25% recycled steel.</p> <p>Manufactured in China in ethical factories.</p> <p>Polished steel with unique engraved design.</p> <p>Packaging: in-store and click and collect, recycled corrugated cardboard, biodegradable packaging peanuts made in Victoria.</p> <p>Marketing: online, in-store.</p>
--	--

- (a) Define the term 'globalisation'. (2 marks)

- (b) Review the specifications of the above coffee table and outline **three** impacts of globalisation affecting its production. (6 marks)

One: _____

Two: _____

Three: _____

- (c) Discuss how green design principles can be incorporated into the design and production of the coffee table. (6 marks)

Question 19

(8 marks)



Throughout history, humans have been a key element in manufacturing processes, both as creators of those processes and as workers in industry. As manufacturing processes involve increasing levels of automation, it is important to note that human skills are essential in the successful production of goods and will continue to be needed in the future.

Discuss how human factors have affected the development of manufacturing processes.

Section Three: Textiles context

60% (77 Marks)

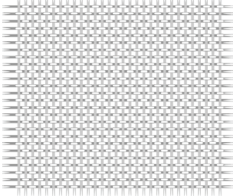
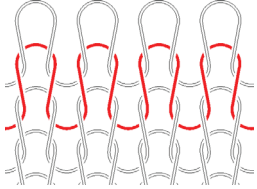

This section contains **six** questions. Answer **all** questions.

Suggested working time: 90 minutes.

Question 20

(11 marks)

- (a) In the table below, name each of the fabric structures and list **one** advantage and **one** disadvantage of each fabric structure. (9 marks)

	Advantage	Disadvantage
 <p>Fabric structure:</p>		
 <p>Fabric structure:</p>		
 <p>Fabric structure:</p>		

- (b) Outline the connection between a fabric's structure, properties and end use in its selection for a manufactured product. (2 marks)

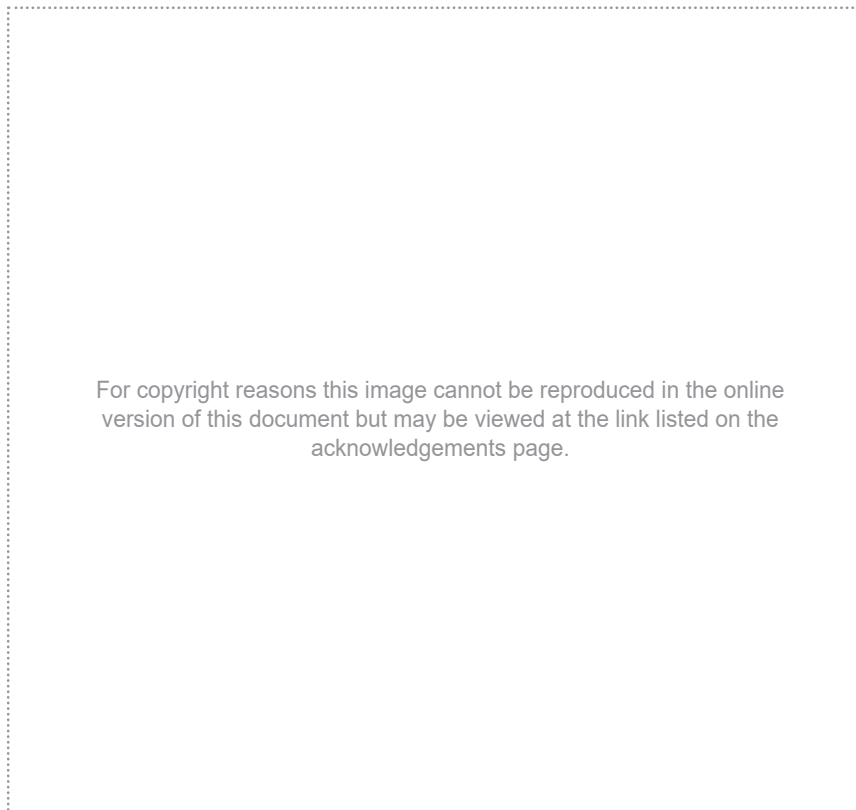
Question 21

(22 marks)

The image below is a universal raincoat designed as a light weight, inexpensive garment to be easily carried and used in multiple situations. It has a fully lined body and hood. The outer fabric is waterproof PVC plastic and the lining is cotton.

The rain coat was evaluated by the designer as the basis for a new design. The design brief for the new model required that the rain coat:

- use an alternate fastening on the centre front for greater wind resistance
- secure the hood more firmly for windy conditions
- include a source of design inspiration to appeal to a specific target market (historical, social, cultural, political).



- (a) In the space below, create **three** annotated rapid concept sketches. Each sketch must address **one** of the design issues described on page 34. (12 marks)

Concept sketch one: use an alternate fastening on the centre front

Concept sketch two: secure the hood more firmly

Concept sketch three: design inspiration to appeal to a specific target market

Question 21 (continued)

- (b) Justify **one** of your design concepts from part (a) using **six** design fundamentals. (6 marks)

- (c) Identify **two** characteristics of the morphology of the cotton fibre used for the lining fabric of the raincoat. (2 marks)

One: _____

Two: _____

- (d) Describe **one** embellishment technique that could be used to enhance the aesthetics of the raincoat. (2 marks)

This page has been left blank intentionally

See next page

Question 22

(12 marks)

The image below is a dress which has two separate parts that are joined together with a striped waistband. The bodice and skirt are made with 100% rayon jersey knit fabric, and the waistband is a cotton/polyester blend knit fabric.



Rayon is a regenerated fibre.

- (a) Define what is meant by the term 'regenerated fibre'. (1 mark)

Cotton/polyester is a blended fibre.

- (b) Identify **one** method used to blend fibres and state **two** advantages of using a blended fibre. (3 marks)

Method: _____

One: _____

Two: _____

The rayon fabric was knitted with yarn.

- (c) (i) Name **two** types of yarn structure. (2 marks)

One: _____

Two: _____

- (ii) Identify the **most** important factor in determining the properties of yarns and state how it impacts the yarn. (2 marks)

- (d) Describe why the designer would choose to make the dress with rayon jersey knit fabric by identifying **two** properties in your response. (2 marks)

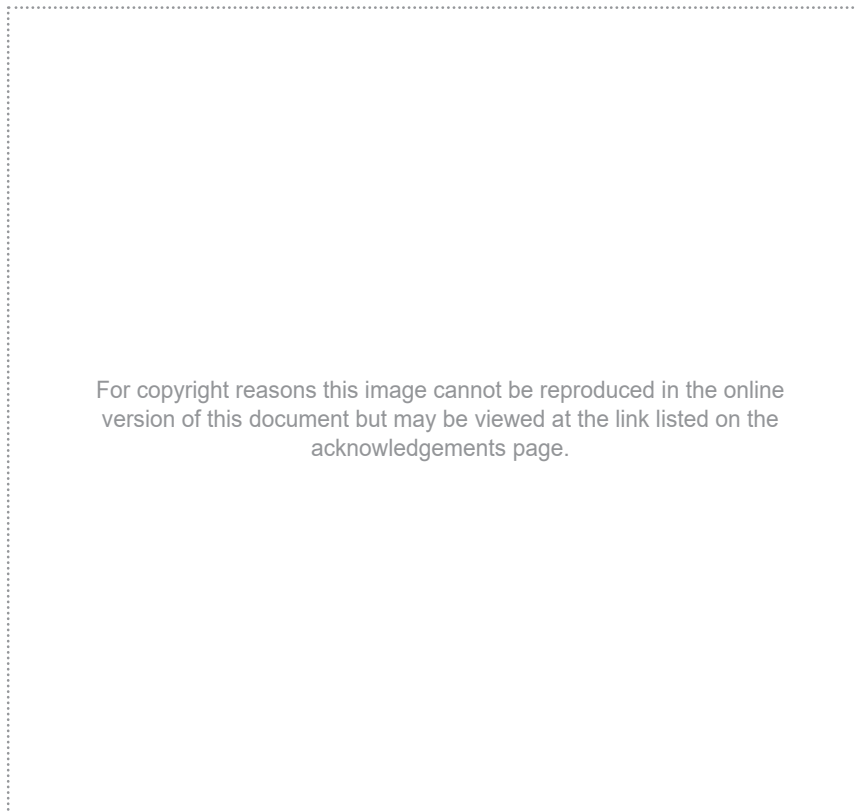
A finish is applied to enhance the fabric of the dress.

- (e) Name and outline **one** finish that would be suitable. (2 marks)

Question 23

(10 marks)

The image below is a 1965 Mondrian dress.



Materials list		
Materials	Width cm	Length required
Wool red	120	60 cm
Wool yellow	120	30 cm
Wool blue	120	40 cm
Polyester black	115	30 cm
Polyester white	115	1.90 m
Acetate lining	120	2.20 m
Interfacing	90	60 cm
Nylon zip	-	55 cm
Thread	-	4 cones

Materials price list	
Wool fabric	\$25.60 per metre
Polyester fabric	\$10.75 per metre
Acetate lining	\$8.99 per metre
Interfacing	\$2.85 per metre
55 cm nylon zip	\$5.25 each
Thread cones	\$3.40 each

Using the image, materials list and materials price list, complete the costing table for making the 1965 Mondrian dress. Round costs to the nearest cent.

Costing			
Materials	Quantity	Cost per unit	Cost
Wool fabric		\$25.60	
Polyester fabric		\$10.75	
Acetate lining		\$ 8.99	
Interfacing	60 cm	\$ 2.85	
55 cm nylon zip	1	\$ 5.25	
Thread cones	4	\$ 3.40	
Total			

Question 24

(14 marks)

The image below is board shorts designed in Western Australia and manufactured offshore from materials sourced overseas.

	<p>Origin: designed and sold in Western Australia. Manufactured in China in ethical factories. Fabric: polyester made in Italy from recycled PET plastic bottles. Garment features: durable, 4-way stretch, quick-drying, colourfast, elastic waistband. Packaging: in-store, markets and click and collect, recycled paper bag; online - plastic post bag for local and international orders. Marketing: online, in-store, local markets.</p>
---	--

- (a) Define the term 'globalisation'. (2 marks)

- (b) Review the specifications of the above board shorts and outline **three** impacts of globalisation affecting their production. (6 marks)

One: _____

Two: _____

Three: _____

ACKNOWLEDGEMENTS

- Question 8** First image adapted from: [...] [Graphic]. (n.d.). Retrieved May, 2021, from https://rmwebed.com.au/web_resources/Sch_Courses/11ITT/11ww_mainfiles/timber_conversion.html
Second image adapted from: [...] [Graphic]. (n.d.). Retrieved May, 2021, from https://rmwebed.com.au/web_resources/Sch_Courses/11ITT/11ww_mainfiles/timber_conversion.html
Third image adapted from: [...] [Graphic]. (n.d.). Retrieved May, 2021, from https://rmwebed.com.au/web_resources/Sch_Courses/11ITT/11ww_mainfiles/timber_conversion.html
- Question 10** Museum of Applied Arts & Sciences. (1985). '*Red and blue chair*' by *Gerrit Rietveld and Cassina* [Photograph]. Retrieved May, 2021, from <https://collection.maas.museum/object/36783>
- Question 12** JahRoc Galleries. (n.d.). *Silhouette chaise lounge* [Photograph]. Retrieved May, 2021, <https://www.jahroc.com.au/wp-content/uploads/2014/10/Silhouette-Chaise-jarrah-black-back.jpg>
- Questions 13, 19 & 25** Left image adapted from: [Photograph showing fuse workers inside the Fuse Factory, Woolwich Arsenal]. (c. late 1800's). Retrieved May, 2021, from https://commons.wikimedia.org/wiki/File:Workers_in_the_fuse_factory_Woolwich_Arsenal_Flickr_4615367952_d40a18ec24_o.jpg
Right image from: Vieira, A. M. (2017). *Harold Kleber Paulinia* [Photograph of factory worker wearing personal protective equipment]. Retrieved May, 2021, from https://commons.wikimedia.org/wiki/File:Harold_Kleber_Paulinia.jpg
Used under Creative Commons Attribution-Share Alike 4.0 International licence.
- Question 14** First image adapted from: Sarang. (2019). [...] [Photograph]. Retrieved May, 2021, from [https://upload.wikimedia.org/wikipedia/commons/thumb/5/56/\[...\]_notches.jpg/640px-\[...\]_notches.jpg](https://upload.wikimedia.org/wikipedia/commons/thumb/5/56/[...]_notches.jpg/640px-[...]_notches.jpg)
Second image from: OpenClipart-Vectors. (2017). [Graphic of [...]]. Retrieved May, 2021, from [https://pixabay.com/vectors/b\[\]w-2024571/](https://pixabay.com/vectors/b[]w-2024571/)
Third image adapted from: Xianfei. (2019). [Photograph of a [...]]. Retrieved May, 2021, from <https://pixabay.com/photos/screw-tools-hardware-metal-4564924/>
- Question 15** Lutsenko, B. (n.d.). [Photograph of black metal shoe rack with pair of boots]. Retrieved May, 2021, from https://i.etsystatic.com/25385324/r/il/9b34bd/2839617082/il_794xN.2839617082_6e2o.jpg
- Question 16** Adapted from: [Photograph of metal handle screwdriver]. (n.d.). Retrieved May, 2021, from https://us.amazon.com/dp/B07TMNW8TJ/ref=psdc_553336_t3_B01LOV12SM

- Question 18** Savage Design. (n.d.). [Photograph of platform 2 coffee table from top, nothing on table]. Retrieved May, 2021, from <https://396436.smushcdn.com/2323793/wp-content/uploads/2017/08/Platform2-Hero-LR-scaled.jpg?lossy=1&strip=1&webp=1>
- Question 20(a)** Fabric structure first image from: Jauncourt. (2007). [Graphic of ... fabric structure]. Retrieved May, 2021, from <https://commons.wikimedia.org/wiki/File:Tabby1a.png>
Used under a Creative Commons Attribution-Share Alike 3.0 Unported licence.
- Fabric structure second image from: Blahedo. (2005). [...] -schematic [Graphic]. Retrieved May, 2021, from [https://commons.wikimedia.org/wiki/File:\[...\]png](https://commons.wikimedia.org/wiki/File:[...]png)
Used under a Creative Commons Attribution-Share Alike 3.0 Unported licence.
- Fabric structure third image from: Elkagye. (2012). *Struto fabric* [Photograph of [...] fabric structure]. Retrieved May, 2021, from https://commons.wikimedia.org/wiki/File:Struto_fabric.jpg
Used under a Creative Commons Attribution-Share Alike 3.0 Unported licence.
- Question 21** [Photograph of a yellow hooded raincoat]. (n.d.). Retrieved May, 2021, from <https://www.amazon.com/Costume-Party-Heart-Raincoat-Wterproof/dp/B0814K5BSR> (first image)
- Question 22** Peloponnesian Folklore Foundation. (1960). *1960s Mary Quant minidress, green, purple and white jersey* [Photograph]. Retrieved May, 2021, from https://commons.wikimedia.org/wiki/File:1960s_Mary_Quant_minidress,_green,_purple_and_white_jersey.jpg
Used under a Creative Commons Attribution-ShareAlike 4.0 International licence.
- Question 23** Guirkinger, A. (2017). Hommage to Piet Mondrian, Yves Saint Laurent (French, 1936–2008), cocktail dress. Fall-winter 1965 haute couture collection [Photograph]. Retrieved May, 2021, from <https://www.vmfa.museum/exhibitions/exhibitions/yves-saint-laurent-perfection-style/yvessaintlaurent-1980x1080/>
- Question 24** South Beach Boardies. (n.d.). [Photograph of board shorts with hooray for fish! print]. Retrieved May, 2021, from <https://southbeachboardies.com/collections/kids-long-boardies/products/kids-long-boardies-hooray-for-fish>

This document – apart from any third party copyright material contained in it – may be freely copied, or communicated on an intranet, for non-commercial purposes in educational institutions, provided that it is not changed and that the School Curriculum and Standards Authority is acknowledged as the copyright owner, and that the Authority's moral rights are not infringed.

Copying or communication for any other purpose can be done only within the terms of the *Copyright Act 1968* or with prior written permission of the School Curriculum and Standards Authority. Copying or communication of any third party copyright material can be done only within the terms of the *Copyright Act 1968* or with permission of the copyright owners.

Any content in this document that has been derived from the Australian Curriculum may be used under the terms of the Creative Commons [Attribution 4.0 International \(CC BY\)](https://creativecommons.org/licenses/by/4.0/) licence.

An *Acknowledgements variation* document is available on the Authority website.