MATERIALS
DESIGN AND
TECHNOLOGY
Section Three

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: non-programmable calculators approved for use in this examination

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

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<thead>
<tr>
<th>Section</th>
<th>Number of questions available</th>
<th>Number of questions to be answered</th>
<th>Suggested working time (minutes)</th>
<th>Marks available</th>
<th>Percentage of written examination</th>
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<tr>
<td>Short answer</td>
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<td>Section Two</td>
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<td>Extended answer</td>
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<td>4</td>
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<tr>
<td>Candidates to choose one of the following contexts:</td>
<td>6</td>
<td>6</td>
<td>90</td>
<td>69</td>
<td>60</td>
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<tr>
<td>Wood</td>
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<tr>
<td>Metal</td>
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<td>Textiles</td>
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</table>

Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2019*. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer booklet.

3. Answer the questions according to the following instructions.

   Section Three: Answer all of the questions within your context: Wood, Metal or Textiles.

4. 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.

5. 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  

You are required to choose one of the following options, according to the context you have studied in 2019.

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

<table>
<thead>
<tr>
<th>Context</th>
<th>Question</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>8–13</td>
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</tr>
<tr>
<td>Metal</td>
<td>14–19</td>
<td>15–24</td>
</tr>
<tr>
<td>Textiles</td>
<td>20–25</td>
<td>25–35</td>
</tr>
</tbody>
</table>

Now turn to the relevant pages and answer the questions for the context you have studied.
This page has been left blank intentionally
Section Three: Wood context

This section contains six questions. Answer all questions.

Suggested working time: 90 minutes.

Question 8 (10 marks)

(a) Identify an innovative timber and list three advantages and three disadvantages of using this material over solid timber. (7 marks)

Innovative timber: ____________________________________________________________

Advantages: ________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Disadvantages: _____________________________________________________________

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(b) With reference to the material identified above, explain the influence this material has had in relation to product design. (3 marks)

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Question 9 (15 marks)

With reference to the characteristics of hardwoods and softwoods, answer the following questions.

(a) Using the diagram below, label the parts in the cross-section of the tree. Two have been completed for you.

(6 marks)

(b) Identify four differences in cellular structure between softwoods and hardwoods.

(4 marks)
(c) Describe one method of seasoning timber.  

(2 marks)

(d) List three consequences of using timber that has not been seasoned appropriately to the correct moisture content.  

(3 marks)
Question 10 (18 marks)

Below is an image and a set of plans for an indoor dining table.
### Material cutting list

<table>
<thead>
<tr>
<th>Part name</th>
<th>Material (mm)</th>
<th>Number required</th>
<th>Total length required (m)</th>
<th>Price per metre</th>
<th>Cost of part(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Stretcher</td>
<td>200 x 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Leg</td>
<td>90 x 90</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Short rail</td>
<td>125 x 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Leg base</td>
<td>125 x 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Foot</td>
<td>125 x 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Top</td>
<td>250 x 38</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Dowel</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(a) Using the plans on page 8 and the information above, complete the cutting list below and calculate the cost of the materials required to manufacture the dining table. Round the costs to the nearest cent. (7 marks)

(b) Other than materials, identify three considerations to be taken into account in costing this product for a client. (3 marks)
Question 10 (continued)

(c) During the production of the dining table, the manufacturer created a number of jigs and templates to help cut some of the shapes and to drill holes.

Identify two advantages that the manufacturer would gain by using the jigs and templates. (2 marks)

One: __________________________________________________________________________

_______________________________________________________________________________

Two: __________________________________________________________________________

_______________________________________________________________________________

(d) In the space below, sketch and annotate a jig or template that could be used to assist in the manufacture of the dining table. (6 marks)
When routing timber, there are many variables to consider and the ability to identify and solve problems is an important skill. In the table below, identify the causes of the possible problems and state the appropriate solutions.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause of problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burning timber</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Router running along uncontrolled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inconsistent cutting depth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood splintering/tearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Router will not start</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In recent years, there has been a movement toward the establishment of small-scale local design and production companies catering for individual needs.

(a) Define the term ‘niche market’. (2 marks)

(b) With reference to the statement above, explore how small-scale local industries have adapted to ensure success in the global market. (4 marks)
From the 1920s to the 1980s, the rapid deforestation of jarrah had huge environmental and social effects in Western Australia. In 2001, laws were changed to end logging in old-growth forests that heavily restricted the amount of jarrah that could be harvested.

Considering this statement, outline five environmental and five social impacts this change in law has had on our local society.
Question 13 (continued)

End of questions: Wood
Section Three: Metal context

This section contains six questions. Answer all questions.

Suggested working time: 90 minutes.

Question 14 (10 marks)

(a) Identify a new or emerging metal and list three advantages and three disadvantages of using this material over traditional materials. (7 marks)

New or emerging metal: ____________________________

Advantages: ____________________________________

_____________________________________________________________________

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_____________________________________________________________________

Disadvantages: ____________________________

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(b) With reference to the material identified above, explain the influence this material has had in relation to product design. (3 marks)

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See next page
Traditional Japanese bladed swords were made through a labour-intensive forging process. Each blade was made up of layers of carbon steel and then heat-treated prior to use.

(a) On the basis of their properties, provide a reason for the use of each of the three different types of steel in the production of the Japanese blade. (3 marks)

(b) The tsuba (hand guard) is made from a non-ferrous alloy. Identify a possible metal from which it could be made. (1 mark)

(c) Identify three advantages of using an alloy. (3 marks)
(d) Identify **four** differences between the characteristics of ferrous and non-ferrous metals.  

(4 marks)

- __________
- __________
- __________
- __________

(e) The blade was heat-treated to change the properties of the steel. For **two** of the heat treatment methods listed below, state the property change that is involved and how each process could be achieved in the school workshop. Use correct workshop terminology.  

(4 marks)

- Hardening
- Tempering
- Annealing
- Normalising

- __________
- __________
- __________
- __________
- __________
Question 16

Below is an image and a set of plans for an indoor dining table.
a) Using the plans on page 18 and the information above, complete the cutting list below and calculate the cost of the materials required to manufacture the dining table (wood top not included). Round the costs to the nearest cent.

(b) Other than materials, identify three considerations to be taken into account in costing this product for a client.

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(b) Other than materials, identify three considerations to be taken into account in costing this product for a client.
Question 16 (continued)

(c) During the production of the dining table, the manufacturer created a number of jigs and templates to help align the parts prior to welding.

Identify **two** advantages that the manufacturer would gain by using the jigs and templates. (2 marks)

One: ____________________________________________________________

Two: ____________________________________________________________

(d) In the space below, sketch and annotate a jig or template that could be used to assist in the manufacture of the dining table. (6 marks)
Metal Inert Gas (MIG) welding is a welding process that joins metal together.

**MIG welder**

Quality MIG welds are the result of not only good welding technique but also the ability to identify and solve problems if they occur. In the table below, identify the causes of the possible problems and state the appropriate solutions.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause of problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>No electrical arc (spark) during welding operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Porosity of weld (small pinholes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workpiece is distorting (warping) after welding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of penetration – shallow fusion between weld metal and workpiece</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrode (wire) is not coming out of handpiece</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Question 18 (6 marks)

In recent years, there has been a movement toward the establishment of small-scale local design and production companies catering for individual needs.

(a) Define the term 'niche market'. (2 marks)

(b) With reference to the statement above, explore how small-scale local industries have adapted to ensure success in the global market. (4 marks)
Western Australia is the largest iron ore producer and exporter in the world, accounting for 38% of global production. Much of the demand for Western Australian iron ore comes from China but this demand has declined recently.

Considering this statement, outline **five** environmental and **five** social impacts of iron ore production on the local mining industry and community.

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End of questions: Metal

See next page
Section Three: Textiles context 60% (69 Marks)

This section contains six questions. Answer all questions.

Suggested working time: 90 minutes.

Question 20 (10 marks)

(a) Identify a knit fabric and list three advantages and three disadvantages of using this material over a woven fabric. (7 marks)

Knit fabric: ____________________________________________

Advantages: ____________________________________________

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Disadvantages: ____________________________________________

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(b) With reference to the knit fabric identified above, explain the influence this material has had in relation to product design. (3 marks)

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Question 21 (15 marks)

(a) Referring to a fibre, describe how its longitudinal shape affects its properties. (2 marks)

(b) List three predominantly crystalline fibres. (3 marks)

(c) With reference to their properties, distinguish the differences between the polymer structures of amorphous and crystalline fibres. (4 marks)
(d) Identify **three** advantages of using a fibre blend. (3 marks)

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(e) Select a type of yarn and outline why a designer would choose that yarn. (3 marks)

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Below are images and pattern pieces for a size 8 skirt. This skirt is lined with acetate fabric and has a side zipper with top hook and eye. Its waistband is interfaced and folded for strength and decorated with a lace trim.
Materials | Price per metre
---|---
Cotton plain weave 150 cm wide | $4.95/m
Patterned cotton sateen weave 150 cm wide | $14.95/m
Interfacing – medium weight woven 112 cm wide | $9.99/m
Acetate lining 115 cm | $4.99/m
Lace trim | $7.50/m

| Materials | Cost |
---|---|
Zipper | $1.99 |
Hook and eye packet size 1 | $3.50 |

**Cutting Instructions**

| Piece A | Piece B | Piece C |
---|---|---|
**FRONT AND BACK** | SIDE | **WAISTBAND** |
CUT 2 ON FOLD | CUT 4 | CUT 1 ON FOLD |
CUT 2 ON FOLD LINING | CUT 4 LINING | CUT 1 ON FOLD INTERFACING |

(a) Using the pattern on page 28 and the information above, complete the materials list below and calculate the cost of the materials required to produce the skirt. Round the costs to the nearest cent. (7 marks)

| Item | Quantity | Price per metre | Cost |
---|---|---|---|
Cotton plain weave | | | |
Cotton sateen weave | | | |
Interfacing | | | |
Lining | | | |
Zipper | | | |
Hooks and eyes | | | |
Lace trim | | | |
Question 22 (continued)

(b) Other than materials, identify three considerations to be taken into account in costing this product for a client.  
(3 marks)

(c) Identify two processes or items of equipment that a manufacturer could use to improve accuracy when marking or cutting out a pattern.  
(2 marks)

One: 

Two: 
(d) In the space below, sketch and annotate a pattern layout the manufacturer could use to minimise waste when cutting out the lining pattern pieces A and B. (6 marks)
Question 23

An overlocker is a piece of equipment that can be used in a variety of ways throughout the production of a textiles item.

Quality overlocking is the result of not only good technique, but also the ability to identify and solve problems if they occur. In the table below, identify the causes of the possible problems and state the appropriate solutions.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause of problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabric rolling under</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loose looper threads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thread not on the edge of the material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stitching gathering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fabric cutting caught in stitching</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Question 24  (6 marks)

In recent years, there has been a movement toward the establishment of small-scale local design and production companies catering for individual needs.

(a) Define the term 'niche market'.  

(b) With reference to the statement above, explore how small-scale local industries have adapted to ensure success in the global market.
Question 25

(10 marks)

Australia exports fibres such as wool and cotton to satisfy global demand. These fibres are then processed in other countries.

Considering this statement, outline five environmental and five social impacts of textile production on the local industry and community.

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End of questions: Textiles
Supplementary page

Question number: _______________
ACKNOWLEDGEMENTS

Question 9

Question 11

Question 15

Question 17

Question 19

Question 22

Question 23

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