

CAMBRIDGE  
NATIONAL

LEVEL 1/LEVEL 2

# ENGINEERING DESIGN

J822

Chris Walker

# EXAM PRACTICE WORKBOOK

# Contents

<b>Introduction</b>	<b>4</b>
<b>TA1 Designing processes</b>	<b>5</b>
<b>1.1 The stages involved in design strategies</b>	<b>5</b>
Recall activities	5
Short-answer exam-style practice questions	6
<b>1.2 Stages of the iterative design process</b>	<b>8</b>
Recall activities	8
Short-answer exam-style practice questions	11
<b>Long-answer exam-style practice questions for TA1</b>	<b>13</b>
<b>TA2 Design requirements</b>	<b>17</b>
<b>2.1 Types of criteria included in an engineering design specification</b>	<b>17</b>
Recall activities	17
Short-answer exam-style practice questions	19
<b>2.2 How manufacturing considerations affect design</b>	<b>21</b>
Recall activities	21
Short-answer exam-style practice questions	24
<b>2.3 Influences on engineering product design</b>	<b>27</b>
Recall activities	27
Short-answer exam-style practice questions	29
<b>Long-answer exam-style practice questions for TA2</b>	<b>33</b>
<b>TA3 Communicating design outcomes</b>	<b>37</b>
<b>3.1 Types of drawing used in engineering</b>	<b>37</b>
Recall activities	37
Short-answer exam-style practice questions	39
<b>3.2 Working drawings</b>	<b>42</b>
Recall activities	42
Short-answer exam-style practice questions	46
<b>3.3 Using CAD drawing software</b>	<b>49</b>
Recall activities	49
Short-answer exam-style practice questions	50
<b>Long-answer exam-style practice questions for TA3</b>	<b>52</b>
<b>TA4 Evaluating design ideas</b>	<b>55</b>
<b>4.1 Methods of evaluating design ideas</b>	<b>55</b>
Recall activities	55
Short-answer exam-style practice questions	57
<b>4.2 Modelling methods</b>	<b>58</b>
Recall activities	58
Short-answer exam-style practice questions	61
<b>4.3 Methods of evaluating a design outcome</b>	<b>63</b>
Recall activities	63
Short-answer exam-style practice questions	65
<b>Long-answer exam-style practice questions for TA4</b>	<b>67</b>

# Introduction

This workbook will help you to prepare to tackle exam questions for your Cambridge National in Engineering Design (J822) exam: Unit R038 Engineering Design concepts.

The exam lasts for 1 hour and 15 minutes and is worth 70 marks. The exam has two sections:

- **Section A** is worth 10 marks and includes 10 multiple-choice questions.
- **Section B** is worth 60 marks and includes short- and medium-answer questions, as well as extended-response analysis and evaluation questions that are based around a short scenario.

You will be tested on the following topic areas:

- Topic Area 1: Designing processes
- Topic Area 2: Design requirements
- Topic Area 3: Communicating design outcomes
- Topic Area 4: Evaluating design ideas

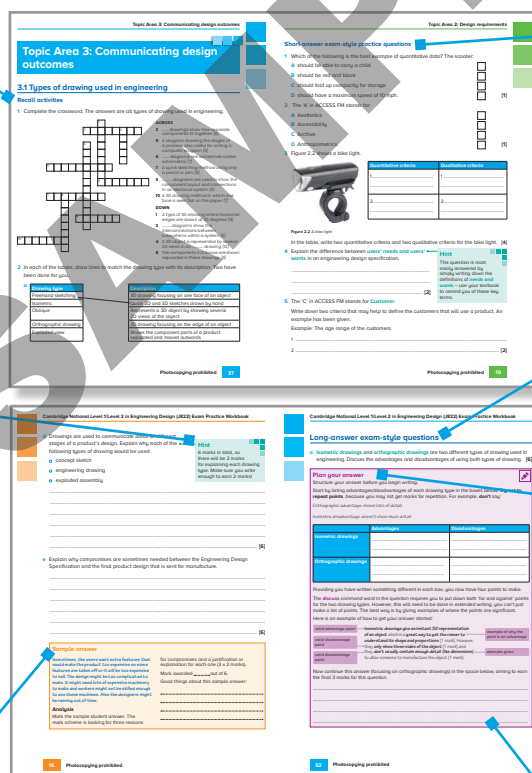
Questions may focus on one topic area or might require answers that combine information from two or more topic areas.

## Features to help you succeed

Each topic area starts with **recall activities** that will help you to remember important information you will need when answering exam questions. These activities include crosswords, word search puzzles, matching exercises, definitions, drawings, and filling in missing words in tables, sentences or diagrams.

Some short-answer and long-answer questions include **hints** next to them to give you extra advice on how to approach the question. They may suggest key points to consider when answering the question, explain what important words included in the question mean, or give guidance on common mistakes candidates make when answering these types of questions.

**Example student answers** or extracts from student answers are provided for some questions. These will help you understand how to gain the most marks and may ask you to think about the strengths and weaknesses of the answer and how it could be improved.



**Short-answer exam-style practice questions** help you to practise answering multiple-choice and short-answer exam questions that are typically worth 1–4 marks.

**Long-answer exam-style practice questions** will help you to practise answering extended-response questions typically worth 6–8 marks. These questions will usually include a context or scenario.

Some questions will also include a series of stages or activities to support you as you answer the question. They may identify and explain key words for you, have headings, bullet points or mind maps for you to complete to help you to plan and structure your answer or include partially completed answers.

All questions will have **spaces for you to write or plan your answers**.

**Answers** to all the questions are available online at [www.hoddereducation.co.uk/cambridgenationals-2022/answers](http://www.hoddereducation.co.uk/cambridgenationals-2022/answers)

## Short-answer exam-style practice questions

1 Which of the following is the best example of quantitative data? The scooter:

- A should be able to carry a child
- B should be red and black
- C should fold up compactly for storage
- D should have a maximum speed of 10 mph.

☐  
☐  
☐  
☐

[1]

2 The 'A' in ACCESS FM stands for:

- A Accessibility
- B Aesthetics
- C Anthropometrics
- D Archive.

☐  
☐  
☐  
☐

[1]

3 Figure 2.2 shows a bike light.



Quantitative criteria	Qualitative criteria
1..... .....	1..... .....
2..... .....	2..... .....

Figure 2.2 A bike light

In the table, write two quantitative criteria and two qualitative criteria for the bike light. [4]

4 Explain the difference between **users' needs** and **users' wants** in an engineering design specification.

.....

.....

..... [2]

### Hint

This question is most easily answered by simply writing down the definitions of **needs** and **wants** – use your textbook to remind you of these key terms.

5 The 'C' in ACCESS FM stands for **Customer**.

Write down two criteria that may help to define the customers that will use a product. An example has been given.

Example: The age range of the customers.

1 .....

2 ..... [2]



6 a Describe what is meant by the **aesthetics** of a product.

.....

.....

b State two aspects of a design which could affect the aesthetics.

1 .....

2 ..... [4]

7 Write down three ways in which an electric kettle can be designed with safety in mind.

1 .....

2 .....

3 ..... [3]

### Sample answer

1 The kettle can be made so it can't burn the user.

2 It can be designed so it doesn't easily tip over when full.

3 It must not be possible to get electrocuted if you pick it up with wet hands.

### Analysis

To gain a mark, the point must be clear, and relate to kettle safety.

Is it clear in the sample answer how an accident might occur? Write your explanations in the table below:

Point 1	.....
	.....
	.....
Point 2	.....
	.....
	.....
Point 3	.....
	.....
	.....

Would you give a mark for every point the student made? Justify your answers.

.....

.....

### 3.3 Using CAD drawing software

#### Recall activities

- 1 Write down what the letters CAD stand for.

C.....

A.....

D.....

- 2 The list of advantages and disadvantages of using CAD drawing software can be broadly grouped into five categories. Unscramble the anagrams below to list the five categories. The first letter of each solution is given to help you, and the first word has been done for you.

Anagram	scot	emit	anti grin	c cases	lay quit
Solution	c o s t	t _ _ _	t _ _ _ _ _ _	a _ _ _ _ _	q _ _ _ _ _

- 3 Five advantages of using CAD drawing software are listed below.

- a Identify which of the five categories from question 2 each advantage belongs to and write them in the table. One has been done for you.
- b Write one further advantage from each category.

Advantage	Category	Further advantage
CAD software is competitively priced.	Cost	..... .....
CAD drawings can be saved in the cloud and opened anywhere in the world.		..... .....
CAD drawings can be quickly edited.		..... .....
CAD tutorials are free to access online.		..... .....
CAD drawings are precise and repeatable.		..... .....

- 4 Write down three disadvantages of using CAD drawing software.

1 .....

2 .....

3 .....

b Describe ways that **virtual testing** can assist the development of a drone.

[6]

### Plan your answer



Now is the time to refresh your knowledge about virtual models and virtual testing before you go any further!

Always plan how to get the marks, never start writing just hoping that you can write enough to get all the marks.

In the question, highlight the command words **describe ways**. For 6 marks, you could describe three virtual tests that would apply to a drone, and aim to get 2 marks for each one.

In order to get 2 marks per test:

- 1 Describe what is being tested.
- 2 Explain why the test is relevant to a drone (you could describe why the test is needed, or what information can be obtained from the test).

What virtual tests would be useful for a drone? Complete the table below – the first test has been described for you.

	1st mark – what is being tested?	2nd mark – why is it relevant to a drone?
Test 1	The weight of the drone could be calculated by the CAD software.	The weight is important because it directly affects how the drone will fly and allows the designer to choose the best motors and propellers to ensure the best amount of lift.
Test 2	..... ..... .....	..... ..... .....
Test 3	..... ..... .....	..... ..... .....

Now that you have completed these activities, write your final answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

### Hint

Before writing your final answer in extended writing, read the question one more time to make sure that you are still doing what the question actually says.