



Saint Benedict
Catholic Voluntary Academy

2026

BE
PREPARED

Product
Design



St Ralph
Sherwin
Catholic Multi Academy Trust

Information needed to help you start the course.

- Complete the sections on engineering manufacturing and engineering design. This will help with some key terminology, especially if you have not taken either of these courses at Year 11.
- If you have taken one of them you will still need to refresh your learning on that course and ensure you go through the sections you haven't taken before.
- You must be confident in Maths and English and a Science, such as Physics.
- Skills and vocabulary needed- good communication and written skills, mathematics (but not to A Level), 2D and 3D drawing and sketching skills, materials and processes knowledge(as contained in this booklet)
- Resources-
 1. The text book for this course is - OCR AS/A Level Design & Technology by Hodder Education. ISBN 978-1-5104-0265-2. You do not need to buy this as we do have shared copies but it can be ordered from Amazon should you wish to do so
 2. Knowledge Organisers for Engineering Manufacture and Engineering Design at KS4 are to be found on the Saint Benedict's Website. The information found in both of these can help with completing the tasks set out in this booklet.

Manufacturing Processes

Types of Manufacturing Processes.

Write down the definition of each of these and give examples of each:

Wasting

Shaping

Forming

Additive Processes

Joining

Finishing

Manufacturing Processes

Details of Different Manufacturing Processes.

Wasting Processes

What is the difference between Turning and Milling?

What wasting process uses a lathe?

Which process uses rotary cutters?

The process of cutting holes into a solid material using a rotating tool is called?

What materials can be cut on a laser cutter?

What two types of tools are used to cut threads?

Manufacturing Processes

Shaping Processes

What is casting? List some of the different type of casting

What is the difference between sand casting and die casting?

Which one is more accurate?

Manufacturing Processes

Shaping Processes – Polymer shaping processes

What is injection moulding?

What is line bending?

What is Vacuum forming?

What is blow moulding

What is compression moulding

What materials are typically used in these processes?

What is powder metallurgy and how does injection moulding differ from powder metallurgy?

Manufacturing Processes

Details of Different Manufacturing Processes.

Forming Processes

What is forging? Write a description of the process

How does forging differ from casting?

What is press forming and how does it differ from forging?

Describe how strip heating and vacuum forming differ from each other.
What types of material are used in strip heating and vacuum forming?

Describe moulding of composite materials

Manufacturing Processes

Details of Different Manufacturing Processes.

Additive Manufacturing

What is additive manufacturing?

Name a type of additive manufacturing

Why is Additive Manufacturing less wasteful than Wasting processes?

What is a disadvantage of Additive Manufacture?

Manufacturing Processes

Details of Different Manufacturing Processes. Joining Processes

Joining using heat-

Describe: Soldering, Brazing and Welding, which is the strongest of these 3 joining methods

Joining without using heat-

Describe the two methods of riveting. Give an application of each type

What are the 3 types of mechanical fastening?

Are these permanent or temporary types of fastening?

What are the advantages and disadvantages of both permanent and temporary fastenings?

Manufacturing Processes

Details of Different Manufacturing Processes.

Joining Processes

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Manufacturing Processes

Details of Different Manufacturing Processes.

Finishing Processes

What are the two main ways of applying a paint finish?

Describe the powder coating process

Give 2 advantages of paint over powder coating

Give 2 advantages of powder coating over painting

Engineering Materials

Polymers:

What is a definition of polymers?

What are the two main groups of polymers (plastics)?

What are the differences between these two main groups?

Give examples of types of polymers for each of these groups and a use for each

Give an advantage of polymers over metals

Give an advantage of metals over polymers

Engineering Materials

Metals:

What is the definition of a pure metal?

What is the difference between a Ferrous and Non-Ferrous metal? Give 4 examples of each type

Give examples of use for 6 metals.

What is the difference between a pure metal and an alloy?

Why do we alloy metals?

Give 5 examples of an alloy and a typical use for each one

Engineering Materials

Ceramics and Composites

What is a definition of a ceramic?

Give three examples of a ceramic and a possible use for each example

What is a definition of a composite?

Give three examples of a composite and a possible use for each example

What advantage do composites have over some other materials?

Engineering Materials

Mechanical Properties of Engineering Materials

Use your Knowledge Books to write a definition for each of the mechanical properties:

1. Hardness

2. Plasticity

3. Elasticity

4. Ductility

5. Conductivity/Resistivity

Engineering Materials

Mechanical Properties of Engineering Materials

Use your Knowledge Books to write a definition for each of the mechanical properties:

1. Tensile Strength

2. Compressive Strength

3. Brittleness

4. Toughness

5. Malleability

Engineering Materials

Characteristics of materials

Use your Knowledge Books to write a definition for each of the characteristics:

1. Cost – material
2. Cost – manufacture
3. Sustainability
4. Availability

Engineering Materials

Ceramics

What is a ceramic material? Write a definition

List 3 types of ceramic material and a use for each one

Smart Materials

What is a smart material? Write down a definition

List 3 types of smart material and an application for each one

Manufacturing Requirements

1. Sketch the symbols for First Angle and Third Angle Projection and label
2. How does a drawing show hidden detail?
3. What is a linear Measurement?
4. What is a definition of a radius?
5. Draw the symbol for diameter

Manufacturing Requirements

6. What is a tolerance and show an example
- 7, Show a symbol for surface finish
8. How is the word Drawing shown as an abbreviation?
9. How is Material shown as an abbreviation?
10. Sketch an example of how holes are shown on an engineering drawing

Manufacturing Requirements

11. What is a chamfer?

12. Sketch a knurl and a countersink and label

Manufacturing Requirements

13. Use the space below to practice two or three different sketches that show different features we have discussed.

Manufacturing Requirements

Influence of the scale of manufacture on the production method

Scales of Manufacture

1 Write a definition for each of the scales of production:

1. One Off

1. Batch

2. Mass

For each Scale of Production give some examples of products that are made.

Manufacturing Requirements

Influence of the scale of manufacture on the production method

Advantages and limitations of jigs, fixtures, templates and moulds

Write a definition for each of these:

1. Jigs
2. Fixtures
3. Templates
4. Moulds

Advantages and limitations of jigs, fixtures, templates and moulds

Explain how a fixture differs from a jig.

Manufacturing Requirements

Influence of the scale of manufacture on the production method

Level of automation

1. What is automation?
2. How does automation differ from manual control?
3. Give advantages of automation over manual control
4. What is a definition of CAM?

Manufacturing Requirements

Influence of the scale of manufacture on the production method

Level of automation

1. Give 5 examples of CAM processes
2. What is fully automated robotic control?
3. List 5 types of robot
4. What advantages and disadvantages does robotic control have in engineering. List your reasons.

Manufacturing Requirements

Influence of the scale of manufacture on the production method

Level of automation

- **Advantages and limitations of using CAM machines to manufacture parts**
- What is CAM? Write a definition
- List as many advantages and limitations of CAM machines as you can find. Add any more that you may think of.

Manufacturing Requirements and Developments in Engineering Manufacture

Quality

Reasons for implementing a quality system in engineering

What is meant by Quality Systems?

List reasons for implementing a quality system

What is the difference between Quality Assurance and Quality Control.
Give a definition of each and how they are used differently

Inventory management

What is inventory? Write a definition

What is Just in Time (JIT)? Why is it cost effective?

What is Material Requirements Planning (MRP) ?

Developments in Engineering Manufacture

Lean Manufacturing

What does Lean Manufacturing enable businesses to do?

What are the 7 categories of waste? Listed for Lean Manufacturing?

Why would reducing any, some or all of these help to improve the performance of manufacturing?

Globalisation

What is Globalisation? Write a definition

What are International Standards and why are they used?

What is Sustainability and what are it's implications?

Discuss the advantages and disadvantages of Globalisation

Designing Processes

Design Strategies

Describe and give advantages and limitations for each of these:

Linear design

Iterative design

User-centred design

Sustainable design

Ergonomic Design

Designing Processes

Iterative design

Draw a diagram to show how iterative design is used to generate progressively better solutions.

Designing Processes

Research techniques

At what points in a design process is research done?

What is the difference between primary and secondary research?

What is the difference between quantitative and qualitative data?

List three ways in which you can conduct primary research.

List three sources for secondary research.

Designing Processes

Ergonomics and Anthropometrics

What is ergonomic design?

Do we design for the average user? Justify your answer.

Give an example of how anthropometric data can be used to create ergonomic designs?

Designing Processes

ACCESS FM

Complete this table:

	Issue (s)	Explain
A		
C		
C		
E		
S		
S		
F		
M		

Designing Processes

Generating Design Ideas

What do sketching and modelling have in common when creating design ideas?

What are the advantages and disadvantages of sketching initial design ideas?

What are the advantages and disadvantages of modelling initial design ideas?

Designing Processes

Evaluating Completed Design Ideas

What is a physical model?

What are the advantages and limitations of a physical model?

What is a virtual model?

What are the advantages and limitations of a virtual model?

Design Requirements

Material availability and form

List some materials that come in *powder* form:

List some materials that come in *rod / dowel* form:

List some materials that come in *sheet* form:

List some materials that come in *tube* form:

List one material that come in *ingot* form:

List one material that come in *filament* form:

List one material that come in *pellet* form:

Design Requirements

Market Pull and Technological Push

What is the difference between market pull and technological push?

Name three products (or parts of products) that were designed because of technological push.

Name three products (or parts of products) that were designed because of market pull.

Design Requirements

British and International Standards

What does the 'CE' standard mark mean? Who awards it

What does the 'UKCA' standard mark mean? Who awards it?

What does the British Standards Kitemark mean? Who awards it?

Draw the three marks mentioned above:

Design Requirements

Legislation for Health & Safety

What are the implications of the *Health and Safety at Work etc Act*?

What are the implications of the *The Management of Health and Safety at Work Regulations*?

What is COSHH and what does it mean to employers?

What is RIDDOR and what does it mean to employers?

Design Requirements

Risk Assessment

Bart is planning to employ someone to help them make batches of garden furniture. The employee will need to use a bandsaw and a table circular saw.

Explain how Bary must use a risk assessment to ensure that the employee is as safe as possible:

Design Requirements

Sustainability

What is a circular economy (in the context of sustainability)?

Complete this table by explaining the terms listed:

	Explanation
Rethink	
Reuse	
Recycle	
Repair	
Reduce	
Refuse	

Communicating Design Outcomes

Types of drawing used in engineering

What is a freehand sketch?

Paste an example of a freehand sketch below.

What is an isometric drawing?

Paste an example of an isometric drawing below.

Communicating Design Outcomes

Types of drawing used in engineering

What is an oblique drawing?

Paste an example of an oblique drawing below.

What is a perspective drawing?

Paste an example of a perspective drawing below.

Communicating Design Outcomes

Types of drawing used in engineering

What is an assembly drawing?

Paste an example of an assembly drawing below.

What is an exploded view drawing?

Paste an example of an exploded view drawing below.

Communicating Design Outcomes

Types of drawing used in engineering

What is a sectional drawing?

Paste an example of a sectional drawing below.

What is an orthographic drawing?

Paste an example of an orthographic drawing below.

Communicating Design Outcomes

Computer Aided Design

Explain how CAD can help a designer to work more rapidly.

Explain how CAD can help a designer to communicate with their client

Explain how CAD can help a designers to work together.

Explain how CAD can help a designer to create prototypes rapidly.

Methods of Evaluating Design Ideas

Ranking Matrixes

We can see from the ranking matrix below that Design 3 is terrible value for money.

Write 5 more facts that can be seen by looking at the matrix:

	Design 1	Design 2	Design 3	Design 4
Aesthetics	5	1	5	2
Cost (Value for money)	4	5	1	3
Consumer suitability	2	1	4	2
Environment suitability	1	1	4	5
Safety	3	2	3	2
Size suitability	3	2	4	1
Functions	2	1	5	4
Material suitability	4	2	3	4
Total:	24	15	29	23

Methods of Evaluating Design Ideas

Modelling

We often model or prototype a design before it can be evaluated.

What is **virtual** modelling?

Give **advantages** and **disadvantages** of virtual modelling:

What is **card** modelling?

Give **advantages** and **disadvantages** of card modelling:

Methods of Evaluating Design Ideas

What is **breadboard** modelling?

Give **advantages** and **disadvantages** of breadboard modelling:

What is **3D Printing**?

Give **advantages** and **disadvantages** of 3D printing:

What is **block** modelling?

Give **advantages** and **disadvantages** of block modelling:

Methods of Evaluating Design Ideas

Methods of Evaluating a Design Outcome

Designers evaluate their models using different methodologies.

What is user testing?

Give advantages and limitations of user testing:

What is a “Quantitative comparison with the design specification”?

Give advantages and limitations of quantitative evaluation:

Methods of Evaluating Design Ideas

Measuring dimensions and functionality

List 3 pieces of equipment that might be used to take accurate measurements:

How might a designer measure the functionality of a food processor?

A product may not be successful even if it passes functional and dimensional evaluation. Why might that be?