About this Revision Guide & Workbook

Revise

These pages provide a recap of everything you need to know for each topic.

You should read through all the information before taking the Quick Test at the end. This will test whether you can recall the key facts.

Quick Test

1. What is iterative design?
2. What are the advantages of user-centred design?
3. When is the systems-based approach often used?

Practise

These topic-based questions appear shortly after the revision pages for each topic and will test whether you have understood the topic. If you get any of the questions wrong, make sure you read the correct answer carefully.

Review

These topic-based questions appear later in the book, allowing you to revisit the topic and test how well you have remembered the information. If you get any of the questions wrong, make sure you read the correct answer carefully.

Mix it Up

These pages feature a mix of exam-style questions for the different topics within a chapter. They will make sure you can recall the relevant information to answer a question without being told which topic it relates to.

Test Yourself on the Go

Visit our website at www.collins.co.uk/collinsGCSErevision and print off a set of flashcards. These pocket-sized cards feature questions and answers so that you can test yourself on all the key facts anytime and anywhere. You will also find lots more information about the advantages of spaced practice and how to plan for it.

Workbook

This section features even more topic-based questions as well as a practice exam paper, providing further practice opportunities for each topic to guarantee the best results.

ebook

To access the ebook revision guide visit

www.collins.co.uk/ebooks

and follow the step-by-step instructions.

Contents

Contents

Tools, Equipment and Processes

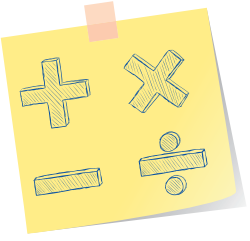
New and Emerging Technologies

Maths and Science Skills in the Exam

You must be able to:

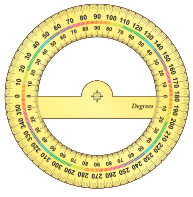
- Use maths skills and science knowledge to answer questions related to Design & Technology.

Some of the exam questions for GCSE Design & Technology will use skills and knowledge that have been learned in maths and science. The following table summarises the maths skills and science knowledge that might be needed. It also gives some examples of how the maths skills might be used in questions in the exam. There are lots of practice questions that include maths skills in the relevant sections of this book. Look for the maths skills logo:



Maths Skills

Type of Maths	Skill or Knowledge	What This Might Be Used To Do
Arithmetic and Numerical Computation	1a Recognise and use expressions in decimal and standard form	• Use decimal and standard form appropriately when using metric units and units of mass, length, time, money and other measures (for example 3.2 × 103 m). • Calculate quantities and sizes of materials. • Calculate costs of materials or energy sources. • Select materials based on their mechanical properties or calculate properties needed. • Calculate tolerances and seam allowances.
	1b Use ratios, fractions and percentages	• Understand and use ratios in the scaling of drawings. • Analyse provided tables and charts of data, such as survey responses and user questionnaires. • Calculate percentages such as profit or waste savings. • Calculate changes in the magnitude of forces when using mechanical devices. • Calculate gear ratios. • State the composition of important metal alloys. • Use percentile ranges from anthropometric or ergonomic data to make design decisions.
	1c Calculate surface areas and volumes (where dimensions are given)	• Determine quantities of materials needed, used or wasted. • Calculate the volume of cuboids, simple and composite shapes.
Handling Data	2a Presentation of data, diagrams, bar charts and histograms	• Construct frequency tables using provided data. • Interpret the meaning of data presented in frequency tables, for example to select materials or to determine user preferences from survey data. • Present information on design decisions or client survey responses. • Create tables of results and findings during prototype development.

Graphs	3a Plot, draw and interpret graphs	• Analyse graphs to extract information and interpret what this information shows. • Analyse responses to user questionnaires. • Evaluate existing products using comparative charts of performance criteria. • Plot or draw graphs from provided data (such as performance data or responses to client surveys).
	3b Translate information between graph and number forms	• Extract information from provided technical specifications or graphs. • Select materials. • Identify tolerances for use in quality control.
Geometry and Trigonometry	4a Using angular measurements in degrees	• Calculate angles and dimensions in components to support marking out. • Calculate angles in structures reinforced by triangulation. • Determine the angular movement of mechanisms. • Create tessellated patterns that use material efficiently and minimise waste of material. 
	4b Visualise and represent 2D and 3D forms, including 2D representations of 3D objects	• Presentation of design ideas. • Communication of intentions to others. • Represent the functions of mechanical devices producing different types of movement.
	4c Calculate: • areas of triangles • areas of rectangles • surface area and volumes of cubes	• Calculate the area or volume to determine quantities or sizes of materials needed.

Science Knowledge

Knowledge from science assists in presenting data appropriately and explaining the reasons for selecting and using materials (and energy sources).

Science Topic	Knowledge
Use scientific vocabulary, terminology and definitions	1a Quantities units and symbols
	1b SI units
	1c Differences between metals and non-metals based on their physical and chemical properties
Life cycle assessment and recycling	2a Basic principles in carrying out a life cycle assessment
Using materials	3a The conditions which cause corrosion and the process of corrosion and oxidation
	3b The composition of some important alloys, their properties and uses
	3c Physical properties of materials and how these are related to the use of materials
	3d Main energy sources, how they are used and the difference between renewable and non-renewable sources
	3e The action of forces and how levers and gears transmit and transform them

Design Strategies

You must be able to:

- Describe the main features of iterative design, user-centred design and a systems-based approach to design
- Explain the advantages and disadvantages of using each design strategy.

Different Design Strategies

- Design strategies are philosophies that guide how the design process takes place.
- Three of the most widely used design strategies are **iterative design**, **user-centred design** and **systems thinking**.
- Design strategies are important to avoid **design fixation**, which is when designers become overly attached to a particular idea.
- It is also important for specialists in different material areas to collaborate and share their expertise.
- Each different approach has its own advantages and disadvantages, which should be considered before they are put into practice.

Iterative Design

- Iterative design is a cyclic approach.
- Each iteration of a design is tested and evaluated. Changes and refinements are then made, leading to a new iteration.
- Dyson vacuum cleaners are a good example of a product range designed using an iterative process. The original DC01 was developed as a result of thousands of different prototypes.

Advantages of Iterative Design

- Because each iteration is fully tested and evaluated it is more likely that problems with the design will be discovered and dealt with earlier.
- It encourages focus on the most critical aspects of a product's design.
- User feedback is constantly being gathered.
- Evidence of progress in product design can be easily provided to stakeholders.

Disadvantages of Iterative Design

- Designers can be so focused on the current iteration that they sometimes lose sight of the bigger design picture.
- It can be time consuming if a lot of prototypes or iterations need to be produced.

Key Point

Using an iterative design approach makes it more likely that problems with a design will be discovered earlier in the process.

Dyson make use of an iterative process when designing products

User-Centred Design

- User-centred design is an approach where the needs and wants of the end user are considered extensively at each stage of the design process.

Advantages of User-Centred Design

- The end user feels listened to and so has a greater sense of ownership of the final product.
- Listening to the end user at each design stage means it is more likely that the final product will meet users' expectations.

Disadvantages of User-Centred Design

- It requires extra time to meet and hold discussions with users and then alter the design as a result of user feedback.
- If the design becomes too focused on a particular end user's requirements, it may become unviable to sell to the wider public.

Key Point

User-centred design considers the needs and wants of the end user at each stage of the design process.

Systems Thinking

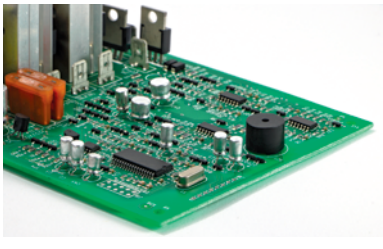
- The systems-based approach is often used when designing electronic, mechanical and mechatronic systems.
- It is a top-down approach that starts with an overview of the overall system in terms of its input, process and output sub-systems. The details of the individual components of each sub-system are considered later.

Advantages of a Systems Approach

- It does not require highly specialist knowledge of electronic or mechanical components to design the overview of the system.
- The top-down approach makes it easy to communicate how the system will work to non-technical specialists, such as clients and stakeholders.
- The system is designed in blocks, so it is easier to find errors or faults in the design.

Disadvantages of a Systems Approach

- Because of the block-based design approach, it can lead to the use of components that are not necessary.
- If unnecessary components are used it can lead to larger systems and extra cost.



Many electronic systems are designed using a systems-based approach

Quick Test

1. What is iterative design?
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3. When is the systems-based approach often used?

Key Words

iterative design
user-centred design
systems thinking
design fixation