

A

Investigate an
engineering project
in a relevant specialist area

A1 Project life cycle

REAL PROJECTS | REAL SKILLS | BRIGHTER FUTURES



INVESTIGATE

Understand
the problem



DESIGN

Develop
solutions



IMPLEMENT

Make it happen



EVALUATE

Review
and improve

Unit 5
A Specialist
Engineering Project

SOLVE
DESIGN
MAKE
IMPROVE



ENGINEERING
REAL-WORLD CHANGE



Learning Objectives

By the end of this lesson, students will be able to:

1



Define what a project life cycle is

2



Identify and describe the four main stages

3



Explain the activities that happen in each stage

4



Apply the life cycle to a real engineering project

5



Produce diagrams and notes suitable for Unit 5 A1 assessment

6



Evaluate why planning and iteration are important in engineering projects



From Concept to Current: The Engineering Project Life Cycle

Case Study: Design & Manufacture of a Portable Solar Phone Charger



REAL WORLD PROBLEM

Sustainable charging on the move



ENGINEERING SOLUTION

Portable, robust, solar-powered charger



REAL IMPACT

Supports off-grid users, travel, emergency situations



Unit 5 – A1
Study Report



1. CONCEPT & REQUIREMENTS

Identify the need, research, set specifications



2. DESIGN & DEVELOPMENT

Generate ideas, CAD design, plan resources



3. PROTOTYPE & TEST

Manufacture, assemble, test and refine



4. MANUFACTURE & DEPLOY

Final production, evaluate and improve

The Foundation: Controlling Chaos

An engineering project is a temporary endeavour designed to solve a technical problem within a specific timeframe and budget.

Without a structured life cycle, projects can face scope creep, budget overruns, delays and safety risks.

Good engineering turns ideas into real-world impact.



*Plan today
Build tomorrow*

Real Projects.
Real Skills.
Brighter Futures.



PROBLEM
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CREATIVITY
& INNOVATION



TECHNICAL
SKILLS



PROJECT
MANAGEMENT



SAFETY
AWARENESS



SUSTAINABILITY



REAL-WORLD
IMPACT

ENGINEERING
CHANGE LIVES

Ever been
stranded with a
dead phone
when you
needed it most?



Navigation?

Communication?

Photos?

Emergency?



TRAVEL



WORK



STUDY



MEMORIES



SAFETY

Every engineering project begins with a **problem...**

*Real problems.
Real solutions.*



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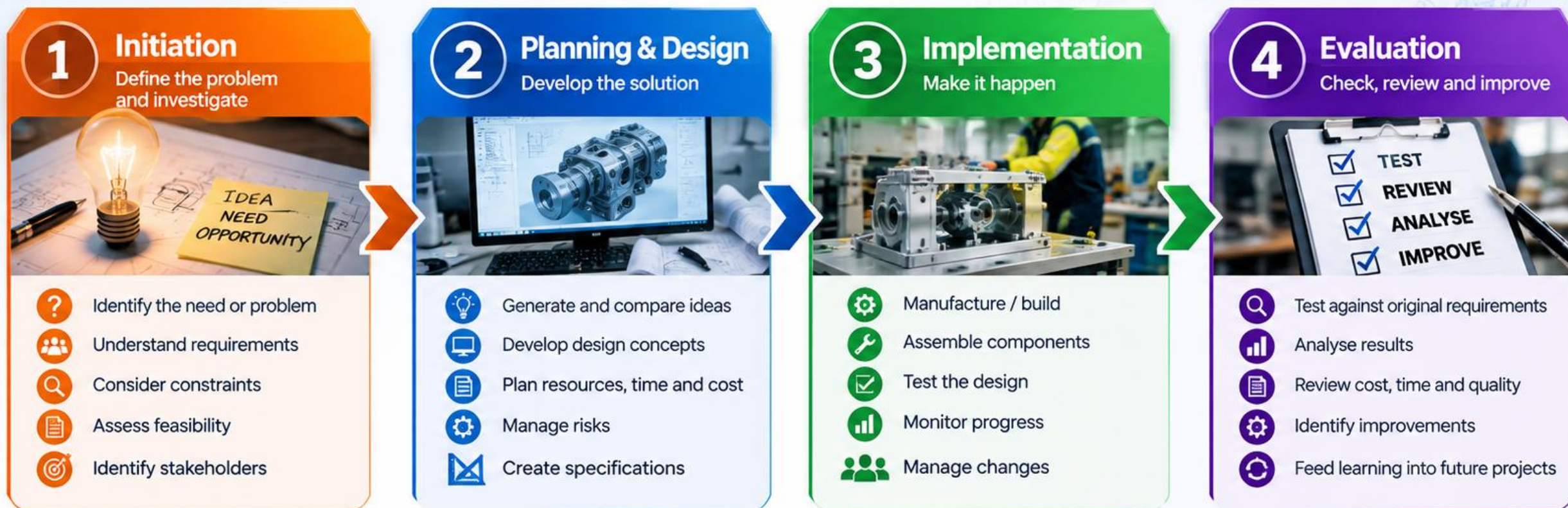
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The Four Stages

A structured approach to take an idea from concept to a real-world solution.

Plan. Design. Make. Improve.



From **need** → to **solution** → to **real-world impact**

ENGINEERING PROJECTS CREATE BRIGHTER FUTURES



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1

Stage 1 – Initiation (The Spark)

Identify the need, investigate the problem and define the objectives.

"Every solution starts with a real need."



The Standard

(What you need to know)



Purpose

Identify the engineering problem and define objectives.



Activities

Market research, stakeholder consultation, defining constraints.



Tools

Feasibility studies, competitor analysis, research methods.



Key Outcome

A clear problem statement and project objectives to guide the next stage.



The Evidence – Solar Charger

(Real-world example)



The Problem

Users cannot charge devices while camping/hiking.



Target Users

Students, hikers, emergency services, outdoor enthusiasts.



Constraints

- **Budget:** £150 (Prototype)
- **Time:** 8 weeks
- **Requirements:** Low cost, lightweight, safe voltage.



Output from this stage

- ☒ Project Brief
- ☒ Initial Research Summary
- ☒ List of Stakeholder Needs
- ☒ Draft Project Objectives



1

Initiation

Define the need

2

Planning & Design

Develop the solution

3

Implementation

Make it happen

4

Evaluation

Check, review and improve

ENGINEERING
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2

Stage 2 – Planning & Design (The Blueprint)

Create technical solutions and delivery plans.

*Good design
turns ideas into reality.*

The Standard



Purpose

Create technical solutions and delivery plans.



Activities

Risk assessment, component selection, CAD drawing, cost estimation.



Tools

CAD software, risk matrix, component datasheets, BOM templates, costing tools.



The Evidence – Solar Charger

(Real-world example)



Materials List

Solar panel, charge controller, battery unit, USB output, 3D printing filament.



Key Deliverables

CAD drawings, circuit diagrams, Bill of Materials (BOM), design specifications.

**Engineer's Insight:** A Risk Matrix is essential here. Identifying potential failures (e.g., battery overheating) before assembly saves cost and ensures user safety.*From
concept...
to reality.*

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Technical Deep Dive: Visualizing the System

Use a block diagram to show how the system works and a Gantt chart to plan how it will be delivered.

1 SYSTEM LOGIC – Block Diagram

How does the solar charger work?



Sunlight

Light energy from the sun



Solar Panel

Converts light energy to electrical energy (DC)



Charge Controller

Regulates the voltage and current to safely charge the battery



Battery

Stores electrical energy (DC)



USB Output

Provides a safe 5V DC output (USB)



Phone / Device

Receives power to charge

From sunlight to power.

Real systems. Real impact.

2 PROJECT LOGIC – Gantt Chart

How will we manage the project over time?

Task	Description	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Research	Research needs, users, existing products	■	■						
Design	Develop ideas and detailed design (CAD)			■	■	■			
Build	Source components and assemble				■	■	■	■	
Testing	Test performance and safety						■	■	
Evaluation	Review results and suggest improvements								■

Key Milestones

- ▶ **Week 2** – Research complete
- ▶ **Week 4** – Design complete
- ▶ **Week 6** – Prototype built
- ▶ **Week 7** – Testing complete
- ▶ **Week 8** – Final evaluation

Before engineers build the system, they must understand both **how it works** and **how they will deliver it**.



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PROJECT MANAGEMENT



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3

Stage 3 – Implementation (The Build)

Turn the design into a working solution.



The Standard

(What you need to know)



Purpose

Manufacture, assemble, and test the design.



Activities

- Component ordering
- Circuit assembly
- Enclosure fabrication
- Testing and fault fixing



Tools

- Soldering tools
- 3D printer
- Hand tools
- Multimeter
- Test equipment



The Evidence – Solar Charger

(Real-world example)



Fabrication

3D printing the casing enclosure.



Electronics

Soldering wiring between the charge controller and battery.



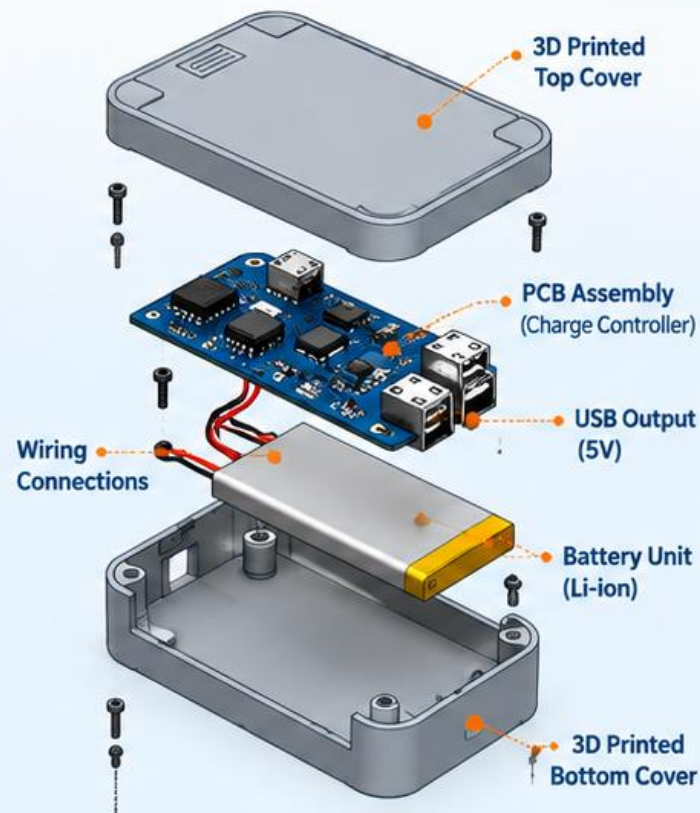
Assembly

Fitting internal components into the printed housing.



Output from this stage

- ✓ Assembled prototype
- ✓ Working circuit
- ✓ Tested and functional unit
- ✓ Records of any issues and fixes



*From components
to a working product.*



1

FABRICATE

3D print the casing



2

ASSEMBLE

Solder and connect components



3

TEST

Check it works

Build. Test. Improve.

1

Initiation

Define the need



2

Planning & Design

Develop the solution



3

Implementation

Make it happen



4

Evaluation

Check, review and improve



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Quality Assurance: The Testing Strategy

Verify the prototype against the specification to ensure it is safe, reliable and fit for purpose.

Test	Parameter	Specification/Target	Result	Status
	Voltage Output	5V $\pm$ 0.25V	5.00V (stable)	✓ Pass
	Charging Time	$\leq$ 3 hours	2.5 hours	✓ Pass
	Overheating	No overheating (< 50°C)	No overheating (Max 42°C)	✓ Pass
	Durability	Survive 1 m drop test	Drop test passed (no damage)	✓ Pass
	USB Output	5V DC, stable output	5.02V (under load)	✓ Pass
	Functionality	Charges device successfully	Phone charged to 50% in 1 hour	✓ Pass



Real Testing. Real Results. Real Confidence.



Functional testing ensures the device is safe and reliable before it reaches the Evaluation stage.

If the prototype does not meet the specification, improvements must be made and retested.



Key Outcome

A fully tested prototype that meets the design specification.

1

Initiation
Define the need



2

Planning & Design
Develop the solution



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4

Stage 4 – Evaluation (The Review)

Check if the project meets the original requirements and identify improvements.

Measure. Reflect. Improve.



The Standard



Purpose

Check if the project meets original requirements (ROI & satisfaction).



Key Questions

- Is it safe?
- Is it cost-effective?
- Does it meet the specification?
- Would customers buy it?
- What could be improved?



Activities

- Test results analysis
- Compare with original objectives
- Evaluate strengths and weaknesses
- Make recommendations



The Evidence – Solar Charger

(Real-world example)



Cost Analysis

Target: < £40
Actual: **£32**



Success

20% under budget



Portability

Target: ≤ 300 g
Actual: **300 g**



Met requirement

Suitable for hiking use



Durability

Casing is functional but needs improvement.



Partial Success

Improve seal and strength



User Feedback

Positive response from target users.



Success

Would buy it



Output from this stage

- ☒ Final Report
- ☒ Test Results Summary
- ☒ Evaluation Against Objectives
- ☒ Recommendations for Improvement



“Meets the needs of real users while staying low-cost and sustainable.”



Overall Outcome



Project is successful

with minor improvements required.



Recommendations

- Improve casing strength and waterproofing
- Consider adding fast-charging capability
- Explore potential for commercial production

1

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The Loop: Continuous Improvement

The project life cycle is iterative. **Evaluation** feeds back into initiation for the next version.

*Better ideas.
Brighter solutions.*



FEEDBACK DRIVES THE NEXT CYCLE

Lessons learned inform new ideas, better designs and higher performance.



1. INITIATION

Identify the problem and set new objectives.



2. PLANNING & DESIGN

Develop improved solutions and plan.



3. IMPLEMENTATION

Build, test and refine the design.



4. EVALUATION

Check performance against requirements.

*Iterate.
Improve.
Innovate.*

Identified Improvements (The Next Cycle)

- 1 **Hardware:** Waterproof casing for better outdoor use.
- 2 **Performance:** Higher efficiency solar panel.
- 3 **Power:** Faster charging battery technology.



WATERPROOF



LIGHTWEIGHT



DURABLE



RENEWABLE

Evaluation doesn't end the project – it makes the **next version better.**



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Why the Process Matters

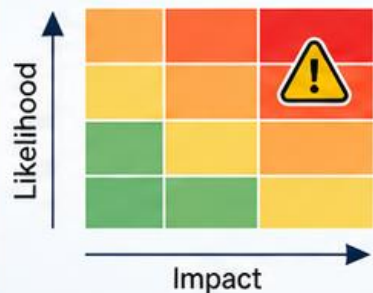
The difference between a hobbyist and an engineer is the **Life Cycle**.

*Better processes.
Greater impact.*

1 Reduces Risk



Helps predict and prevent problems before they happen using tools such as **risk matrices**.



*Identify
Risks.
Take Action.*

2 Controls Resources



Keeps the project **on time** and **within budget**, ensuring efficient use of materials, time and people.



*Plan.
Monitor.
Deliver.*

3 Ensures Quality



Uses testing and verification to make sure the product is **safe, reliable** and **meets the specification** (e.g. 5V output).



*Test.
Verify.
Be Confident.*



Pro-Tip: Consideration of **sustainability** (materials recycling) and **full stakeholder analysis** separates standard projects from **distinction-level engineering**.

*Think Beyond Today.
Design for Tomorrow.*



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MEETS
USER NEEDS

A structured process doesn't just complete a project – it creates **better solutions for the future**.



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Field Guide Reference

Key tools and terms used in a specialist engineering project.



Use this guide throughout your project to choose the right tool for the right task.

Plan better. Work smarter. Succeed.

Tool / Term	What it looks like	Purpose / When to use it																														
 Gantt Chart Project management		● Visual timeline for task management. ● Shows what needs to be done, when and by whom. ● Helps keep the project on track and meet deadlines.																														
 Feasibility Study Decision making	<table><tr><th>Factor</th><th>Considerations</th><th>Outcome</th></tr><tr><td>Technical</td><td>Can it be built with available skills?</td><td>✓ Yes</td></tr><tr><td>Financial</td><td>Is it within budget?</td><td>✓ Yes</td></tr><tr><td>Practical</td><td>Is it achievable in the time?</td><td>✓ Yes</td></tr></table>	Factor	Considerations	Outcome	Technical	Can it be built with available skills?	✓ Yes	Financial	Is it within budget?	✓ Yes	Practical	Is it achievable in the time?	✓ Yes	● Assesses whether a project is possible within constraints (time, cost, resources, skills). ● Helps identify potential risks and solutions before committing to full design and build.																		
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 Bill of Materials (BOM) Component listing	<table><tr><th>Item</th><th>Description</th><th>Qty</th><th>Unit Cost</th><th>Total Cost</th></tr><tr><td>1</td><td>Solar panel</td><td>1</td><td>£12.00</td><td>£12.00</td></tr><tr><td>2</td><td>Charge controller</td><td>1</td><td>£8.00</td><td>£8.00</td></tr><tr><td>3</td><td>Battery (Li-ion)</td><td>1</td><td>£10.00</td><td>£10.00</td></tr><tr><td>4</td><td>USB output module</td><td>1</td><td>£2.00</td><td>£2.00</td></tr><tr><td colspan="4">Total</td><td>£32.00</td></tr></table>	Item	Description	Qty	Unit Cost	Total Cost	1	Solar panel	1	£12.00	£12.00	2	Charge controller	1	£8.00	£8.00	3	Battery (Li-ion)	1	£10.00	£10.00	4	USB output module	1	£2.00	£2.00	Total				£32.00	● Comprehensive list of all parts, materials and costs. ● Used for budgeting, ordering and project planning. ● Helps ensure the design meets cost and specification requirements.
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Total				£32.00																												
 Iterative Continuous improvement		● The process of repeating rounds of analysis, design, build and testing. ● Used to make continuous improvements based on feedback and results. ● Part of the engineering life cycle.																														



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Conclusion

This investigation shows that the project life cycle provides a **structured and logical framework** for managing engineering projects.

*"A clear process
turns ideas into
real-world solutions."*

By dividing work into:



Engineers can deliver solutions **efficiently** and **safely**.



The solar charger example demonstrates how each stage contributes to turning an idea into a **successful product**.

Without planning and evaluation, projects may fail, exceed budget, or be unsafe.



Therefore, the project life cycle is **essential** in all **specialist engineering fields**.



*Small
Ideas.
Big Impact.*

Plan well. Work smart. Create a **safer, brighter future**.



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