Name:_____ Teacher:_____

S3 Engineering Science
1 – What is an Engineer?

Success Criteria		R/A/G
1	I can name the 4 main **types** of engineering.	
2	I can describe what different engineers do.	
3	I can explain how engineers design, build, test and improve products and systems.	
4	I can describe positive and negative effects of engineering on society.	
5	I can describe positive and negative economic effects of engineering.	
6	I can describe positive and negative environmental effects of engineering.	
7	I can use real examples in my answers.	
8	I can explain my ideas clearly using **what + why**.	

What is Engineering?

Engineering is about using **science, maths, technology and creativity** to solve real problems.

Engineers design, build, test and improve things that people use every day, such as:

- transport systems
- buildings and bridges
- power systems
- machines and engines
- materials and products

Engineers often work in teams. On one project, different types of engineers work together to make sure the final product is **safe, reliable and fit for purpose**.

The four main types of engineers in S3:

Type of engineer	What do they mainly work with?	Examples
Electrical engineer	electricity, electronics, power, wiring and control systems	tram displays, motors, wiring, lighting, power distribution
Mechanical engineer	moving parts, machines and forces	engines, brakes, gears, wheels, turbines
Civil engineer	buildings and infrastructure	roads, bridges, railways, tunnels, dams
Chemical engineer	materials and chemical processes	fuels, plastics, coatings, water treatment, rust protection

You should also be aware that **structural, electronic and environmental engineers** are studied later in National 5 and Higher Engineering Science.

Quick Match

Write the correct type of engineer beside each job.

1. Designs a bridge: _____
2. Works on engines and gears: _____
3. Designs wiring and control systems: _____
4. Develops rust-proof coatings and plastics: _____

Sort the jobs

Put each job into the correct column.

designs a road, works on a motor, develops fuel, designs a display screen, improves water treatment, designs a tunnel, works on brakes, develops paint coatings

Electrical	Mechanical	Civil	Chemical

Check your understanding

Complete the sentences.

1. Engineering is about solving _____
2. Engineers often work in _____
3. A civil engineer mainly works on _____
4. A chemical engineer mainly works on _____

One project, many engineers

Most real projects need **more than one type of engineer**.

For example, a tram system needs:

- power and electronics
- moving parts and braking
- tracks, stations and structures
- materials that can cope with weather and wear

This means engineers must work together to design a complete **system**.

Engineers and systems

A **system** is a group of parts working together to do a job.

Many systems have:

- an **input** – what goes into the system
- a **process** – what happens inside the system
- an **output** – the result
- sometimes **feedback** – information used to improve or control the system

Example: Automatic doors

- **Input:** sensor detects a person
- **Process:** control system sends a signal
- **Output:** doors open
- **Feedback:** system checks the doors have opened fully

Your turn – System thinking

Choose one engineered object.

Engineered object: _____

Input: _____

Process: _____

Output: _____

Feedback (if any): _____

Practice

Assignment – What would each engineer do?

For each project below, write **one job** each engineer might do and explain **why it matters**.

Try to use these words in your answers where appropriate:
safe, reliable, strong, efficient, durable, clear, power, materials, movement, structure

1. Modelled example – Edinburgh Trams

Engineer	What might they do?	Why is this important?
Electrical	Design the display, wiring, lighting and power systems	Passengers need clear information and the tram must run safely
Mechanical	Design the wheels, brakes and moving systems	The tram must move and stop safely and smoothly
Civil	Design the tracks, stations and supporting structures	The tram needs a safe route and strong infrastructure
Chemical	Help choose coatings, paints and materials	Parts must resist rust, weather and wear

Sentence starters

- The _____ engineer would help to design _____.
- This is important because _____ .
- If this was not designed properly, _____ .

2. Queensferry Crossing

Engineer	What might they do?	Why does it matter?
Electrical		
Mechanical		
Civil		
Chemical		

3. SpaceX Rockets

Engineer	What might they do?	Why does it matter?
Electrical		
Mechanical		
Civil		
Chemical		

Challenge question

Choose **one** of the projects above.

Which type of engineer do you think has the biggest role in this project? Explain your answer:

Reflection

Tick the statements you can do:

- ○ I can name the four main types of engineers.
- ○ I can describe what electrical engineers do.
- ○ I can describe what mechanical engineers do.
- ○ I can describe what civil engineers do.
- ○ I can describe what chemical engineers do.
- ○ I can explain how engineers work together on one project.
- ○ I can identify input, process and output in a system.
- ○ I can answer using **what** and **why**

Impacts of Engineering

Engineering can change people's lives in good ways and bad ways.
These changes are called **impacts**.

There are three main types of impact:

- **social**
- **economic**
- **environmental**

A good answer should explain:

- **what** the effect is
- **why** it happens
- **who or what** is affected

Quick starter – what kind of impact?

Write **social**, **economic** or **environmental** beside each one.

1. A new sports centre creates jobs. _____
2. Better street lighting makes people feel safer. _____
3. A new road damages local habitats. _____
4. Faster internet makes communication easier. _____
5. A new shopping area brings in money. _____
6. A factory creates pollution. _____

The three main types of impact

Type of impact	What does it affect?	Examples
Social impact	people's lives	safety, comfort, communication, travel, access to services
Economic impact	money and jobs	costs, profits, jobs, trade, tourism, local business
Environmental impact	the natural world	pollution, carbon emissions, habitats, waste, energy use

Social impacts

Social impacts are effects on **people's lives**.

Examples:

- safer crossings near schools
- better public transport
- faster internet
- quieter electric buses
- improved medical equipment

Economic impacts

Economic impacts are effects on **money and jobs**.

Examples:

- a new sports centre may create jobs
- a shopping area may bring in more customers
- a project may cost a lot to build
- local businesses may gain or lose trade

Environmental impacts

Environmental impacts are effects on the **natural world**.

Examples:

- solar panels reduce fossil fuel use
- building work may damage habitats
- electric vehicles can reduce air pollution
- large projects may use lots of steel, concrete and energy

Quick Sort

Write each example in the correct column.

safer travel, more jobs, habitat loss, less pollution, easier communication, more tourism, noise, higher building costs,

Social	Economic	Environmental

Check your understanding

Complete the sentences.

1. Social impacts affect _____
2. Economic impacts affect _____
3. Environmental impacts affect _____
4. Engineering projects can have both _____ and _____ impacts.

Practice

Modelled example

Question: Explain one positive social effect of better cycle paths.

One positive social effect is that people can travel more safely by bike. This is important because it may encourage more people to cycle to school or work and reduce the risk of accidents.

Task: Complete the sentences.

1. One positive economic effect of a new leisure centre is _____

   This is important because _____

2. One negative environmental effect of building a new road is _____

   This affects _____

3. One positive social effect of better hospital equipment is _____

   This matters because _____

Social impacts

Social impacts are about **people's lives**, not money or jobs.

Think about:

- safety
- comfort
- convenience
- communication
- travel
- services
- quality of life

1. Smartphones

Smartphones are part of everyday life for many people.

How have smartphones made life better?

How have smartphones made life worse?

2. Online gaming

Online gaming is a common part of life for many young people.

Positive social impacts:

-
-

Negative social impacts:

-
-

Challenge

Choose one of your answers and turn it into a full **what + why** sentence.

Economic impacts

Economic impacts are about **money and jobs**.

Think about:

- cost
- profit
- jobs
- trade
- tourism
- spending
- local businesses

1. New leisure centre

The local council plans to build a new leisure centre on the edge of a town. It will include a gym, café, swimming pool and activity spaces.

How could this make money for the area?

What is the economic effect?	Who gains money?	Why?

How could this cause other businesses to lose money?

What is the economic effect?	Who loses money?	Why?

2. Self-checkout machines

A supermarket installs more self-checkout machines.

Economic advantage: Who stands to make money from this, and why?

Economic disadvantage: Who stands to lose money from this, and why?

Environmental impacts

Environmental impacts are about the **natural world**.

Think about:

- pollution
- habitats
- carbon emissions
- waste
- energy use
- damage to land
- noise

1. Wind farm

A new wind farm is planned in a rural area.

Positive environmental effects:

What is the environmental effect?	Why is it positive?

Negative environmental effects:

What is the environmental effect?	Why is it negative?

Practice summary

Write **social**, **economic** or **environmental** beside each one.

1. A new railway helps people get to work more easily. _____
2. A new shopping area brings more customers into a town. _____
3. Building work damages local habitats. _____
4. Better street lighting makes an area feel safer. _____
5. A new factory creates jobs. _____

Final Reflection

Tick the statements you can do:

o I can describe what a social impact is.

o I can describe what an economic impact is.

o I can describe what an environmental impact is.

o I can tell the difference between the three types of impact.

o I can explain both positive and negative effects of engineering.

o I can use real examples in my answers.

o I can answer using what + why.

Case study

Your teacher will give you an engineering project to research.

Use a trusted source to find out:

- what the project is
- why it is being built or developed
- what materials or technology are being used
- who it is designed to help
- what the positive and negative impacts might be

Record your findings

Question	Notes
What is the project?	
Why is it being built or developed?	
What materials or technology are being used?	
Who is it designed to help?	
What are the positive impacts?	
What are the negative impacts?	

Knowledge Organiser

What is an Engineer?

Engineering is about using science, maths, technology and creativity to solve real problems. Engineers design, build, test and improve things people use every day.

Main types of engineer

Type	Main area
Electrical	electricity, electronics, wiring, control systems
Mechanical	moving parts, machines, forces
Civil	buildings, bridges, roads, infrastructure
Chemical	materials, fuels, coatings, processes

Most real projects need **more than one type of engineer** working together.

Systems

A **system** is a group of parts working together to do a job.

- **Input** = what goes in
- **Process** = what happens
- **Output** = the result
- **Feedback** = information used to improve or control the system

Impacts of engineering

Type of impact	Affects
Social	people's lives
Economic	money and jobs
Environmental	the natural world

Examples

- **Social:** safer roads, better transport, faster communication
- **Economic:** more jobs, higher costs, more customers
- **Environmental:** less pollution, habitat damage, carbon emissions

Answering questions: What + Why

A strong answer should explain:

1. **What** the effect or job is
2. **Why** it matters
3. **Who or what** is affected

Key words

- **Reliable** = works properly again and again
- **Efficient** = does the job well with little waste
- **Fit for purpose** = suitable for the job
- **Impact** = effect or change caused by something

Quick reminders

- Engineering projects can have **positive and negative** impacts.
- Use **real examples** in your answers.
- Always explain using **what + why**.

End of Topic Self-Check

1. Name the **four main types of engineers** studied in this topic.

2. What is a **system**? (Use the words **input**, **process** and **output** in your answer.)

3. Choose **one** type of engineer and describe **one job** they might do in a real project.

4. What is the difference between a **social impact** and an **economic impact**?

5. Give **one positive** or **one negative** impact of an engineering project and explain **why** it matters.