Royal Academy of Engineering

THIS IS ENGINEERING

2

Keeping preterm babies safe

Student sheet

Problem-based learning resources

The **Royal Academy of Engineering** is harnessing the power of engineering to build a sustainable society and an inclusive economy that works for everyone.

In collaboration with our Fellows and partners, we're growing talent and developing skills for the future, driving innovation and building global partnerships, and influencing policy and engaging the public.

Together we're working to tackle the greatest challenges of our age.

Sheffield Hallam University | Sheffield Institute of Education

Introduction

Babies are cute. Our instincts mean we naturally respond well to big eyes and round faces. However, most newborns look a little different! They are often squashed by birth and cry long before they can smile!

Birth is a biological process that doesn't really look much like the pretty cards and photos. It is hard work and the gap from the start of labour to the final birth can be anything up to 48 tiring, sweaty hours! Most births in the UK are safe and mother and baby are typically home within a day or two of the birth.

A normal pregnancy lasts 37 weeks but babies who come before that are called preterm. There are about 60,000 preterm babies born in the UK every year and many will need specialist help. However, even babies born 10 weeks early have a roughly 90% chance of surviving given the right help.

Monitoring body conditions

What's the connection between a baby incubator, a spacesuit and an Apple Watch? All three of then monitor your body conditions to keep you safe. Different devices check different things but between them they can monitor factors like heart rate, breathing rate, body temperature, the level of oxygen in your blood, your movement and even your brain activity!

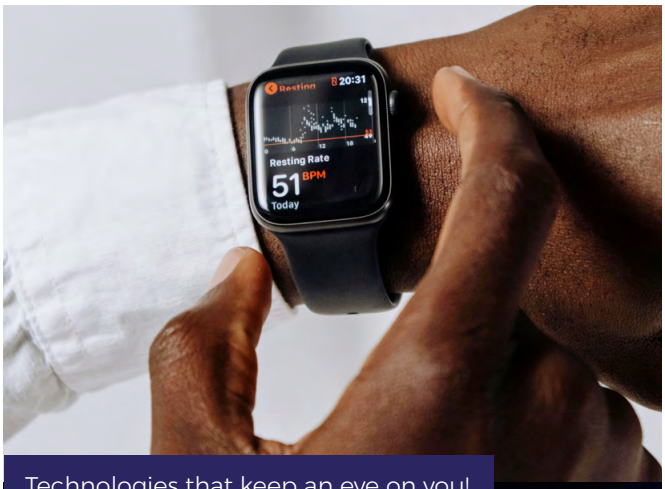
Of course, there are differences as well. The spacesuit needs to supply you with oxygen, keep you warm and shield against the vacuum of space. You wouldn't last 5 minutes outside it! A baby incubator will also sometimes have to provide oxygen or food to very young babies. Their survival chances drop if they are taken out of the incubator. No-one has yet died because they took off their Apple Watch!

All these devices are manufactured. There are probably fewer than 100 modern spacesuits in the world. There are thousands of incubators in the UK. Apple sold over 30 million watches in 2020. Designing and building these items is a challenge – manufacturing large numbers of them is even worse!

The following pages will help you to construct an engineering project based around the needs of preterm babies and how engineering technology can build devices to keep them safe as they grow. You will need to plan your own work and carry it out in a way that shows you have mastered key engineering knowledge and skills. Your teacher may need you to do particular things to match any assessment requirements for your course.

Plan carefully – and good luck!

A preterm baby being cared for in an incubator



Technologies that keep an eye on you!

Constructing your project strategy

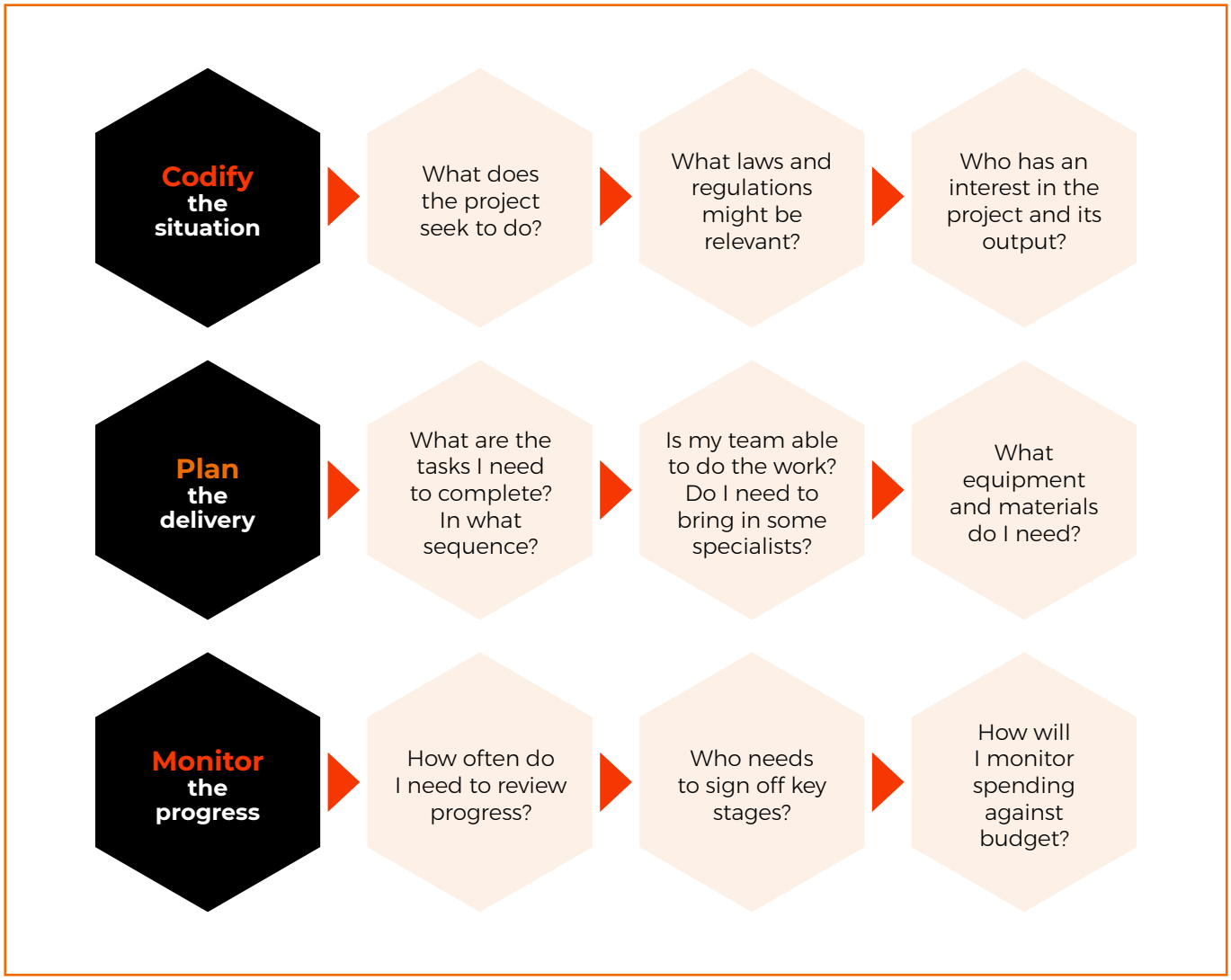
The first part of the incubator development project is to construct a project strategy.

A project strategy is the big picture overview of what the project is for, any key limitations or possibilities and any wider context problems. It is not as detailed as a project delivery plan but should ensure that you are busy doing the right things – not just busy!

The strategy consists of three big areas:

- codifying the situation
- planning the delivery
- developing a system to monitor progress.

The diagram below shows some of the things you need to consider at each stage.



Finally, you can set yourself some tasks and targets. The tasks are the larger parts of the project, so for a portable incubator you might need to draw up your initial plan and calculate all the relevant measures like the length of track needed.

The targets are smaller jobs that together make up these tasks or things you need to complete because of the assessment system at your college (e.g. produce a report, demonstrate your ability to weld metals).

Use the tables on the next pages to set these tasks and targets and record your progress.

Setting tasks

Use this table to list your key tasks – a typical project will have five or fewer big tasks.

Task – what are the big jobs you need to do?	Start date	Finish date	Evidence – how do you know you have done it?

Setting targets

Use this table to list your targets – you do not have to fill every row. Add the date when you complete them and list the evidence you have that you have succeeded.

Target – what targets do you need to hit?	Date completed	Evidence – how do you know you have done it?

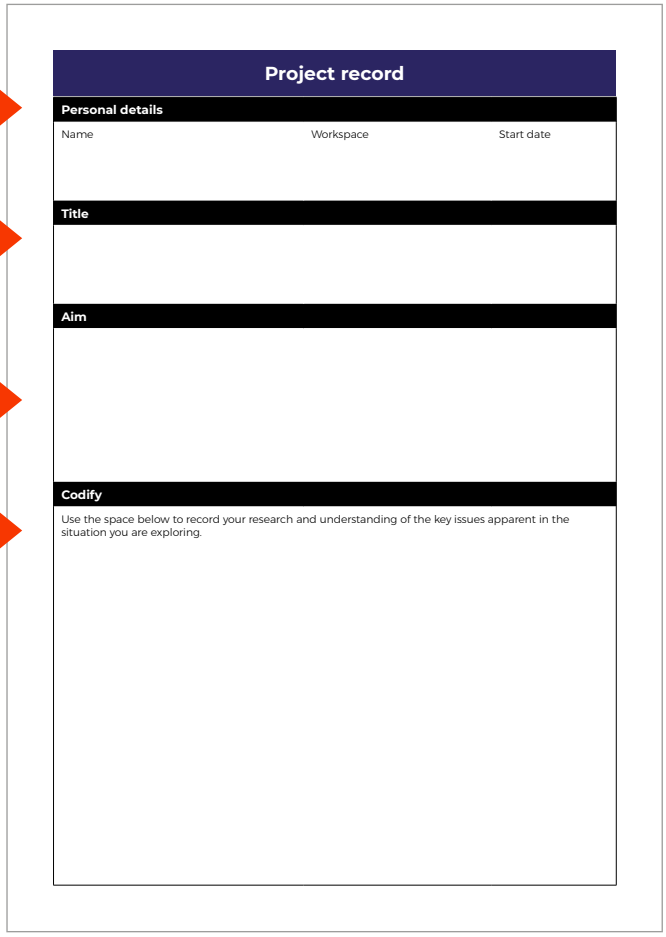
Using the Project Record on page 8

Enter your **name and college** details here with the start date for the project.

Make the **title** short (under 10 words) and descriptive – so that other people can recognise what its about.

The project can have more than one **aim** – what are you planning to do? And why?

Use this space to record your **thoughts and ideas** before you get to planning the project. Record your research ideas and any findings here.



Project record

Personal details

Name | Workspace | Start date

Title

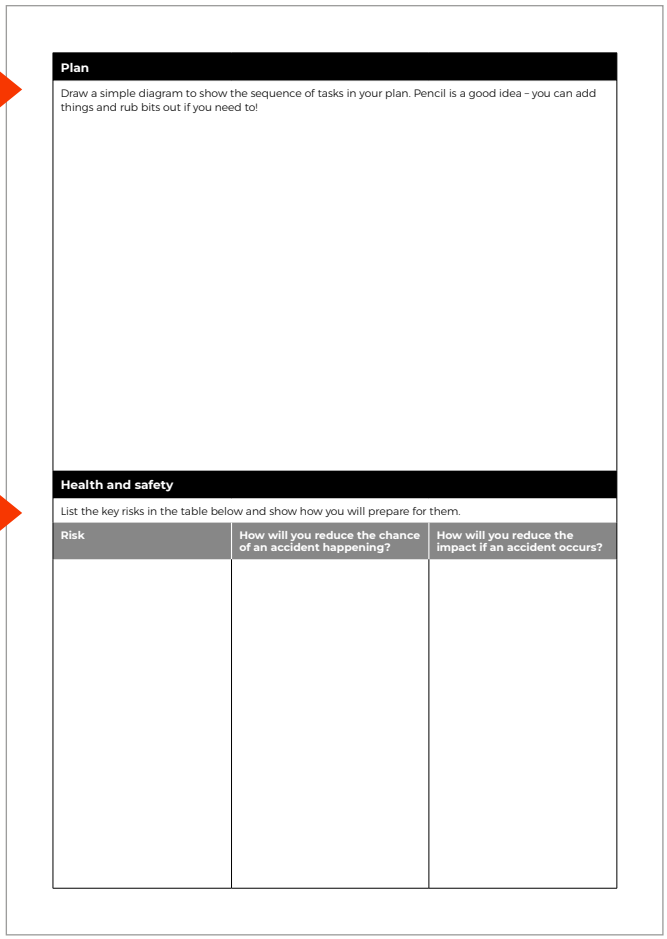
Aim

Codify

Use the space below to record your research and understanding of the key issues apparent in the situation you are exploring.

Use this space to **plan** – a flow chart or sequence of tasks you need to complete will go in here. Time spent in planning is never wasted! You might not get the plan right first time – so be prepared to change it before you start – and even during the project!

You must stay safe! Think about the **risks** in what you plan to do and work out how you can reduce the risk or prepare so that if something does go wrong you are ready. Make sure you list any safety equipment you need before you start work.



Plan

Draw a simple diagram to show the sequence of tasks in your plan. Pencil is a good idea – you can add things and rub bits out if you need to!

Health and safety

List the key risks in the table below and show how you will prepare for them.

Risk	How will you reduce the chance of an accident happening?	How will you reduce the impact if an accident occurs?

Now you get to the details of **what you need**. Think about the materials you will use (don't forget connectors if you're working with computers!) and any tools you will use. Most of your tools will already be in your toolkit so you don't need to mention these but do check if you need any specialist equipment like meters or specialist spanners.

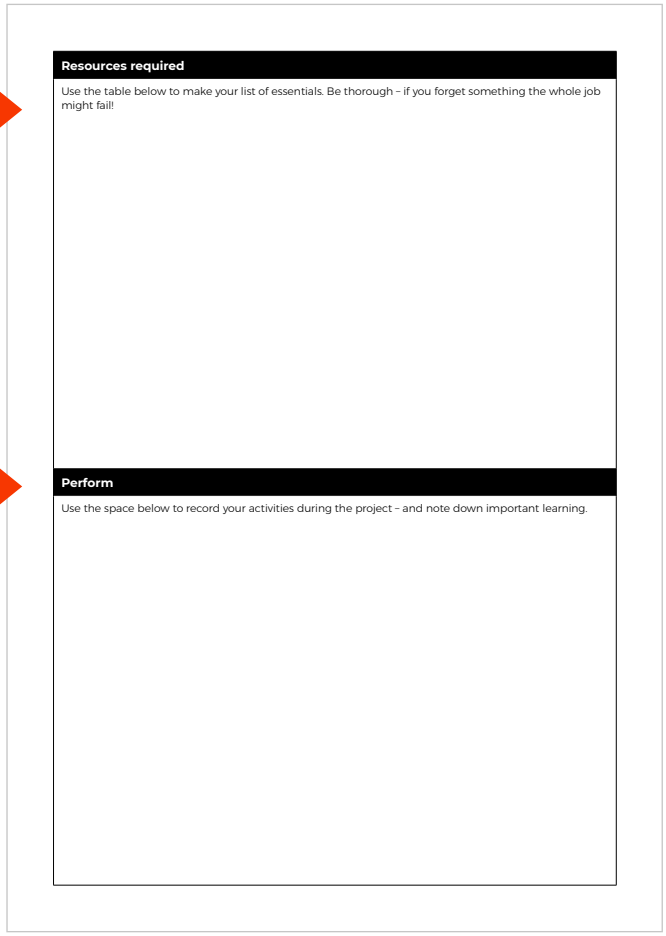
The **perform** section records you work. Every time you complete a task add it to the table. Now is a good time to reflect on anything you learnt from doing the work. The table continues on to the next page.

At the end of the project, **review** how well you did and note down your thoughts in this space. Get a colleague to comment on your work as well – feedback is always useful. You can offer to comment on their work as well. Finally, your supervisor may need to add a comment.

This document can be added to the front of your project.

This is a public document so only include things you are happy for other people to read. More personal comments can be added to your personal logbook.

Also, you won"t be able to fill in everything at the start – this document will grow as you work through the project.

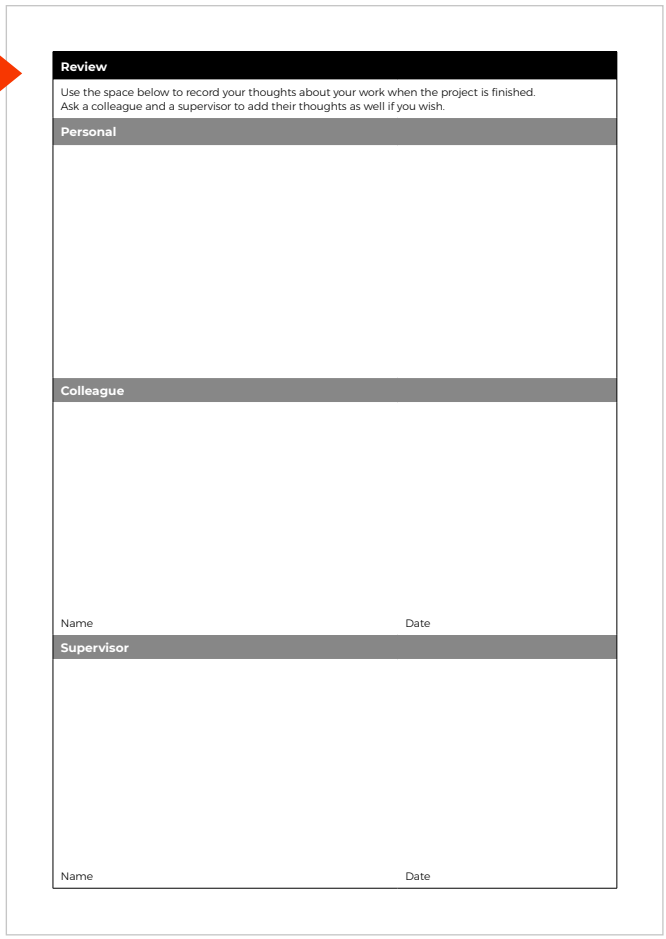


Resources required

Use the table below to make your list of essentials. Be thorough – if you forget something the whole job might fail!

Perform

Use the space below to record your activities during the project – and note down important learning.



Review

Use the space below to record your thoughts about your work when the project is finished.
Ask a colleague and a supervisor to add their thoughts as well if you wish.

Personal

Colleague

Name Date

Supervisor

Name Date

Project record

Personal details

Name	Workspace	Start date

Title

Aim

Codify

Use the space below to record your research and understanding of the key issues apparent in the situation you are exploring.

Plan

Draw a simple diagram to show the sequence of tasks in your plan. Pencil is a good idea – you can add things and rub bits out if you need to!

Health and safety

List the key risks in the table below and show how you will prepare for them.

Risk	How will you reduce the chance of an accident happening?	How will you reduce the impact if an accident occurs?

Resources required

Use the table below to make your list of essentials. Be thorough – if you forget something the whole job might fail!

Perform

Use the space below to record your activities during the project – and note down important learning.

Review

Use the space below to record your thoughts about your work when the project is finished.
Ask a colleague and a supervisor to add their thoughts as well if you wish.

Personal

Colleague

Name Date

Supervisor

Name Date