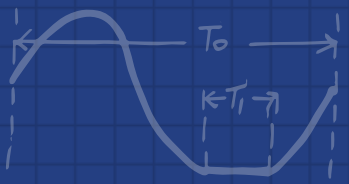
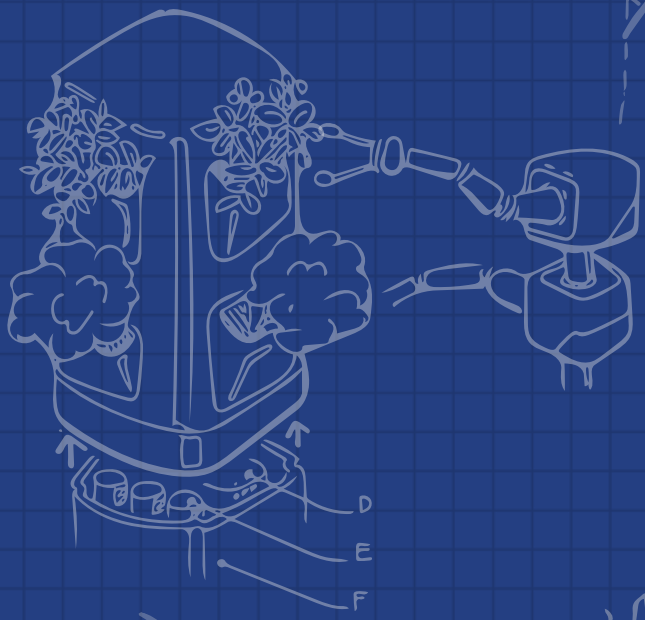
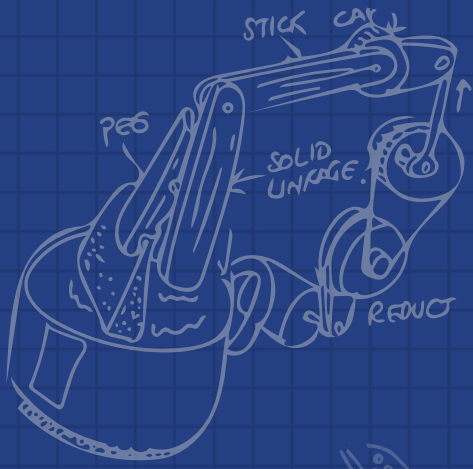
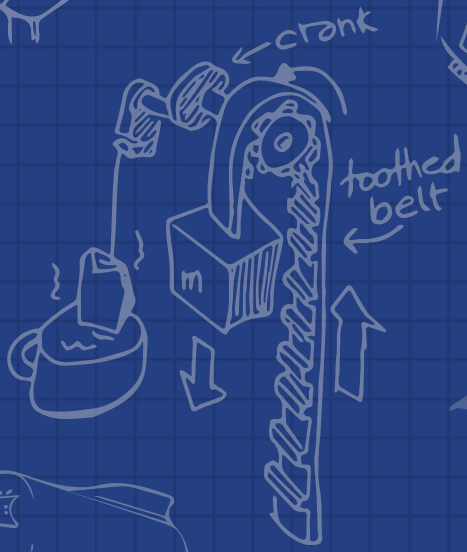
Name:

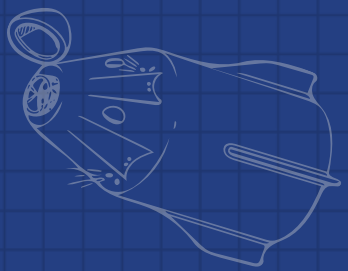
DESIGN FOLIO

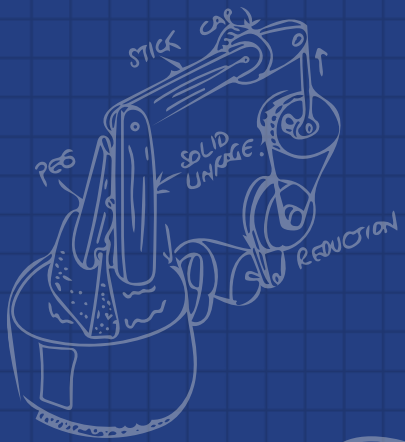


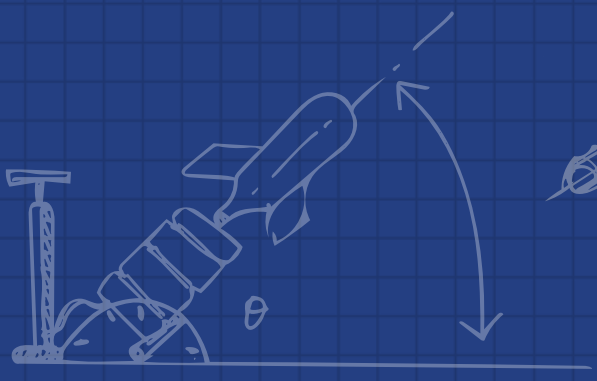


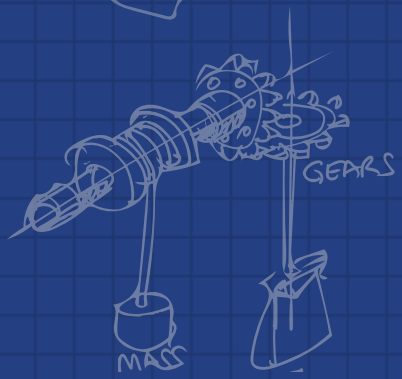








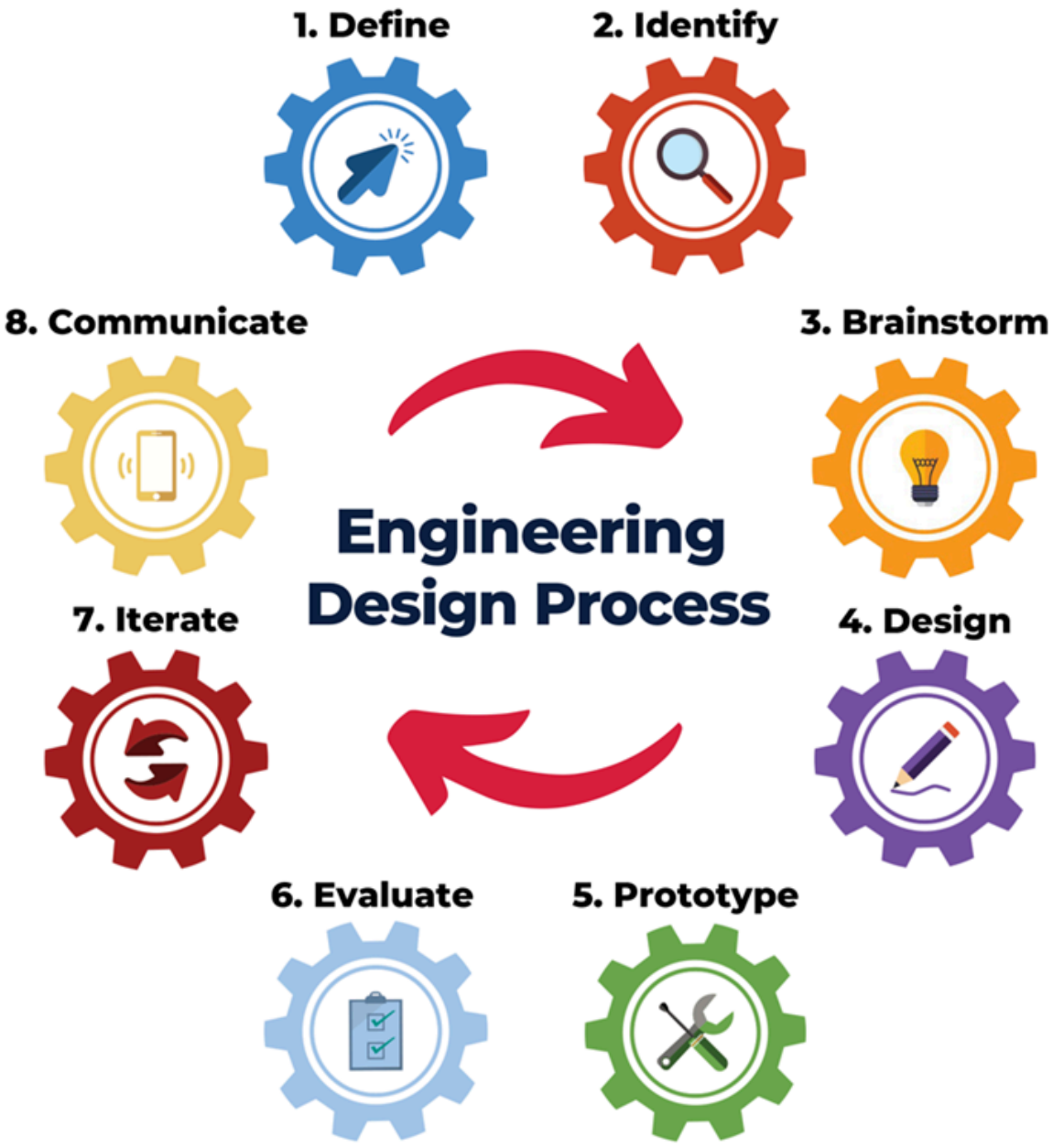




The Engineering Design Process

The engineering design process is a series of steps that help guide you in solving problems and creating effective solutions. This folio guides you through the eight step engineering design process.

Instructional videos and materials that support this folio are available at https://education.nsw.gov.au/teaching-and-learning/curriculum/stem/stem-curriculum-resources.



Define

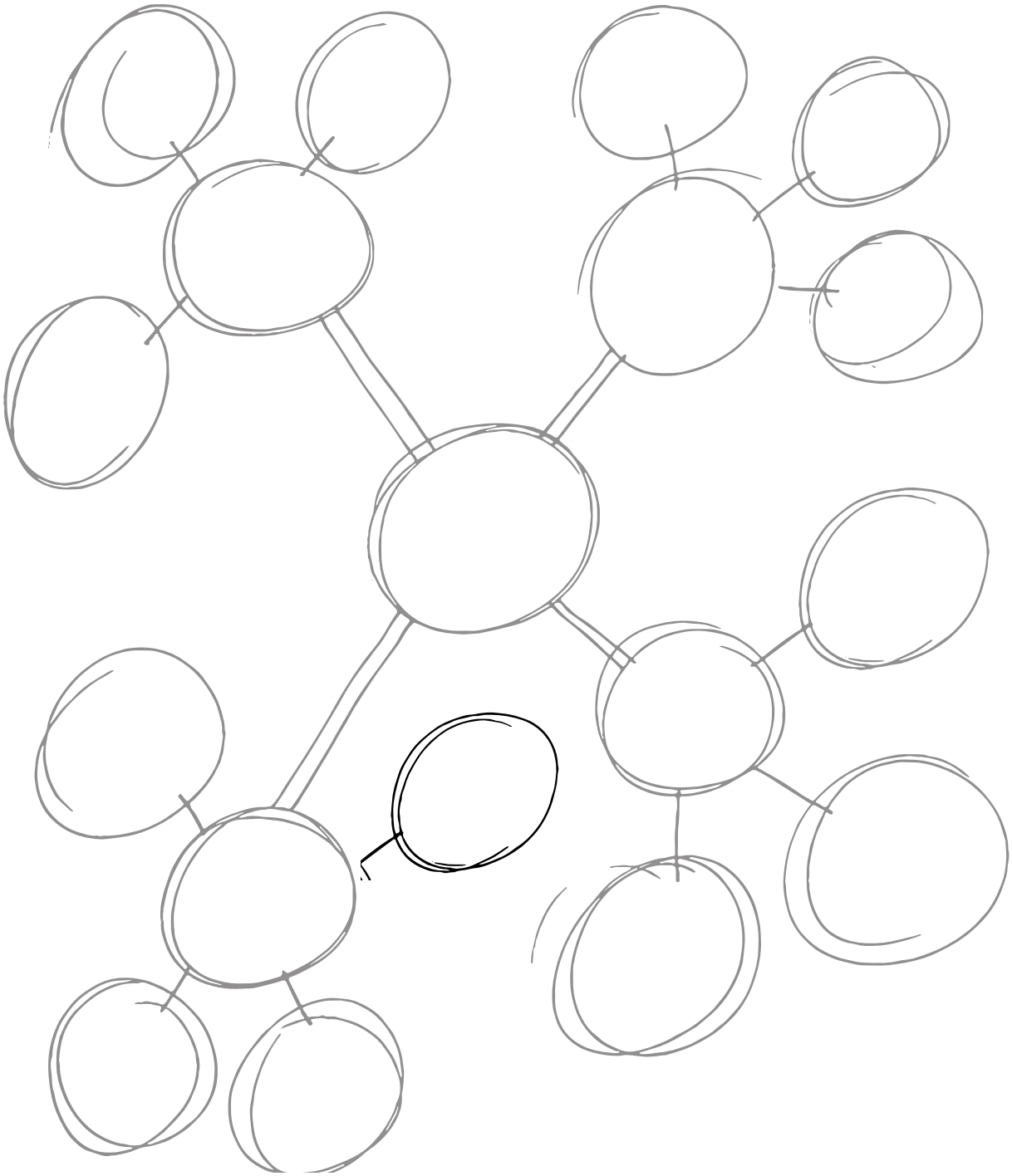
Design Brief Statement: Is a clear statement describing the problem or challenge to be solved.

_____

_____

You need to investigate different areas to fully understand the problem. Use the mind-map template below to help define the problem and identify what needs to be researched to develop a solution.

Always speak to people who will use your solution. To spark ideas, research other designs and try to understand their mechanisms.



Identify two areas of research that you have identified in your mind map that requires further investigation.

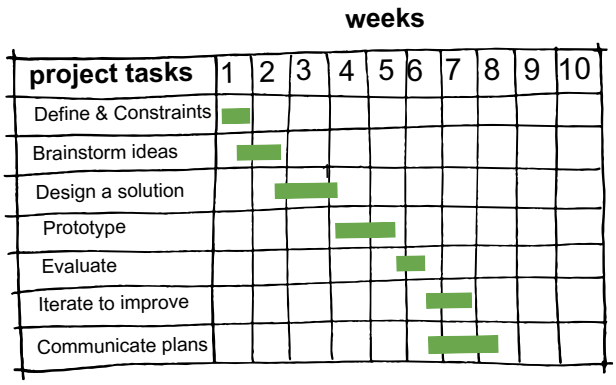
_____ _____

Activity: In the space below provide a summary of your findings from the two areas you researched.

Initial Idea Generation

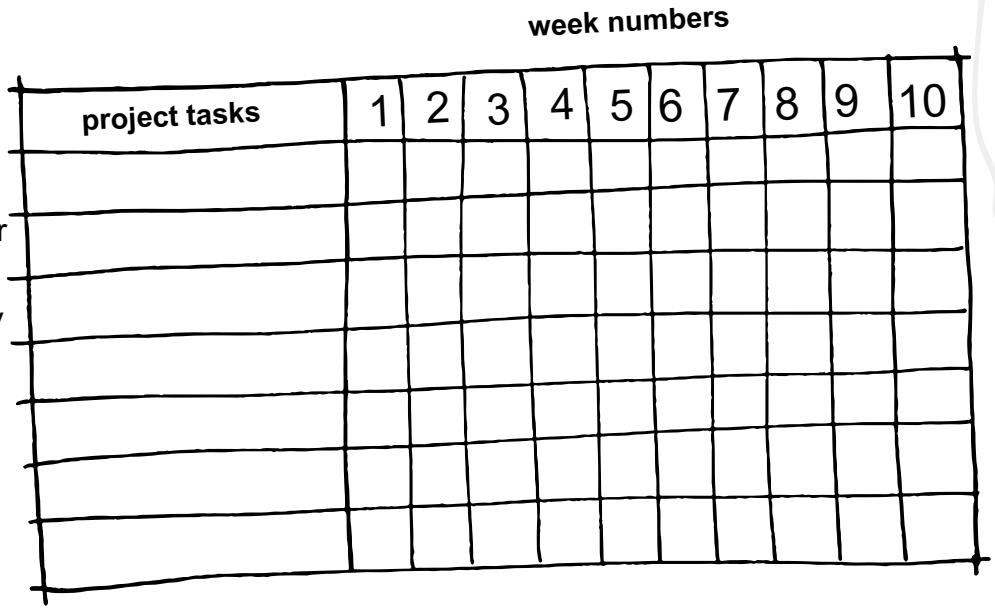
In the space below produce a number of thumbnail sketches of possible ideas that might be useful in solving the problem. Use notations to explain your ideas where possible.

Identify



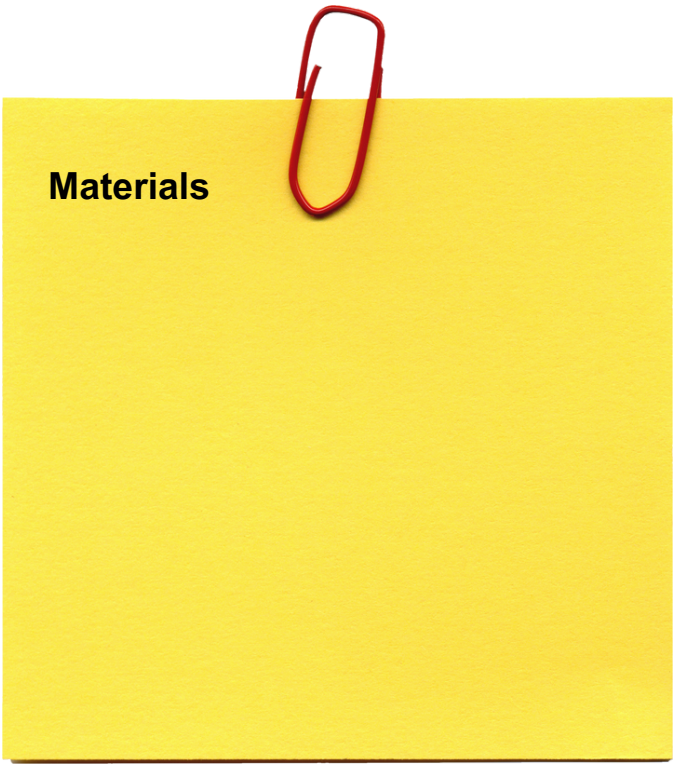
A Gantt chart is commonly used by industry as a tool in project planning. In the project shown (left) 'Iterate' and 'Communicate' are scheduled for the same week. Why might that be?

Activity
Try scheduling your own project in this blank Gantt chart (right) . Your teacher will specify a project completion date. You may also be given a date for 'deliverables'. It could be that you report on your progress at agreed 'milestones'.



A constraint is a limitation that must be satisfied by a design, e.g. time, materials or cost.

Identify materials
The available materials is a constraint to work within. Identify (name) the materials that you have access to. On the Post It note to the right, please make a materials list.



Design Brief Statement:

Success Criteria:

A **'Design Brief Statement'** is what designers e.g. architects, interior designers and product designers write down to show they understand a project. It states the purpose of the design and how success will be measured, i.e. visually appealing to a particular group of people, sales numbers, easy to use, etc.

Activity: On the post Note to the left write a more detailed design brief statement, now you have completed additional research.

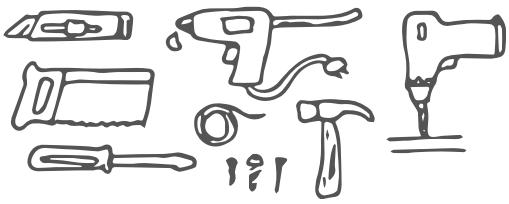
Success criteria are clear goals that show if your design works well and solves the problem.

Activity: On the Post It note write a list of success criteria for your project.

'In the space to the right answer the following questions related to tools, equipment, machinery and safety.

1. Now is a good time to find out which tools and equipment you will have access to. Make a list of equipment you might need.

2. Will you need training before using some machinery?



Think about safety.

3. Identify the hazards and write down your top safety tips.

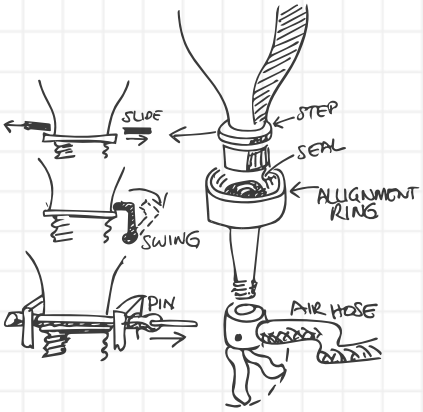
Investigate

Brainstorm

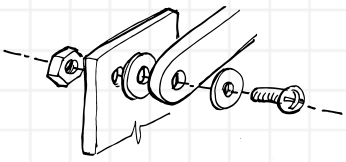
List or sketch *lots* of ideas. This will encourage creative thinking.

Activity: Fill two pages with thumbnail sketches. Draw parts individually, or as an 'assembly'. Be sure to use notes (annotations) next to your sketches to help explain your ideas.

Thumbnails are small, quick sketches. They are 'thoughts on paper' with no time for neatness. Label the important parts.



Thumbnail sketches continued.



An exploded view is a great way to imagine how parts will assemble or fit together.

Design

Design drawings show the shape, material and size of all physical components.

Activity: Sketch orthogonal views of the design you want to make.
Draw to a scale if you can. i.e 1:2 (half size) or 1:4 (quarter size).

Scale means making something smaller or larger while keeping its shape.

Top view

Side view

Front view

Activity: Make an isometric drawing/sketch of your final design solution.

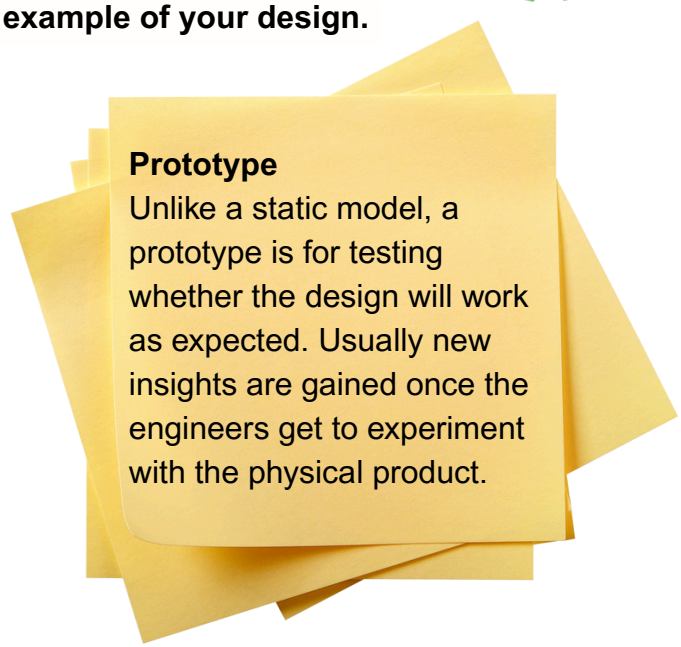
For a tutorial on how to sketch an isometric drawing go to Youtube ,'Drawing with Mr Lawrence how to draw cube shapes', 'Middle school draw to invent' or 'Splat 3D design skills for STEAM'. Draw on a separate sheet if you wish.

Prototype

A prototype is where you construct a working example of your design.

Activity: Attach some photographs of your prototype to this page and, if possible, a link to a video of your prototype in action.

Alternatively, outline the steps in construction of your prototype.
Describe at least two ways you overcame obstacles during the construction.



Evaluate

Test and evaluate prototypes against the set constraints and success criteria set at the beginning of the process.

Testing: The best conditions for testing a new design is under real conditions. Conduct a series of tests on your Prototype and evaluate the results using the PMI template below.

Plus, minus, interesting (PMI) is a quick method for evaluating ideas.
Write down all the positive points of your design, then all the negative. Note anything interesting, e.g. questions that need to be answered to move forward.

Test results Did you meet your criteria and constraints?

Plus Identify what parts of your design worked well.

Minus Consider where your design did not perform as well as expected.

Interesting Observations that are neither plus or minus, although worth noting.

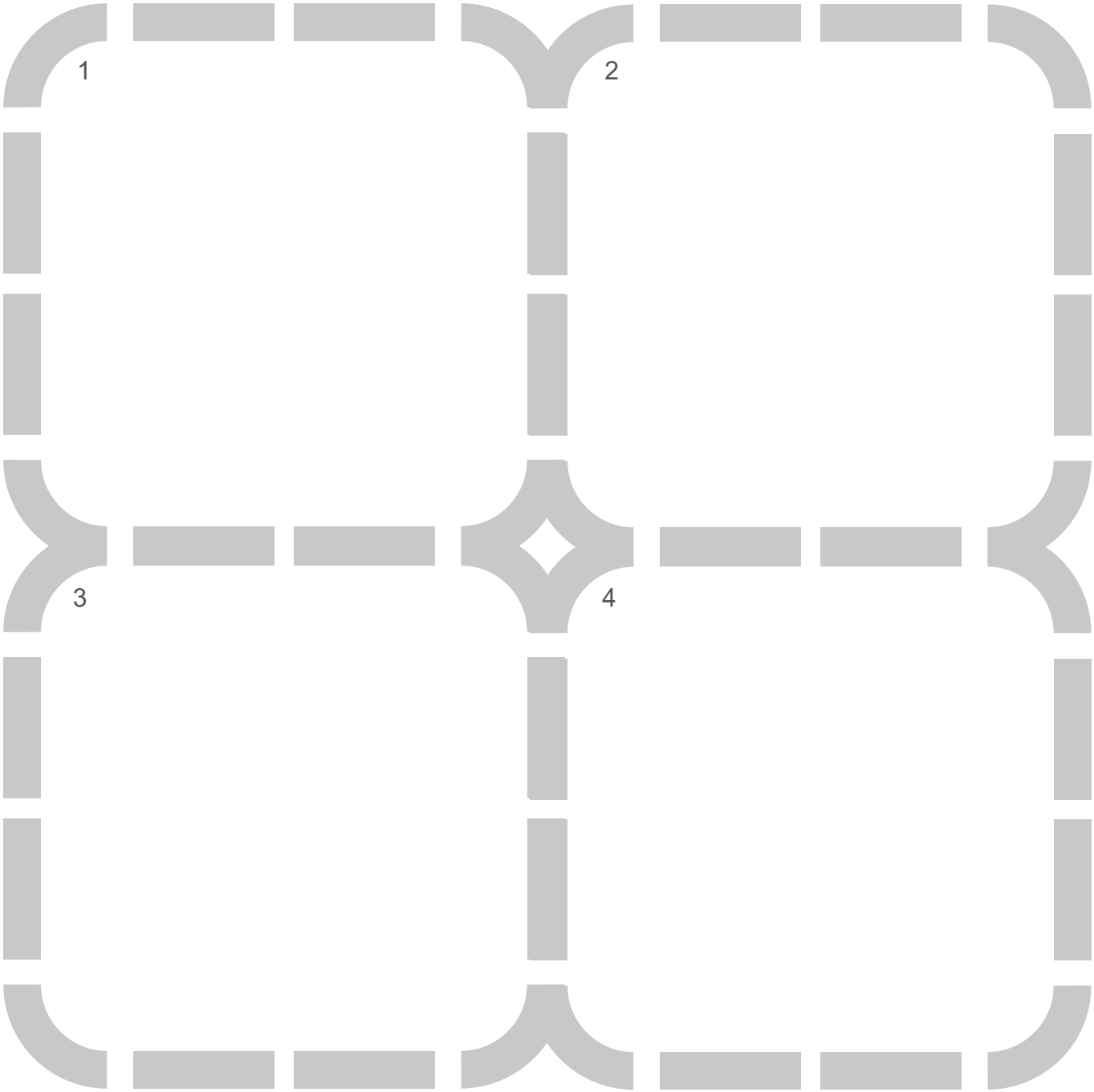
Iterate

An iteration is the next or improved version of a design.

Often with design projects, we don't get time to make an improved version/iteration. Let's at least consider a second iteration.

Activity: In the boxes below, sketch and explain four possible improvements to your design.
Apply what you learnt from testing & evaluating.

Tip: 'Annotate' your work, i.e. use arrows and notes on your sketches. Work like an engineer!



Communicate

Records of the design are kept, usually as a digital (CAD) file. This information is important for other members of a team who may have to update or modify the design in the future.

Activity: Attach your final plans after this page. Your teacher may ask you to draw using a scale (e.g. 1:2 or 1:4) or to draw using full scale i.e. actual size. You may need a large sheet of paper, or tape together several sheets of A4 paper.

The Australian standard that engineers follow when creating technical drawings is called AS1100.