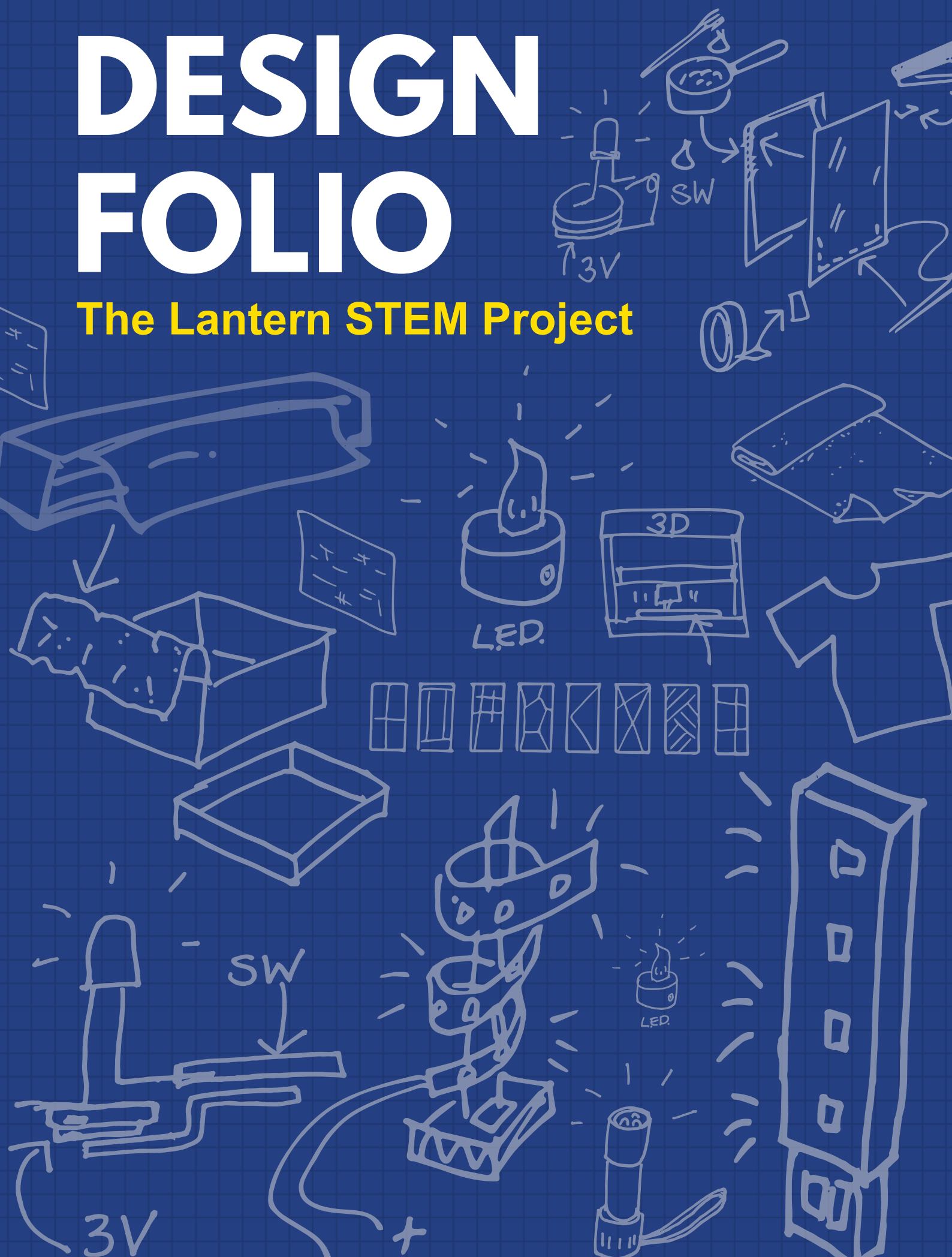
Name:

DESIGN FOLIO

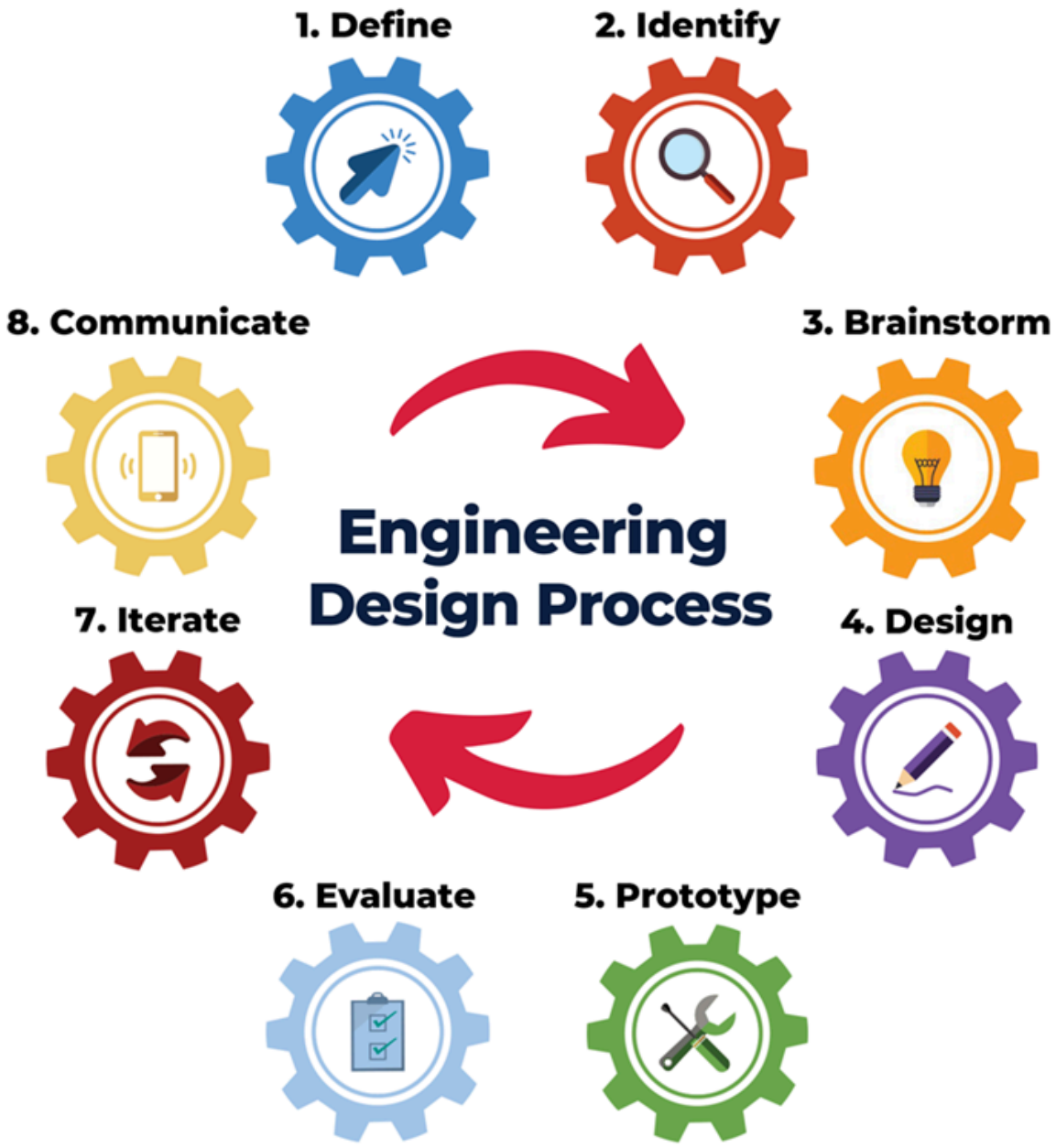
The Lantern STEM Project



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.



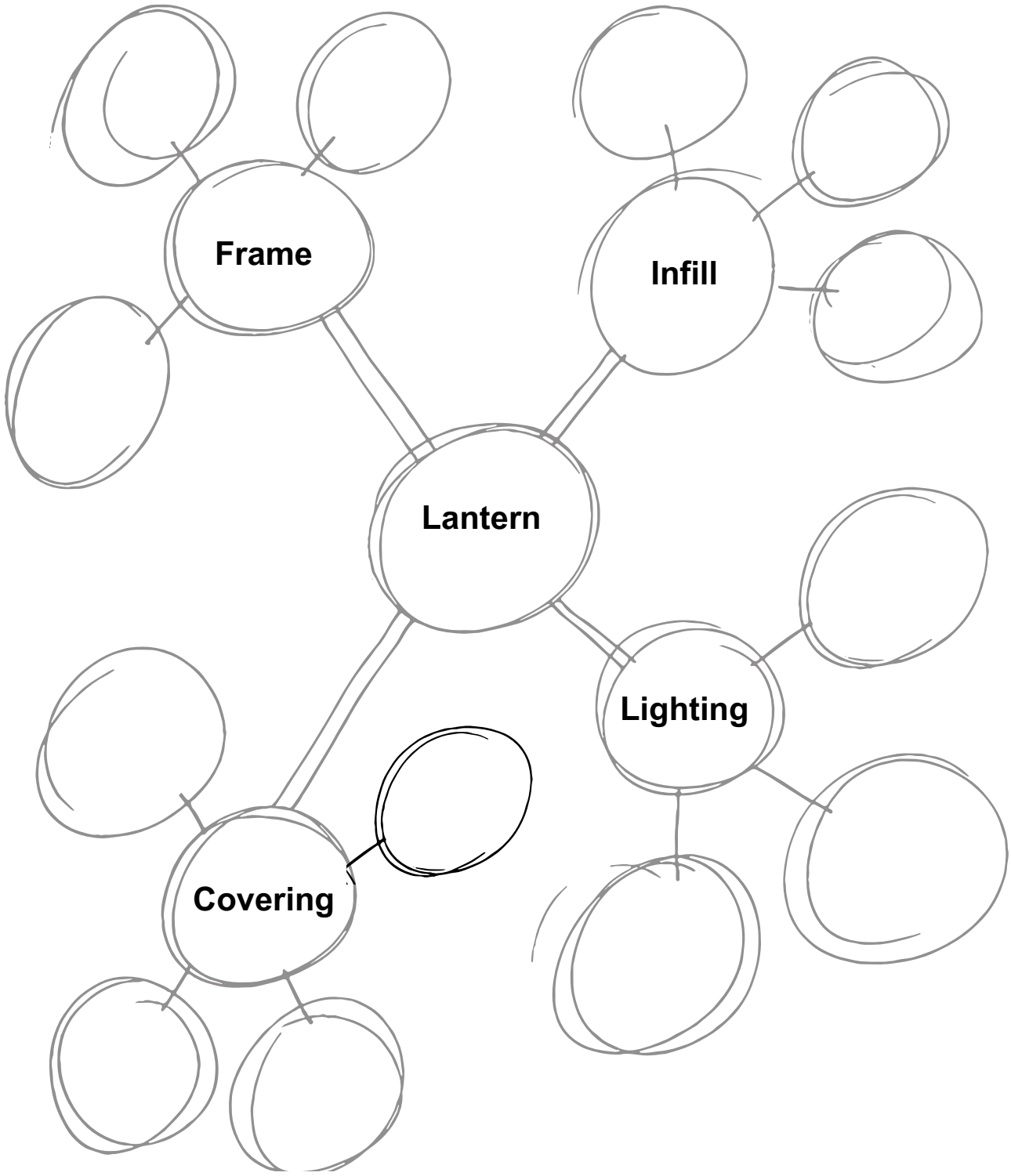
Define

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

Design and build a lantern with _____.

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

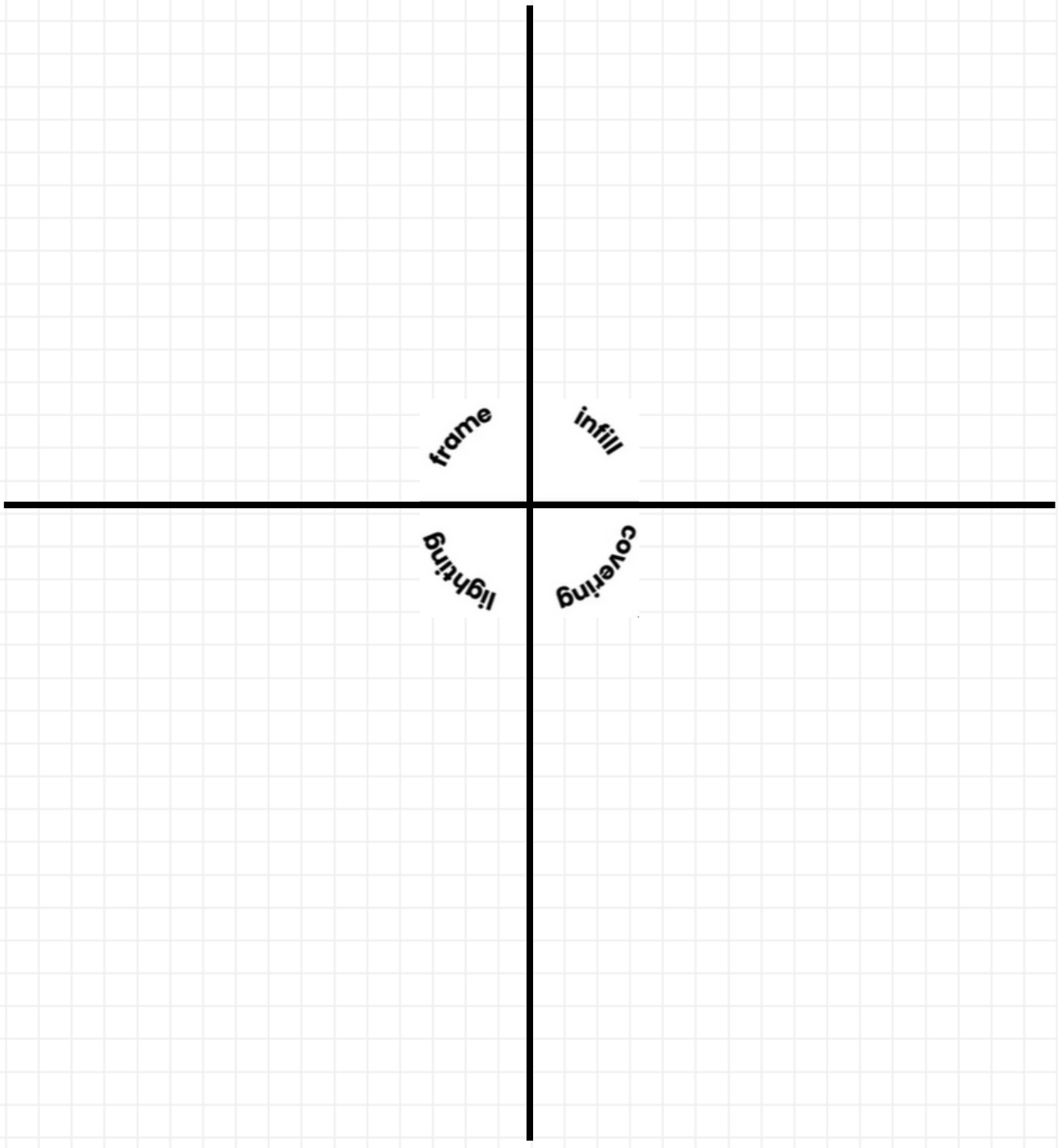
Always speak to people who will use your solution. To spark ideas, research other designs and try to understand their mechanisms.



What three properties does the lantern frame require?

_____ _____ _____

Activity: Research possible lantern designs, gathering ideas for the frame, infill, covering and lighting. In the space below, provide a summary of your findings from your research.

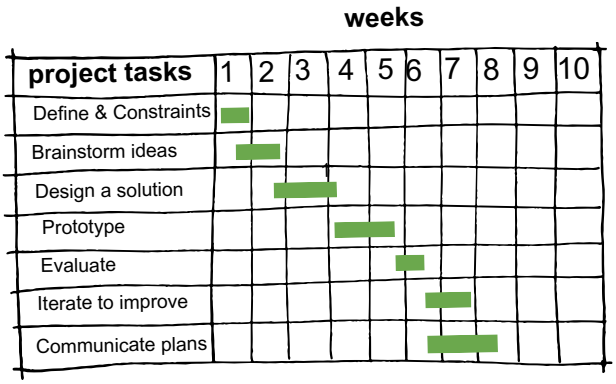


A lantern needs a light source.
Sketch three possible ideas for your lantern's light source. How is this light source powered and turned on and off?

Frame. The frame structure must allow the light source to be activated or turned on and off. Choose how you would like the light source to be accessed for your lantern. Sketch and describe below.

Identify

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



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'.

week numbers

project tasks	1	2	3	4	5	6	7	8	9	10
Define & Constraints										
Brainstorm ideas										
Design a solution										
Prototype										
Evaluate/test										
Iterate & improve										
Communicate plans										

Identify materials

The available materials is a constraint to work within. Identify (name) the materials that you have access to on the sticky note on the right. Add to this list as the project goes forward. Consider the following:

- The translucent panel material and pattern.
- The light source and mechanism for activating.
- A frame structure to hold it all together.
- Method of fastening parts together.

Materials

Design Brief Statement:

Success Criteria:

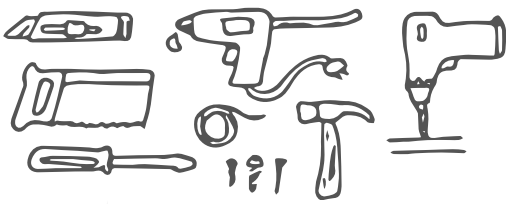
A '**Design Brief Statement**' is what designers e.g. architects, interior designers and product designers, write down to show they understand a project. It states the purpose of the design and how success will be measured, i.e. visually appealing to a particular group of people, sales numbers, easy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

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

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

Activity: List the tools and equipment you will have access to and answer the following questions in the space to the right:

1. Will you need training before using some machinery?
2. Think about safety. Identify the hazards and write down your top safety tips.

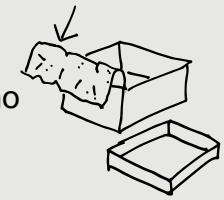


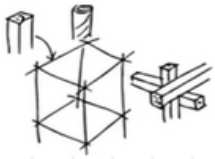
Brainstorm

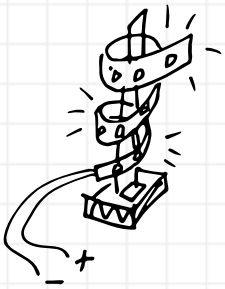
List or sketch *lots* of ideas. This will encourage creative thinking.

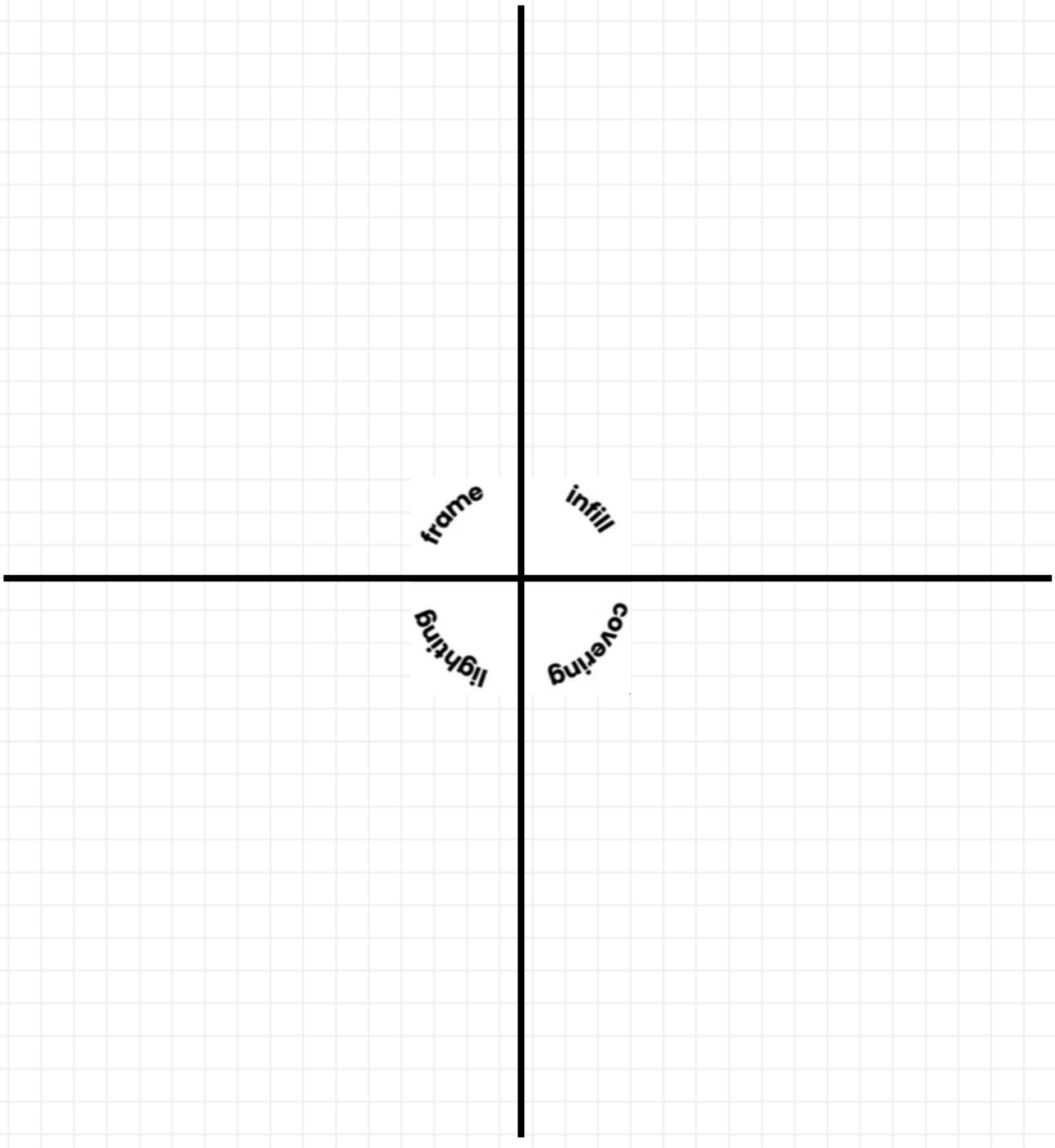
Activity: Fill two pages with thumbnail sketches. Draw parts individually, or as an 'assembly'. Be sure to use notes (annotations) next to your sketches to help explain your ideas.

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







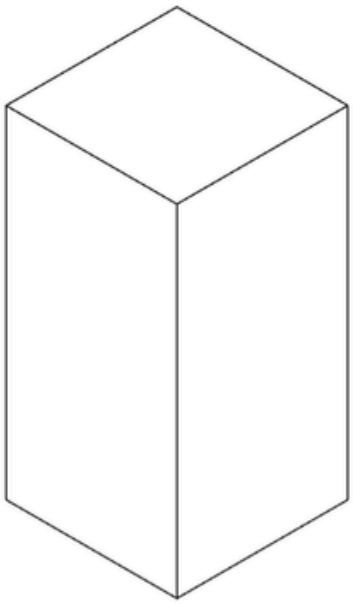


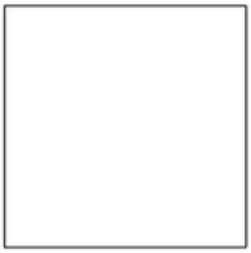
Design

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

The examples below show orthographic (top, side and front views) and isometric drawings.

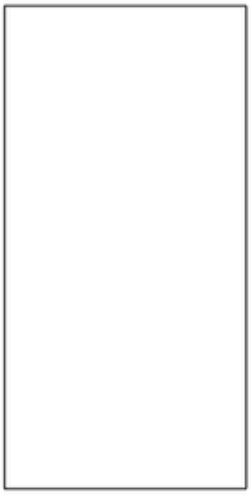
Isometric



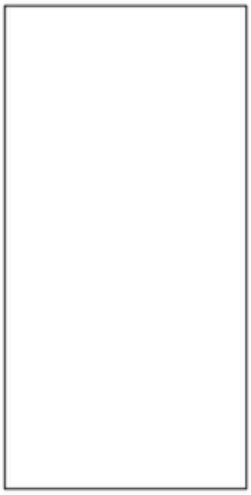


Top view

Orthographic



Side view



Front view

Design

Design drawings show the shape, material and size of all physical components including any infill designs.

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

Top view

Side view

Front view

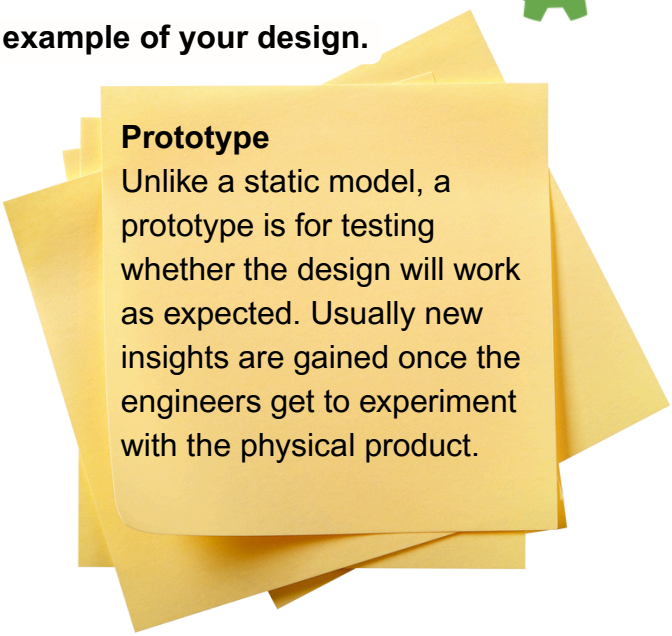
Activity: Make an isometric drawing/sketch of your design. Annotate your work.

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: Consider the materials you will need for prototyping. Think about the frame, joints, base and panels. Make a list of materials, including items like glue, wire, scissors, stapler that you will need to construct your prototype.



Feature	Materials, quantity, equipment

Prototype

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 established at the beginning of the process.

Testing: Conduct a series of tests on your prototype and evaluate the results using the PMI template below. The best conditions for testing a new design is under real conditions, i.e. turning the light on in the dark. You may choose to film your test as evidence.

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? e.g. panels are translucent.

Plus Identify what parts of your design worked well e.g. 'aesthetics'

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

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

Iterate

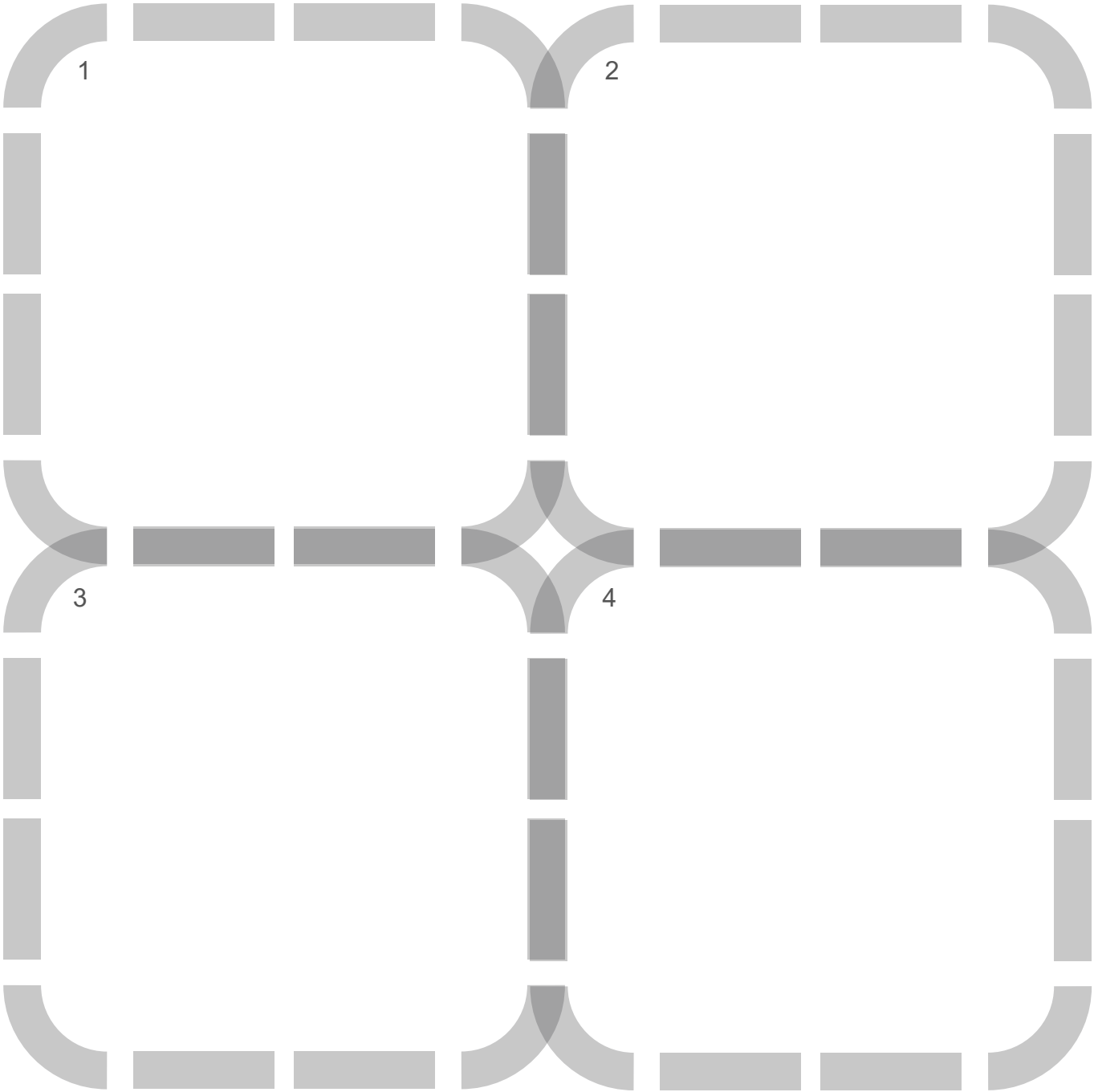
An iteration is the next or improved version of a design.

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!
Possible areas for improvement may include:

- The light can be seen through the panels.
- Easier to turn the light on and off.
- More stable frame.
- Improved aesthetics.



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.