

ELECTRONICS - STEADY HAND GAME

WORLD ASSOCIATION OF TECHNOLOGY TEACHERS

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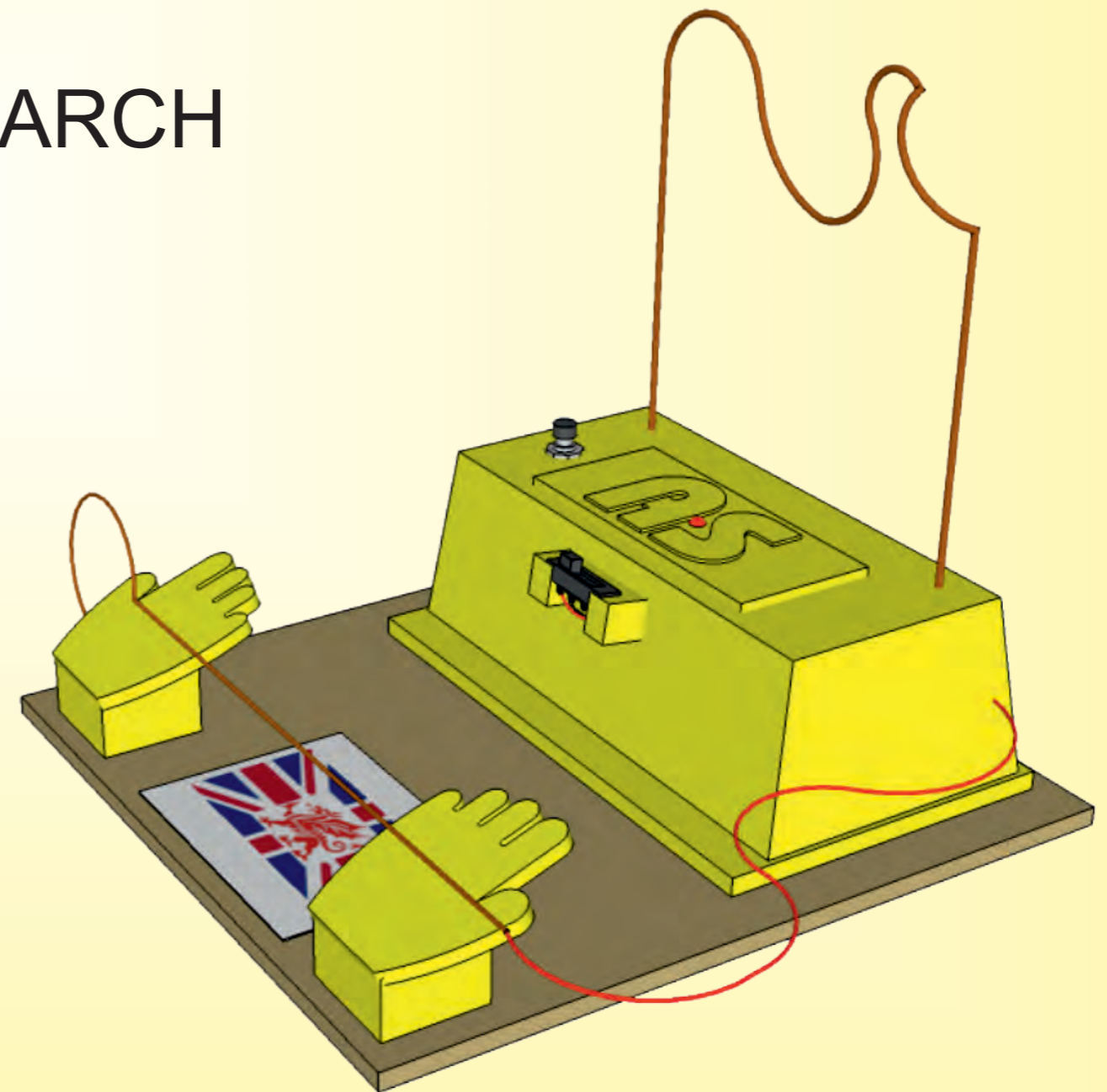
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THE DESIGN SITUATION

DESIGN CONCEPT

FURTHER GUIDANCE

THEME - RESEARCH



ELECTRONICS - STEADY HAND GAME

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WHAT IS A DESIGN SITUATION?

Designers often start with a **design situation**. This outlines the problem that needs solving. It defines the target audience, the purpose of the 'product' and any constraints. It is the "why" and "what" behind a project, setting the stage for creative, innovative, imaginative designing, resulting in a manufactured, desirable product.

YOUR DESIGN SITUATION AND INSPIRATION FOR A STEADY HAND GAME

A local toy company is seeking innovative and engaging products to expand its selection of educational toys, for children aged 8–12. The goal is to develop a new version of the classic steady hand game, which combines fun with learning.

The electronic game should incorporate hand-eye coordination and challenges in a playful / fun way.

You (the designer) must create a steady hand game based on an exciting theme (E.G. outer space, jungle adventure, or a racing track), to capture the interest and maintain the attention of children.

The game should feature a buzzer and/or LED, that activate, when a metal loop touches the wire, creating an interactive experience.

In addition, your design must be user friendly and safe for children, with the circuit held securely within a base unit. The final product must be both cost-effective to manufacture and robust enough to withstand frequent use, by energetic young players.

The steady hand game should be aesthetically appealing and stand out in the competitive toy market.

Consider using eco-friendly materials, where possible.



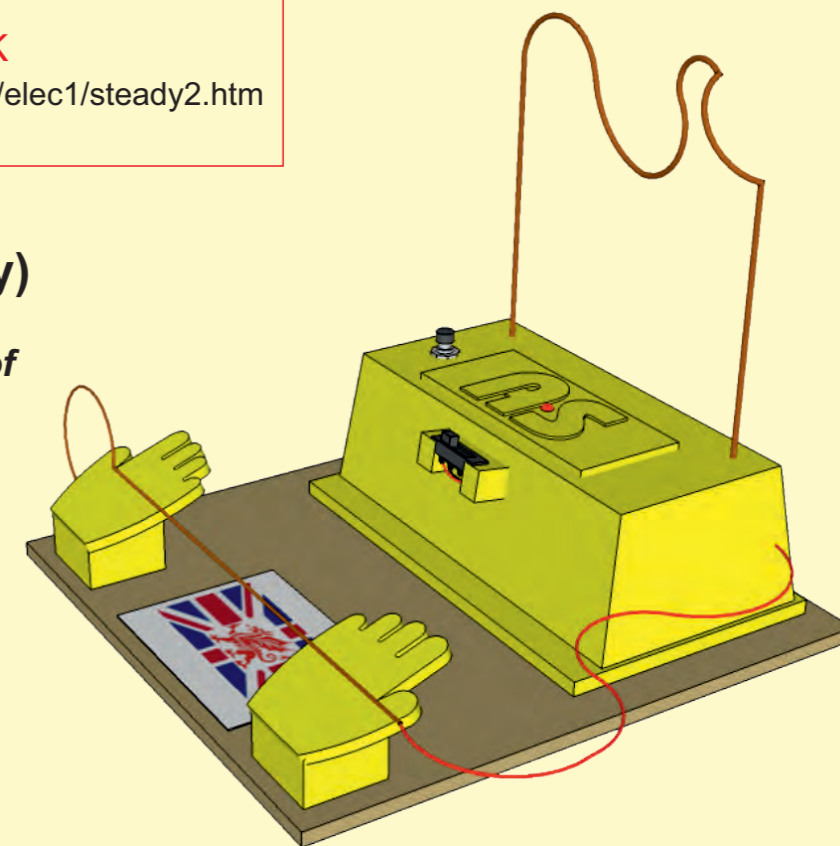
USEFUL LINK

<https://technologystudent.com/elec1/steady2.htm>

BASIC CONCEPT DESIGN (provided by the toy company)

A concept design is the initial stage of the design process, where ideas are generated and visualised.

Concept designs often include sketches, rough models, or digital renderings that convey the overall vision and key features of a product, space, or system. While not a final design, concept designs aim to communicate the core idea clearly and inspire further development.



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<https://technologystudent.com/elec1/steady2.htm>

ADVANTAGES AND DISADVANTAGES OF THE CONCEPT DESIGN

The design of this electronic steady hand game for children appears well-thought-out and engaging.

Positives

Interactive Components: The wire loop and wand mechanism are classic and effective for testing fine motor skills and hand-eye coordination. Including a buzzer and / or an LED enhances interactivity and provides immediate feedback, making it enjoyable for children.

Thematic Handles: The yellow hand-shaped supports are visually appealing and child-friendly, adding a touch of playfulness that young users will appreciate.

Safety Considerations: Having an MDF base and securely mounted components suggests durability and safety, essential for a children's product. The on/off switch and reset button provide added control and usability.

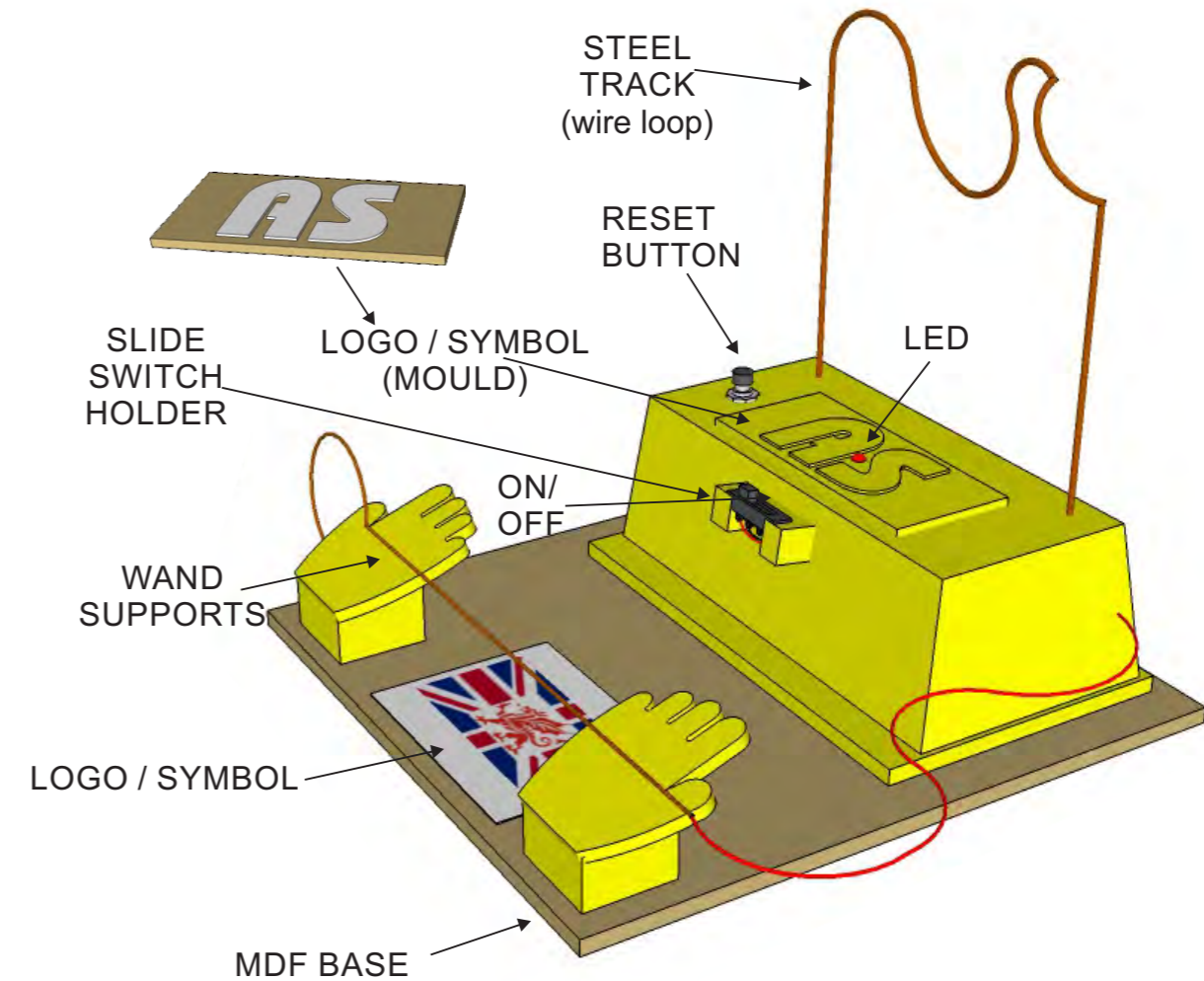
Improvement Opportunities

Visual Appeal: Introducing a cohesive theme (e.g. space, jungle or sports) across the design elements, could make the product more engaging.

Adjustable Difficulty: Adding replaceable wire mazes of varying complexity, could broaden the game's appeal to children of different ages or skill levels.

Educational Value: Transparent sections to show the internal circuit or an accompanying guidebook, could teach children basic concepts about circuits, sparking curiosity and learning.

Overall: The game is a solid foundation for a fun and educational product, but incorporating additional features like thematic elements or modularity could take it to the next level.



How would you improve the concept design?

ELECTRONICS - STEADY HAND GAME

FURTHER DETAIL AND GUIDANCE

Thematic Design

The theme of the steady hand game is important because it must capture children's attention.

For example, an 'outer space theme' could feature a rocket-shaped wand navigating through a wire maze, with a background designed like an asteroid field.

Alternatively, a 'jungle theme' might involve a vine-shaped wire and a jungle background.

Educational Value

The circuit will include components that introduce basic electronics. The PCB will hold a thyristor, resistors, LED, push to break switch, slide switch and battery snap.

Ergonomics

A comfortable and ergonomically designed grip for the wand, making it easy for smaller hands to use.

Durability

Use robust materials for the wire and wand to prevent wear and tear. Ensure the base is stable, perhaps with a non-slip bottom or weighted material.

Safety

Securely 'house' electronic components, ensuring they are inaccessible to children. The steady hand game will be powered by low-voltage batteries to minimise risks.

Eco-Friendliness

Consider using recycled or biodegradable materials for the game's base and wand.

Packaging and Assembly

The product could come as a DIY kit, allowing kids to build it themselves with parental supervision. This approach not only teaches them assembly skills, but also deepens their understanding of how the game works.

Marketing

You could design a poster aimed at promoting the game. The poster must interest parents / guardians as well as the potential users (young children).



USEFUL LINK

<https://technologystudent.com/elec1/steady2.htm>

EXAMPLE THEMES FOR A STEADY HAND GAME

- 1. Outer Space Adventure:** Navigate a rocket through an asteroid field without touching the space debris.
- 2. Jungle Escape:** Guide an explorer through twisting jungle vines to find hidden treasure.
- 3. Underwater World:** Manoeuvre a submarine through coral reefs and underwater caves.
- 4. Medieval Quest:** Help a knight carry a sword through a castle full of traps to rescue a princess.
- 5. Racing Circuit:** Drive a race car around a winding racetrack to claim victory.
- 6. Haunted Mansion:** Steer a flashlight through spooky paths to escape the ghosts.
- 7. Pirate Treasure Hunt:** Lead a pirate ship through treacherous waters to find buried treasure.
- 8. Robot Challenge:** Navigate a robot arm through a factory assembly line to complete tasks.
- 9. Superhero Mission:** Fly a superhero through skyscrapers to save the city.
- 10. Magical Journey:** Guide a wizard's wand through enchanted forests to retrieve a magic crystal.

Write three of your own themes for the steady hand game.

11.

12.

13.



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Select your favourite theme. Collect images relating to the theme, that could be useful / inspirational for your design of the steady hand game.

THEME: SPACE ADVENTURE



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THEME: _____

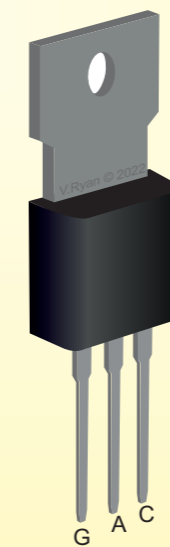
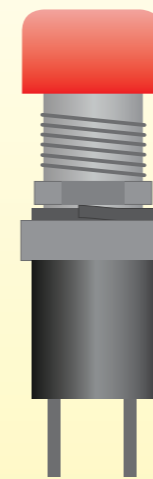
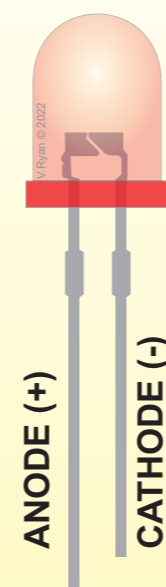
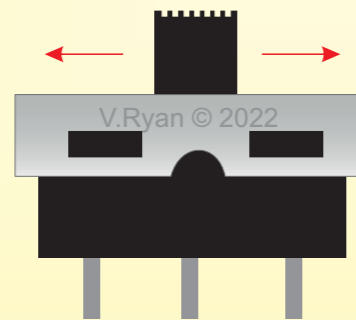
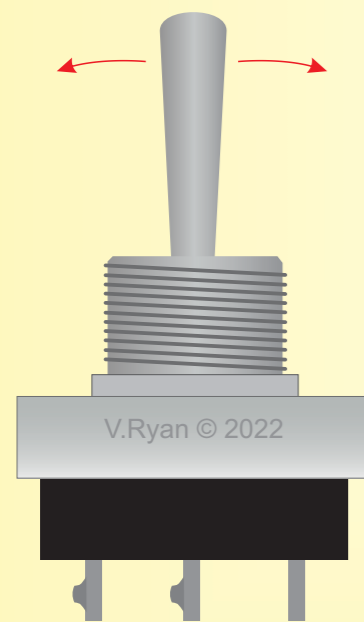
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ELECTRONIC CIRCUIT COMPONENTS HOW THE CIRCUIT WORKS





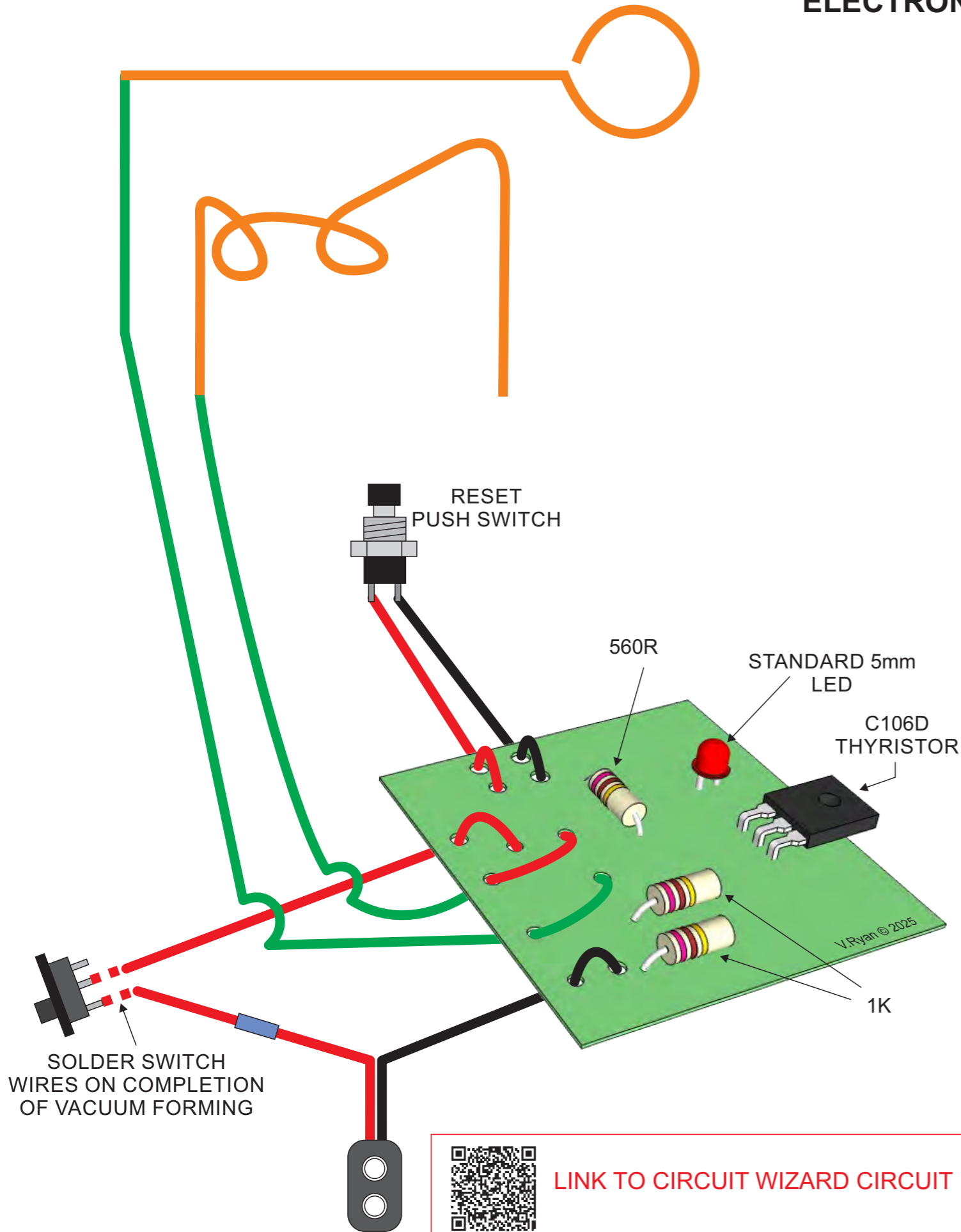
USEFUL LINKS

<https://technologystudent.com/elec1/thyris2.htm>

ELECTRONICS - STEADY HAND GAME

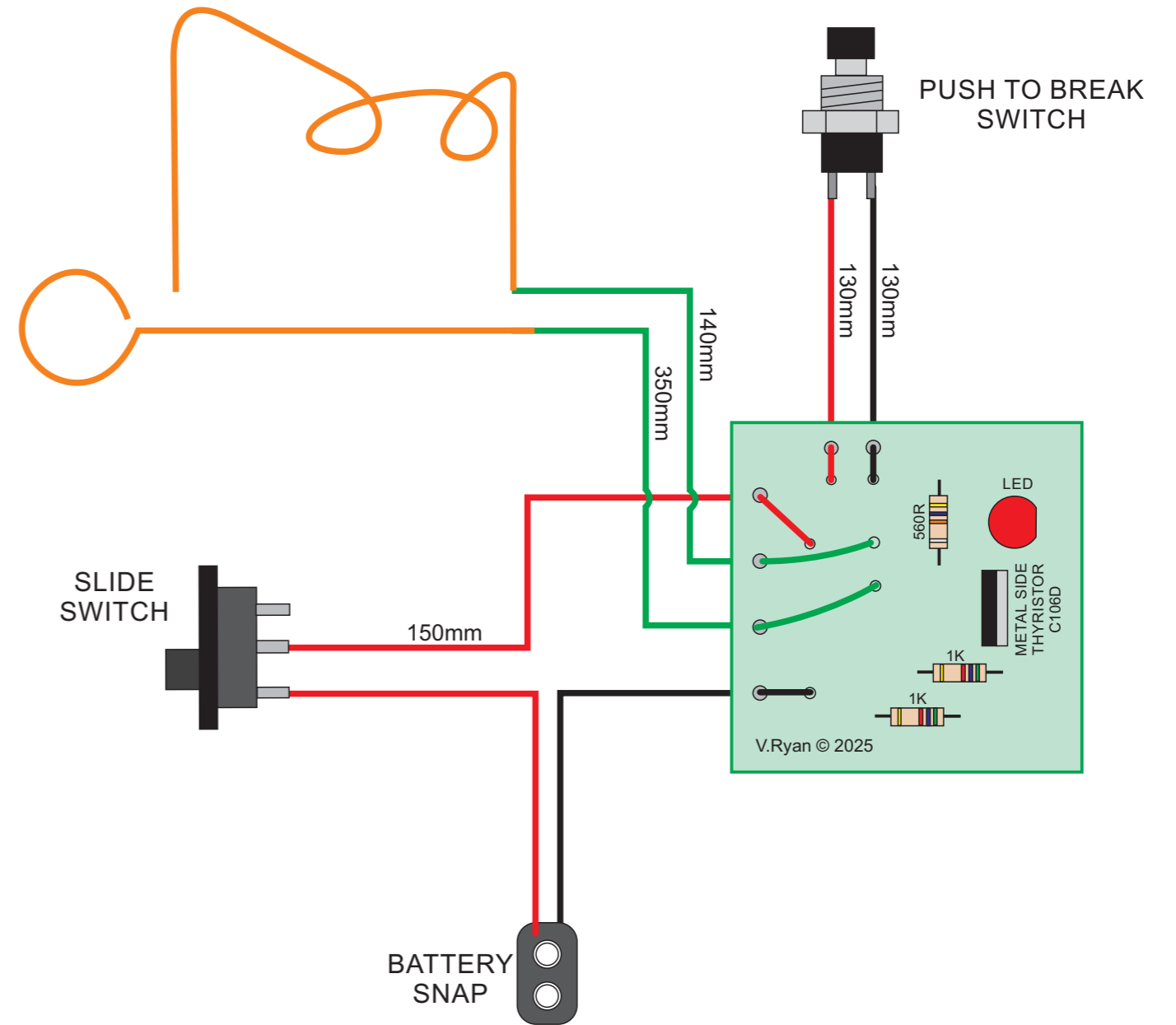
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ELECTRONIC CIRCUIT



LINK TO CIRCUIT WIZARD CIRCUIT

<https://technologystudent.com/pdf23/reset-thyristor1.cwz>



COMPONENTS

1- SLIDE SWITCH, 2 - 1K RESISTORS, 1 - 560R RESISTOR, 1 - C106D THYRISTOR

1 - STANDARD LED, 1 - PUSH TO BREAK SWITCH, 1 - BATTERY SNAP

RED AND BLACK AND GREEN WIRES AS SHOWN ON THE CIRCUIT LAYOUT.

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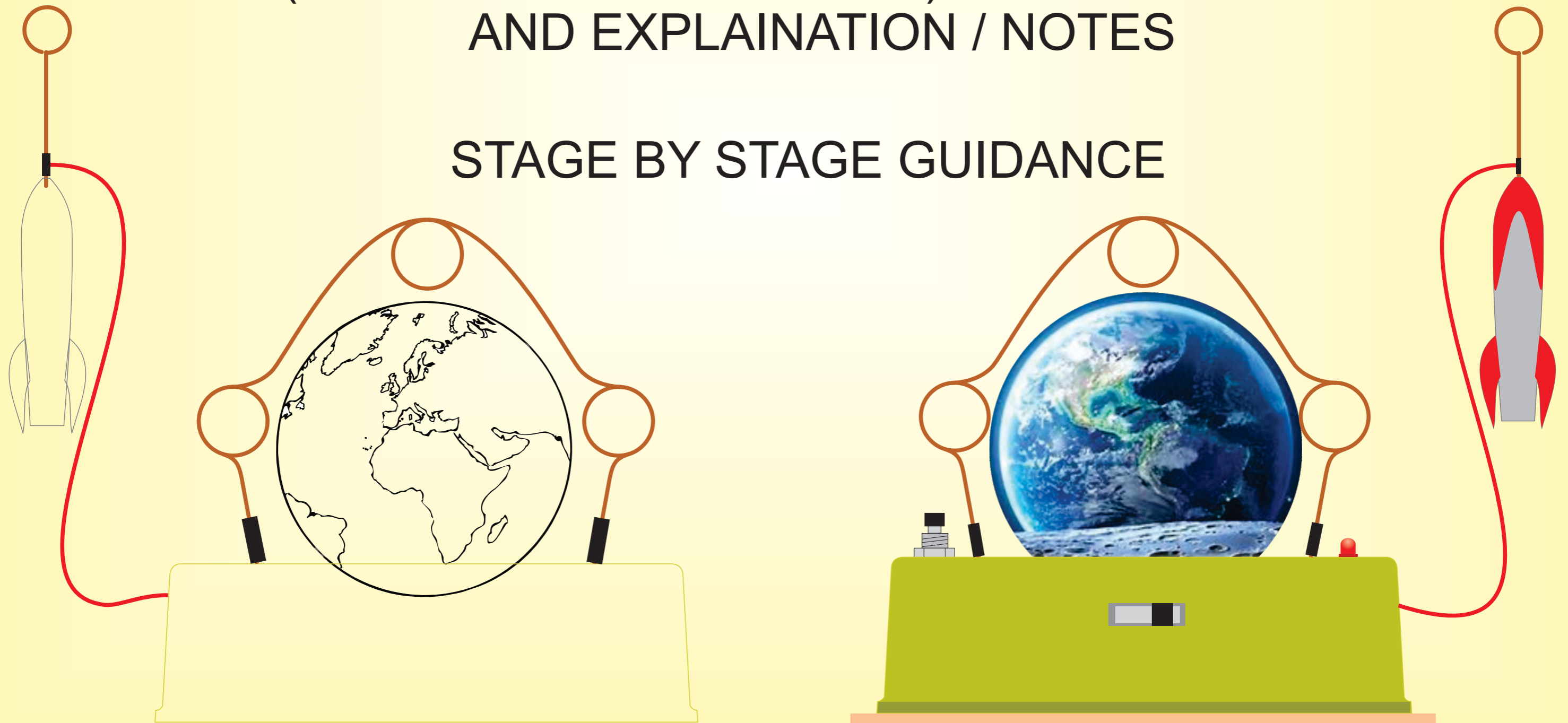
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THEME SELECTION AND IDEAS

3D (ISOMETRIC PROJECTION) OF SELECTED IDEA
AND EXPLANATION / NOTES

STAGE BY STAGE GUIDANCE



This Design Sheet should include:

1. The images that inspire your design, a sketch of your idea, notes explaining how the images relate to your idea.
2. Include your general thoughts about the design.
3. Explain how the idea / design can be improved .
4. A colour rendered illustration of the idea.

STEADY HAND GAME - IDEA ONE

3. Here are a few ideas to enhance the design of my electronic steady hand game.

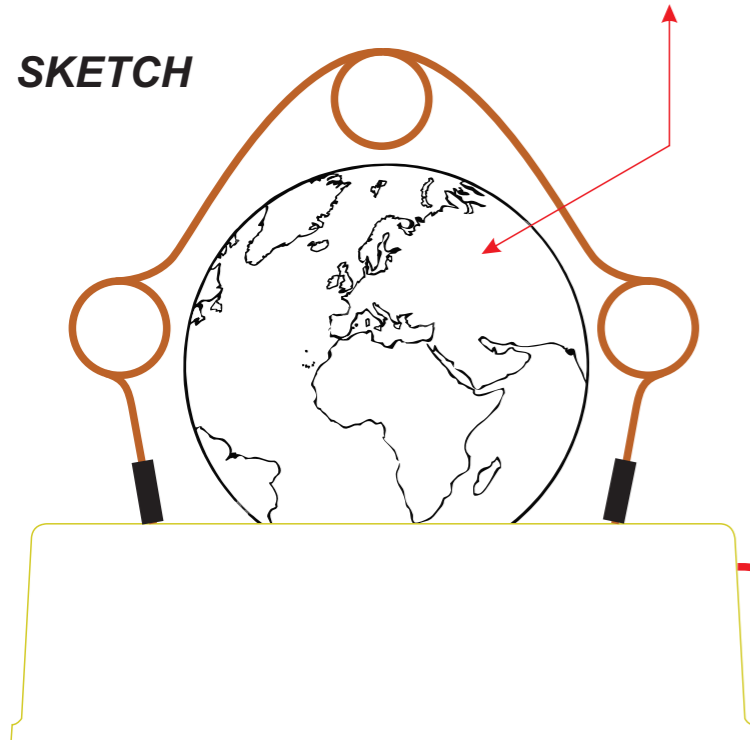
1. **Visual Theme:** I could refine the theme by adding more detailed visuals to the globe, such as landmasses, oceans, or even a night-time city lights effect. This could make the design more captivating.
2. **Interactive Features:** I will consider adding small lights or sounds that activate when the rocket successfully completes sections of the course. A celebratory sound or light burst when the game is completed, would make it more rewarding.
3. **Different Difficulty Levels:** I could introduce adjustable difficulty settings by incorporating interchangeable wire shapes (e.g., loops, zigzags, or curves). This could cater to various skill levels.
4. **Personalization:** I will allow players to customise the rocket wand with stickers or colours. It adds a personal touch, especially if targeted towards younger audiences.
5. **Educational Element:** Since the theme relates to Earth, I may include an educational aspect, like interesting facts about the planet or challenges to complete, that teach about geography or sustainability, as players progress.
6. **Ergonomics:** I will make a model of the wand, so that I can check how comfortable the shape is to hold and use. If the handle is small or awkward to grip, a sleeker design with a softer material might improve usability.
7. **Aesthetics:** Adding LED lights around the base or on the globe, could give it a more dynamic and futuristic look.

1.

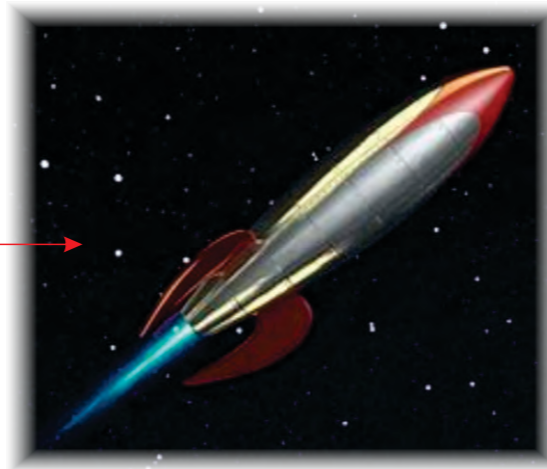


This image of the Earth is the inspiration for the background artwork, positioned behind the wire loop. It will be glued to the back of the base / casing.

SKETCH



This image of the rocket is the inspiration for the wand, that is held in the users hand.



2.

General thoughts regarding my design.

I think the design is quite engaging and imaginative! The combination of the Earth and the rocket-themed wand really adds a playful and educational touch to the game. It evokes a sense of exploration and adventure, which fits nicely with the "steady hand" challenge. The yellow base and the Earth, creates a strong visual connection to the theme, while the rocket wand makes the task feel more dynamic and exciting.

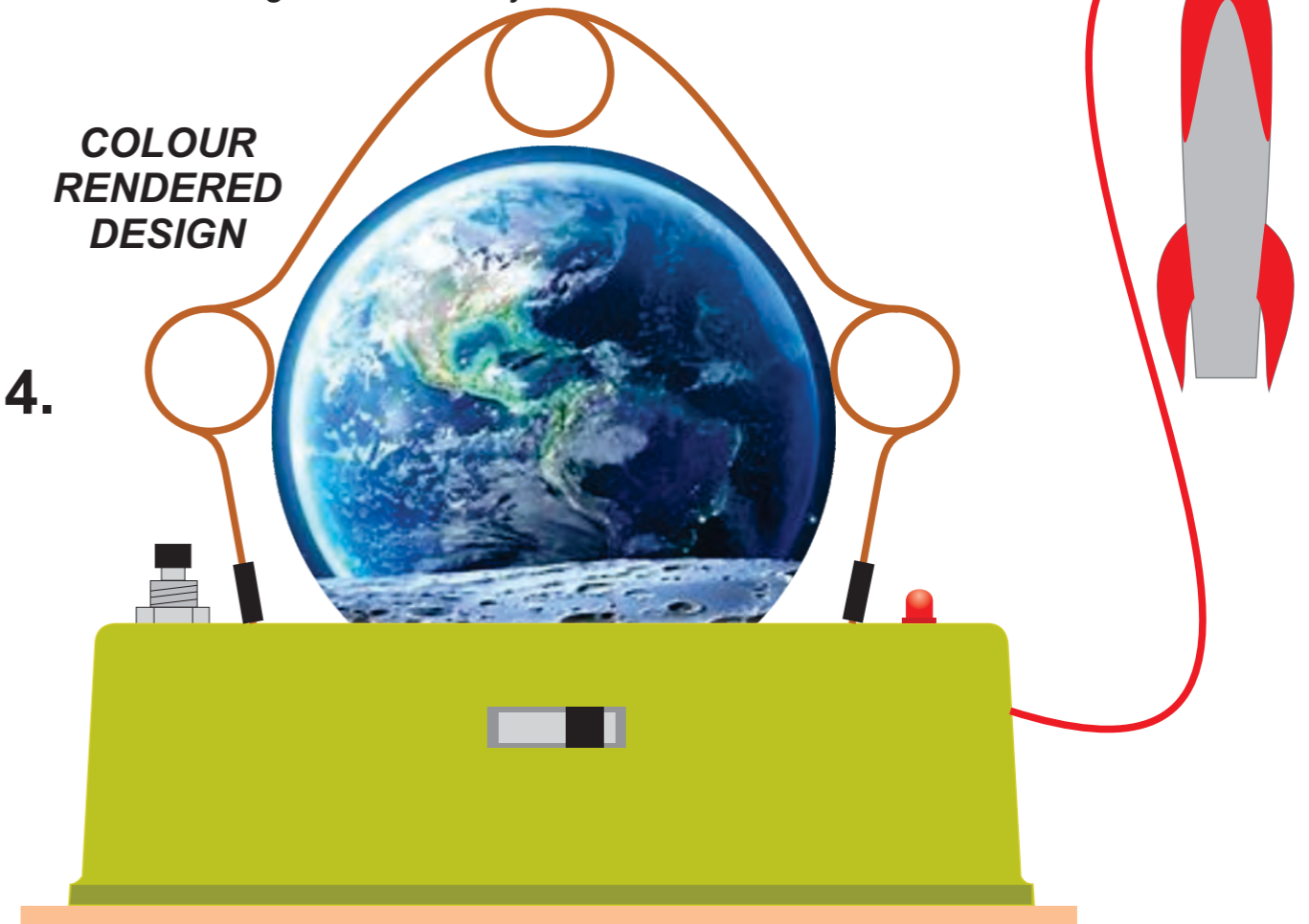


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<https://technologystudent.com/elec1/steady1.htm>

4.

COLOUR RENDERED DESIGN



STEADY HAND GAME - IDEA ONE

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USEFUL LINK

<https://technologystudent.com/elec1/steady1.htm>

STEADY HAND GAME - IDEA TWO

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USEFUL LINK

<https://technologystudent.com/elec1/steady1.htm>

Draw at least one 3D version of your Steady Hand Game. Include your thoughts on the design and important features.

STEADY HAND GAME - SELECTED IDEA - 3DPRESENTATION

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SAMPLE LAYOUT

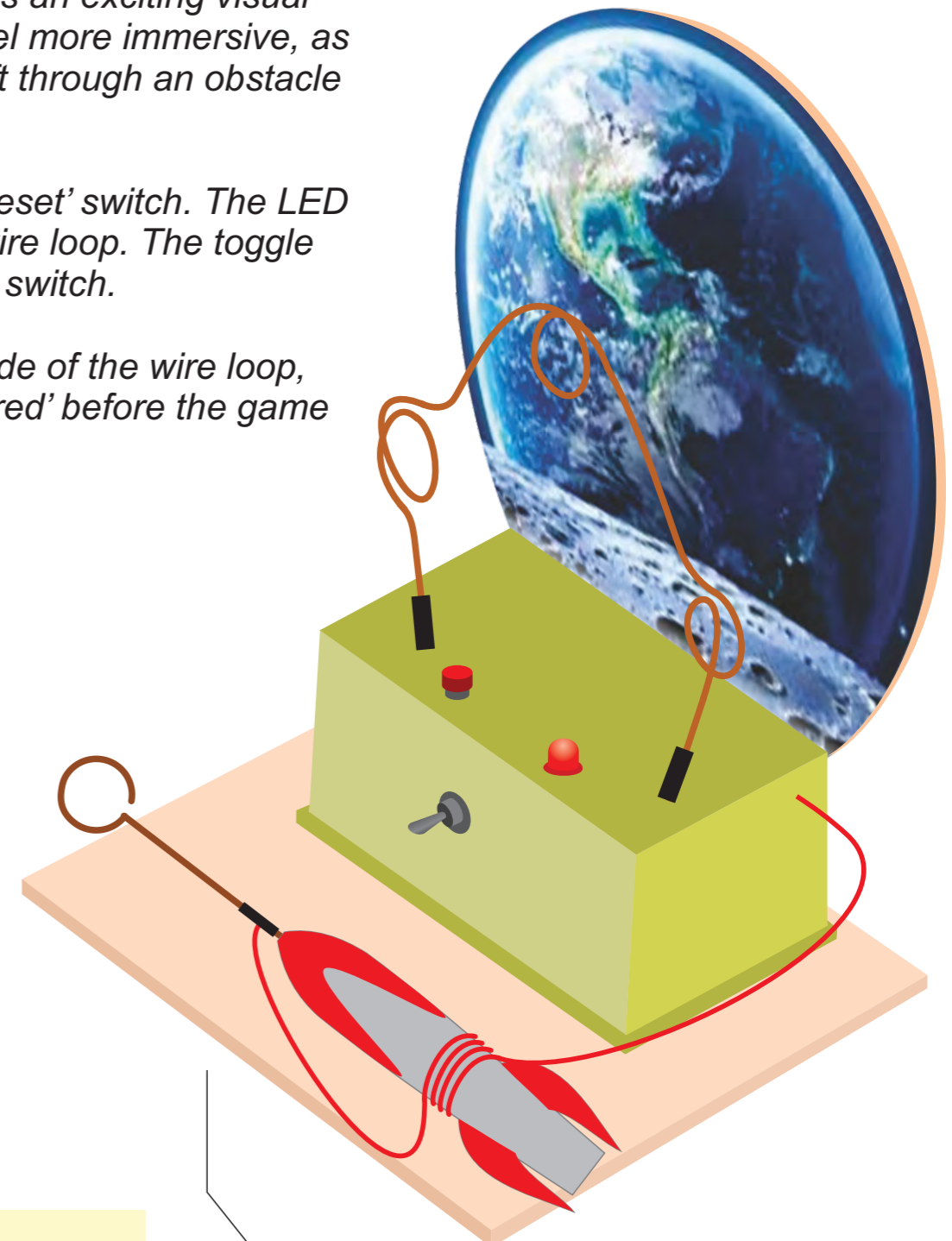
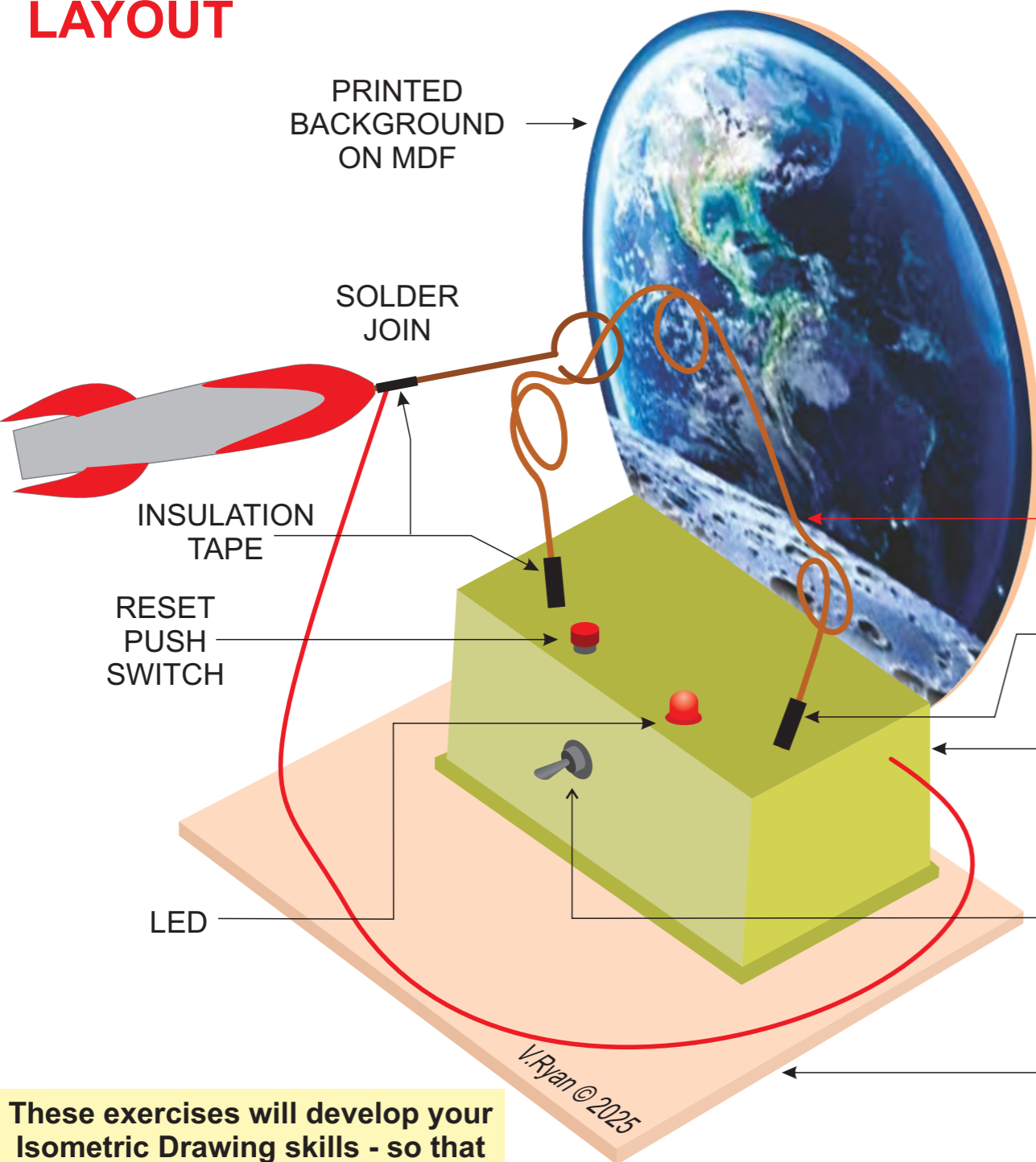
GAME IN USE

This steady hand game idea has great potential! The traditional challenge of manoeuvring a wand through a wire loop is already engaging, but combining it with a 'space' theme background, adds an exciting visual element. It will make the game feel more immersive, as if players are piloting a spacecraft through an obstacle course.

The push switch represents the 'reset' switch. The LED lights if the wand touches the wire loop. The toggle switch is the power switch.

The insulation tape on either side of the wire loop, prevents the circuit being 'triggered' before the game has started.

GAME NOT IN USE WAND STORED



A potential stand . holder for the wand, when it is not in use

These exercises will develop your Isometric Drawing skills - so that you can draw your Steady Hand Game design in 3D

ISOMETRIC DRAWING AND SKETCHING EXERCISES

- <https://technologystudent.com/pdf22/isometric-upgrade-combined1a.pdf>
- <https://technologystudent.com/pdf22/isometric-upgrade-combined1aa.pptx>

ISOMETRIC DRAWING - CRATING OF 3D OBJECTS

- <https://technologystudent.com/pdf22/isometric-upgrade4aa.pdf>
- <https://technologystudent.com/pdf22/isometric-upgrade4aa.pptx>

EXTENSION WORK

Design a way of storing the wand, when the game is not in use. (See the example opposite).



USEFUL LINK

<https://technologystudent.com/elec1/steady1.htm>

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These exercises will develop your Isometric Drawing skills - so that you can draw your Steady Hand Game design in 3D

ISOMETRIC DRAWING AND SKETCHING EXERCISES

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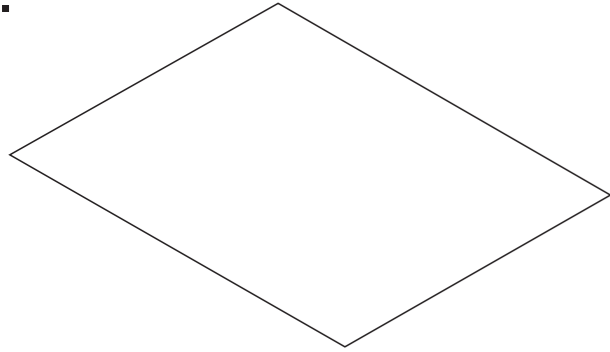
ISOMETRIC DRAWING - CRATING OF 3D OBJECTS

<https://technologystudent.com/pdf22/isometric-upgrade4aa.pdf>
<https://technologystudent.com/pdf22/isometric-upgrade4aa.pptx>

GUIDANCE - DRAWING YOUR STEADY HAND GAME IN ISOMETRIC PROJECTION

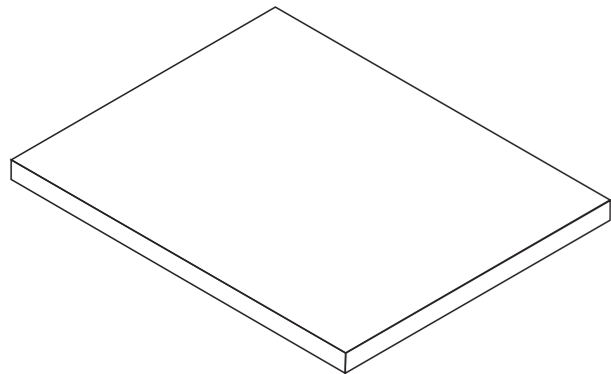
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1.



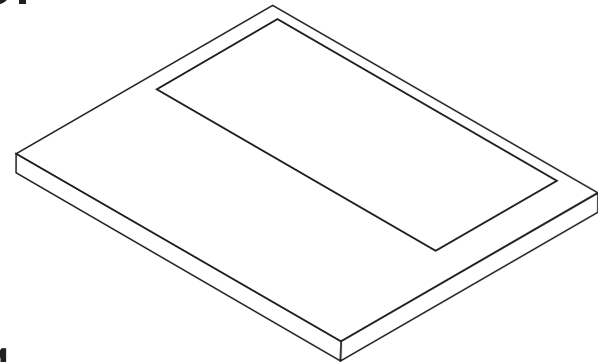
Draw the top of the base

2.



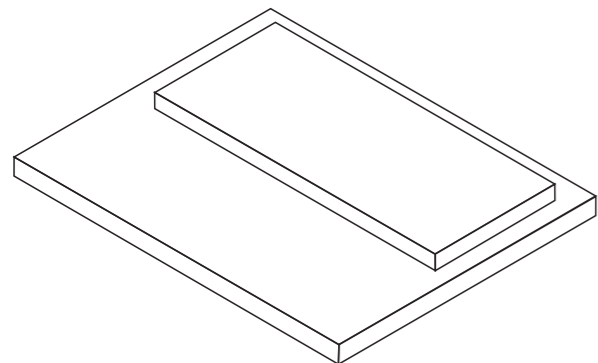
Add the thickness to the base.

3.



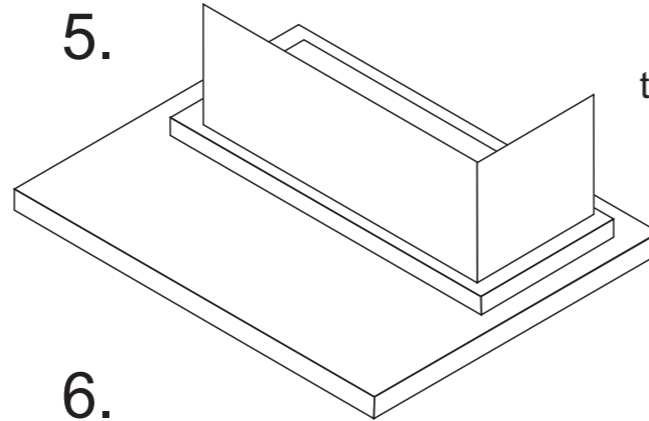
Draw the outline of the bottom of the circuit housing.

4.



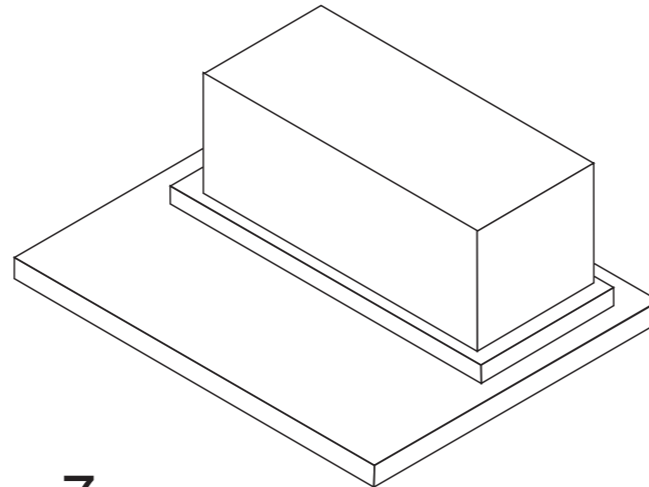
Add depth to the bottom of the housing.

5.



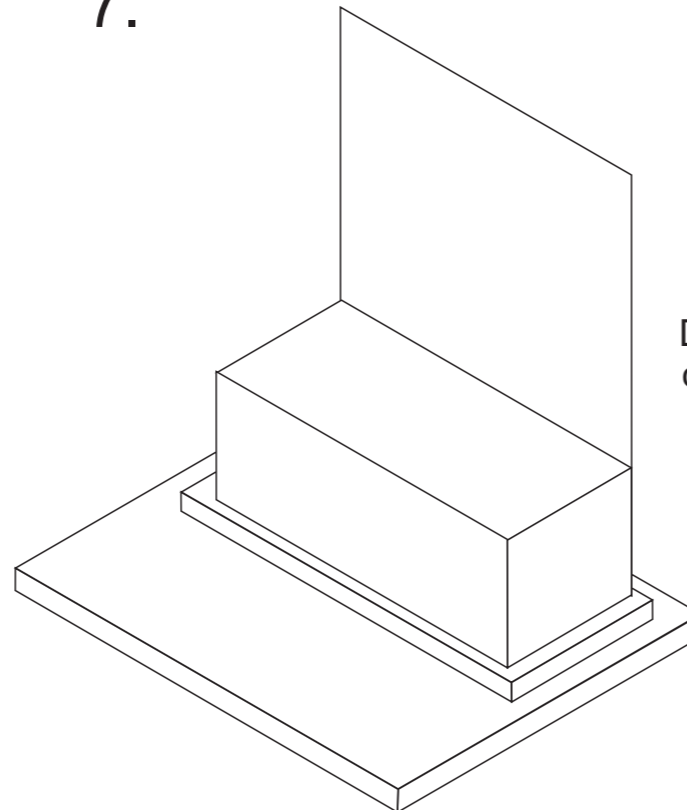
Draw the sides of the circuit housing.

6.



Add the top of the circuit housing.

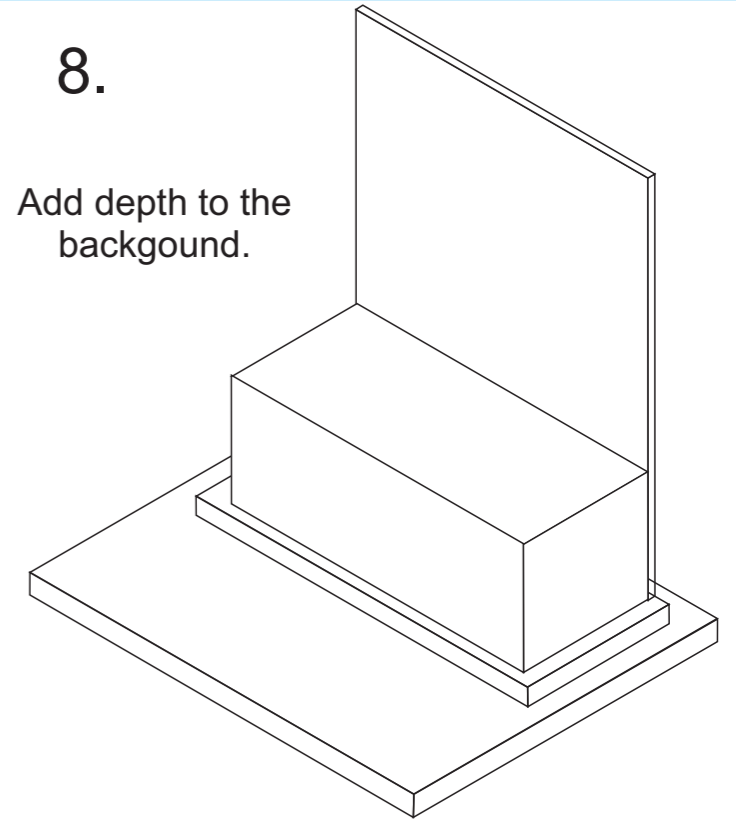
7.



Draw the front face of the background.

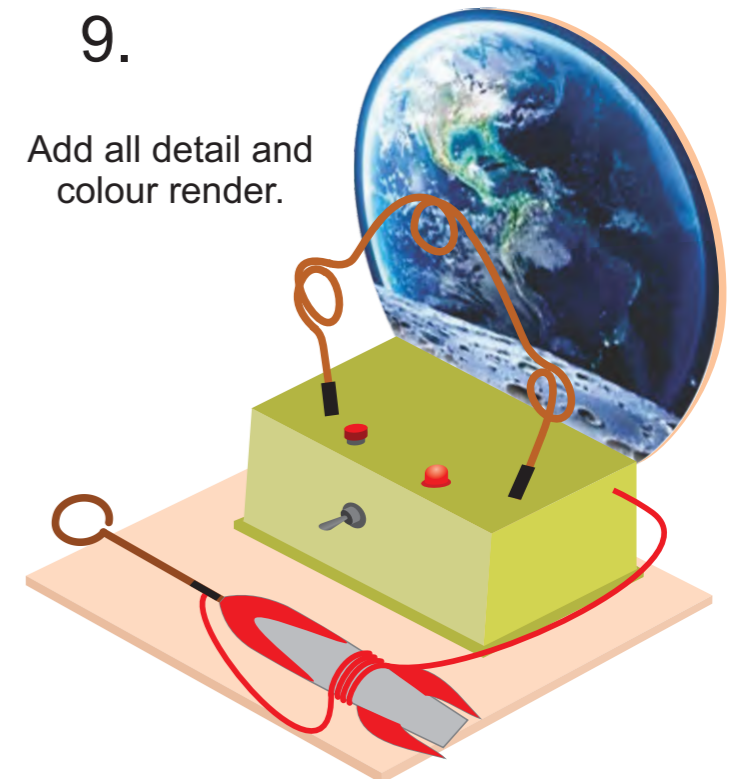
8.

Add depth to the background.



9.

Add all detail and colour render.



USE THESE LINKS TO HELP YOU DEVELOP SHADING AND RENDERING SKILLS

<https://technologystudent.com/pdf22/shading-combined1aa.pdf>
<https://technologystudent.com/pdf22/shading-combined1aa.pptx>

**Draw at least one 3D version of your Steady Hand Game.
Include your thoughts on the design and important features.**

STEADY HAND GAME - SELECTED IDEA - 3D PRESENTATION

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USEFUL LINK

<https://technologystudent.com/elec1/steady1.htm>

Use the outline of the steady hand game to help you draw a 3D version of your Steady Hand Game. Include your thoughts on the design and important features.

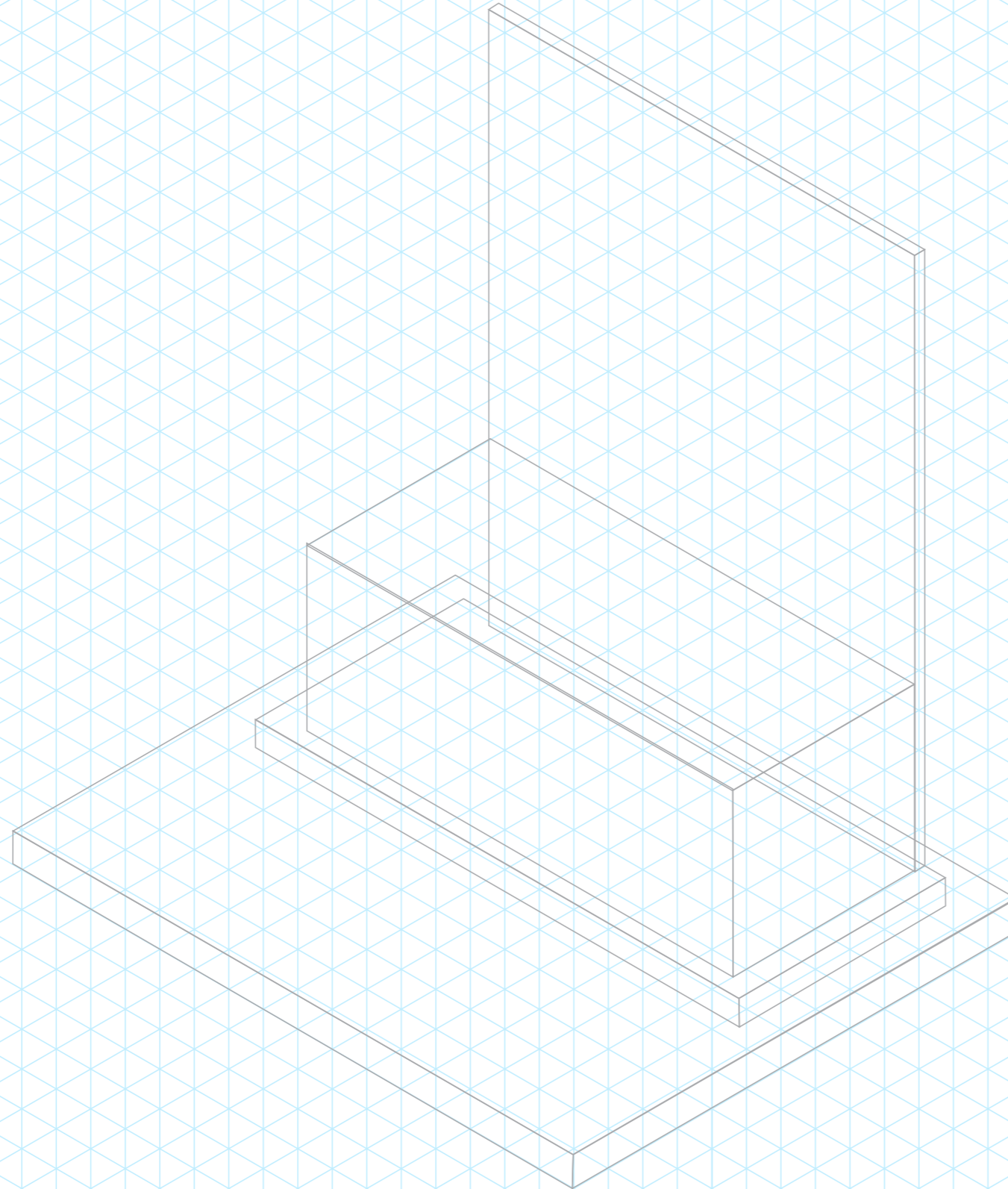
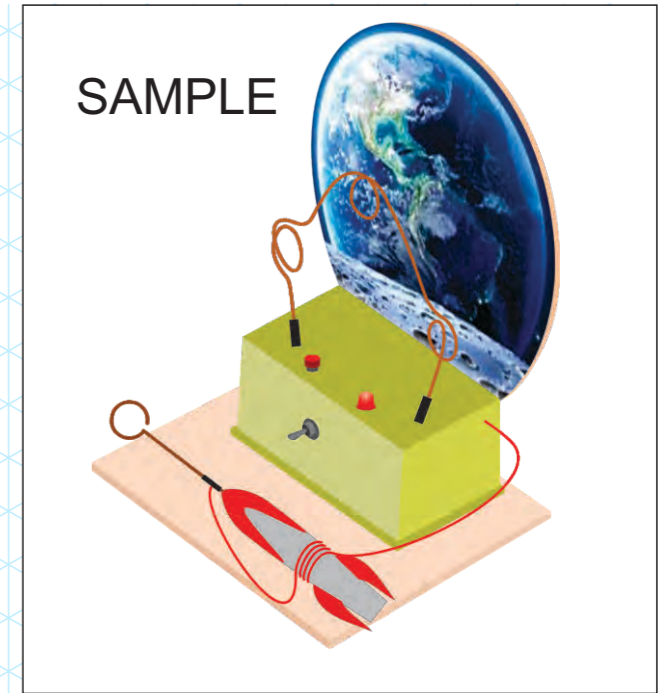
STEADY HAND GAME - SELECTED IDEA - 3D PRESENTATION

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USEFUL LINK

<https://technologystudent.com/elec1/steady1.htm>



Use the isometric grid to help you draw a 3D version of your Steady Hand Game. Include your thoughts on the design and important features.

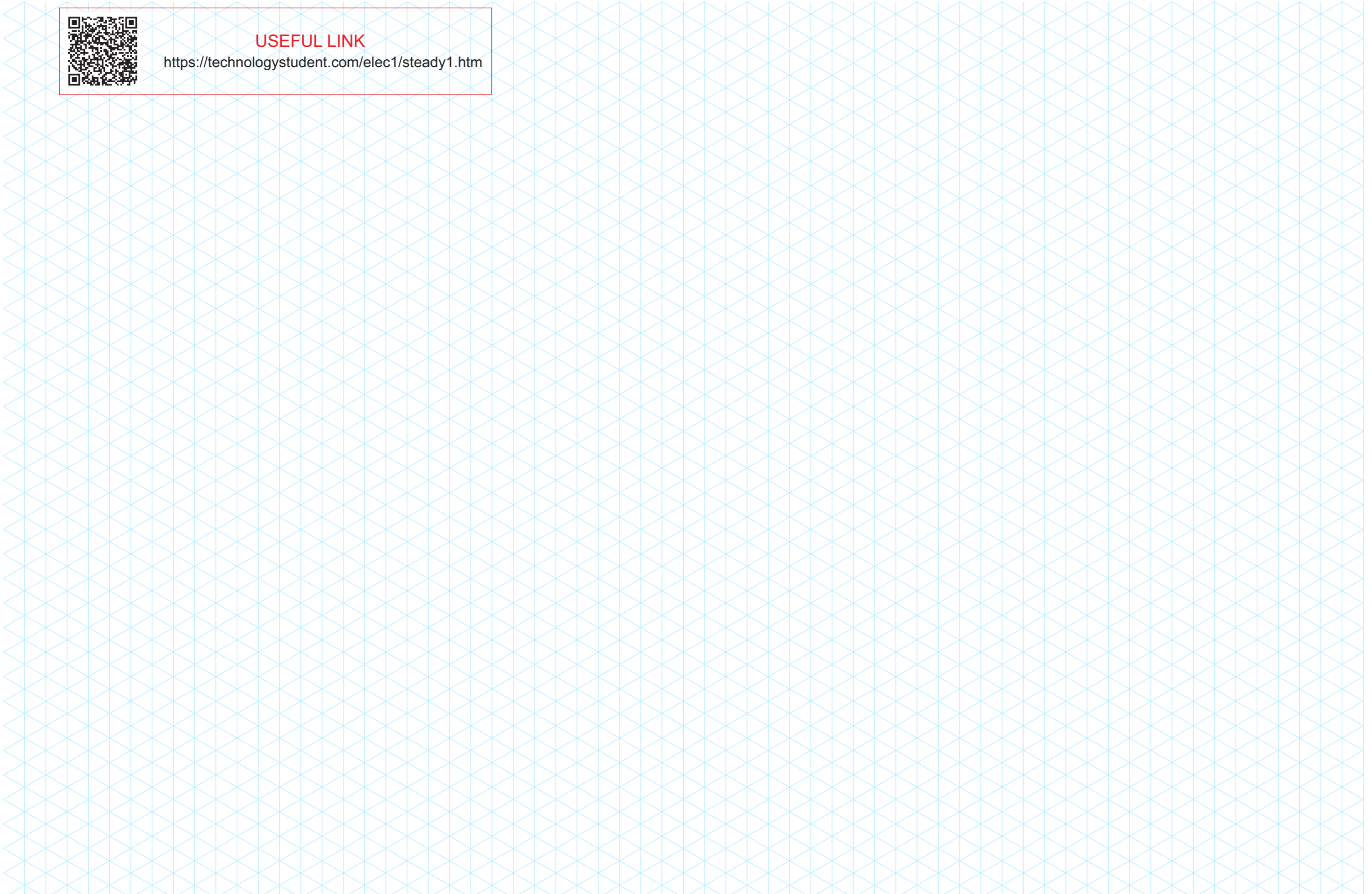
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ASSEMBLY GUIDANCE

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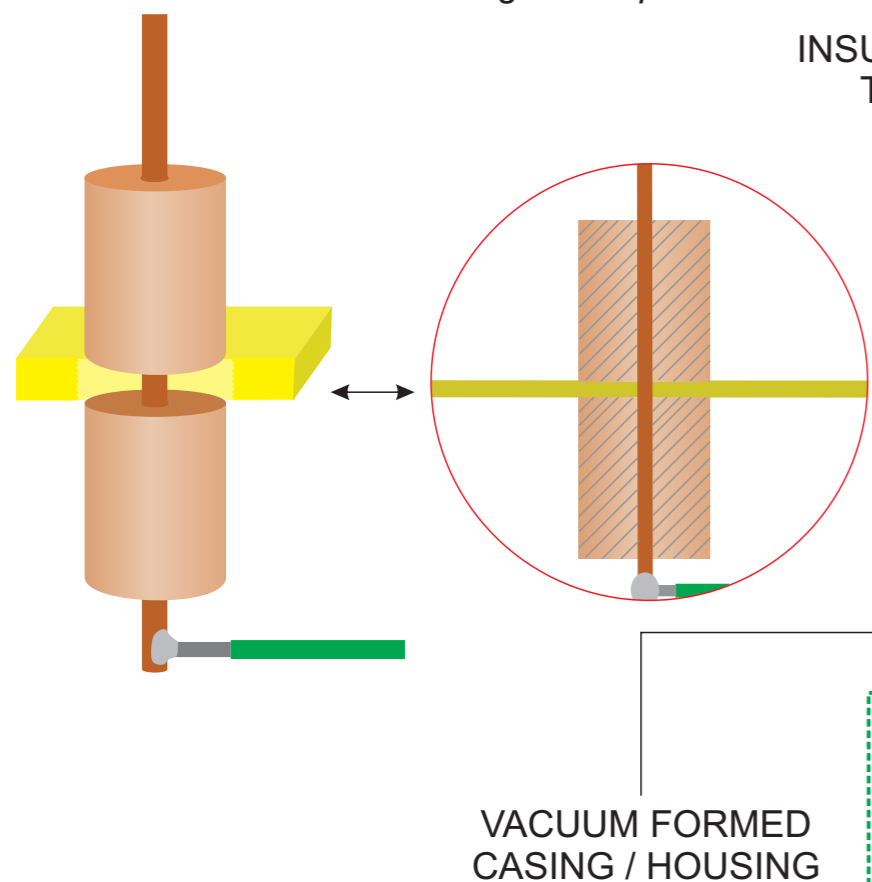
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One of the problems associated with this design is; 'how to fit the wire loop to the casing / housing, so that it is stable and does not move around'.

TECHNIQUE ONE

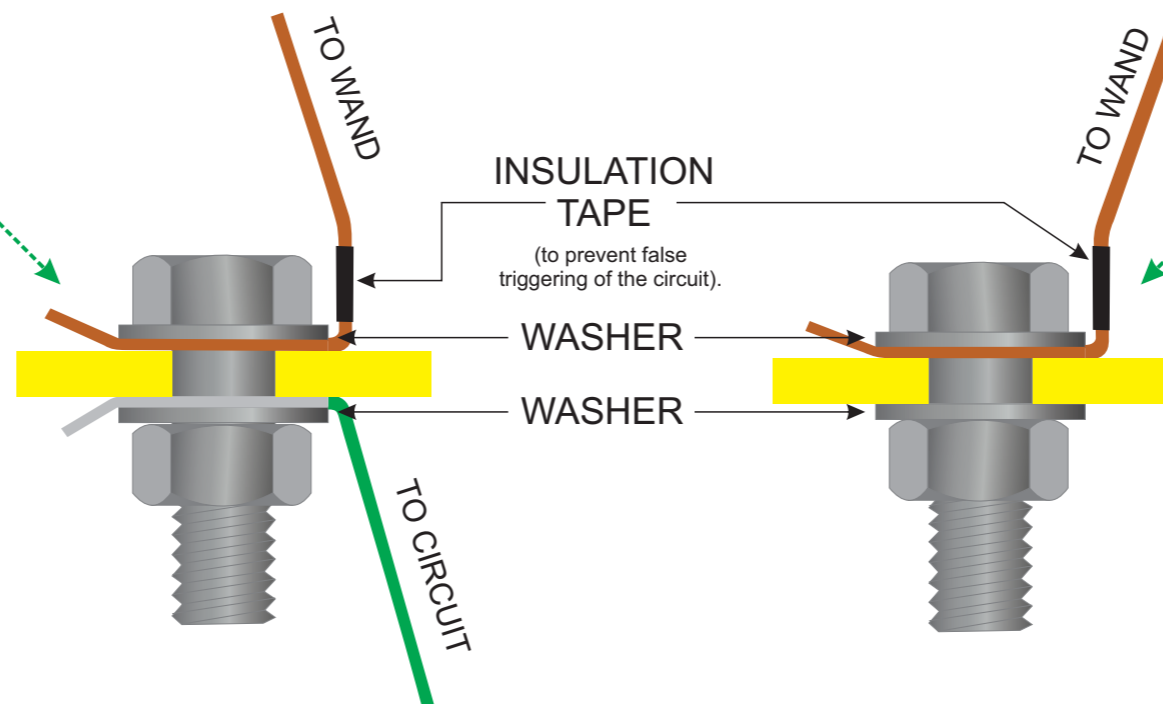
- Four small lengths of dowel rod, drilled to the diameter size of the loop wire, are used to hold the loop wire stable and in position. The dowels are glued in position.



VACUUM FORMED CASING / HOUSING

TECHNIQUE TWO

- An alternative method of joining the wire loop to the casing, is to use small nuts and bolts. The wire loop and the 'circuit wire' are trapped between washers and the plastic casing and the nuts tightened.



INSULATION TAPE
(to prevent false triggering of the circuit).

WASHER

WASHER

TO CIRCUIT

TO WAND

TO WAND

The loop is made from either steel welding rod or brazing rod. It is shaped using a variety of pliers and / or homemade jigs and formers.

The wand is made from steel welding rod or brazing rod. It fits into the dowel handle, which is drilled to take the rod. The circuit's connecting wire is soldered onto the rod and insulation tape is wrapped around the join.

The wand is shaped using a small round section of steel or simply shaped with a pair of pliers.

SOLDERED JOINT
Wrapped with insulation tape

SHAPED AND PAINTED DOWEL

WAND

SECTIONAL VIEW OF THE CASING HOLDING THE ELECTRONIC CIRCUIT



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EVALUATION AND TESTING (Checklist Approach)



EVALUATION AND TESTING - CHECK LIST

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CHECKLIST TO EVALUATE YOUR STEADY HAND GAME.

Below is a check list that you can follow when evaluating and testing your steady hand game.

1. Functionality

Does the LED activate when the wand touches the wire?
Is the circuit reliable without intermittent issues?

2. Aesthetics

Is the game visually appealing and aligned with its theme?
Does the design attract the intended audience?

3. User Experience

Is the game easy to understand and play?
Does the game provide an appropriate level of challenge?

4. Durability

Is the structure sturdy and built to last through repeated use?
Are the components securely attached?

5. Safety

Are all wires and components insulated and safe to touch?
Is there minimal risk of sharp edges or other hazards?

6. Target Audience Fit

Does the design suit the age group and preferences of the audience?

7. Cost-Effectiveness

Was the game affordable to produce whilst maintaining quality?
Is it priced reasonably for its value?

8. Sustainability

Were recycled or eco-friendly materials used?
Is it designed for easy repair or recycling at the end of its life?

9. Testing and Feedback

Were users consulted during prototyping and were their suggestions implemented?
Were all features thoroughly tested before finalising the product?



USEFUL LINK

<https://technologystudent.com/elec1/steady4.htm>



1. Functionality

2. Aesthetics

3. User Experience

4. Durability

5. Safety

6. Target Audience Fit

7. Cost-Effectiveness

8. Sustainability

9. Testing and Feedback

EVALUATION AND TESTING - CHECK LIST

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Does the LED activate when the wand touches the wire?
Is the circuit reliable without intermittent issues?

2. Aesthetics

Is the game visually appealing and aligned with its theme?
Does the design attract the intended audience?

3. User Experience

Is the game easy to understand and play?
Does the game provide an appropriate level of challenge?

4. Durability

Is the structure sturdy and built to last through repeated use?
Are the components securely attached?

5. Safety

Are all wires and components insulated and safe to touch?
Is there minimal risk of sharp edges or other hazards?

6. Target Audience Fit

Does the design suit the age group and preferences of the audience?

7. Cost-Effectiveness

Was the game affordable to produce whilst maintaining quality?
Is it priced reasonably for its value?

8. Sustainability

Were recycled or eco-friendly materials used?
Is it designed for easy repair or recycling at the end of its life?

9. Testing and Feedback

Were users consulted during prototyping and were their suggestions implemented?
Were all features thoroughly tested before finalising the product?



USEFUL LINK

<https://technologystudent.com/elec1/steady4.htm>



SAMPLE ANSWER

1. Functionality

The LED appears to light immediately, when the wand touches the wire. It can be clearly seen when illuminated.

2. Aesthetics

The design is interesting and functional. It could benefit from more visual appeal, such as an alternative theme or vibrant colours, to make it more engaging.

3. User Experience

The game has been criticised for being straightforward. However, it provides an appropriate challenge level. Adding more interactive elements could enhance the user experience.

4. Durability

The components appear soldered securely to the circuit board. It has been tested robustly by several potential clients.

5. Safety

The wires are insulated and there are no visible sharp edges, which is good for safety. The casing for the circuit components prevents the user coming in contact with components.

6. Target Audience Fit

The design suits a general audience, but could be tailored further (e.g. adding a theme for kids or a more sophisticated style for adults).

7. Cost-Effectiveness

The materials are relatively inexpensive, suggesting a cost-effective design. Production costs will be reduced further, when mass manufacture begins.

8. Sustainability

Recycled and eco-friendly materials have been used, improving the products environmental impact.

9. Testing and Feedback

Testing by a number of potential clients has been positive. Some suggestions regarding improvements will be made (see above).

ELECTRONICS - STEADY HAND GAME

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<https://www.facebook.com/groups/254963448192823/>

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WORKSHEETS SUPPORTING PRACTICAL WORK

SAFETY AND SOLDERING

MANUFACTURING A PRINTED CIRCUIT BOARD (PCB)

VACUUM FORMING

USE THE NEXT SHEET / SLIDE TO WRITE DOWN YOUR ANSWERS.

USEFUL LINK
<https://technologystudent.com/pcb/sldsaf1.htm>

ELECTRONICS - STEADY HAND GAME

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WRONG / POTENTIAL HAZZARD
What is wrong / unsafe / bad practice, as identified by the diagrams / parts of diagrams, labelled below?

CORRECT / GOOD PRACTICE
Explain what is correct and good practice, as identified by the diagrams / parts of diagrams, labelled below?

PASSED SAFETY TEST
APPLIANCE ID: 1243z
Test Date: 23/6/22
Expiry Date: 23/6/23
Test By: Mr Pat. Longdale

USEFUL LINKS
<https://technologystudent.com/equip1/vacform1.htm>
<https://technologystudent.com/gprep07/vac2.html>

VACUUM FORMING THE 'CIRCUIT CASING'

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The steady hand game circuit is housed inside the circuit casing (see below). The casing is manufactured through a process called Vacuum Forming.

In the space opposite, using diagrams 1 to 5 for reference, describe the vacuum forming process.

1. HEATER
2. HEATER
3. HEATER
4. HEATER
5. HEATER

USE THE NEXT SHEET /
SLIDE TO WRITE DOWN
YOUR ANSWERS.



USEFUL LINK

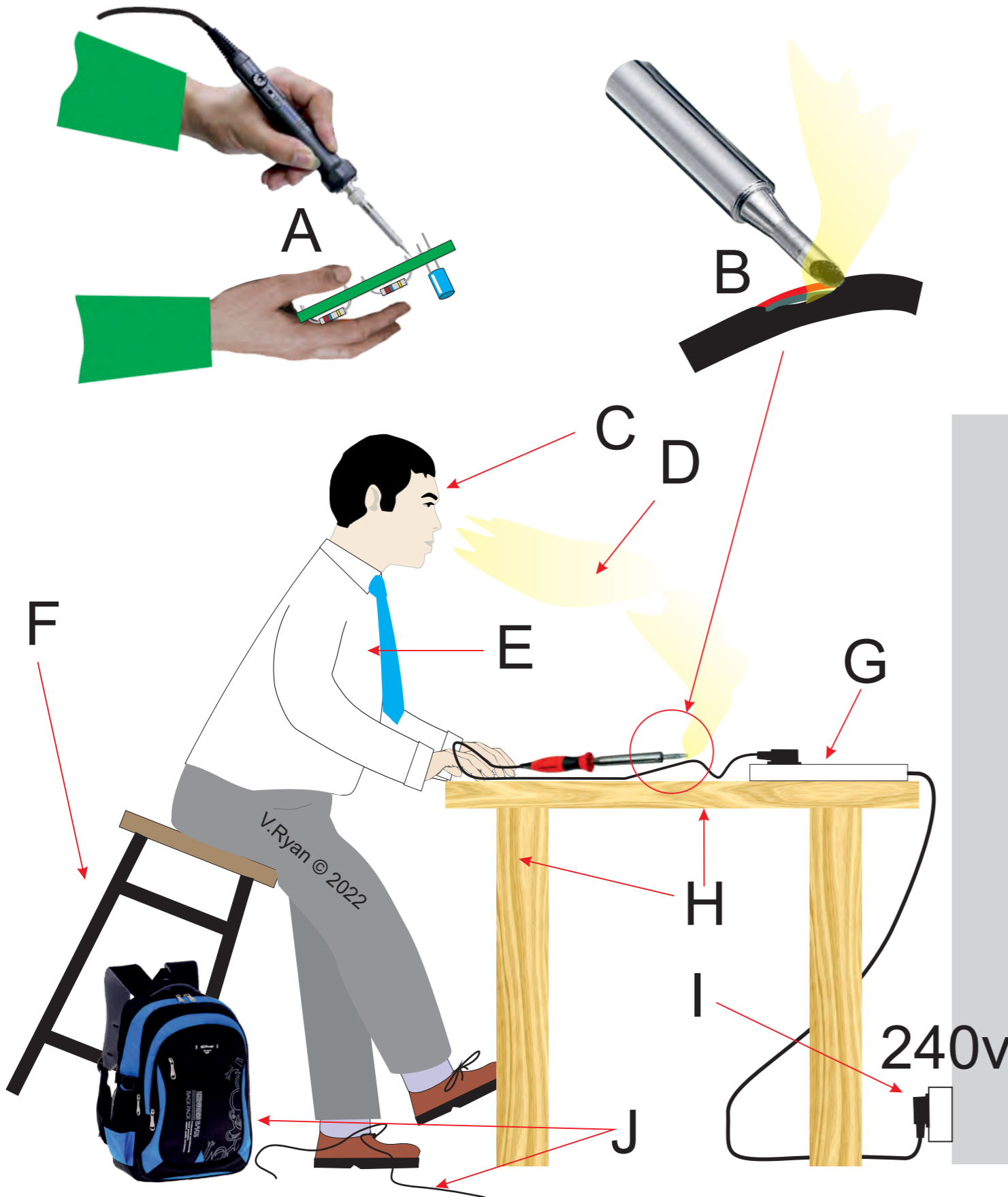
<https://technologystudent.com/pcb/sldsaf1.htm>

ELECTRONICS - STEADY HAND GAME

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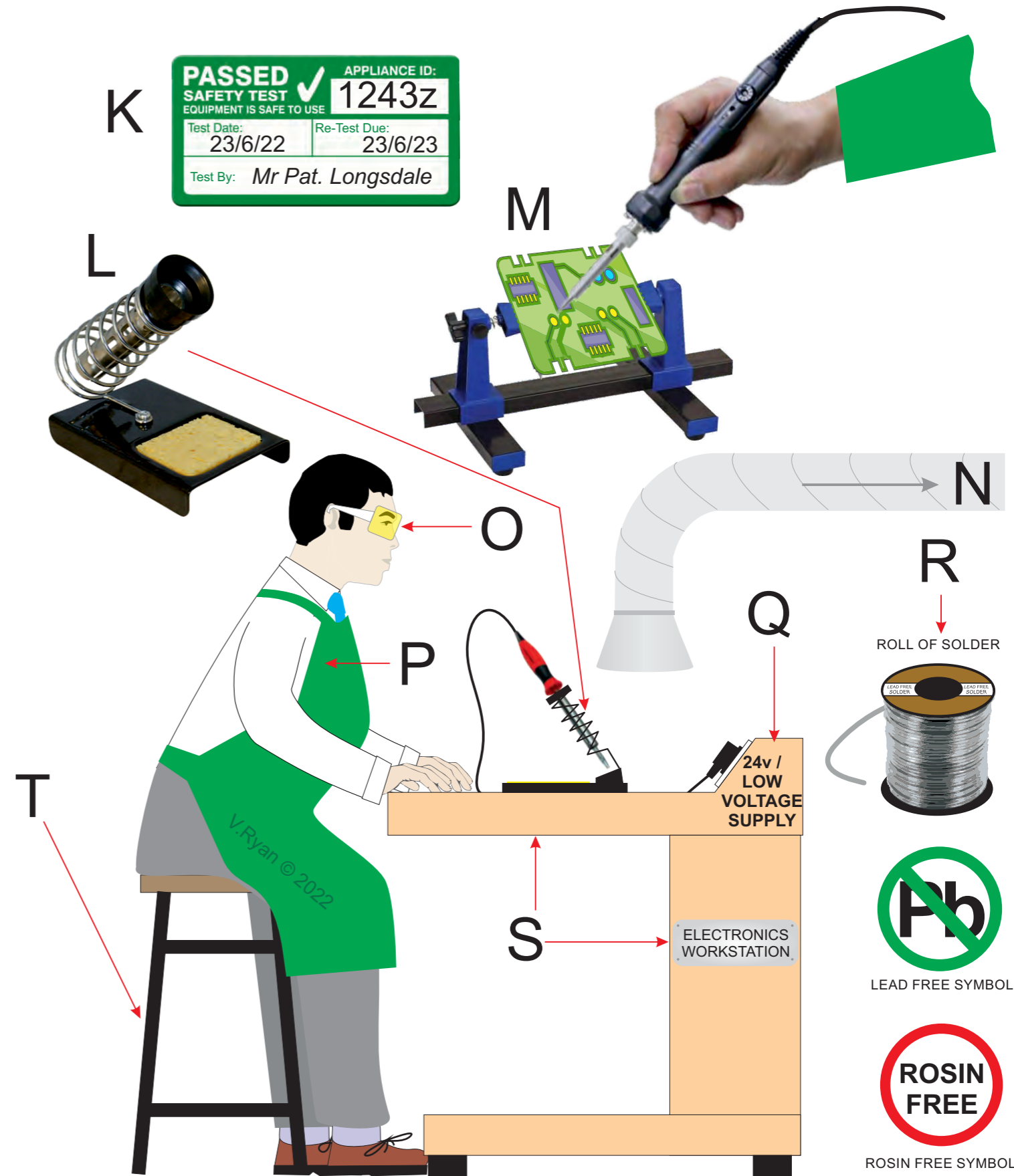
WRONG / POTENTIAL HAZZARD

What is wrong / unsafe / bad practice, as identified by the diagrams / parts of diagrams, labelled below?



CORRECT / GOOD PRACTICE

Explain what is correct and good practice, as identified by the diagrams / parts of diagrams, labelled below?





WRONG / POTENTIAL HAZZARD

- A.
- B.
- C.
- D.
- E.
- F.
- G.
- H.
- I.
- J.

CORRECT / GOOD PRACTICE

- K.
- L.
- M.
- N.
- O.
- P.
- Q.
- R.
- S.
- T.



USEFUL LINK

https://technologystudent.com/elec_fish/new_pcb1.html

SOLDERING QUESTIONS - GOOD AND BAD JOINTS

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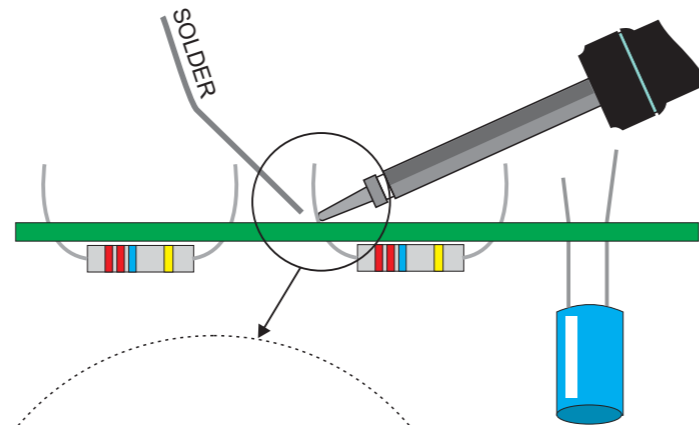
<https://www.facebook.com/groups/254963448192823/>

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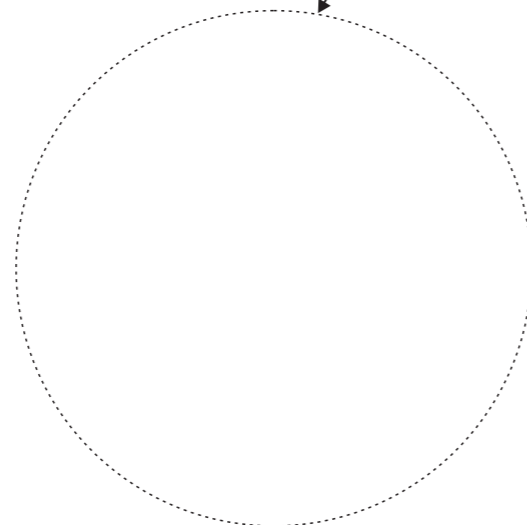
1. What is the composition of typical solder?

2. Why are modern solders lead free?

3. The soldering iron shown in the diagram opposite, is being used to metallurgically join the component pin/wire to the copper track of a circuit.



In the circle (dotted line), draw a magnified view, showing how a good soldering joint should look.



4. What is wrong with this solder joint ? How has it happened?



5. What is wrong with this solder joint ? How has it happened?



6. Describe the soldering process (soldering a component to a PCB)



USEFUL LINKS

<https://technologystudent.com/pcb/PCB3A.htm>

<https://technologystudent.com/pcb/pcb4a.htm>

MANUFACTURING A PCB

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Complete the sequence drawing of manufacturing a printed circuit board / circuit, by adding images / sketches and notes to each stage.

PHOTO-RESIST BOARD

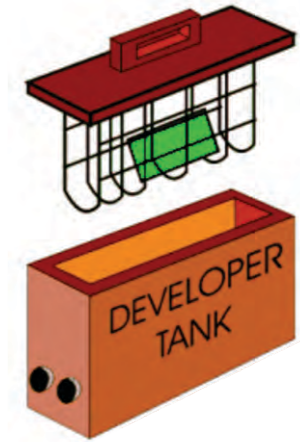
PHOTO-RESIST BOARD is a piece of glass reinforce plastic. One of the sides is copper clad and this has a photosensitive coating. When the plastic film is peeled back the sensitive coating is revealed.

THE PCB MASK

UV LIGHT BOX



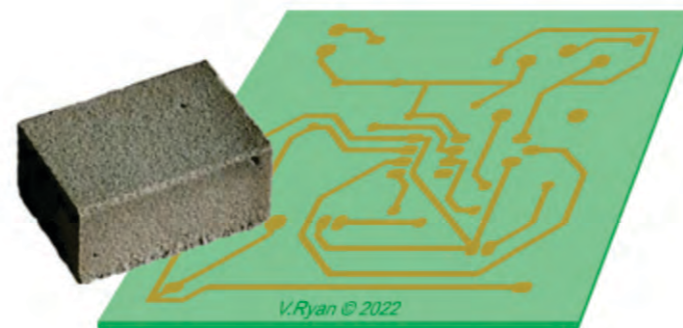
DEVELOPER



ETCHANT

The etchant is held in a 'bubble etch tank' and is heated. This solution slowly etches away the unwanted copper, leaving the tracks only. At this stage it is important to keep checking that the PCB is completed (time - 15 to 45 minutes).

PCB ERASER



PCB DRILL

The last stage is drilling the holes for the components. A small PCB drill is used for this purpose. Care is needed because a good PCB can be ruined by careless drilling.

SOLDER

