Stage 4 STEM – Olympiad

## Extension Challenge 1: Artificial hand

In this challenge you are required to construct a functioning artificial hand using the suggested resources listed below.

## Outcomes

* **SC4-8WS** selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems

[Science Years 7-10 Syllabus (2018)](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/learning-areas/science/science-7-10-2018) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2018

* **TE4-1DP** designs, communicates and evaluates innovative ideas and creative solutions to authentic problems or opportunities
* **TE4-10T** explains how people in technology related professions contribute to society now and into the future

[Technology Mandatory Years 7-8 Syllabus (2017)](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/learning-areas/technologies/technology-mandatory-7-8-new-syllabus) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2017

## Resources required

* One A4 sheet of cardstock
* Paper straws, string and toilet roll.
* Additional materials may be included to improve function during modification
* A 30cm ruler, pencil, scissors and sticky tape
* Watch the video [How 3D printed prosthetic hands are changing these kids’ lives](https://youtu.be/Cl8ijPGEKO8) (duration 3:29)

## Glossary

To assist with your understanding of the task, define the following terms in the table below.

Table 1 – Glossary

|  |  |
| --- | --- |
| Term | Definition |
| Prosthetic  |  |
| Artificial |  |
| Grasp |  |
| Lever |  |
| Tendon |  |

## Directions to students

1. Complete the glossary definitions task to help with your understanding.
2. Watch the video [How 3D printed prosthetic hands are changing these kids’ lives](https://youtu.be/Cl8ijPGEKO8) (duration 3:29) to see how biomedical engineering can improve the lives of others by making artificial hands.
3. Trace around your hand and wrist onto the piece of cardstock. Cut along the outline.
4. For knuckle joints, mark on the fingers where they will need to bend. Using the ruler, fold a crease along the marked lines so that the finger can bend inward.
5. For bones, cut sections of straw shorter than the distance between folds on the fingers. Secure them in place using sticky tape. Add a section of straw at the wrist.
6. For controlling tendons, cut five lengths of string approximately 40cm long. Feed each length of string through the straws and secure at the fingertips with sticky tape.
7. Test that the fingers can close when each string is pulled.
8. Secure your cardstock hand at the wrist to the end of a 30cm ruler.
9. Holding the 30cm rule at the opposite end to the hand, attempt to grip, hold and pick up a toilet roll.
10. Modify the function of your artificial hand to grip the toilet roll if required. For example, adding a material to improve grip or changing the location of fingers.
11. Complete the recount and learning reflection activity.
12. Submit evidence of completion to your teacher for feedback.

## Success criteria

A student is successful if their artificial hand can grip, lift and hold a toilet roll 30cm about the desk for 30 seconds.

## Evidence of completion

In the space provided below, provide evidence of your completed artificial hand. This could be a digital photograph or a pencil sketch. Include annotations that explain how the hand functions.

## Procedure recount

In the space provided below, provide a procedure recount of how you made your artificial hand. Remember to include the correct names of materials, equipment and techniques used. Seek advice from your teacher if you need help.

## Challenge reflection

Consider the process of designing, making and testing your artificial hand (the design process). What worked well for you? What did you have difficulty with? What would you differently next time? Are there other materials you could have used and why?

## Extension challenge reflection

Consider the purpose and application of artificial limbs, like those presented in the video. How can an artificial limb improve the lives of others? What impact could this improvement in quality of life may have on an individual and in turn, society?