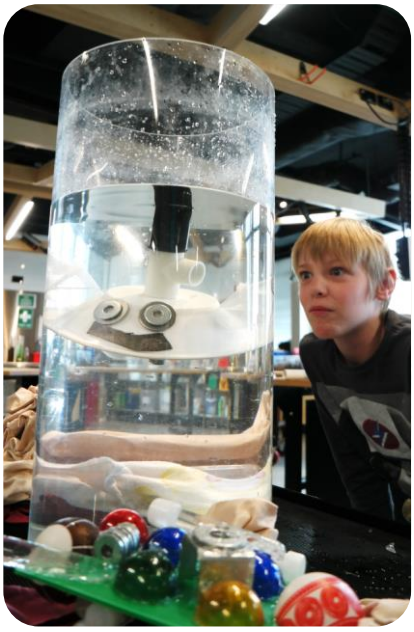
Questacon MAKER PROJECT

WORKSHOP TEACHER RESOURCE

Lesson Plan: Simple Submersibles (120 minutes)



This resource provides all you need to know to run your own Simple Submersibles workshop in your classroom, similar to those run at the Ian Potter Foundation Technology Learning Centre in Canberra, and aligns with the innovation process.

Simple Submersibles explores the concepts of buoyancy through a semi-structured, hands-on building activity. The activity is staged, with each new challenge building on the last. This allows students to progress from simple predictions of what will float and sink to creating a neutrally buoyant submersible from simple materials.

This lesson focuses on the Make, Try and Refine segments of the Innovation Process. Submersibles are best described as continual "works-in-progress" or prototypes. They require precision and refinement, and places for changes are best discovered through frequent testing.

You can find more activities, lesson plans, and information about the Innovation Process at the Teacher Resources section of our website at www.questacon.edu.au*.*

Activity Objectives

Students will work in small groups (2-3 students) to create unique submersibles that are neutrally buoyant in water using simple materials and tools such as card, string, masking tape, scissors and hot glue – whatever is cheap, recycled and accessible!

Each challenge will get progressively harder and students are encouraged to continually refine their submersibles due to added restrictions or alternate materials (see extension challenges below).

Materials and Tools

- Clear storage tubs to test submersibles in water (buckets or full sinks will also work)
- Rags and paper towel
- Building materials that float or sink, e.g. balloons, paddle pop sticks, wooden skewers, dowel, PET bottles, plasticine, straws, pipe cleaners, CDs, nuts and bolts, paperclips, pipettes, cotton reels, plastic or polystyrene cups, core flute, anything else you have in large quantities
- Water resistant joining and sticking materials (hot glue, string, twisty ties, rubber bands etc.)
- Scissors
- Extension materials: syringes & plastic tubing to fit (these can be substituted with a submerged balloon and a straw to fill it with air), aspirin tablets, magnets

Lesson Outline – 120 minutes

The below lesson outline provides an overview of workshop elements.

Please ensure you follow your school WH&S procedures while conducting this lesson.

Introduction (10 minutes)	Introduce the Innovation Process, tools, materials and workspace. The challenge will be introduced in stages. You might like to begin by introducing a few basic ideas about buoyancy i.e. density. See our short activity "Does Fruit Float." You may choose to discuss some examples of submersibles (i.e. Deepsea Challenger).
Buoyancy discovery (5 minutes)	Lay out all the building materials on a table. *Challenge 1: Scavenger hunt. Ask students to find three objects that they believe will float, three objects they believe will sink and three objects they're not sure about.* Ask students to test their predictions in the tubs of water. Discussion: In small groups or as a class, students discuss their findings (i.e. What were their predictions? Which discovery surprised them?)
Buoyancy application (15 minutes)	Instruct the students to split into groups of 2-3. *Challenge 2: Build a raft. Ask students to build a vessel that floats using at least some of the objects they tested in the scavenger hunt.* Students may wish to supplement their building materials with more building supplies.

Negative buoyancy discovery (10 minutes)	*Challenge 3: Sink your raft. Challenge students to now submerse their floating vessel.* Many will add materials that have negative buoyancy to counteract the materials with positive buoyancy. Discussion: You may wish to discuss other methods of making the rafts sink (e.g. putting a hole in the hull, changing orientation).
Neutral buoyancy discovery + application (40 minutes)	Once the students have sunk their vessel, introduce the concept of neutral buoyancy (objects that neither float nor sink but maintain a fixed position in the water column). Some real life examples include fish swim bladders, and SCUBA divers' buoyancy control devices. *Challenge 4: Neutral Buoyancy. Challenge students to make their vessels neutrally buoyant* Helpful tip: Achieving neutral buoyancy is difficult and may take significant tinkering. If students are struggling, you can offer them a syringe filled with air as a swim bladder. This makes fine tuning their submersible relatively easy by adding or subtracting small volumes of air.
Extension Activities (allow 20+ minutes for group success)	There are a number of extension activities that can be tailored to the individual groups and their designs, such as: • Controllable buoyancy: Introduce a second syringe or some aspirin and challenge students to create a submersible that floats or sinks on command • Introduce fluids of different density e.g. oil – to be used in the submersible
Wrap up (Allow 25 minutes for reflection and pack up)	**Design Sharing:** Share design approach, successes and challenges, and encourage class reflection as a group. Facilitate questions and discussion on workshop, including: • Was testing important during the design phase? • What would you do differently next time? • If you were to build this full scale what materials could you use? **Submersible deconstruction**: recycle as much material as possible.

Further Investigation

Real-world examples that face the challenges of neutral buoyancy include NASA's Neutral Buoyancy Laboratory, and Australia's Deepsea Challenger (videos available on YouTube using search terms "National Geographic Deepsea Challenger Descent" and "Astronauts NASA Neutral Buoyancy Lab"). Students can investigate the advantages and disadvantages of the different submersibles, including remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs) and human occupied vehicles (HOVs).

Other examples, such as fish swim bladders, free diving, icebergs in water, and the impacts of water temperature on buoyancy (e.g. hot water vs cold water) are areas for exploration. You may also like to accompany your Simple Submersibles lesson with our 'Does Fruit Float?' activity.

Curriculum Links

Our resources provide a framework for classroom activities and lesson plans that link to the Australian Curriculum in both the Science, and Design and Technology streams. Some of these curriculum links are highlighted below.

Science Inquiry Skills	Science as a Human Endeavour	Science Understanding
Science Inquiry Skills are incorporated across all year levels by encouraging questioning and planning, planning and conducting, processing and analysing data and information, evaluating, and communicating.	If this lesson plan is extended to research and discuss the applications of submersibles, where and how they are used in society (e.g. ocean exploration, research, film production), it links to the Science as a Human Endeavour Strand. *ACSHE161, ACSHE228, ACSHE192, ACSHE230*	As well as investigating the physical forces of gravity, if this activity is extended to research and discuss motion, buoyancy and/or transfer of energy it links across various aspects of the Science Understanding Strand. *ACSSU076, ACSSU043, ACSSU077, ACSSU094, ACSSU117, ACSSU118, ACSSU150, ACSSU155, ACSSU175, ACSSU229*

Design and Technology Processes and Production Skills	Design and Technology Knowledge and Understanding
This activity provides hands-on engagement and skills and aligns with project management, design, and production with a strong emphasis on safety. *ACTDEP035, ACTDEP036, ACTDEP037, ACTDEP038, ACTDEP049, ACTDEP050*	Facilitating discussion surrounding real life applications of technology, and the impact of cultural, financial, ethical and social factors on design can extend the scope of this activity to incorporate additional curriculum links. *ACTDEK034, ACTDEK046*

If you have any questions regarding this teacher resource, contact the Smart Skills team at QSSI@questacon.edu.au, and connect with us on Twitter and Facebook.

If you would like to know more about our teacher professional development opportunities, contact the teacher professional development team at teachers@questacon.edu.au.