Who Should Get the Helium? Jigsaw Activity

YEAR 7
PHYSICAL SCIENCES

QGC | FUTUREMAKERS | QUEENSLAND MUSEUM NETWORK | Queensland Government

Future Makers

Future Makers is an innovative partnership between Queensland Museum Network and Shell's QGC business aiming to increase awareness and understanding of the value of science, technology, engineering and maths (STEM) education and skills in Queensland.

This partnership aims to engage and inspire people with the wonder of science, and increase the participation and performance of students in STEM-related subjects and careers — creating a highly capable workforce for the future.

QUEENSLAND MUSEUM NETWORK

Queensland Government

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

This teacher resource is produced by Future Makers, a partnership between Queensland Museum Network and Shell's QGC business, with support from the Australian Research Council and other parties to ARC Linkage Project LP160101374: The University of Queensland, Australian Catholic University Limited and Queensland Department of Education.

Thank you to the University of Queensland School of Education for contributing to a number of the activities included in this workbook.

EVALUATE

Who Should Get the Helium? Jigsaw Activity

Teacher Resource

Students consider the ethical implications of helium use as a non-renewable resource across various industries. Students may either participate in a community of inquiry or a jigsaw activity to investigate:

- How helium is used by various industries.
- The helium shortages have been and/or are currently experienced by industry.
- Why there is a helium shortage.
- If it is possible to resolve this problem, and, if so in what ways.

Detailed step-by-step instructions for the jigsaw activity can be seen below.

1. Select stimulus material for students to view in relation to the worldwide helium shortage. Stimulus material could include the following:

    - We Need Helium More Than Ever (And We're Running Out)
      The Good Stuff. YouTube. 30 June, 2017.

    - Huge Helium Gas Find in East Africa Averts Medical Shortage
      Ian Sample. The Guardian. 29 June, 2016.

    - Uses of helium:

      Filling balloons (balloon rides, party balloons, blimps, meteorological research)

      Gas-cooled nuclear reactors

      Some neon lights

      MRI machines (can be replaced by hydrogen)

      In diving apparatus

      Breathing mixtures

      Pressurising agent (rockets)

      Purge systems of unwanted gas

      Leak detection

      Shielding gas for arc welding

      Inert atmosphere in welding

      Food preservation

      Cryogenics

Protective gas when growing silicon

Semi-conductors – fibre optics

Gas for supersonic wind tunnels

2. After viewing the stimulus material, ask students:

   - What helium shortages have been and/or are currently experienced by industry?
   - Why is there a shortage?
   - Can the problem be resolved? In what ways?

3. Set up a jigsaw activity. Roles are designated for groups to research. Alternatively, groups could use relevant media articles to derive answers from their role's perspective. Each group will use their research findings to create five main points of view to communicate as 'experts' in the next jigsaw configuration, with all responding to the same question: Why is helium important to 'me'?

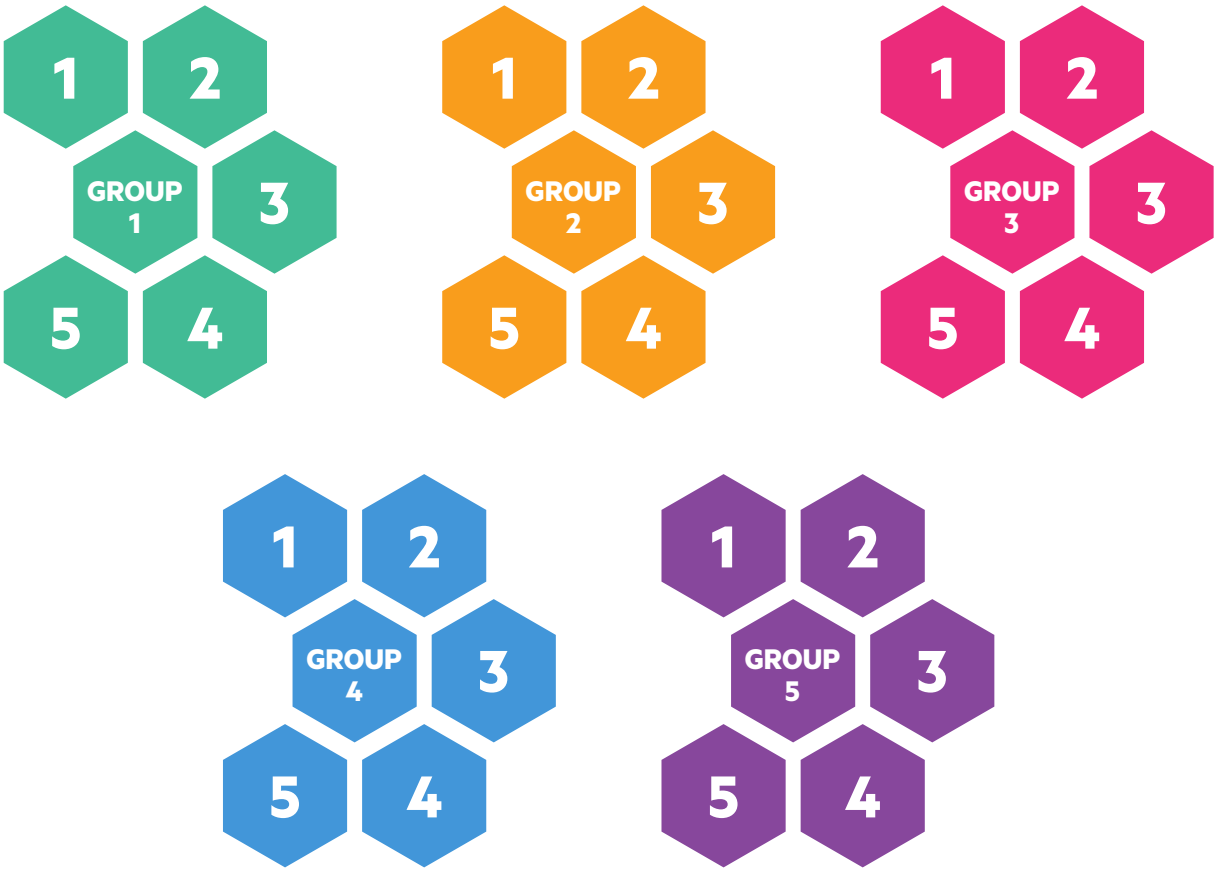
Group 1 Meteorologists

Group 2 Sustainable chemists

Group 3 Party suppliers

Group 4 NASA representatives

Group 5 Technical scuba divers



ROLE 1

Meteorologists

FOLD FOLD

As a meteorologist, you work closely with the data that weather balloons collect.

Weather balloons filled with helium take off twice a d y in over 200 places around the globe to measure current weather conditions and collect data.

This data, collected by the attached instrument called a sonde, is transmitted back via radio signal for analysis and shared internationally. You understand the vital importance of weather balloons as the most effective data collection method for weather pattern analysis and extreme storm warnings.

Annual usage in weather balloons around the world (2010):
140 million cubic feet of helium (~4 million cubic meters)

CUT OUT THIS TABLE TOP CARD

ROLE 2

Sustainable Chemists

FOLD FOLD

As a chemist who specialises in sustainability, you are concerned that the helium used in life-saving medical equipment such as MRIs is being used for trivial purposes such as filling party balloons.

Each MRI needs around 10,000L to function. The gas is the second most abundant element in the observable universe, but Earth has lost its initial helium as it is lighter than air, it just floats into space.

What is available today is produced inside rocks through radioactive decay of uranium and other elements, and it is difficult o locate where the gas builds up into useful reserves. You understand that helium is a precious non-renewable resource.

Annual usage by MRIs around the world (2016):
1.2 billion cubic feet of helium (34 million cubic meters)

CUT OUT THIS TABLE TOP CARD

Party Suppliers

ROLE 3

FOLD FOLD

As a small business owner, you know how hard it is to cover costs and make a living, only making a couple of dollars per helium balloon that you sell.

The price of helium has increased around 10% per year since you started the business and customers are unhappy when you put up prices, which also affects your sales. Sometimes your helium supplier does not provide your regular order because they have a limited helium supply.

Annual usage for latex and foil balloons around the world (2012):
360 million cubic feet of helium (~10 million cubic meters)

CUT OUT THIS TABLE TOP CARD

NASA Representatives

ROLE 4

FOLD FOLD

NASA can use up to 100 million cubic feet of helium per year, costing millions of dollars. Helium is used throughout NASA as a cryogenic agent for cooling various materials, in precision welding applications, as well as lab use.

Helium is also used as an inert (unreactive) purge gas for hydrogen systems and as a pressurising agent for ground and flight fluid systems of space vehicles. As a representative of NASA, you are aware of the huge volume and vital role that helium plays in your agency.

NASA's Annual usage of helium (2015):
100 million cubic feet (~2.8 million cubic meters)

CUT OUT THIS TABLE TOP CARD

FOLD

FOLD

ROLE 5

Technical Scuba Divers

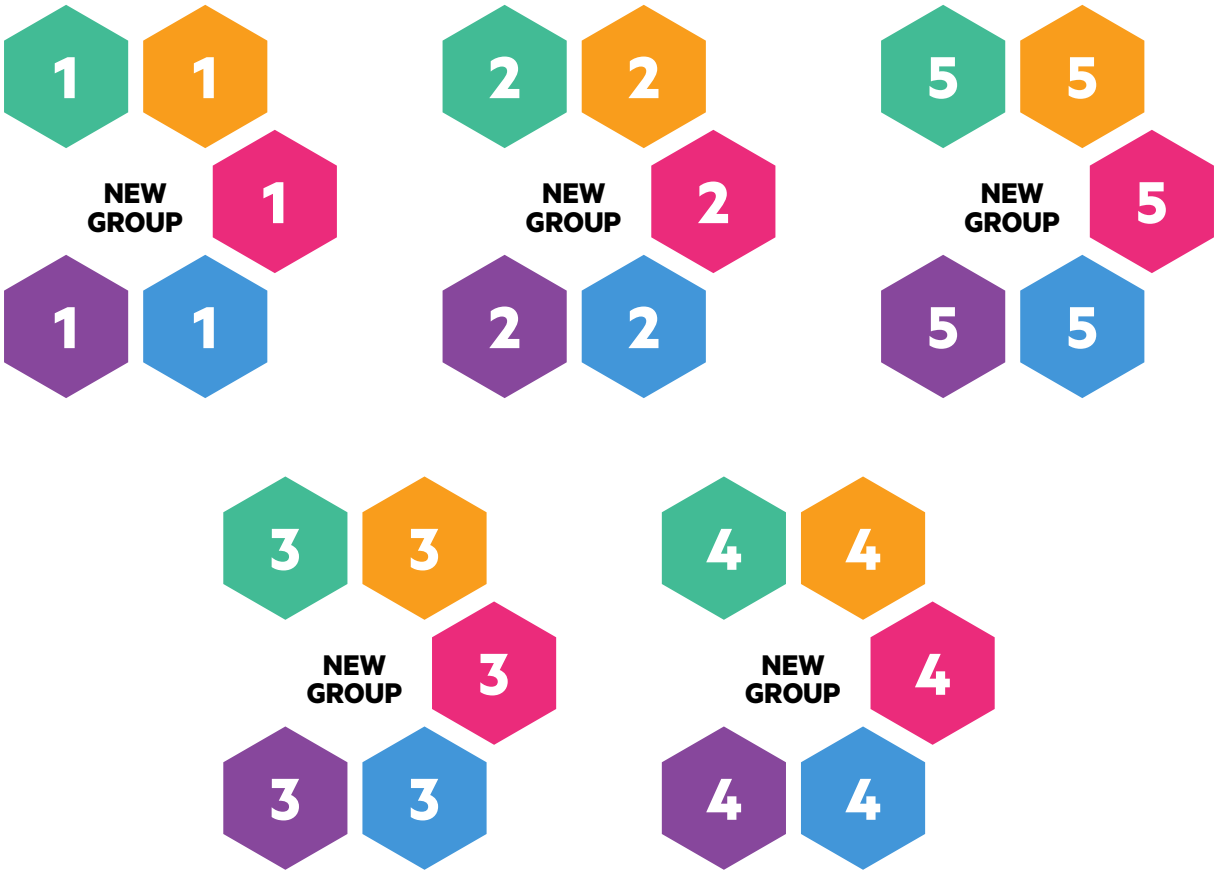
You are a technical diver that is part of a research team investigating ongoing changes in the Great Barrier Reef. Helium is an inert (unreactive) gas that is used instead of nitrogen in oxygen tanks because it does not induce narcosis.

There are predictions in Diver Magazine (2011) that your usual tank cost of US$65 could increase to US$1300. That's about US$25 per minute of diving. With funding only just covering the costs of the research you support, you are concerned that you will no longer have a job in research or in the diving industry in the future.

Annual usage of helium for scuba diving around the world (2016):
360 million cubic feet (~10 million cubic meters)

CUT OUT THIS TABLE TOP CARD

4. Students move into ‘shared knowledge groups’ where each ‘expert’ shares why helium is important to them.



5. Students remain in ‘shared knowledge groups’ as expert representatives of their role. The following scenario is given to each group for evaluation:

   Helium supplies are tightening up. Hiccups in global helium supply lines, along with increasing demand in a growing economy, are leading to shortages of the noble gas.

   According to the industrial gas firm Linde, helium supply interruptions in the Middle East and allocations of helium from the U.S. Bureau of Land Management’s Texas helium reserves have restricted the company’s ability to supply customers with this gas. Linde says it is now allocating helium in 'a fair and reasonable way.

   There is not enough helium to go around; you only have 80% of your usual stock. As representatives of Linde, how will you define ‘fair and reasonable’ allocation of helium in times of a global shortage?

   In order to answer this question, groups should consider the following questions:

   - Is it possible to solve the problem of the helium shortage by fair and reasonable allocation of helium?

- Are there alternatives to helium that could be considered for some of the listed uses? Should these uses still be considered for helium allocation? Why/Why not?
- In what ways could the problem of helium shortage be solved fairly and reasonably?
- Fair and reasonable for whom? Who will the allocation benefit?
- Are these benefits widespread (a wide range of people/communities)? How do you know that?
- What flow-on benefits might the allocation have? In what ways are the flow-on benefits significant?
- If allocations are considered to be fair and reasonable, does that mean they are also ethical? Why/Why not?
- How could an ethical approach to helium allocation be achieved or maintained?
- Should global need be prioritised over local need when considering helium allocation? Why do you think that?
- Are there some helium uses that would be considered less ethical/less important than others? Why do you think that?
- How would the amount of helium allocated to each group/use be decided upon?
- Who should have the right to make decisions regarding the allocation of helium? Why do you think that?

6. Students move back to their original 'expert' groups to share how Linde's various decisions will affect their roles.

Curriculum Links

Science

YEAR 7

Science as a Human Endeavour

Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures (ACSHE223)

Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE120)

General Capabilities

Literacy

Comprehending texts through listening, reading and viewing

Composing texts through speaking, writing and creating

Word knowledge

ICT Capability

Investigating with ICT

Managing and operating ICT

Critical and Creative Thinking

Inquiring – identifying, exploring and organising information and ideas

Reflecting on thinking and processes

Analysing, synthesising and evaluating reasoning and procedures

Personal and Social Capability

Self-management

Social awareness

Social management

Ethical Understanding

Understanding ethical concepts and issues

Reasoning in decision making and actions

Explain values, rights and responsibilities

Cross-Curriculum Priorities

Sustainability

Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments. (OI.7)

Designing action for sustainability requires an evaluation of past practices, the assessment of scientific and technological developments, and balanced judgements based on projected future economic, social and environmental impacts. (OI.8)