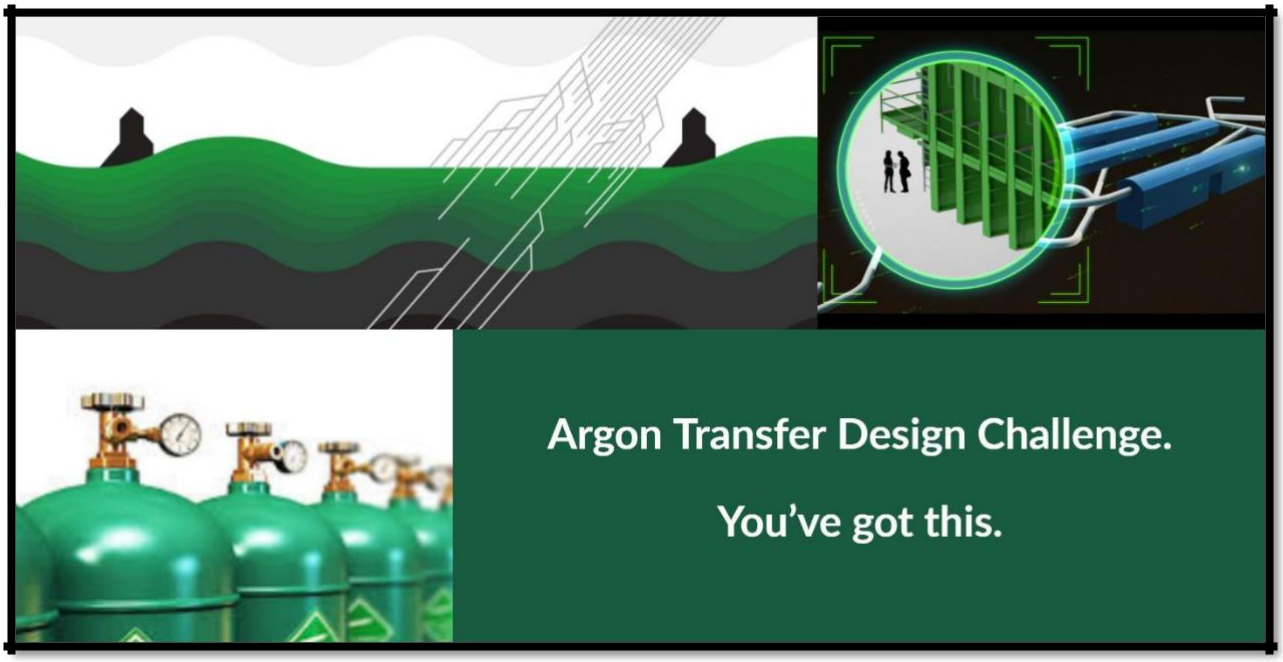


Check out the resources and content on **Pages 1-10** of your digital packet.
Be sure to click all of the hyperlinks to watch videos and read articles that will add to your knowledge about the Deep Underground Neutrino Experiment (DUNE).

BY THE NUMBERS

How many scientists and engineers? _____ How many countries? _____

The neutrino detectors will be built in a cavern that is 70 m long, 20 meters wide, and 29 meters high. The volume of the chamber is _____cubic meters (m_3).

DUNE needs _____ tons of argon. Argon is shipped as a liquid by truck. If every truck carries 20 tons of argon, then _____truckload deliveries are needed to fill the detectors.

The argon must go down 4,850 feet, which is _____ meters deep.

The focus of this challenge is getting the argon into the neutrino detectors located one mile underground at the Sanford Underground Research Facility in Lead, South Dakota.

What are your team's current questions about transporting 70,000 tons of argon to the underground detectors?

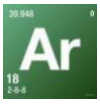
Team Member #1: Become an Argon Expert

Check the resources and content on pages 12-13 of your digital packet.

What makes argon the top choice for this experiment?

1.

2.



What do you want to tell your team about argon from the online periodic table?

Make a list of the questions that YOU have about the element, argon.
(What do you need to know in order to safely contain, transport, and handle argon?)

Make a claim. Give evidence. Explain your Reasoning.

What did you learn about argon from the online simulation that will help your team know how to **contain** and **store** argon? Be ready to show your team how to use the simulation and explain your claim.

Claim:

Argon can be stored and transported in _____state by using containers like…

Evidence: I found the following evidence to support my claim…

1.

2.

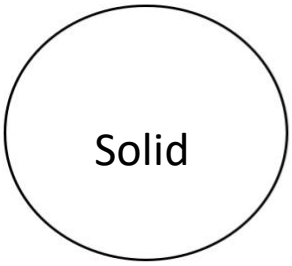
3.

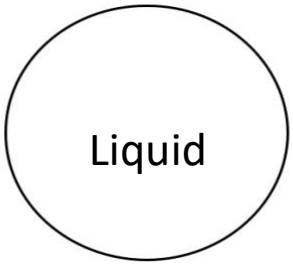
Reasoning: This evidence supports my claim because…

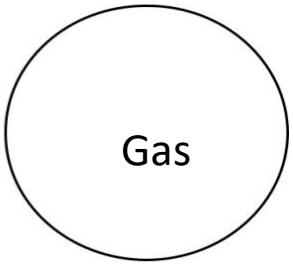
Team Member #2: Become a Phase Change Expert

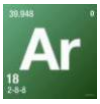
Check the resources and content on pages 15-16 of your digital packet.

Draw argon atoms inside each circle to represent the atoms' positions and movements as a solid, a liquid, and a gas.









What does your team need to know about **phase changes** and **energy transfer** in argon?

Make a claim. Give evidence. Explain your Reasoning.

What did you learn about **phase changes** in argon from the online simulation that will help your team understand what happens when **temperature** or **pressure** are changed? Be ready to show your team how to use the simulation and explain your claim.

Claim:

Adding energy (heat) from argon can cause a phase change because it causes the argon atoms to….

Removing energy (heat) from argon can cause a phase change because it causes the argon atoms to…

Evidence: I have found evidence to support my claim including…

1.

2.

3.

Reasoning: This evidence supports my claim because…

Team Member #3: Become a Matter Transport Expert

Check the resources and content on pages 18-19 of your digital packet.

What are your questions about moving argon as a….

Solid

Liquid

Gas

Watch the video and read the hyperlinked article on page 18. What do you want to tell your team about moving argon from the surface to the underground?

Make a claim. Give evidence. Explain your Reasoning.

What did you learn about how **pressure** impacts argon from the online simulation that will help your team know how to move argon down the **mile-deep shaft**? Be ready to show your team how to use the simulation and explain your claim.

Claim:

We should transport the argon down the shaft as a _____(solid, liquid, or gas).

Evidence: I found the following evidence to support my claim…

1.

2.

3.

Reasoning: This evidence supports my claim because…