MAGMA DRILLERS

SAVE PLANET EARTH

DRILLING ENGINEER

Mission 2: Energy from magma

It is the year 2035, natural disasters ravage the planet. The world is recovering from years of environmental exploitation under Donald Trump (who tragically died after a freak wave of plastic burger boxes buried him during a beachside golf tournament). Kim Kardashian is now president of the United States; her revolutionary thinking leads the world in a search for cleaner energy and an effort to become better guardians of the natural forces around us. She has chosen you to be part of a team to push the limits of science, technology, and bravery to save the planet.

In order to complete this mission, you will have to watch both the "energy from magma" video and the drilling engineer video for this mission.

Again, you will be asked to collaborate with other scientists in order to achieve your goals. You will use what you have learnt so far to help you decide on what research and plans need to be completed to safely drill the next well.

The information on the following page will help you answer the questions below. Once you are confident about your answers to those questions, you will be able to report back to your team and help make a final decision on how to drill to intercept magma bodies safely.

Extreme conditions and geothermal wells

Volcanic areas can be extremely hot, so geothermal wells already push the limit of our engineering abilities, as far as temperatures, pressures and acidity goes. It is not uncommon for geothermal wells to be hotter than 300°C. Water in geothermal areas can be so acid that it could melt steel in very little time.

Drilling into a magma chamber really pushes the boundaries. Magmas are usually hotter than 900 °C and can be up to 1300°C, depending on the type of magma. Magma also tends to give off lots of acidic gases.

Most drilling equipment is made of steel. Steel is strong, but becomes weaker as it gets hotter. By adding molybdenum however, steel can resist relatively high temperatures. Current technology can resist temperatures up to 770 °C. Therefore, in order to drill into magma, either research into stronger steel alloys (such as Cr-Mo Steel or superalloys) needs to be made, or a lot of cold fluid needs to be pumped down the hole to cool the magma down.

Question 1 - Expected conditions

What temperatures ranges are we expecting to encounter when drilling for magma?

_____ → _____

Question 2 – Steel Types

Fill in the following table based on the information you have received.

Type of Steel	Hottest temperature
Chomoly Steel	
Superalloys	

Which type of steel could potentially deliver more energy?_____

Questions 3 – Feasibility

Which type of steel is most likely to succeed when drilling into magma?

_____

_____

_____

Question 4 - Target

What magma temperature would you be targeting?

Target Temperature:

Why are you targeting that temperature?

Question 5

What other information might help you achieve the best outcome for the drilling project?

Well done! You are now at the end of your passport.

The next section will be filled out by a judge.

Drilling planning evaluation

Did everyone on the team share information that helped make the final decision?

How well did your team communicate to achieve its goals? What could improve your communication in the future?

Did your plan address all the potential risks and hazards?

Was your mission cost effective?

Did your drilling plan meet all requirements for the mission?

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1 2 3 4 5

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1 2 3 4 5

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1 2 3 4 5

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1 2 3 4 5

CURIOUS MINDS
HE HIHIRI I TE MAHARA

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UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
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