

# How to Get Air and Water on Mars



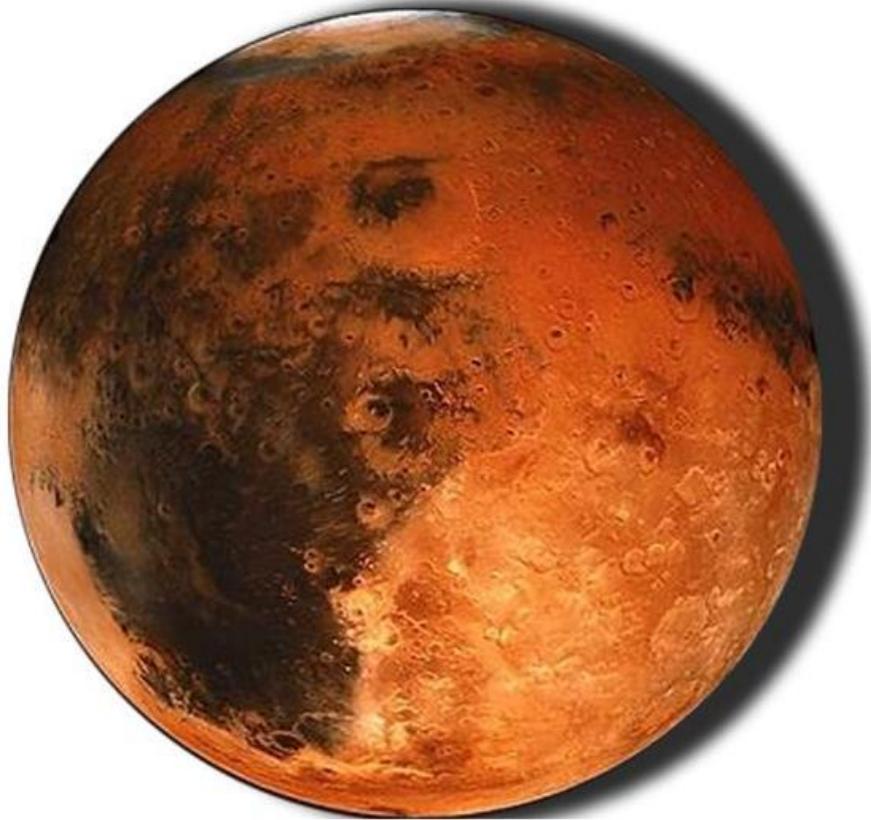
## Part I

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*9<sup>th</sup> October 2020*

# How to Get Oxygen on Mars

## Chapter 1



*Breathable air is about 21 % oxygen and 78 % nitrogen*

There is a bit of water vapour, carbon dioxide and other gases too, but let us keep it simple.

I need to source breathable air on Mars. Otherwise I have to lug it all with me from Earth, which I'm reluctant to do, especially when there is no need.

So let us begin with this challenge. How to get air on Mars? We'll break this down into two parts – how to get oxygen and how to get nitrogen. If we can get both, then we have air.



*Let us simplify the problem.  
How would I get oxygen **on Earth**?*

How? It couldn't be simpler. 21 % of the air all around us is oxygen. All we have to do is suck this air in through a filtering machine and filter out the oxygen. Effortless!

Similarly for nitrogen. If I want nitrogen then all I have to do is suck air in through a filtering machine and filter out the nitrogen.

It couldn't be simpler!

That is pretty standard.

That is how they do it on Earth.



### *Now, let us come back to Mars*

1.89 % of the atmosphere of Mars is nitrogen and 0.146 % of the atmosphere of Mars is oxygen. That might not seem like a lot but it does tell us that oxygen and nitrogen are there. Water is also there too, but in trace amounts.

Good news is it *does not matter* where I land on Mars. The atmosphere of Mars extends to everywhere on the planet. So no matter where I land, I still have a supply of oxygen, nitrogen and water available for me in the Martian atmosphere, *if I can get it out*.

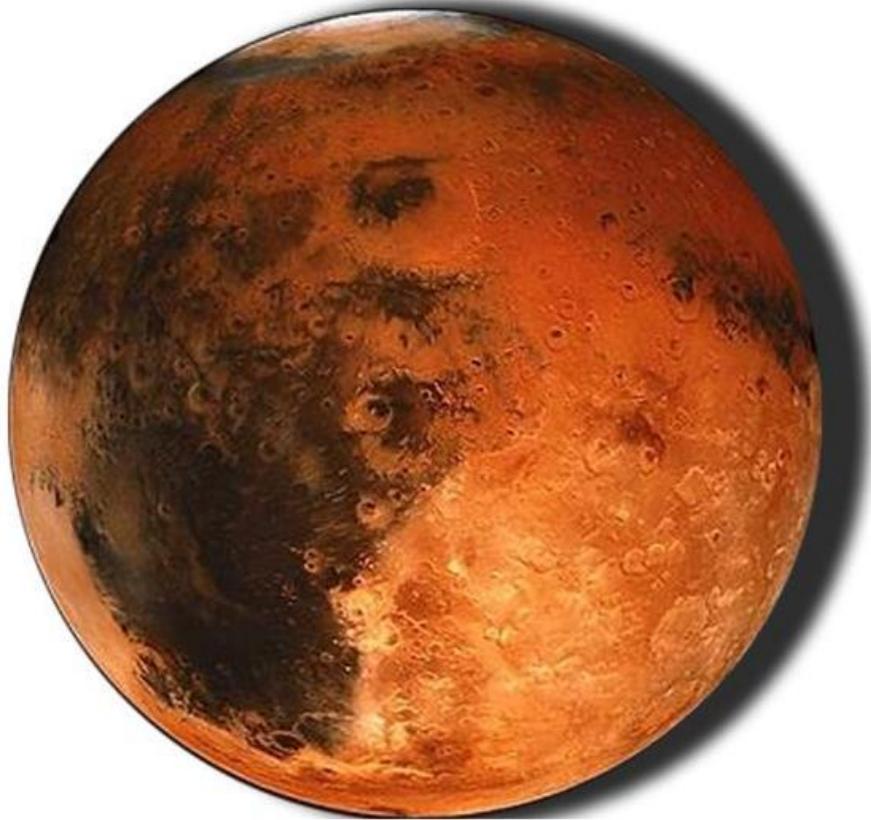
To make this practically viable however I do need to overcome two problems. One is that the atmosphere of Mars is more rarefied, which makes it more difficult to obtain the gases that I want from it. The other problem is that oxygen and water are available only in trace amounts in the Martian atmosphere, although the story is a little better with nitrogen.

Ok, so we have a possible source of air and water on Mars if we can overcome a few obstacles. Fortunately those obstacles are easy to overcome, *if one knows how*.

So, let me explain how...

# Pressure, Temperature & Carbon Dioxide

## Chapter 1



*The air on Mars is at a low pressure*

So the first thing to do is this: *compress it*.

That makes it much easier to extract and to separate out the different gases.

Carbon Dioxide is the easiest, because that goes liquid at only  $-37^{\circ}\text{C}$ , which is at a far higher temperature than for most gases. Now it just so happens that 95.3 % of the atmosphere of Mars is composed of Carbon Dioxide, so that is the first thing we extract.



*Even if one were to only compress the atmosphere of Mars to the same pressure as that of Earth's, one would only need to cool the compressed gas to  $-37^{\circ}\text{C}$  in order to **liquefy** the Carbon Dioxide*

That is very, very easy to do, and if one compressed the atmosphere even more, it would be easier again.

So the first step I would take would be to compress Martian air in a tank, cool it and then pour off the Carbon Dioxide.

That would leave me with a remaining gas in the tank that had ***much higher concentrations*** of nitrogen, water and other gases.

As such, it now becomes much easier to extract these gases.



### *How would I do it?*

I would compress the gases further and then cool them down to cryogenic temperatures.

Each gas liquefies at a different temperature, so as each gas liquefies I simply pour that off. The different temperature at which each gas liquefies for a given pressure gives me a way of separating the gases.

That is a pretty standard process on Earth.

*That gives me an **unlimited supply** of oxygen, nitrogen (which makes breathable air) and water on Mars, no matter where I land*

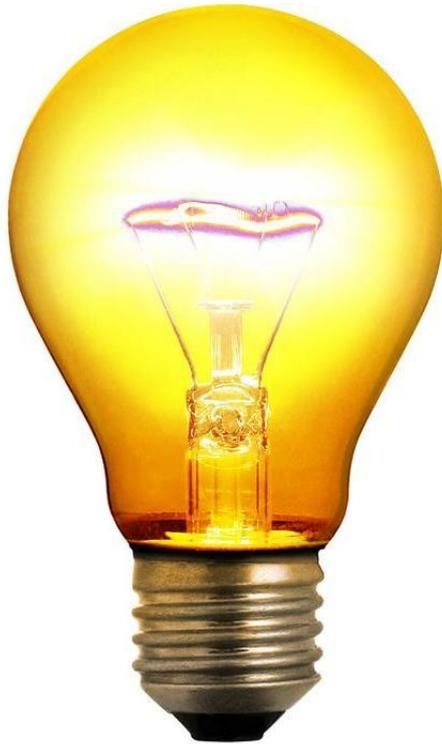
That is the air that I breathe and the water that I drink, and that water can also be used to make hydrogen by electrolysis if people wish that as a fuel. There is also some methane in the Martian atmosphere which one can extract along with the other gases, seeing as you are going through the whole gas extraction process anyway.

Simple, yes?



*Understand?*

*Is there air? You don't know!*



*If I understand correctly, Space Agencies thought that extracting air and water from the Martian atmosphere was not viable because the atmosphere was **too thin***

However, all one has to do to correct that is simply **compress** the gases first, which is very easy to do.

It's not rocket science.

*Young Einstein*

# How to Get Air and Water on Mars



**End of Part I**