



### **1) Stimpack**

Our surgical capacities and capabilities are reduced in space, thus we are largely reliant on the self-healing ability of our bodies to treat injuries. Come up with a chemical cocktail that, when injected or consumed, speeds up the wound recovery process by stimulating cell reproduction and preferentially induces controlled blood clotting to prevent hypovolemic shock. Keep in mind that the astronaut diet is highly planned and thus malnutrition has a very rare prevalence.



## 2) Neptunian Chemistry

The element neptunium shares a few properties with the planet Neptune, which it was named after. While neptunium was the first artificial element to be made through nuclear manipulations, Neptune was the first planet to be found as a result of mathematical predictions. They are both the outer rim of human experimentation. But how much neptunium is on Neptune? How would you experimentally check your result?



### **3) Terraforming Venus**

As we know there is no life on planet Venus. Its atmosphere consists of carbon dioxide mostly. It causes the biggest greenhouse effect in the solar system and 735 K average temperature on the surface. If we could somehow turn the carbon dioxide to oxygen, the atmospheric composition and the temperature would be closer to suitable for life.

Suggest a method which allows to produce oxygen from carbon dioxide on Venus. How many percent of the gas should you transform to make the atmosphere livable for humans? Estimate the average temperature on the surface after your work. Would it be a place to live on?



#### **4) Can you make any element metallic?**

Positive Marsh test is when the watchglass turns orange due to the arsenic deposited. Yellow arsenic is a soft and waxy molecular compound consisting of tetraarsenic molecules. The other allotrope of arsenic, grey arsenic is a shiny and conductive metal – no surprise arsenic is a metalloid. Similar dichotomy arises between white and black phosphorous. Since even typical nonmetals, like hydrogen, are known to show metallic characteristics (i.e. in the core of Jupiter), the question naturally arises: can you make any element metallic with right choice of circumstances? Where would they occur in the solar system?



## 5) Spacefood

Spacefaring brings unexpected challenges when it comes to feeding the crew of a spaceship, space station, or colony. Fresh produce does not last more than a few weeks and meat requires refrigeration. Ideally, hydroponic farms are available on the vessel, but their capacity nowadays is insufficient to provide nutrients for a large mission.

There are multiple shakes on today's market that advertise themselves as an alternative to a full meal, with all the nutrients required for a healthy life. These can be a viable alternative to fresh food - however, eating the same flavored shake becomes depressing after a while. How can you improve the selection of taste and consistency of these products to a level that would be sufficient to feed a crew entirely on these meal alternatives? Come up with at least 7 different food items with different tastes, all of which should be appropriate for space travel.