

## Exercise set 1

**Instructions:** Prepare your responses to each of the below questions in the form of a PDF document (not handwritten!). Make sure your name is clearly visible on the document and the pages are numbered. Upload your completed document on the course Moodle no later than one week after the lecture (i.e. by 17<sup>th</sup> September 2024, 23:59). Each student must upload their own work.

### Question 1.1: An Alternative to Teflon in Non-Stick Cookware

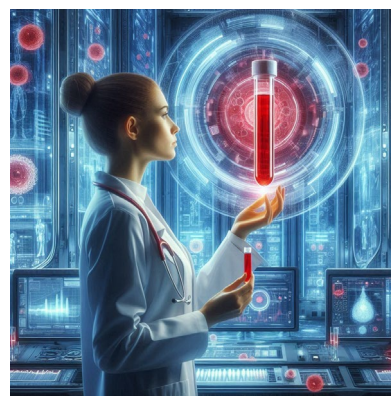
Teflon (polytetrafluoroethylene, PTFE) coated cookware is a popular choice for home cooks. The great advantage of PTFE-coated pots and pans is that food will not stick while cooking as it would to other materials, making it easy to flip pancakes or remove cooked eggs. This non-stick property also makes cleaning very easy, generally taking only a few seconds to wash by hand. As such, PTFE is used in a variety of household products. However, PTFE is considered unsafe if consumed or absorbed into the body and can increase the chance of cancer and other diseases. Especially when heated to high-temperature, PTFE-coated pans that were prepared using certain chemicals in the coating process can emit toxins that can cause significant health risks such as polymer fume fever, or Teflon flu.



The negative public image of Teflon and associated health risks open the opportunity for alternative non-stick coatings to get established in the market. You are part of the product development team of a large cookware producer, and you are interested in developing a new material for non-stick pans. For this, first (i) define the needs (separated into essential, desirable, and useful) that the material should meet, and second (ii) convert the essential needs into detailed specifications.

### Question 1.2: A specification for artificial blood

Some fluids or fluid mixtures have very high oxygen solubilities and are under development as artificial blood substitutes that could be used in hospitals and especially on the battlefield or in disaster areas, where real human whole-blood storage is a problem. An essential need for a fluid blood substitute is that it must be able to dissolve oxygen,  $O_2$ . Convert this need into a specification and state the assumptions that you make.



### Question 1.3: Ocean Plastics Pollution

Plastic accumulation in our oceans and on our beaches has become a global crisis. Billions of kilograms of all kinds of plastic products and waste can be found in swirling patches that make up about 40 percent of the world's ocean surfaces. If current rates of plastic pollution continue, plastic waste is expected to outweigh all the fish in the sea by 2050. This pollution has a direct and deadly effect on wildlife with thousands of seabirds, sea turtles, seals, and other marine mammals being killed after ingesting or getting entangled in plastic each year.



Consider that you are part of a team including members of different governments and product development engineers from an environmental organization and your team is asked to develop a solution to this problem. Come up with as many ideas as possible that could reduce the amount of plastic pollution in the oceans (at least 25 ideas).