



ALPHA SESSION

TASK α -1: Define the broad experimental parameters *within your area of specialty*.

- 1) Which variables will be important to include in our experiments?
 - Nutrients: Nitrate (NO_3^-)
Nitrite (NO_2^-)
Ammonium (NH_4^+)
Phosphate (PO_4^{3-})
 - Salts: Sodium (Na^+)
Potassium (K^+)
Magnesium (Mg^{2+})
Calcium (Ca^{2+})
Fluoride (F^-)
Chloride (Cl^-)
Sulfate (SO_4^{2-})
Perchlorate (ClO_4^-)
 - Concentrations: Variable - values are listed in "Recipe for Martian Soil Extract"
 - Perhaps the students will suggest other variables?
- 2) For each variable, what range of values should be tested?
 - See above
- 3) What are your justifications for choosing those variables and range of values?
 - Nutrient and Salt species have been documented at various Mars lander sites; additional support from published literature regarding Earth soils similar in chemical composition to Martian soils.
 - Concentrations of salts, nutrients, minerals have likewise been determined by Martian landers and/or supported by several published articles (a few examples provided to students as background readings).

TASK Q-2: For EACH variable, define at least ONE hypothesis we will need to test. If you have multiple hypotheses for each variable, all the better!

1) Try to structure each hypothesis in such a way that it can be easily answered by a numerical measurement, or by a simple “Yes-No” or “True-False” answer.

- Example (True or False): Martian soils contain the necessary nutrients (N, P) to support life.
- Example (Numerical Measurement): At which concentration(s) do the various salt ions become toxic to cyanobacteria?
- Example (Yes or No): Are cyanobacteria able to extract N, P-nutrients from moist Martian soils?