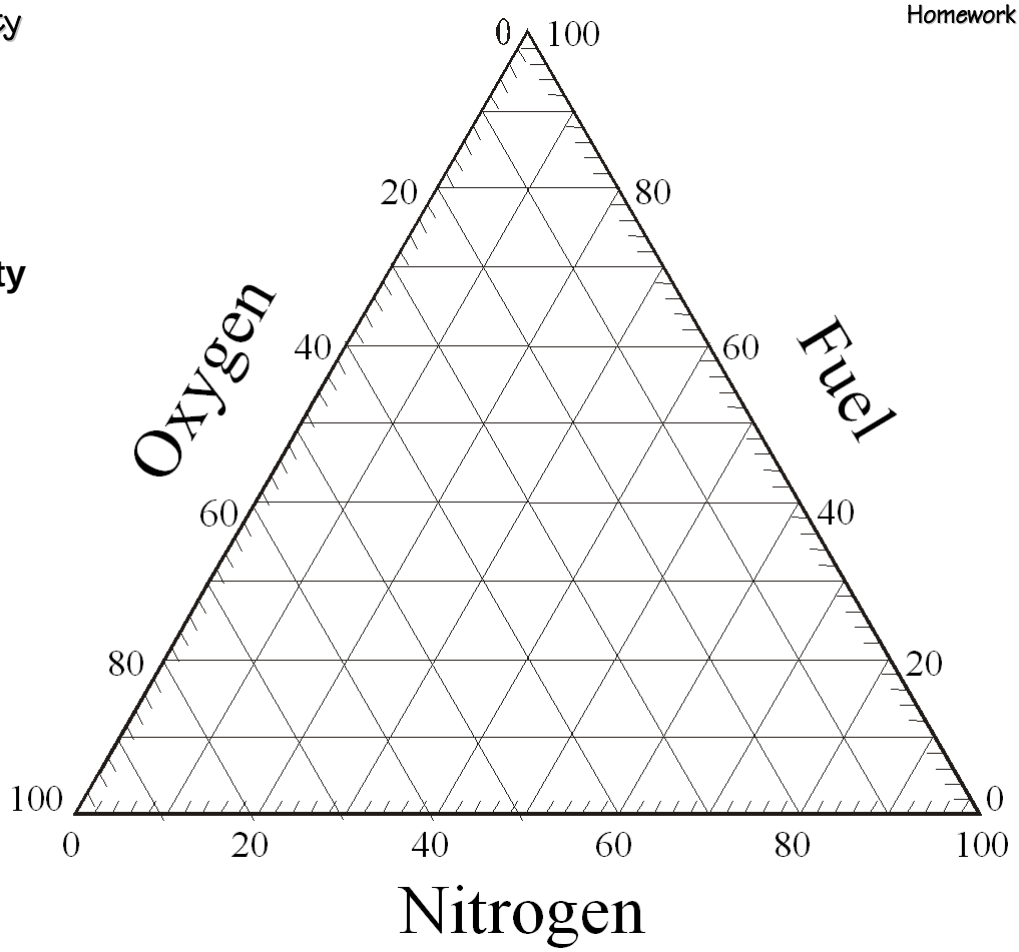
Ethylene Flammability Diagram

All values are in volume % (mol %)



1. Make a flammability diagram for ethylene (C_2H_4), using the ethylene flammability data in the text, by doing the following:
   (a) Draw the Air Line on the diagram to show all possible combinations of ethylene + air
   (b) Mark and label the LFL and the UFL points
   (c) Calculate the stoichiometric concentration for ethylene mixed with pure oxygen
   (d) Plot the point corresponding to (c)
   (e) Draw the Stoichiometric Line from that point to the 100% nitrogen apex
   (f) Mark and label the MOC on the stoichiometric line
   (g) Draw the general shape of the flammability boundary, using the three points marked in (b) and (f) above, and using the following information:
   (h) The lower boundary can be approximated by a horizontal line (i.e., the minimum fuel concentration for combustion does not change much with increasing oxygen %), and
   (i) The upper boundary must not go to the right of the MOC oxygen concentration.

2. A vessel that is vapor-full of 100% ethylene vapors at atmospheric pressure is to be taken out of service for maintenance. To what concentration (vol %) must the ethylene vapors be diluted with nitrogen before air can be safely introduced without creating a flammable mixture inside the vessel?

3. What is the minimum number of pressure purge cycles needed to dilute the vapors down to the concentration in 2 above, assuming the vessel is pressured up to 15 psig with nitrogen?