This cumulative exam will be based on a recent Science issue on the development and information in the periodic table. Most of the questions will be short numerical questions using the WolframAlpha website. [https://www.wolframalpha.com](https://www.wolframalpha.com)

**A laptop with wifi access to internet is required.** Cell phone or small screen pads are not permitted (too difficult to proctor).

The PDFs from the Science article are the cume website. PDFs are also available at Kim’s office.

Do NOT bring used or marked copies of the articles. Fresh copies of the articles will be available at the exam. Do bring a calculator, pen or pencil, ID to the exam and laptop.

On the next page are two short examples of WolframAlpha for chemistry calculations. The cume problems will be of roughly similar style.
Miscellaneous WolframAlpha examples for chemistry

a. How many molecules of octane in 1 gallon of octane?
   a. Enter “molar mass of octane”
      a. Result is “114.23 grams per mole”
   b. Enter “avogadro constant”
      a. Result is “6.022141×10^23 reciprocal moles”
   c. Enter “density of octane”
      a. Result is “0.703 grams per cubic centimeter”
   d. Enter “convert 1 gallon to cubic centimeters”
      a. Result is “3785 cubic centimeters”
   e. Enter the above in almost any order, either all at once or in steps.
      One possible order is:
      “(3785 cubic centimeters)(density of octane)(avogadro constant)/(114.23 grams per mole)”
      a. Result is “1.403×10^25”

b. How many molecules of oxygen in my office. Assume 70 F, 12x15x9 in feet, and 1 atm.
   a. Enter “12 feet x 15 feet x 9 feet”
      a. Result is “45873 liters”
   b. Enter “molar gas law constant”
      a. Result is “0.0820573 liter atmospheres per mole kelvin”
   c. Enter “oxygen content in earth atmosphere”
      a. Result is “20.948 volume percent”
   d. Enter “convert 70 F to Kelvin”
      a. Result is “294.3 kelvins”
   e. Enter “avogadro constant”
      a. Result is “6.022141×10^23 reciprocal moles”
   f. Enter the above in almost any order, either all at once or in steps.
      One possible order is:
      “(1 atm)(45873 liters)/((0.0820573 liter atmospheres per mole kelvin)(294.3 kelvins))”
      a. Result is “1899.5 moles” of gas
      b. Enter “(1899.5 moles) (0.20948) (6.022141×10^23 reciprocal moles)”
      c. Result is “2.396×10^26” of oxygen molecules