

Chemistry 101

Sample exam 1 (chapters 1, 2 and 4)

Closed book, open notes, handouts, homework; no collaboration, 50 minutes. 50 points possible.

- (1 point) How many **significant figures** in 0.002050?
- (1 point) Express 14,200.5 meters in **scientific notation**.
- (1 point) Methylene chloride at 8°C is a liquid that has a **density** of 1.2 g/ml. What is the temperature of the methylene chloride in **kelvins**?
 - (1 point) What is the **volume** in milliliters of 12.346 g of methylene chloride at 8°C?
 - (1 point) What is this volume expressed in cubic centimeters?
- (1 point) An **element** is uniquely defined by the number of
 - protons it contains
 - electrons it contains
 - neutrons it contains
 - mass it contains
- (1 point) The element **chlorine** has two isotopes and an atomic mass of 35.5 amu. If 75% of the naturally-occurring chlorine is chlorine-35 (³⁵Cl), then the other isotope of chlorine should be:
 - chlorine-33
 - chlorine-34
 - chlorine-36
 - chlorine-37
 - can't tell from the information given
- (1 point) How many **neutrons** does chlorine-35 (³⁵Cl) have?
 - 17
 - 18
 - 19
 - 35
 - none of these
- (1 point) How many **electrons** does the 1+ ion of **sodium** have?
 - 10
 - 11
 - 15
 - 16
 - none of these
- (2 points) **Order** from least mass (1) to most mass (4):
hydrogen atom electron water molecule proton
- (2 points) Write the **condensed electronic configuration** of chlorine:

10. (2 points) A carbon-12 atom weighs 2.01×10^{-23} g. Carbon has a density of 2.267 g/cm^3 . **How many atoms** are in a sample of carbon that has a volume of 2.0 cm^3 ? Watch significant figures!

11. Provide the proper name or the proper chemical formula as appropriate for the compounds below.

a. sodium bicarbonate or sodium hydrogen carbonate (baking soda)

b. silicon tetrahydride (silane – a water repellent for glass)

c. $\text{Al}(\text{OH})_3$ (drain cleanser)

d. SiO_2 (quartz – a common mineral)

12. The phosphate ion, PO_4^{3-} , is a crucial ion in the energy transport chain of the cell (it's the "P" in ATP, for instance). For this ion (P is the central atom):

a. Draw an acceptable Lewis (electron) dot structure;

b. Comment on the ion's shape (and explain how you derived that);

c. Comment on the polarity of the P–O bond, and of the overall polarity of the ion.