

1) In 1970 congress passed the "Clean Air Act" in an effort to reduce air pollution. Between the years of 1982 and 2001, carbon monoxide was reduced by 62% and sulfur dioxide was reduced by 52%.

a) (4 pts) What is the chemical formula for the following compounds:

carbon monoxide: CO sulfur dioxide SO₂

b) (4 pts) The following are two additional pollutants; what is the chemical name for these compounds?

NO₂ nitrogen dioxide O₃ ozone

c) (4 pts) Air pollutants are certainly bad for you to inhale, but just how many **liters** of air would you breathe in a 1.0 hour lunch break. (Assume that each breath you take is 250 ml and you take 45 breaths per minute?)

$$\left(\frac{1\text{L}}{1000\text{mL}}\right) \left(250\frac{\text{mL}}{\text{breath}}\right) \left(45\frac{\text{breaths}}{\text{min}}\right) (60\text{min}) = 675\text{L}$$

(proper sig figs.)

670 liters
Enter answer here

d) (4 pts) If the concentration of carbon monoxide in 1982 was 7.3 ppm, what was the concentration (in ppm) in the year 2001?

Carbon monoxide reduce 62% → 38% remaining

$$(7.3\text{ ppm})(0.38) = 2.8\text{ ppm}$$

2) Consider a block of wood (10 cm high, 10 cm wide, and 8 cm thick) that weights 723 grams.

(4 pts) What is the density of this wood?

$$\text{Volume} = (10\text{cm})(10\text{cm})(8\text{cm}) = 800\text{cm}^3 = 800\text{mL}$$

$$\text{density} = \frac{\text{g}}{\text{mL}} = \frac{0.723\text{grams}}{0.800\text{mL}} = 0.904\text{g/mL}$$

0.9 g/mL

3) (6 pts) All matter can be generally classified as either an element, a compound, or a mixture. Please give an example for each of these classes:

element sodium compound water mixture dirt

Many possible answers

4) (8 pts) The periodic table is organized in rows and columns. The elements listed in the columns have similar properties and hence are grouped into the following names. Provide the name (*not the symbol*) for an element in the following groups:

Alkali metal sodium Alkaline earth metal calcium

Transition metal iron Halogen chlorine

many possible answers

5) Balance the following chemical equations:



c) (2pt) What is the name of the type of reaction in part B?

combustion

6) (9 pts) Complete the following table:

	# of protons	# of electrons	# of neutrons
^{19}F	9	9	10
^{32}S	16	16	16
$^{35}\text{Cl}^-$	17	18	18

7) The traditional red laser pointer ($\lambda = 650 \text{ nm}$) is nice but a green laser pointer ($\lambda = 532 \text{ nm}$) are easier to see. I would also love to have a blue laser pointer ($\lambda = 473 \text{ nm}$), but at this time the price is outside of my limits ($\sim \$700$). Please refer to the cover page for equations and constants.

a) (2 pt) Which laser pointer produces radiation with the smallest frequency (ν)? red green blue (circle one)

b) (2 pt) Which laser pointer produces radiation with the highest energy (E)? red green blue (circle one)

c) (8 pts) Calculate the energy of the blue laser radiation. *Show all work to receive partial credit.*

$$E = \frac{hc}{\lambda} = \frac{(6.63 \times 10^{-34} \text{ J}\cdot\text{s})(3.0 \times 10^8 \frac{\text{m}}{\text{s}})}{473 \times 10^{-9} \text{ m}} = 4.21 \times 10^{-19} \text{ J}$$

8) In order to draw Lewis structures (which we will do later today in lab) we need to determine the number of "valance" electrons. Indicate below the number of valance electrons in each of the following elements.

Carbon 4 Nitrogen 5 Oxygen 6 Lithium 1 Fluorine 7

9) **Multiple Choice**

Circle the substance that is not an EPA listed criteria air pollutant.

- a. PM_{2.5}
- b. CO
- c. O₃
- d. CO₂

The most abundant gas that makes up the air is

- a. CO₂
- b. O₂
- c. Ar
- d. N₂

The correct number of significant figures in 0.0300 is

- a. 1
- b. 2
- c. 3
- d. 4
- e. 5

In PM₁₀, the 10 refers to

- a. 10 cm
- b. 10 mm
- c. 10 μm
- d. 10 nm

The correct name of CaCl₂ is

- a. carbon dichloride
- b. calcium dichloride
- c. carbon chloride
- d. calcium chloride

Ice is a type of

- a. compound
- b. mixture
- c. element
- d. water vapor

Lithium is in the group of the periodic table known as

- a. Alkali metals
- b. Alkali earth metals
- c. Transition metals
- d. Halogens

10) (6pt) Perform the following calculations and express the result with the correct number of significant figures.

a. $12.11 + 18.0 - 1.013 = 29.097 = 29.1$

b. $7.32 \times 12.5 \times 99.99 = 9.15 \times 10^3$

c. $(0.102 \times 0.01004)/3 = 3.41 \times 10^{-4}$
(The 3 is an exact number)

11) (4pt) Express the following in scientific notation:

a) 0.00305 3.05×10^{-3}

b) 6500.02 6.50002×10^3

12) (15pts) Perform the following unit conversions:

a. How many ml are there in 500 μL .

$$0.5 \text{ mL}$$

b. How many inches are in 1.1 m?

$$1.1 \text{ m} \left(\frac{100 \text{ cm}}{1 \text{ m}} \right) \left(\frac{1 \text{ in}}{2.54 \text{ cm}} \right) = 43.3 \text{ in}$$

43 in

c. How many ng are there in 2 mg?

$$(2 \text{ mg}) \left(\frac{1 \text{ g}}{1000 \text{ mg}} \right) \left(\frac{10^9 \text{ ng}}{1 \text{ g}} \right) = 2 \times 10^6 \text{ ng}$$

d. How many ppm are there in 0.5 %?

$$\frac{0.5}{100} = \frac{x}{10^6} \quad x = 0.5 \times 10^4 = 5 \times 10^3 \text{ ppm}$$

e. How many ppb are there in 0.89 ppm?

$$\frac{0.89}{10^6} = \frac{x}{10^9}$$

$x = 890 \text{ ppb}$