Name _____ Test 1

PHYS 0107 (Intro Chem) Fall 2006

1. (8 pts.) In the late 1700's a substance called baryte was thought to be an element. Scientists of the day observed the following for baryte.

Baryte is insoluble in water.	It melts at 1580 °C.	It has a density of 4.48 g/cm^3
It is formed in hydrothermal veins and around hot springs.	It is formed when sulfuric acid and barium hydroxide are mixed.	It is formed as a sole product when a particular metal is combined with oxygen.

Is barite an element? What observation best supports your answer.

2. (6 pts.) How is the mass number (also known as the nucleon number) of an element determined?

3. (6 pts.) Is the mass number of an element the same as the atomic mass of the element? Explain.

4. (6 pts.) Provide the atomic symbols for carbon-12, carbon-13, and carbon-14.

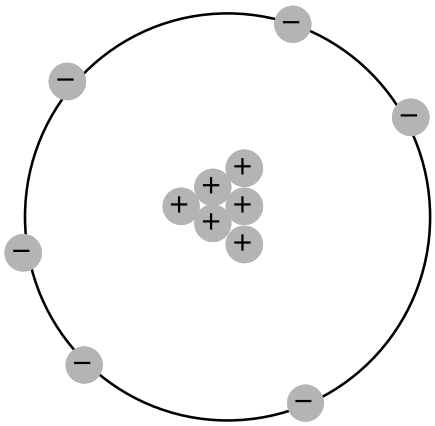
5. (4 pts) $^{235}UF_6$ and $^{238}UF_6$ are chemically very similar, yet one can be separated from the other. Why can $^{235}UF_6$ be separated from $^{238}UF_6$ (in other words how is $^{235}UF_6$ different than $^{238}UF_6$)?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____

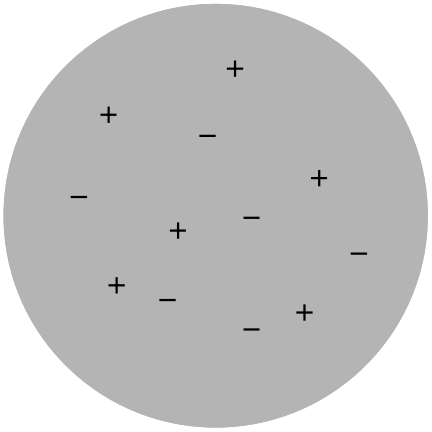
6. (6 pts.) Which of the following subatomic particles is(are) found in the nucleus of an atom?

neutron proton electron

7. (10 pts.) Rutherford's experiment* supported which model of atomic structure, the nuclear model or the chocolate chip cookie model (in class, the plum pudding model was called the chocolate chip cookie model)?



The "nuclear" model: Atoms are mostly empty space with small, very dense, positively charged nuclei.



The chocolate chip cookie model: the mass of the atom and the charges are evenly distributed throughout the atom.

*Rutherford shot very high energy α-particles at an extremely thin, gold foil. He expected the particles to pass through the foil virtually unmolested, yet he observed that some of the positively charged α-particles bounced back toward the source of the α-particles.

Explain how the model you chose is supported by Rutherford's experiment.

8. (6 pts) What makes an atom of carbon carbon, the number of neutrons it possesses or the number of protons it has?

9. (6 pts.) Of the three subatomic particles that we discussed in class (the electron, the proton, and the neutron), which two subatomic particles are similar in mass, and which one has a mass that is drastically lower than the other two?

10. (9 pts.) What are the charges of an electron, a neutron, and a proton?

11. (9 pts) When copper (atomic symbol Cu) oxidizes, it turns into copper cations that have a charge of positive two (Cu^{2+}). Cu contains 29 protons.

a. How many electrons does the neutral copper atom contain?

b. How many electrons does the +2 copper ion contain?

c. How many protons does the +2 copper ion contain?

12. (9 pts.) Complete the table for the following atom or ions

	$^{79}_{35}Br^-$	$^{19}_{9}F$	$^{23}_{11}Na^+$
number of protons			
number of neutrons			
number of electrons			

13. (6 pts.) When chlorine-37 is hit with a neutron, the neutron is absorbed by the nucleus and a proton is ejected from the nucleus. Write a balanced nuclear reaction (remember to indicate what new element is formed). The symbol for a proton is $^{1}_{1}p^+$

$$^{37}_{17}Cl + {}^{1}_{0}n \longrightarrow$$

14. (9 pts.) In the first step of a nuclear explosion ^{236}U forms when ^{235}U absorbs a neutron. The ^{236}U atom can fission into ^{92}Kr and ^{141}Ba.

a. What else forms during the reaction?

$$^{236}_{92}U \longrightarrow {}^{92}_{36}Kr + {}^{141}_{56}Ba + ?$$

b. In light of your response to question a, explain why this reaction can become a run away nuclear reaction (an explosion).

c. Is mass conserved in the reaction; that is, is the mass of the reactants the same as the mass of the products or is one higher than the other?

15. (6 pts.) a If three electrons were added to a phosphorous atom, the new electron configuration would resemble what element?

b. If two electrons were added to nitrogen atom, the new electron configuration would resemble what element.

16. (6 pts.) a. Which of the following is a reasonable estimate for the volume of a tea cup. Remember 1 cup = 8 fl oz, and 1 fl oz = 30 mL.

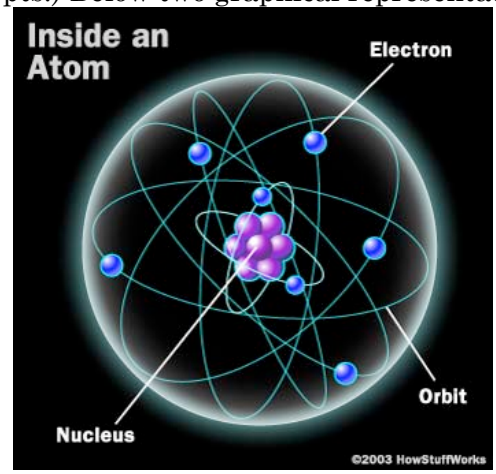
25 mL 250 mL 2.5 L 25 L

b. Which of the following is a reasonable height for a typical adult. Remember, 1 in = 2.54 cm, 1 cm = 10 mm, and 1 m = 100 cm.

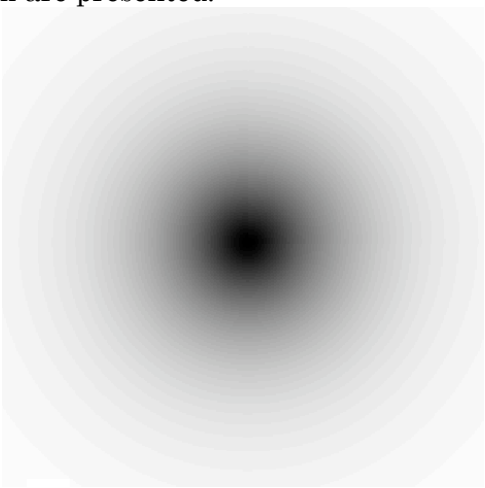
17 mm 170 mm 170 cm 17 m

17. An investigator wanted to determine whether a crystal was a diamond or a piece of leaded glass, so the density of the crystal was determined. When the crystal, which had a mass of 4.421 g, was added to 5.00 mL of water, the volume of the water increased to 5.81 mL. The density of diamond is 3.52 g/cm^3. Is the crystal a diamond? Support your assertion by determining the density of the crystal.

18. (12 pts.) Below two graphical representations of an atom are presented.



A



B

Describe what each model implies about the electrons in each atom.

Which model more accurately represents the current theory about the structure of an atom and the location of the electrons that are part of the atom.