1. What is the atomic number?
2. What is the mass number?
3. Describe the location, charge, and relative mass of protons, neutrons and electrons in the modern electron cloud model of the atom.  Draw a diagram including all of this information.
4. Discuss how most of an atom is empty space.
5. Define isotope.
6. Four elements are described below:

| Element | # of protons | # of neutrons | # of electrons |
|---------|--------------|---------------|----------------|
| A | 5 | 6 | 2 |
| B | 1 | 1 | 1 |
| C | 1 | 0 | 0 |
| D | 5 | 5 | 5 |

A) Which elements are isotopes of each other? (2 pairs)
B) How will elements A and D compare in terms of chemical/physical properties?
C) How will elements A and D compare in terms of atomic mass?
D) How will elements B and C compare in terms of charge?
E) Draw atomic symbols for all four elements.

7. Fill in the chart:

| Isotope | # of protons | # of neutrons | # of electrons |
|---------|--------------|---------------|----------------|
| $^{57}_{26}Fe$ | | | |
| $^{24}_{12}Mg^{+2}$ | | | |
| $^{14}_{6}C$ | | | |
| $^{12}_{6}C$ | | | |
| $^{235}_{92}U$ | | | |
| $^{35}_{17}Cl^{-1}$ | | | |
| | 33 | | 36 |
| | 64 | 92 | |

8. Boron has two naturally occurring isotopes, $^{10}B$ and $^{11}B$.  The percent abundance and atomic mass of each is given below.  Using this data, determine the atomic mass of boron.

| Isotope | Percent Abundance | Atomic Mass |
|---------|-------------------|-------------|
| Boron-10 | 19.78 % | 10.013 amu |
| Boron-11 | 80.22 % | 11.009 amu |

9. Neon has three naturally occurring isotopes:  $^{20}Ne$ has a mass of 19.992 amu and an abundance of 90.48%, $^{21}Ne$ has amass of 20.994 amu and an abundance of 0.27%, and $^{22}Ne$ has a mass of 21.991 amu and an abundance of 9.25%.  Calculate the average atomic mass of neon.

10. Write the symbol for the species with 17 protons, 19 neutrons, and 18 electrons.
11. Write the symbol for the species with 3 protons, 3 neutrons, and 2 electrons.
12. Use the quantum mechanical model to explain how electrons move about the nucleus.
13. How many electrons can a single atomic orbital hold? How many orbitals can be found in an s sublevel? p? d? f?
14. "s" sublevels can hold a total of ___ electrons. p sublevels can hold ___ electrons, while d sublevels can hold ___, and f sublevels can hold ___ electrons.
15. Which is bigger, the 3s sublevel or the 5s sublevel? How many electrons can each hold?
16. List the three rules for electron configurations.
17. Give electron configurations (longhand) for: Fe, Br, Ar, He, U, Ag, K, Ne.
18. Give shorthand electron configurations for: In, I, Rb, Au, Cu,
19. $1s^22s^22p^63s^23p^4$ is the electron configuration for which element?
20. $1s^22s^22p^63s^23p^64s^23d^{10}4p^6$ is the electron configuration for which noble gas?
21. Complete this chart of scientists:

| Scientist | Discovery/Theory | How did this change how people thought the atom looked? |
|---|---|---|
| Dalton | | |
| Thomson | | |
| Rutherford | | |
| Bohr | | |
| Schrödinger | | |
| Chadwick | | |

22. Sodium-24 undergoes beta radiation. Its half-life is 15 hours.
    a. Write the equation for the beta decay of sodium-24.
    b. If you start with 68.5 g of sodium-24, how much will be left after 90. hours?
23. $^{235}$U undergoes alpha radiation.
    a. Write the equation for the alpha decay of uranium-235.
    b. What is the half-life of uranium-235 if a 875 g sample decays to 27.3 g in $3.52 \times 10^9$ years?
24. Carbon-11 decays by positron emission.
    a. Write the nuclear chemistry equation.
    b. The half-life of carbon-11 is approximately 20 minutes. How long will it take a 46 g sample of carbon-11 to 2.9 g?
25. Ruthenium-97 undergoes electron capture.
    a. Write the equation.
    b. The half-life of ruthenium-97 is 2.84 days. If there are 25.0 g of the sample left after 17.0 days, how many grams were in the original sample?
26. Iridium-192 undergoes beta *and* gamma decay. Write the equation.