# Regents Chemistry

## Thanksgiving Break Assignment (74 points)

On a separate piece of paper, answer the following questions. This assignment is due on Monday, December 2nd. Failure to complete this assignment by the deadline will result in a 10 point deduction for each day late. Any evidence of copying or cheating will result in a grade of a **zero**. The assignment grade will be determined by multiplying the number of earned points by two.

1. Draw two different compounds using the representations for atoms of element X and element Z given below. [2]

   Atom of element X = ●  Atom of element Z = ○

2. Given the nuclear equation: $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{142}_{36}Ba + ^{91}_{36}Kr + 3^{1}_{0}n$ + energy
   a. State the type of nuclear reaction represented by the equation. [1]
   b. The sum of the masses of the products is slightly less than the sum of the masses of the reactants. Explain this apparent loss of mass. [1]
   c. This process releases greater energy than an ordinary chemical reaction does. Name another type of nuclear reaction that releases greater energy than an ordinary chemical reaction. [1]

3. As a neutral sulfur atom gains two electrons, what happens to the radius of the atom? [1]

4. After a neutral sulfur atom gains two electrons, what is the resulting charge of the ion? [1]

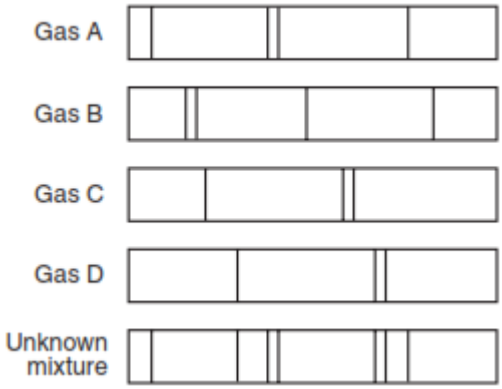
5. A student is given samples of sodium, argon, arsenic, and rubidium.
   a. Which two of the given elements have the most similar chemical properties? [1]
   b. Explain your answer to part a in terms of atomic structure. [1]

6. Base your answers to this question on the electron configuration table below.

| Element | Electron Configuration |
|---|---|
| *X* | 2–8–8–2 |
| *Y* | 2–8–7–3 |
| *Z* | 2–8–8 |

   a. What is the total number of valence electrons in an atom of electron configuration X? [1]
   b. Which electron configuration represents the excited state of a calcium atom? [1]
   c. What is the nuclear charge of element Z? [1]
   d. Explain, in terms of atomic structure, why element Z is unlikely to form a chemical bond. [1]

7. Many advertising signs depend on the production of light emissions from gas-filled tubes that are subjected to a high-voltage source. When light emissions are passed through a spectroscope, bright-line spectra are produced.
   a. Identify the two gases in the unknown mixture shown to the right. [2]
   b. Explain the production of an emission spectrum, in terms of the energy states of an electron. [1]




8. John Dalton was an English scientist who proposed that atoms were hard, invisible spheres. In the modern model, the atom has a different internal structure.
   a. Identify one experiment that led scientists to develop the modern model of the atom. [1]
   b. Describe this experiment. [1]
   c. State one conclusion about the internal structure of the atom, based on this experiment. [1]

9. Base your answers to this question on the article below and your knowledge of chemistry.

**Radioactivity at home**

You may be surprised to learn that you do not need to visit a nuclear power plant or a hospital X-ray laboratory to find sources of radioactivity. They are all around us. In fact, it is likely that you'll find a few at home. Your front porch may incorporate cinder blocks or granite blocks. Both contain uranium. Walk through the front door, look up, and you'll see a smoke detector that owes its effectiveness to the constant source of alpha particle emissions from Americium-241. As long as the gases remain ionized within the shielded container, electricity flows, and all is calm. When smoke enters the chamber, it neutralizes the charges on these ions. In the absence of these ions, the circuit breaks and the alarm goes off.

Indicator lights on your appliances may use Krypton-85; electric blankets, promethium-147; and fluorescent lights, thorium-229. Even the food we eat is radioactive. The more potassium-rich the food source, the more potassium-40—a radioactive isotope that makes up about 0.01% of the natural supply of this mineral—is present. Thus, brazil nuts, peanuts, bananas, potatoes, and flour, all rich in potassium, are radiation sources.

—*Chem Matters*
April 2000

a. Write the equation for the alpha decay that occurs in a smoke detector containing americium-241. [2]
b. How is the radioactive decay of krypton-85 different from the radioactive decay of americium-241? [1]
c. State one benefit or useful application of radioactivity not mentioned in this article. [1]
d. State one risk or danger associated with radioactivity. [1]

10. Base your answers to this question on the data table below, which shows three isotopes of neon.

| Isotope | Atomic Mass (atomic mass units) | Percent Natural Abundance |
|---|---|---|
| $^{20}Ne$ | 19.99 | 90.9% |
| $^{21}Ne$ | 20.99 | 0.3% |
| $^{22}Ne$ | 21.99 | 8.8% |

a. In terms of subatomic particles, state one difference between these three isotopes of neon. [1]
b. Based on the atomic masses and natural abundances shown in the data table, calculate the average atomic mass of neon. Your response must include a correct numerical setup and the calculated result with the correct number of significant figures. [3]
c. Write the Lewis electron-dot structure of an atom of neon-22 in the ground state. [1]

11. A plan is being developed for an experiment to test the effect of concentrated strong acids on a metal surface protected by various coatings. Some safety precautions would be the wearing of chemical safety goggles, an apron, and gloves. State one additional safety precautions that should be included in the plan. [1]

12. What is the chemical formula for tin(II) fluoride? [1]

13. A student is given two beakers, each containing an equal amount of clear, odorless liquid. One solution is acidic and the other is basic.
a. State two safe methods of distinguishing the acid solution from the base solution. [2]
b. For each method, state the results of both the testing of the acid solution and the testing of the base solution. [2]

14. In the following reaction, 80 grams of oxygen and 20 grams of hydrogen gas are produced.

$$2H_2O(\ell) \rightarrow 2H_2(g) + O_2(g)$$

a. Identify the type of chemical reaction shown by the equation above. [1]
b. Determine the mass of water present before the reaction began. [1]