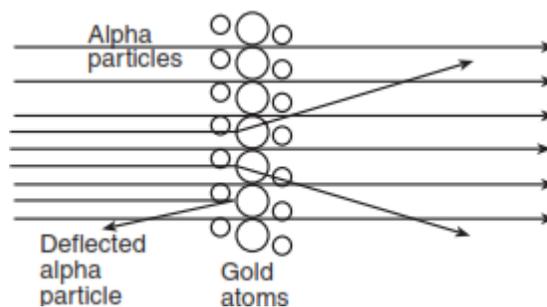


Regents Chemistry Holiday Break Assignment 2013 [78 points]

The following assignment is due on January 6, 2014. Each day the assignment is turned in late, 10 points will be deducted from your overall score. This assignment was designed to help you start studying for the midterm examination. Any evidence of copying or cheating will result in a zero for this assignment.

1. Base your answers to the following questions on the information below and the diagram to the right.

One model of the atom states that atoms are tiny particles composed of a uniform mixture of positive and negative charges. Scientists conducted an experiment where alpha particles were aimed at a thin layer of gold atoms. Most of the alpha particles passed directly through the gold atoms. A few alpha particles were deflected from their straight-line paths. An illustration of the experiment is shown to the right.

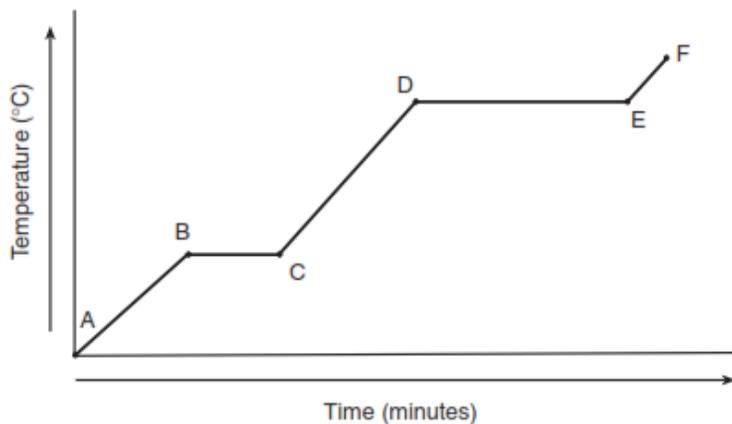


- Most of the alpha particles passed directly through the gold atoms undisturbed. What does this evidence suggest about the structure of the gold atoms? [1]
- A few of the alpha particles were deflected. What does this evidence suggest about the structure of the gold atoms? [1]
- How should the original model be revised based on the results of this experiment? [1]

2. Base your answers to the following questions on the information below.

Given the heating curve where substance X starts as a solid below its melting point and is heated uniformly.

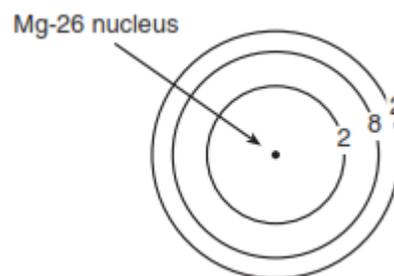
- Identify the process that takes place during line segment **BC** of the heating curve. [1]
- Identify a line segment in which the average kinetic energy is constant. [1]
- Using (●) to represent particles of substance X, draw at least five particles as they would appear in the substance at point F. [1]
- Describe, in terms of intermolecular forces, what is happening to substance X during line segment **DE**. [1]



- A student determines the density of zinc to be 7.56 grams per milliliter. Determine the student's percent error. Your answer must include the correct numerical setup and your calculated result. [2]
- Given the nuclear equation: ${}_{29}^{58}\text{Cu} \rightarrow {}_{28}^{58}\text{Ni} + X$. What nuclear particle is represented by X? [1]
- What is the gram-formula mass of $(\text{NH}_4)_2\text{CO}_3$? [1]
- Calculate the number of moles of carbon dioxide present in 11 grams of CO_2 . [1]
- A scientist in a chemistry laboratory determined the molecular formulas for two compounds containing phosphorus and oxygen to be P_2O_5 and P_4O_{10} .
 - Write an IUPAC name for the compound P_2O_5 . [1]
 - Calculate the percent composition by mass of oxygen in P_2O_5 . [1]

8. Naturally occurring elemental carbon is a mixture of isotopes. The percent composition of the two most abundant isotopes is listed below.
- 98.93% of the carbon atoms have a mass of 12.00 atomic mass units.
 - 1.07% of the carbon atoms have a mass of 13.00 atomic mass units.
- a. Calculate the average atomic mass of carbon. Your answer must include the correct numerical setup the calculate result. [2]
 - b. Describe, in terms of subatomic particles, one difference between the nuclei of carbon-12 atom and the nuclei of carbon-13 atoms. The response must include both isotopes. [1]

9. Base your answers to the following questions on the diagram to the right, which represents an atom of magnesium-26 in the ground state.



- a. What is the total number of valence electron in an atom of Mg-26 in the ground state? [1]
 - b. Draw a Lewis electron-dot diagram for a magnesium-26 atom in the ground state. [1]
 - c. What is the nuclear charge of Mg-26? [1]
 - d. Determine the number of subatomic particles found in the nucleus of a Mg-26 atom. [2]
 - e. Write an acceptable excited state electron configuration of Mg-26. [1]
10. Explain, in terms of energy states and electron transitions, how an element's bright line spectrum is produced. [1]
11. Explain, in terms of atomic structure, why germanium is chemically similar to silicon. [1]
12. Explain, in terms of atomic structure, why the atomic radius of iodine is greater than the atomic radius of fluorine. [1]
13. Explain, in terms of atomic structure, why the first ionization energy of fluorine is greater than the first ionization energy of boron. [1]
14. Based on Reference Table N, what is the fraction of a sample of potassium-42 that will remain unchanged after 62.0 hours? [1]
15. What is the freezing point of gallium in degrees Celsius? [1]
16. Given a mixture of sand and water, state one process that can be used to separate the water from the sand. [1]
17. A metal, M, was obtained from a compound in a rock sample. Experiments have determined that the element is a member of Group 2 on the Periodic Table of Elements.
- a. What is the phase of element M at STP? [1]
 - b. Explain, in terms of electrons, why element M is a good conductor of electricity. [1]
 - c. Explain why the radius of an ion of element M is smaller than the radius of an atom of M. [1]
 - d. Using the symbol M for the element, write the chemical formula for the compound that forms when element M reacts with nitrogen. [1]
18. Explain, in terms of collision theory, why an increase in temperature increases the rate of a chemical reaction. [1]
19. Identify the type of chemical reaction represented by the equation: $4\text{Fe}(s) + 3\text{O}_2(g) \rightarrow 2\text{Fe}_2\text{O}_3(s)$. [1]
20. A gas sample is placed in a rigid container at STP.
- a. Calculate the gas pressure in the rigid container, in atmospheres, if the temperature is increased to 400°C . [1]
 - b. Explain the change of gas pressure in terms of the kinetic molecular theory of gases. [1]