Name:_____ Period:_____ Date:_____

Ms. Randall Unit 2 Atomic Theory Constructed Response practice 2013-2014

Base your answers to questions **1** and **2** on the information below.

The accepted values for the atomic mass and percent natural abundance of each naturally occurring isotope of silicon are given in the data table below.

Naturally Occuring Isotopes of Silicon

Isotope	**Atomic Mass** (atomic mass unit)	**Percent Natural Abundance** (%)
Si − 28	27.98	92.22
Si − 29	28.98	4.69
Si − 30	29.97	3.09

1. Show a correct numerical setup for calculating the atomic mass of Si.

2. Determine the total number of neutrons in an atom of Si-29.

_____

3. Write an electron configuration for an atom of aluminum-27 in an excited state.

Period:_____

4. Base your answer to the following question on the information below

In living organisms, the ratio of the naturally occurring isotopes of carbon, C-12 to C-13 to C-14, is fairly consistent. When an organism such as a woolly mammoth died, it stopped taking in carbon, and the amount of C-14 present in the mammoth began to decrease. For example, one fossil of a woolly mammoth is found to have 1/32 of the amount of C-14 found in a living organism.

State, in terms of subatomic particles, how an atom of C-13 is different from an atom of C-12.

5. Draw a Lewis electron-dot diagram for a sulfur atom in the ground state.

6. Base your answer to the following question on the information below.

An atom has an atomic number of 9, a mass number of 19, and an electron configuration of 2–6–1.

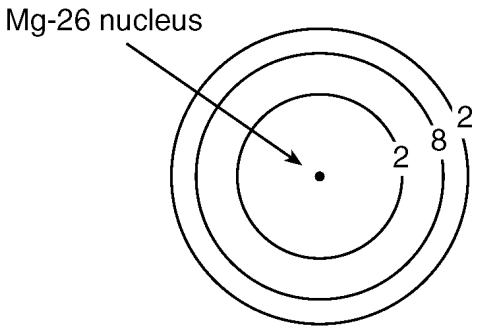
Explain why the number of electrons in the second and third shells show that this atom is in an excited state.

7. Base your answer to the following question on the information below.

Two isotopes of potassium are K-37 and K-42.

Explain, in terms of subatomic particles, why K-37 and K-42 are isotopes of potassium.

8. Base your answer to the following question on the diagram below, which represents an atom of magnesium-26 in the ground state.



Write an appropriate number of electrons in *each* shell to represent a Mg-26 atom in an excited state. Your answer may include additional shells.

9. Base your answer to the following question on the data table below, which shows three isotopes of neon.

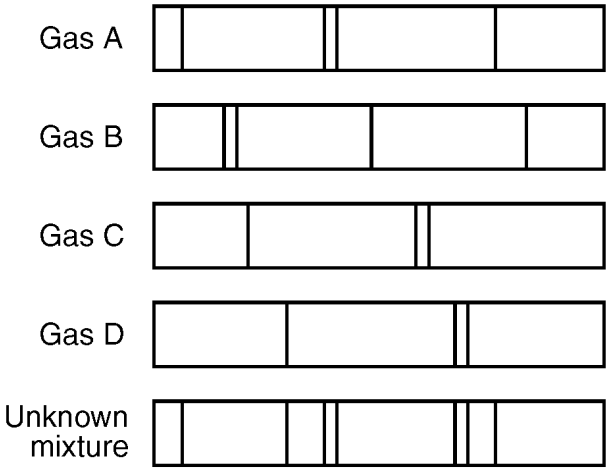
Isotope	**Atomic Mass** (atomic mass units)	**Percent Natural Abundance**
^{20}Ne	19.99	90.9%
^{21}Ne	20.99	0.3%
^{22}Ne	21.99	8.8%

Based on natural abundances, the average atomic mass of neon is closest to which whole number?

Period:_____

Base your answers to questions **10** and **11** on the information and the bright-line spectra represented below.

Many advertising signs depend on the production of light emissions from gas-filled glass tubes that are subjected to a high-voltage source. When light emissions are passed through a spectroscope, bright-line spectra are produced.



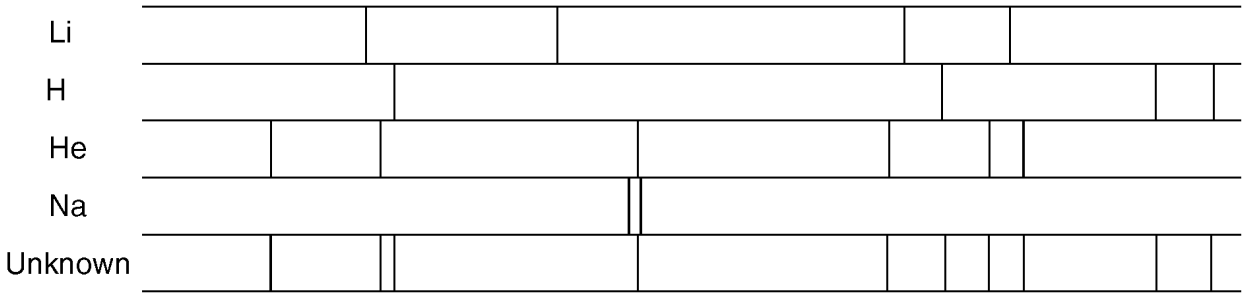
10. Explain the production of an emission spectrum in terms of the *energy states of an electron*.

11. Identify the *two* gases in the unknown mixture.

Period:_____

12. Base your answer to the following question on the diagram below, which shows bright-line spectra of selected elements.

Bright-Line Spectra

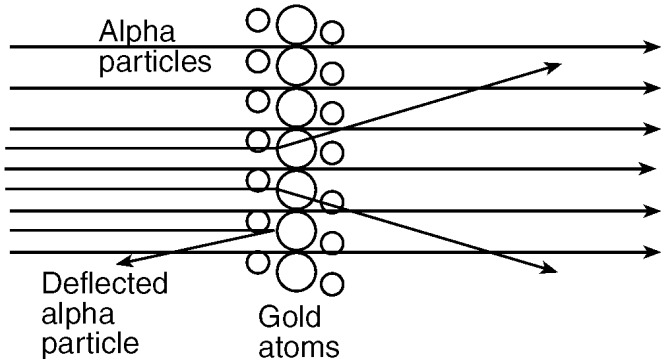


Explain how a bright-line spectrum is produced, in terms of *excited state, energy transitions,* and *ground state.*

13. Base your answer to the following question on the information and diagram below.

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 below.



How should the original model be revised based on the results of this experiment?

Period:_____

14. Base your answer to the following question on on the information below.

    In the modern model of the atom, each atom is composed of three major subatomic (or fundamental) particles.

    What is the sign of the net charge of the nucleus?

15. Draw the electron-dot (Lewis) structure of an atom of calcium.

Answer Key

Unit 2 Atomic Theory Constructed response practice

1. (27.98)(0.9222) + (28.98)(0.0469) + (29.97)(0.0309)
2. 15
3. *Examples:* – 2-7-4 – 1-8-4 – 2-6-2-3
4. A C-13 atom has seven neutrons and a C-12 atom has six neutrons.
5. 

6. *Examples*: – The third shell has one electron before the second shell is completely filled – The electron configuration is not 2-7, which is the ground state for an atom with atomic number 9
7. Acceptable responses include, but are not limited to:
   same number of protons, different number of neutrons
   K-37 has fewer neutrons than K-42.
   same element; different number of neutrons
8.
9. 20
10. Acceptable responses: Energy is released when an electron falls from a high state (excited) to a low state (ground), excited state to ground state, high energy to low energy.
11. Allow credit for **A** *and* **D**.
12. Examples: –Excited state to ground state releases energy.
    –energy released — excited to ground
    –An electron absorbs energy and moves to a higher shell (energy level). As the electron returns to a lower shell (energy level), it releases energy in the form of a bright-line spectrum.
13. Examples:
    – The atom has a positively charged nucleus; negative electrons surround the outside.
    – The positive charges are in the nucleus; electrons are not mixed in the nucleus.
    – nucleus smaller than atom
14. positive or (+)
15. example:

    Ca: