

Name Mr. Shank

Period AP 2,3

Quiz 2: Discovery of the Atom and Mass Spectrometry

You are an astronaut and the year is 3050. Your spaceship recently arrived on the planet Mars on an exploration mission, and after many hours exploring the planet, you have become hungry. You reach for the dumplings you brought on your trip, but you find that they are glowing and extremely heavy. In order to eat the dumplings and survive on Mars, you must determine the identity of the unknown, glowing substance.

1. The original mass of the dumplings was 2 kg, and their mass on Mars is 20 kg. A fellow astronaut claims that the extra mass in your dumpling is the result of the creation of new "dumpling" atoms and not the result of addition of matter from Mars. Circle the (a) scientist and (b) chemical principle below whose discovery best explain why your fellow astronaut must be wrong.

(a) Millikan Thomson Faraday Lavoisier

(b) Law of Constant Composition Law of Conservation of Mass Law of Gravity

2. You next shoot alpha particles at your dumplings, and you find that some (though very few) of the alpha particles bounce back from the glowing material. This suggests that the glowing material must contain:

- a) electrons
b) protons
c) neutrons

3. To analyze the results of your alpha particle experiment, you would be wise to read the book written by which chemist?

- a) Pauling
b) Rutherford
c) Thomson
d) Millikan

4. You decide that the best way to determine the identity of the unknown substance is to send a sample of it through a mass spectrometer. Though you brought a mass spectrometer with you to Mars, your not-so-bright fellow astronaut forgot to bring the part to ionize the sample. Why is this a problem? Answer with a complete sentence clearly expressing your reasoning.

A mass spectrometer separates isotopes based on their mass-to-charge ratio. If you do not have the part to ionize the sample, your sample will not be charged, and ~~you~~ it will not have a mass-to-charge ratio to assist in separation.

5. Fortunately, you found a few items on your spaceship that will allow you to determine whether the unknown atoms are already charged (in other words, ions). Circle the items below would be helpful in determining whether the unknown substance consists of neutral atoms or ions?

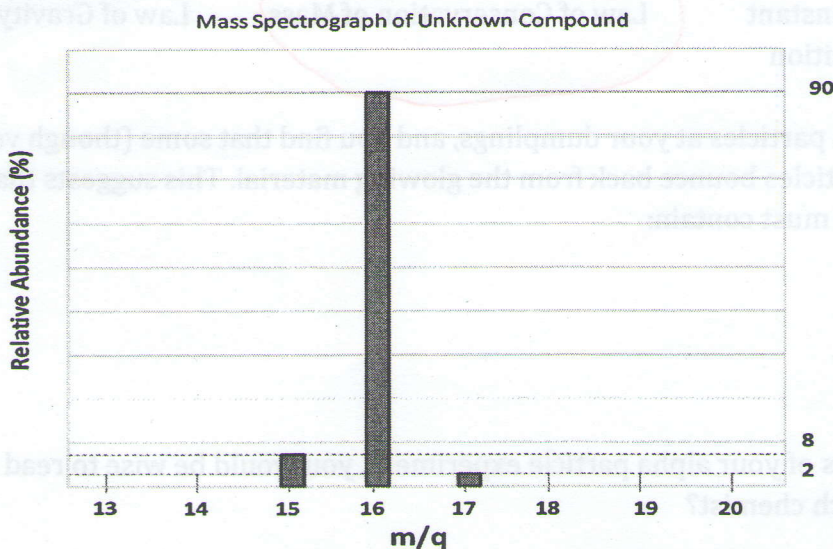
Magnet

Microscope

Neutron Ray

Charged Metal Plate

6. You find from your mass spectrometry experiment that the unknown contains only one element. From the mass spectrograph below, identify that element **and** give its average (weighted) mass.



Show Work Here

$$15(.08) + 16(.9) + 17(.02) = 15.94$$

$$15.94 \approx 16$$

Weighted Mass

Unknown Compound

7. Luckily, you were correct in your interpretation of the mass spectrograph above, and the dumplings were safe to eat. However, you should have been more careful. Which of the following ions below could have given the same mass spectrograph given in problem six (6)?

	S^{2+}	B^+	Ti^{3+}	Zr^{2+}	Hg^{7+}
m	32	11	48	91	201
q	2	1	3	2	7
$\frac{m}{q}$	16	11	16	45.5 ~46	~29