

Atomic Theory Quiz A

1. List the “scientists” who have created models of the atom through history, in order, oldest to newest
Dalton, Rutherford, Thomson, Democritus, Bohr
2. Put the models of the atom in historical order, oldest to newest:
the atom has a nucleus with electrons flying around it in orbitals, the atom is a small hard sphere, the atom is like the Sun with electrons flying around like planets in orbits, the atom is just an indivisible particle, the atom has a nucleus with electrons flying around outside but not in an organized way
3. The scientist who discovered the electron was A. Dalton B. Bohr C. Rutherford D. Thomson
4. The electrons fly around the nucleus in orbits, and each orbit can also be understood to be an energy level, is a model of the atom. What is it called when electrons “jump” up to a higher than normal orbit? What happens when that electron returns to normal, or the ground state?
5. How many electrons fit into each of the first three electron orbitals?
6. What is the difference between an electron orbit and an electron orbital? (anything?)
7. What are the three simple sub atomic particles of atoms? What charges and masses do they have?
Redraw, and then fill in the table.

Name	Symbol	Charge	mass	Location in an atom

8. Define Isotope
9. How many of each of the subatomic particles are in the most common isotope of gold?
10. How many of each subatomic particles are in the most common isotope of the anion sulfide?

Atomic Theory Quiz A ANSWERS

1. List the “scientists” who have created models of the atom through history, in order, oldest to newest
Democritus - Dalton - Thomson - Rutherford - Bohr
2. Put the models of the atom in historical order, oldest to newest: the atom is just an indivisible particle, the atom is a small hard sphere, the atom has a nucleus with electrons flying around outside but not in an organized way, the atom has a nucleus with electrons flying around it in orbitals, the atom is like the Sun with electrons flying around like planets in orbits
3. The scientist who discovered the electron was D. Thomson
4. What is it called when electrons “jump” up to a higher than normal orbit? Moving into the excited state. What happens when that electron returns to normal, or the ground state? Electrons emit energy previously gained (to get excited). This energy release is visible light, and it is called the spectra
5. How many electrons fit into each of the first three electron orbitals? First orbital holds up to 2 electrons. The second orbital holds up to 8 electrons. Third orbital is weird: it can hold up to 8 electrons and feel full, or it can stretch out and hold up to 18 electrons and feel full.
6. What is the difference between an electron orbit and an electron orbital? (anything?) Orbits imply radius from nucleus, like a planet moving around the Sun. Orbits are also energy levels. An orbital is more of a zone that the electron would be found, not at a particular radius, but in this zone. Orbitals are also energy levels.
7. What are the three simple sub atomic particles of atoms? What charges and masses do they have?
Redraw, and then fill in the table.

Name	Symbol	Charge	mass	Location in an atom
Proton	p^+	+1	1 amu	In the nucleus
Neutron	n^0	0	1 amu	In the nucleus
Electron	e^-	-1	Zero in high school	Flying around outside of the nucleus

8. Isotope— atoms that have the same chemical properties because they have the same number of electrons and protons and they bond the same way, but have more or fewer neutrons. This changes their mass a little bit, but not the properties. They exist in odd proportions in nature. Many atoms have a dozen or more isotopes.
9. How many of each of the subatomic particles are in the most common isotope of gold? Au—197 has total mass of 197 amu, which means 197 protons plus neutrons. Gold is number 79. Gold has 79 protons, 79 electrons, and $(197-79 =)$ 108 neutrons.
10. How many of each subatomic particles are in the most common isotope of the anion sulfide? This is “tricky” in that this is NOT a sulfur atom, it is the sulfur ANION. S^{2-} still has mass of 32 amu. So, the sulfide anion has total mass of 32 amu, which means 32 protons plus neutrons. Sulfur is number 16. Sulfide has 16 protons, and $(32-16 =)$ 16 neutrons. This anion has gained 2 electrons to become isoelectric to argon, S^{2-} has 18 electrons.

Atomic Theory Quiz B

1. Why do most of the atomic masses on periodic table of the elements have decimal masses when every proton and neutron has mass of 1 whole amu?
2. What is a “naturally occurring isotope”? Is there such thing as a not naturally occurring isotope too?
3. Calculate the average weighted atomic mass for this element, based upon the data in the chart.

Silver Data	Atomic mass	Percent abundance
Ag—107	106.905	51.84%
Ag—109	108.905	48.16%

4. What isotope is the most common isotope of Cadmium? Cd-110, Cd-112, Cd-113, Cd-114, or Cd-115? How do you know this?
5. Is Sr-87 the most common isotope of strontium? Is Sr-88 the most common isotope of strontium? How can you tell?
6. Name all seven metalloids and write their symbols next to their names (size order, small to large)
7. Name groups 17, 18, 2, and 1.
8. What elements are in group 4?
9. What is the ONE similarity that every atom in period 5 has?
10. ALL of the inner transitional metals are in one group, which one? All of them are in 2 periods, which ones?

Atomic Theory Quiz B ANSWERS

1. Why do most of the atomic masses on periodic table of the elements have decimal masses when every proton and neutron has mass of 1 whole amu? Because the different isotopes, which all have whole number masses (in high school) exist in weird proportions. Ex: An element is 23.408% of one isotope and 76.592% of another. These percentages have decimals, so does the average weighted atomic mass.
2. What is a “naturally occurring isotope”? Is there such thing as a not naturally occurring isotope too? Naturally occurring means they exist in the Earth. Humans, when they cause nuclear reactions, produce some odd isotopes, some of which are not normally found on Earth.
3. To calculate the average weighted atomic mass for this element, we can do it 2 ways, the “nice” way using the approximate masses, or the “harder but more exact way” using the atomic masses with decimals. The answers we get will be really, really close. The first way is okay, but using the actual masses is more exact.

Silver Data	Atomic mass	Percent abundance
Ag—107	106.905	51.84%
Ag—109	108.905	48.16%

$$(107 \text{ amu})(.5184) = 55.4688 \text{ amu}$$

$$(109 \text{ amu})(.4816) = \underline{52.4944 \text{ amu}}$$

$$107.9632 \text{ amu (about 108 amu) \quad or...}$$

$$(106.905 \text{ amu})(.5184) = 55.461024 \text{ amu}$$

$$(108.905 \text{ amu})(.4816) = \underline{52.448648 \text{ amu}}$$

$$107.90967 \text{ amu (about 108 amu) again!}$$

4. What isotope is the most common isotope of Cadmium? On the periodic table, cadmium’s average weighted atomic mass is 112.41 amu, which rounds to 114. That’s the most common isotope, Cd-114
5. Is Sr-87 the most common isotope of strontium? Is Sr-88 the most common isotope of strontium? How can you tell? On the periodic table, strontium’s average weighted atomic mass is 87.62 amu, which rounds to 88. That’s the most common isotope, Sr-88. Watch your rounding to the nearest whole number work.
6. Name all seven metalloids and write their symbols next to their names (size order, small to large)
Boron (B), Silicon (Si), Germanium (Ge), Arsenic (As), Antimony (Sb), Tellurium (Te), and Astatine (At).
7. Group 17 are the halogens, 18 are the Noble Gases, 2 are the Alkali Earth Metals, and 1 are the Alkali metals.
8. Group 4 elements include Ti, Zr, Hf, and Rf. These are titanium, zirconium, hafnium, and rutherfordium
9. What is the ONE similarity that every atom in period 5 has? Only that they ALL have 5 electron orbitals. They include reactive metals, less reactive metals, metalloids, a halogen and a noble gas. Not very similar at all!
10. ALL of the inner transitional metals are in one group, which one? All of them are in 2 periods, which ones? All fit only into group 3. This makes group 3 the largest BY FAR of all the groups. Elements 57 → 71 are in period 6. These 57 → 71 set are called the Lanthanide Series since they start with Lanthanum. Elements 89 → 103 are in period 7. These elements 89→103 are called the Actinide Series since #89 is actinium.

Atomic Theory Quiz C

1. Calculate the average weighted atomic mass for lithium using the data at right.

Lithium Data	Atomic mass	Percent abundance
Li—6	6.015	7.59%
Li—7	7.016	92.41%

2. Why not just average Lithium 6 and Lithium 7 to get an average mass of 6.5 amu?

- 3-6. How many protons, neutrons and electrons are in each species (exact atom or ion) shown? (redraw table, fill in)

Species	Mass	Number of protons	Number of neutrons	Number of electrons
Al-27				
Al ⁺³ cation	27 amu			
Ta-181				
Ta-179				
Ta+5 cation	181 amu			
P-31				
P ⁻³ anion	31 amu			

7. What did Rutherford propose once he figured out what he really did in the Gold Foil Experiment?
8. What were some of the flaws in the original Rutherford Gold Foil Experiment results that he could not figure out?
9. Neon lights emit an orange color. Explain how that orange color is a mixture of color. Explain how another compound that might emit a similar orangey color (to your eyes) but how it would definitely be a different substance than altogether.
10. Explain the difference between spectra and spectra emission lines.

Atomic Theory Quiz C ANSWERS

Lithium Data	Atomic mass	Percent abundance
Li—6	6.015	7.59%
Li—7	7.016	92.41%

1. Calculate the average weighted atomic mass for lithium.

$$(6 \text{ amu})(0.0759) = 0.4554 \text{ amu}$$

$$(7 \text{ amu})(0.9241) = \underline{6.4687 \text{ amu}}$$

$$6.9241 \text{ amu (about 7 amu) or...}$$

$$(6.015 \text{ amu})(0.0759) = 0.4565 \text{ amu}$$

$$(7.016 \text{ amu})(0.9241) = \underline{6.4835 \text{ amu}}$$

$$6.9400 \text{ amu (about 7 amu) again!}$$

2. Why not just average Lithium 6 and Lithium 7 to get an average mass of 6.5 amu? That's an average. We do average weighted atomic mass, which takes into account THE MASS, and the PROPORTION of the naturally occurring isotopes of an element.

- 3-6. How many protons, neutrons and electrons are in each species (exact atom or ion) shown? (redraw table, fill in)

Species	Mass	Number of protons	Number of neutrons	Number of electrons
Al-27	27 amu	13	14	13
Al ⁺³ cation	27 amu	13	14	10
Ta-181	181 amu	73	108	73
Ta-179	179	73	106	73
Ta+5 cation	181 amu	73	108	68
P-31	30 amu	15	16	15
P ⁻³ anion	31 amu	15	16	18

7. What did Rutherford propose once he figured out what he really did in the Gold Foil Experiment? Atoms are mostly empty space, atoms have a dense and positively charged nucleus, and that the electrons must be flying around outside the nucleus, making up the vast majority of the atom's size.
8. What were some of the flaws in the original Rutherford Gold Foil Experiment results that he could not figure out? The electrons are negative and the nucleus positive, why weren't the electrons attracted to the nucleus? Also, if the atom was mostly empty space, how come we couldn't walk through walls, or see through everything? Also, if the electrons were flying around, how come they didn't seem to "escape" from the nucleus?
9. Neon lights emit an orange color. Explain how that orange color is a mixture of color. Explain how another compound that might emit a similar orangey color (to your eyes) but how it would definitely be a different substance than altogether. Neon emits a unique spectra, as it takes a unique amount of energy to excite neon compared to all other substances. Since neon emits that exact, unique amount of energy to return its electrons to the ground state, it emits a unique amount of energy (which we see). Our human eyes cannot always determine subtle differences in colors, but by using the refractive lenses to see the exact colors and their exact wavelengths, we can see that not all oranges are the same, nor are all the "blue" spectra, nor all of the "green" spectra.
10. Explain the difference between spectra and spectra emission lines. Spectra we see with our eyes, and it's the whole mixture of colors that are emitted by the electrons returning to the ground state. The Spectra Emission Lines are seen with refractive lenses, when we "break" the mixture of colors of the spectra into specific colors at specific wave lengths that we could measure quantitatively.