

Atom Review Key

Answer the following questions:

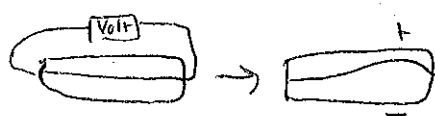
1. Draw Dalton's model of the atom:



2. What are some shortcomings of Dalton's model?

not detailed enough → too general

3. Describe Thomson's experiment. Provide a diagram to help with your explanation:

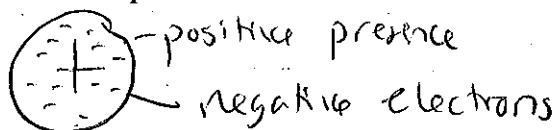


gas (light) produced w/ electrical current
gas bends towards (+) magnetic field

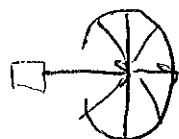
4. What subatomic particle did Thomson discover with his experiment? electron

5. What was name of Thomson's model of the atom? plum pudding

6. Draw AND label Thomson's model of the atom:



7. Describe Rutherford's experiment (provide a diagram to aid your explanation):

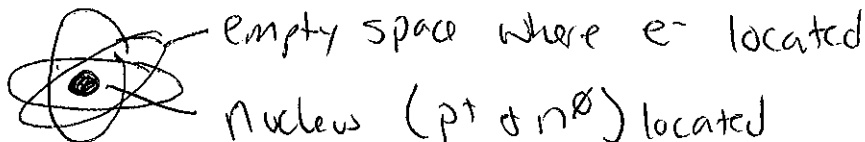


90% laser passed through gold foil
10% got deflected

8. What two things did Rutherford discover about the atom with his experiment?

90% empty space and 10% nucleus

9. Draw AND label Rutherford's model of the atom:



10. How did Bohr improve Rutherford's model of the atom? (hint: what is different about the electrons?)

Place e^- in specific rings (energy levels) around nucleus

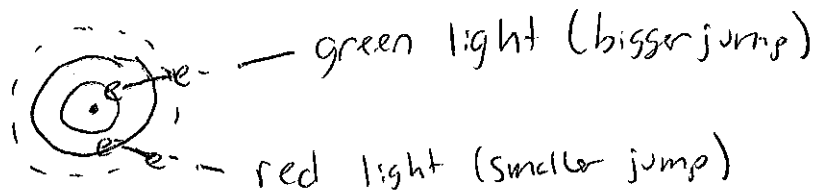
11. Draw AND label the Bohr model of an oxygen atom:



12. Draw AND label the Bohr model of a chlorine atom:



13. Draw a Bohr model of a neon atom. Show an electron moving from $n = 1$ to $n = 3$ and an electron moving from $n = 2$ to $n = 3$. Which of these is more likely to emit red light? Green light?



14. Define wavelength, amplitude, and frequency?

distance b/w two points on successive waves

height of wave

of waves that pass a point in 1 sec

15. List the colors of visible light in order of increasing energy. ROYGBV

16. As wavelength gets shorter, frequency increases.

17. As wavelength gets shorter, energy increases.

18. What is the difference between a bright line spectrum and a continuous spectrum? How do energy levels account for the appearance of bright line spectra?

continuous - blend of one color into next (no distinction)

bright line - distinct color banding (like UPC code)

as e^- jump & fall energy levels - light is given off in specific

19. Explain how electron movement between energy levels produces photons of light. wavelengths

e^- take in (absorb) energy and jump up energy levels,

\therefore when they fall they give off (emit) energy in the form of light

20. How do waves of red light and blue light differ with respect to frequency? wavelength? energy?

red: lower, longer, lower

blue: higher, shorter, higher

21. Compare the Bohr model to our current model of the atom (quantum model). How are they different? How are they similar?

quantum place e^- in atomic orbitals (but still at energy levels) \rightarrow more specific e^- placement

22. Use the quantum mechanical model to explain how electrons move about the nucleus.

in specific regions of space energy level + atomic orbital

23. What are atomic orbitals?

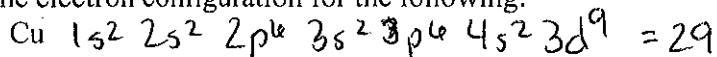
regions of space around nucleus w/ high probability of e^-

24. What do the letters s, p, d, and f represent in the current quantum model of the atom?

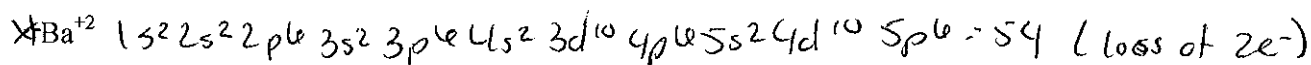
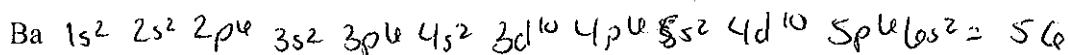
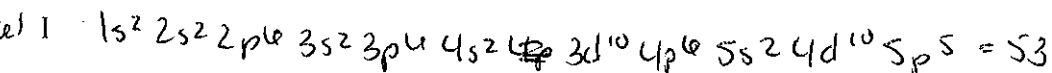
atomic orbitals

25. "s" sublevels can hold a total of 2 electrons, p sublevels can hold 6 electrons, while d sublevels can hold 10, and f sublevels can hold 14 electrons.

26. Write the electron configuration for the following:



take e^- from highest energy level $\leftarrow \text{Cu}^{2+} 1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 = 27$ (loss of $2e^-$)



* isoelectronic

27. In an electron configuration, there is a whole number, followed by a lower case letter, and then a number as a superscript to the letter. (Example: $4p^3$) What do each of the symbols represent?

energy level

atomic orbital

of e^- in that orbital

28. Define the following terms (or write the equation that defines them):

Atomic Number: # of p^+

Mass Number: $p^+ + n^0$ (mass of isotope of an element)

Average Atomic Mass: sum of all the isotopes of an element based of percent abundance

Atom: element on the periodic table (contains p^+, e^-, n^0)

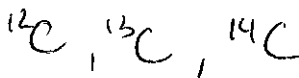
Ion: charged atom (gained/lost e^-)

Isotope: same element (p^+), different mass number (n^0)

29. Provide an example of an ion:



30. Provide an example of two or more isotopes:



31. Fill in the following table:

Subatomic Particle	Mass (amu)	Charge	Location
Proton	1	+	nucleus
Neutron	1	0	nucleus
Electron	1/1840	-	'cloud'

32. What two subatomic particles contribute to an atom's mass?

proton + neutron

33. What two subatomic particles contribute to an atom's charge?

proton + electron

34. Fill in the following table:

Atomic Symbol	Atomic #	# of protons	# of neutrons	# of electrons	Mass #
${}_{26}^{57}\text{Fe}$	26	26	31	26	57
${}_{12}^{24}\text{Mg}^{+2}$ *	12	12	12	10	24
${}_{35}^{80}\text{Br}^{-1}$ *	35	35	45	36	80
${}_{14}^{28}\text{Si}^{-3}$ *	14	14	14	17	28
${}_{92}^{235}\text{U}$	92	92	143	92	235
${}_{14}^{29}\text{Si}$	14	14	15	14	29

Put a star next to all the ions in the table above

35. Fill in the atomic symbol for the following table:

Atomic Symbol	# of protons	# of neutrons	# of electrons
${}_{5}^{11}\text{B}^{3+}$	5	6	2
${}_{1}^{2}\text{H}$	1	1	1
${}_{1}^{1}\text{H}^{+}$	1	0	0
${}_{5}^{10}\text{B}$	5	5	5

36. Using the table above, which elements are isotopes of each other (2 pairs)?

${}^{10}\text{B}$ + ${}^{11}\text{B}$ ${}^2\text{H}$ + ${}^1\text{H}$

37. Write the atomic symbol for an ion with 17 protons, 19 neutrons, and 18 electrons.

${}_{17}^{36}\text{Cl}^{-}$

38. Write the atomic symbol for an atom with 6 protons, 8 neutrons, and 6 electrons.

${}_{6}^{14}\text{C}$

39. Calculate the average atomic mass of a sample that contains 80% Iodine-127, 17% Iodine-126, and 3% Iodine-128 (the number after the element is the mass number).

$$\begin{aligned}
 127 \times 0.80 &= 101.6 \\
 126 \times 0.17 &= 21.42 \\
 128 \times 0.03 &= 3.84 \\
 \hline
 &= 126.86 \text{ amu}
 \end{aligned}$$

40. Calculate the average atomic mass of a sample that contains 50% Gold-197 and 50% Gold-198 (the number after the element is the mass number)

$$197 \times 0.50 = 98.5$$

$$198 \times 0.50 = 99$$

$$197.5 \text{ amu}$$

41. Fill in the following statements with the appropriate elemental symbol:

- Ra is the 7th period alkaline earth metal
- Ar is the 3rd period noble gas
- Cs is the 6th period alkali metal
- F is the 2nd period halogen
- Sc is the transition metal with the lowest atomic number
- Tb is the 9th Lanthanide element
- B is the only non-metal in the boron family
- La is the 1st inner transition metal
- Sb is the element in the nitrogen family that is in the 5th period
- Mg is the element in the 3rd period and 2nd family

Use the blank periodic table to complete the following questions.

42. Label the chart with the following groups: ~~Hydrogen Family~~, Transition Metals, Halogens, Alkaline Earth Metals, Alkali Metals, Noble Gases, Inner Transition Metals, Boron Family, Carbon Family, Nitrogen Family, and Oxygen Family.

43. Label metals and nonmetals on the chart below. Label periods and groups on the periodic table (write their numbers in).

The periodic table grid is labeled with the following handwritten text:

- Alkali metals** (written vertically in the first column)
- Alkaline earth metals** (written vertically in the second column)
- Transition metals** (written across the d-block)
- Boron family** (written vertically in the first column of the p-block)
- Carbon family** (written vertically in the second column of the p-block)
- Nitrogen family** (written vertically in the third column of the p-block)
- Oxygen family** (written vertically in the fourth column of the p-block)
- Halogens** (written vertically in the fifth column of the p-block)
- Noble gases** (written vertically in the sixth column of the p-block)
- Inner transition metals** (written below the f-block)

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