Atomic Structure and Electrons in Atoms Review

Who was the first person to talk about "atoms" in the fourth century B.C.? Democritus

How did J.J. Thompson discover the electron?

Cathode ray tube & noticed an attraction/repulsion of the particles.

Define the word atom in your own words.

Simplest form of an element

Fill in the following table concerning subatomic particles.

Particle	Where is it found in the atom?	What is its charge?	Check the particles that have equal masses.
Proton	nucleus	+	✓
Neutron	nucleus	no charge	✓
Electron	in electron cloud	−	

What part(s) of Dalton's atomic theory is/are incorrect?

✗atoms are indivisible, smallest part
atoms can be split & he didn't know about P, N, e.

✗atoms of the same element are identical
he didn't know about isotopes (same # P, diff # N)

Describe Rutherford experiment and how he discovered the nucleus. Gold foil Experiment. He was testing Thomson's Plum Pudding Model & found the radiation did not go straight through. There were times the radiation scattered which meant there was something dense in the middle of the atom.

Nucleus!

How many protons and electrons are in an atom of the element sulfur? p^+ 16 e^- 16

= neutral
Atomic # = P
APE

What does the atomic number of an element represent?

atomic # is the # of protons. (in the nucleus)

How do we find the mass number of an atom?

mass # = p + n

isotopes #p=16

How do sulfur-32 and sulfur-34 differ, and why?

32=16+n
34=16+n

mass # is diff b/c the # of neutrons!

Sulfur-32 16p 16n
Sulfur-34 16p 18n

mass#=p+n

Fill in the missing information for the following elements.

Element	Atomic Number	Mass Number	Number of protons	Number of neutrons	Number of electrons
V	23	51	23	51=23+n 28	23
Si	14	28	14	14	14
Ca	20	40	20	40=20+n 20	20
Mg	12	25=12+13 25	12	13	12

APE

Mass=#p+n

A sample of silicon has three isotopes with the following abundances. Find the average atomic mass of silicon.

silicon-27	30.26%
silicon-28	66.22%
silicon-29	3.52%

27 x 0.3026 = 8.170
28 x 0.6622 = 18.54
29 x 0.0352 = 1.02

27.73

Remember to divide the % by 100! Add all the #'s up ... do not divide by total.

27.73 amu

Each model of the atom listed below should match up with one phrase (A-E).

C	Dalton	A. gold foil experiment
A	Rutherford	B. planetary model
D	Thomson	C. atoms are solid spheres
B	Bohr	D. cathode ray tubes
E	Quantum Mechanical	E. n and l values

energy level, sublevel (s, p, d, f)

1 3 5 7 orbitals

The Pauli Exclusion principle states that an orbital may contain 2 (#) electrons with opposite spins.

Write the complete electron configurations for the following:

C $1s^2 2s^2 2p^2$ or $[He] 2s^2 2p^2$

Cr $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$ or $[Ar] 4s^1 3d^5$

Cl $1s^2 2s^2 2p^6 3s^2 3p^5$ OR $[Ne] 3s^2 3p^5$

How many electrons are in the highest occupied energy level for nitrogen? 5

energy levels

$1s^2 2s^2 2p^3$

How many unpaired electrons are there? 3

How many total electrons can the 1st energy level hold?

s only ⇒ 2e⁻

How many total electrons can the 2nd energy level hold?

s & p ⇒ 8e⁻

1 2 1 6

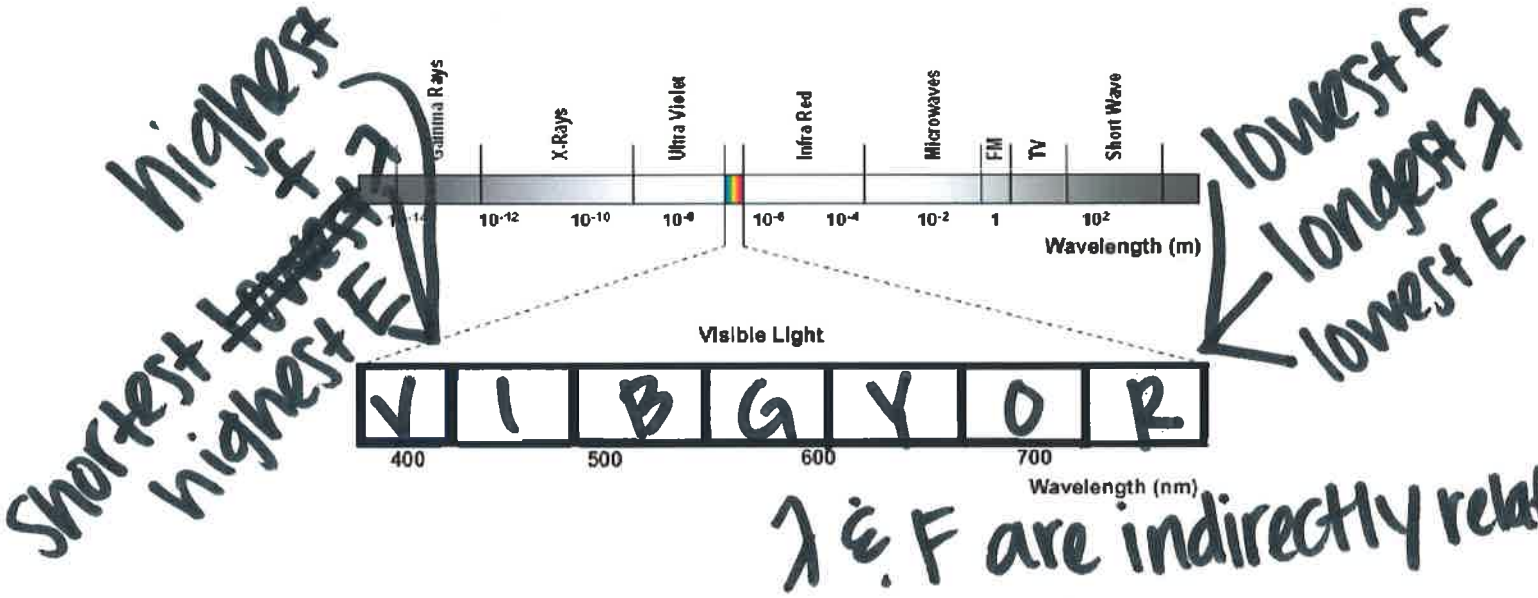
How many total electrons can the 3rd energy level hold?

s p d ⇒ 18e⁻

1 2 1 6 1 10

Which of the following is an incorrect sublevel designation? 5s ✓ 4p ✓ 3d ✓ 2f

↓ b/c f doesn't start until energy level 4.



highest f, shortest λ, highest E

lowest f, longest λ, lowest E

λ & F are indirectly related

Using the diagram, write the colors of the rainbow into the boxes according to increasing wavelength. Also, label the side of the diagram where you would find the highest frequency, energy and where you would find the lowest frequency, energy.

E: J

$h = 6.626 \times 10^{-34}$ J·s

$c = \lambda f$

$E = hf$

f: s^{-1}, 1/s, Hz

λ: m

$c = 3.0 \times 10^{8}$ m/s

Calculate the frequency of light that has a wavelength of 4.1×10^{-2} cm. ($c = 3.0 \times 10^{8}$ m/s)

$c = \lambda f$

$f = x$

$\lambda = 4.1 \times 10^{-2}\ cm \left| \frac{1m}{100cm} \right. = 4.1 \times 10^{-4}\ m$

$c = 3.0 \times 10^{8}$ m/s

$3.0 \times 10^{8} = (4.1 \times 10^{-4})x$

$f = 7.3 \times 10^{11}\ s^{-1}$

Calculate the energy of a photon of light that has a frequency of $1.55 \times 10^{18}\ s^{-1}$. ($h = 6.626 \times 10^{-34}$ J·s)

$E = x$

$h = 6.626 \times 10^{-34}$ J·s

$f = 1.55 \times 10^{18}\ s^{-1}$

$E = hf$

$E = (6.626 \times 10^{-34}\ J \cdot s)(1.55 \times 10^{18}\ s^{-1})$

$E = 1.03 \times 10^{-15}$ J