Thursday, October 11, 2018

Your Learning Goal:

Students will be able to understand atomic structure and the key characteristics of atomic components

Table of Contents: Going Subatomic – 11 R

Catalyst: (11 L)

What does everything in the universe have in common?

Homework:

Watch Big Bang Video

Take Cornell Notes 10L+R

Agenda:

1. Catalyst
2. Foldable Notes
3. CER

Table of Contents

Catalyst

What does everything in the universe have in common?

LEAF:

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Going Subatomic

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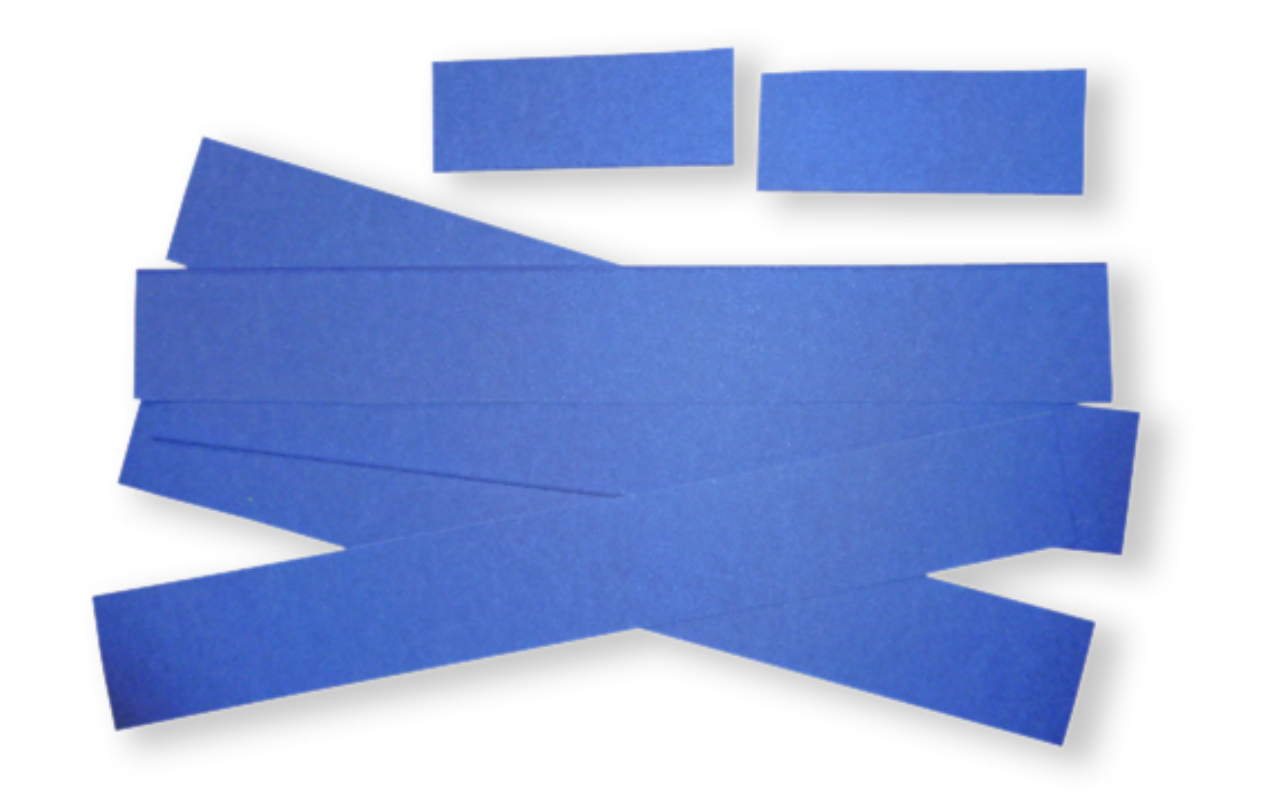
Matter

- Anything that has mass and takes up space (volume)
  - Examples:
    - A brick has mass and takes up space
    - A desk has mass and takes up space
    - A pencil has mass and takes up space
    - Air has mass and takes up space

All of the above examples are considered matter because they have mass and take up space. Can you think of anything that would not be considered matter?

How small is an Atom?

Cut your strip of paper IN HALF as many times as you can



No cuts	28 cm	11 in	Piece of paper
1 cut	14 cm	5.5 in	Hand, grapefruit
2 cuts	7.0 cm	2.75 in	Finger length, Apple
3 cuts	3.5 cm	1.38 in	Mushroom , paper clip
4 cuts	1.75 cm	.69 in	Dimes, keyboard keys, rings, insects
5 cuts	0.88 cm	.35 in	Peas
6 cuts	.44 cm	.17 in	Sunflower seeds
7 cuts	.22 cm	.09 in	Ant's width
8 cuts	1.0 mm	.04 in	Thread, sharp pencil tip width
10 cuts	.25 mm	.01 in	If you can cut this small, you are superhuman!
12 cuts	.06 mm	.002 in	Microscopic range, human hair
14 cuts	.015 mm	.006 in	Width of paper, microchip components
18 cuts	1.0 micron	.0004 in	Water purification openings, bacteria
19 cuts	.5 micron	.000018 in	Visible light waves
24 cuts	.015 micron	.0000006 in	Electron microscope range, DNA, membranes
31 cuts	$1x10^{-10}$ m (move the decimal 10x to the left)	$4.5x10^{-9}$ in (move the decimal 9x to the left)	Size of an Atom!
41 cuts	A little more than $1x10^{-15}$ m	A little more than $4x10^{-14}$ in	The size of the nucleus of an atom (the largest nuclei would be this amount x10)
58 cuts	About $1x10^{-18}$ m	A little less than $4x10^{-18}$ in	**Quarks! They may be even smaller than this.**

Atoms are so small that…

- it would take a stack of about 50,000 aluminum atoms to equal the thickness of a sheet of aluminum foil from your kitchen.
- if you could enlarge a penny until it was as wide as the US, each of its atoms would be only about 3 cm in diameter – about the size of a ping-pong ball
- a human hair is about 1 million carbon atoms wide.
- a typical human cell contains roughly 1 trillion atoms.
- a speck of dust might contain $3x10^{12}$ (3 trillion) atoms.
- it would take you around 500 years to count the number of atoms in a grain of salt.

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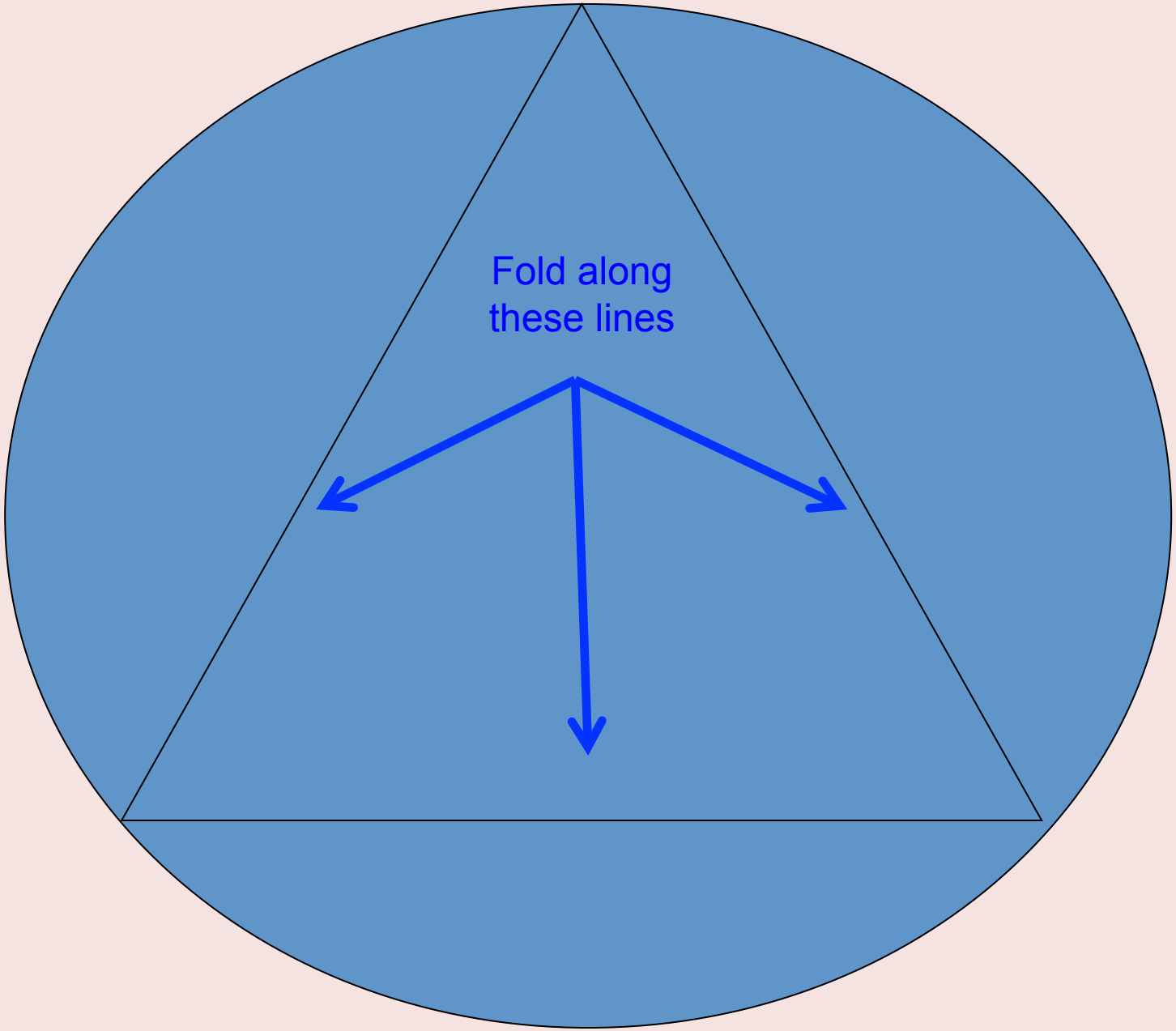
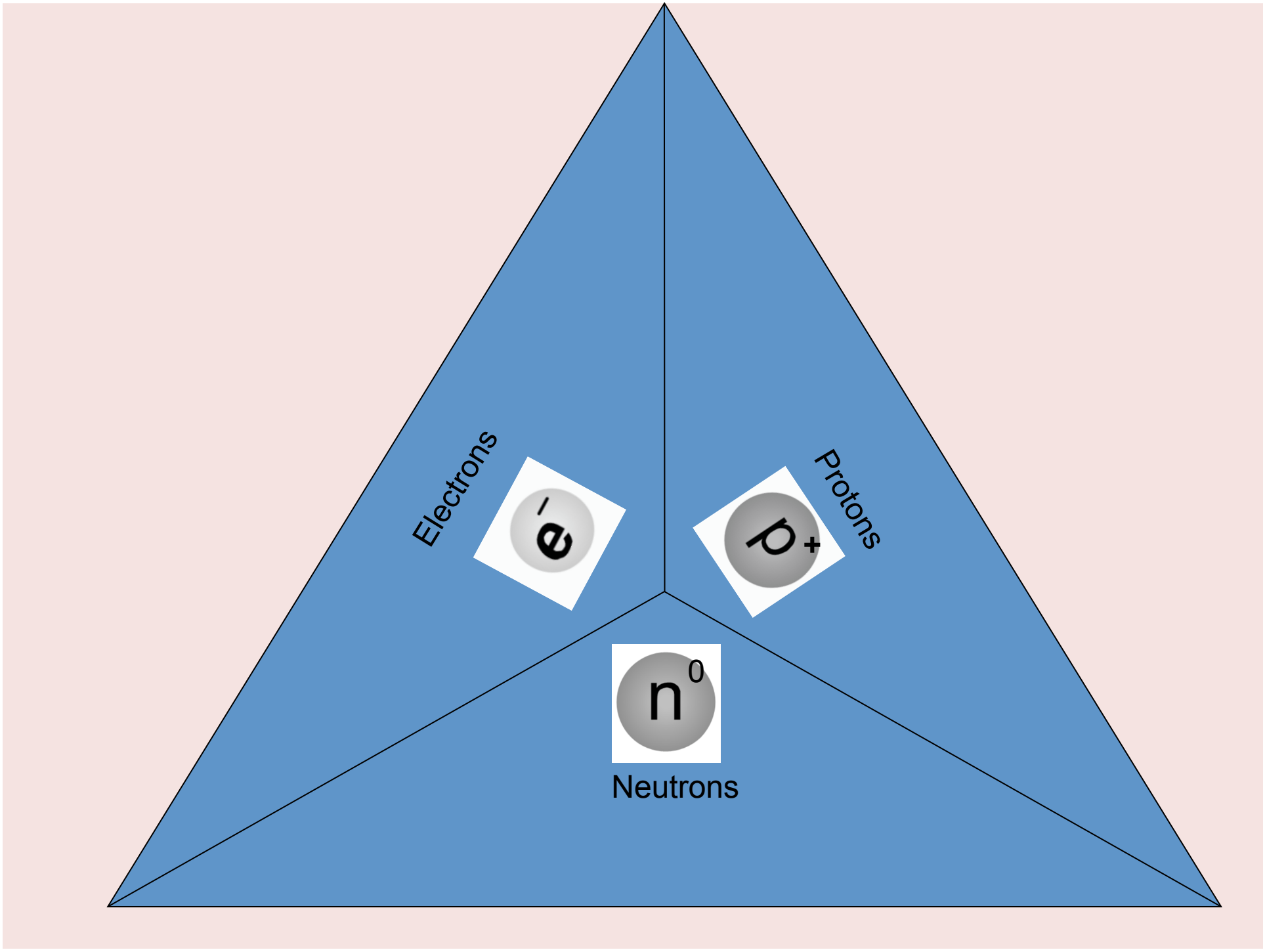
C-C-C-C-C-… + 999,995 more

1 trillion atoms →

Is made of approximately 3 trillion atoms

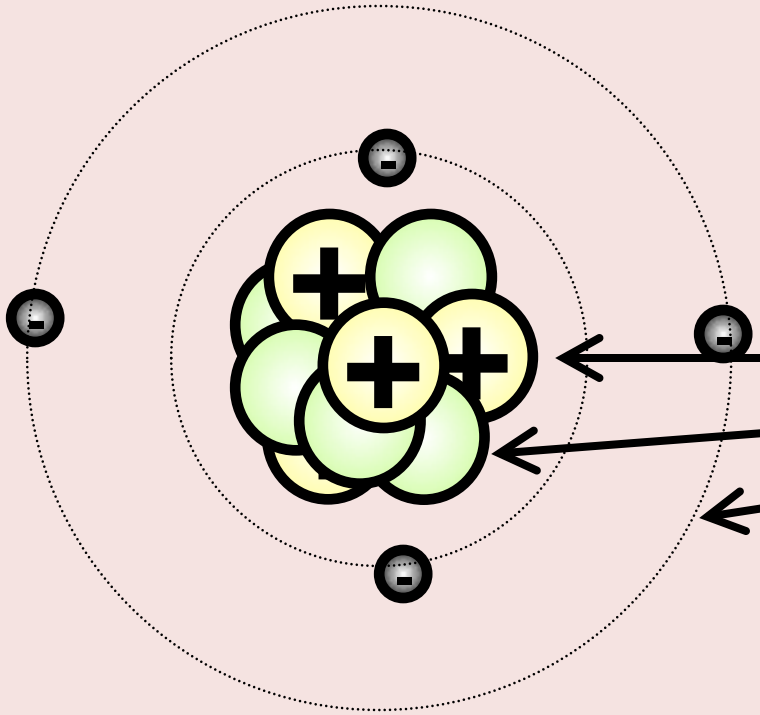
Just one of these grains


Fold along
these lines


Electrons
e´
Protons
p+
n0
Neutrons

Write

Atoms



- Smallest possible unit into which matter can be divided, while still maintaining its properties.
- Made up of:
  - Protons
  - Neutrons
  - Electrons

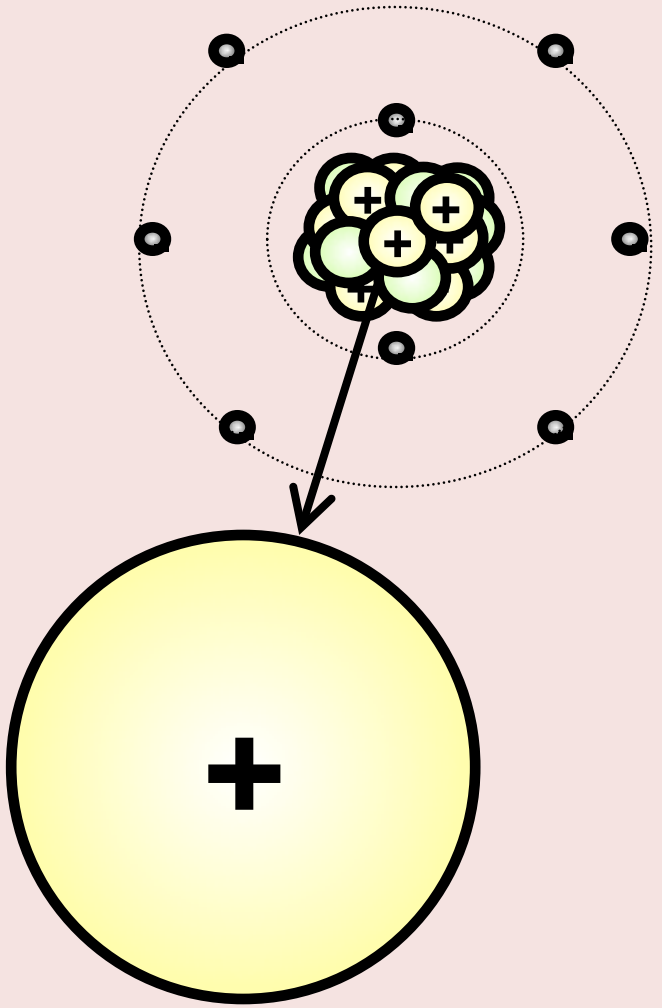
For example, what is the smallest possible unit into which a long essay can be divided and still have some meaning?

- The solar system is commonly used as an analogy to describe the structure of an atom

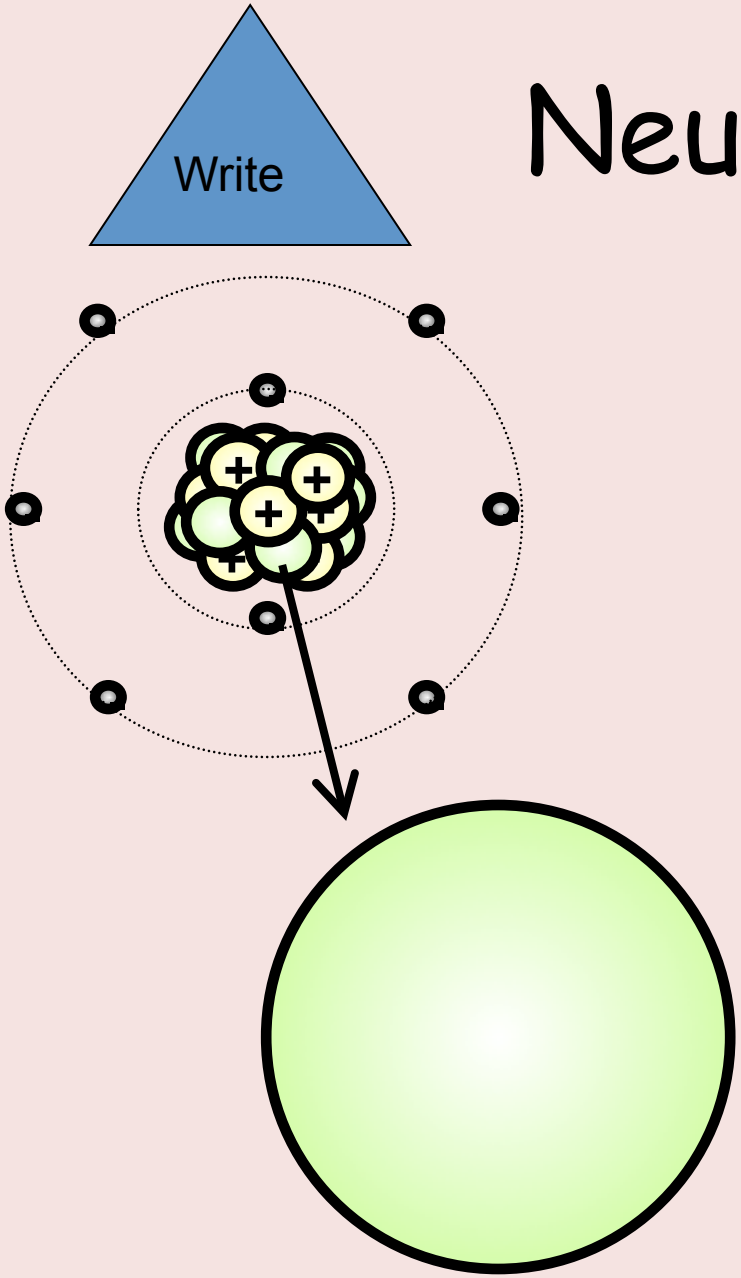
Write

Protons (+)

- Positively charged
- Make up the nucleus of the atom
- Equal to the atomic number of the atom
- Contribute to the atomic mass
- Equal to the number of electrons



Neutrons

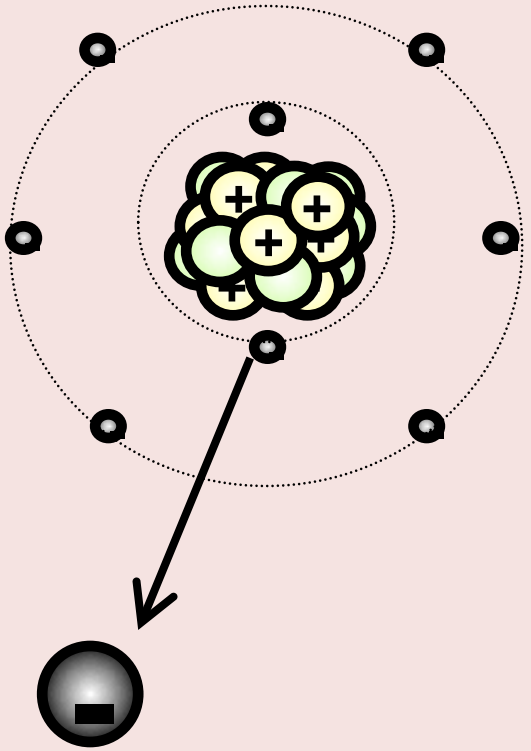


- Neutral particles; have no electric charge
- Help make up the nucleus of the atom
- Contribute to the atomic mass

Write

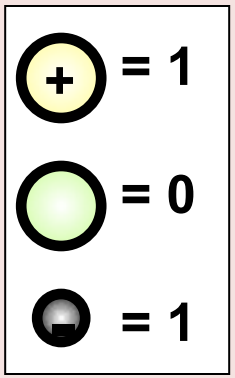
Electrons (-)

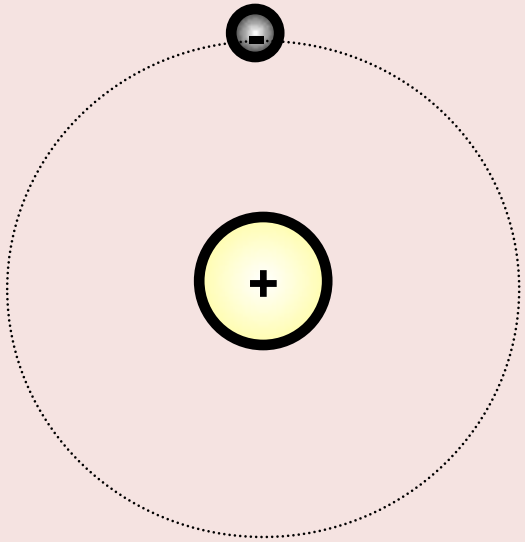
- Negatively charged
- Found outside the nucleus of the atom. Maximum number of electrons (1^{st} = 2, 2^{nd} = 8, 3^{rd} = 8)
- Mass is insignificant when compared to protons and neutrons
- Equal to the number of protons
- Involved in the formation of chemical bonds



Hydrogen (H) Atom

- Notice the one electron in the first orbital



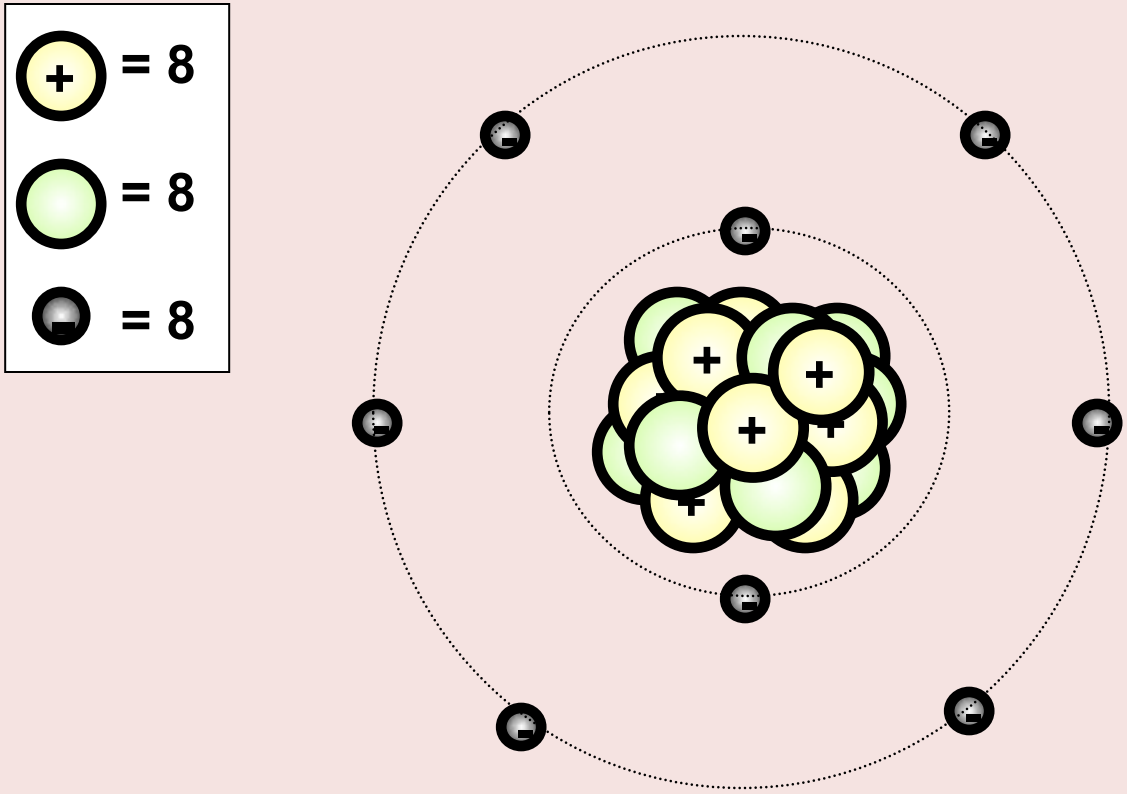


How many more electrons can fit in the 1st orbital/ level?

Even though there are no neutrons present, Hydrogen is still considered an atom

Oxygen (O) Atom

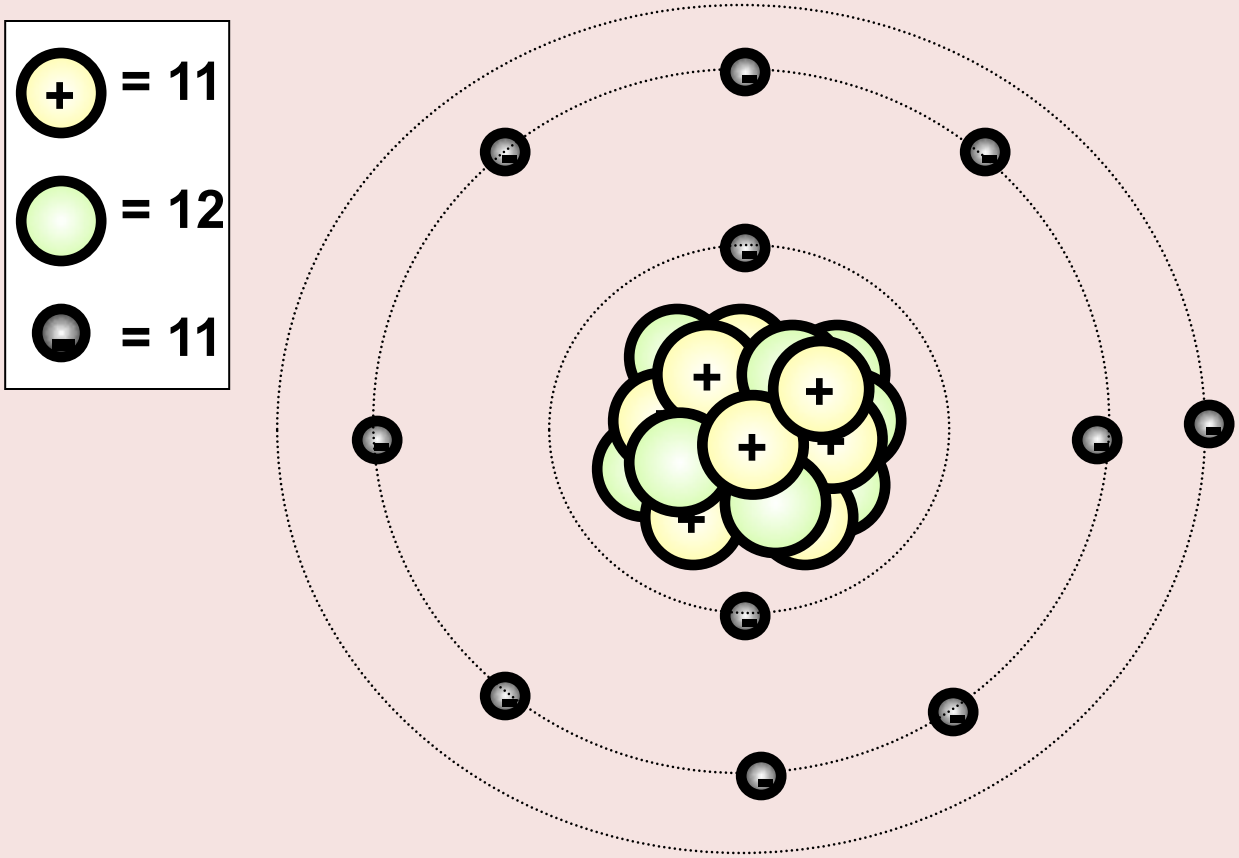
- Notice the two electrons in the first orbital/level and the six in the second



How many more electrons can fit in the 2nd orbital/ level?

Sodium (Na) Atom

- Notice the two electrons in the first orbital/level, eight in the second, and one in the third



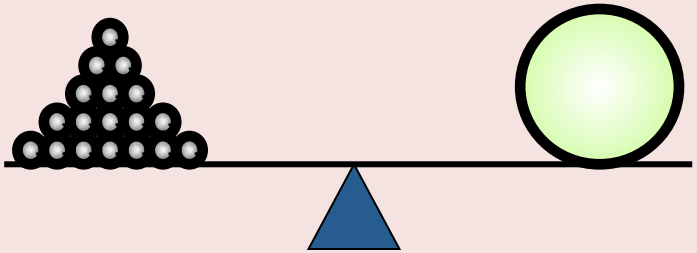
How many more electrons can fit in the 3rd orbital/ level?

Sub-Atomic Particles

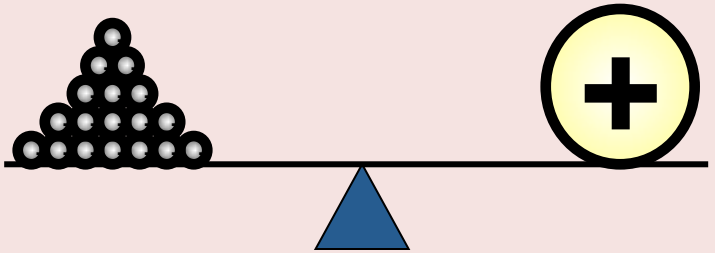
Weight Comparison

(protons, neutrons, electrons)

Neutron = 1.6749286 x10^{-27} kg
Proton = 1.6726231 x10^{-27} kg
Electron = 9.1093897 x10^{-31} kg



1839 electrons = 1 neutron



1836 electrons = 1 proton

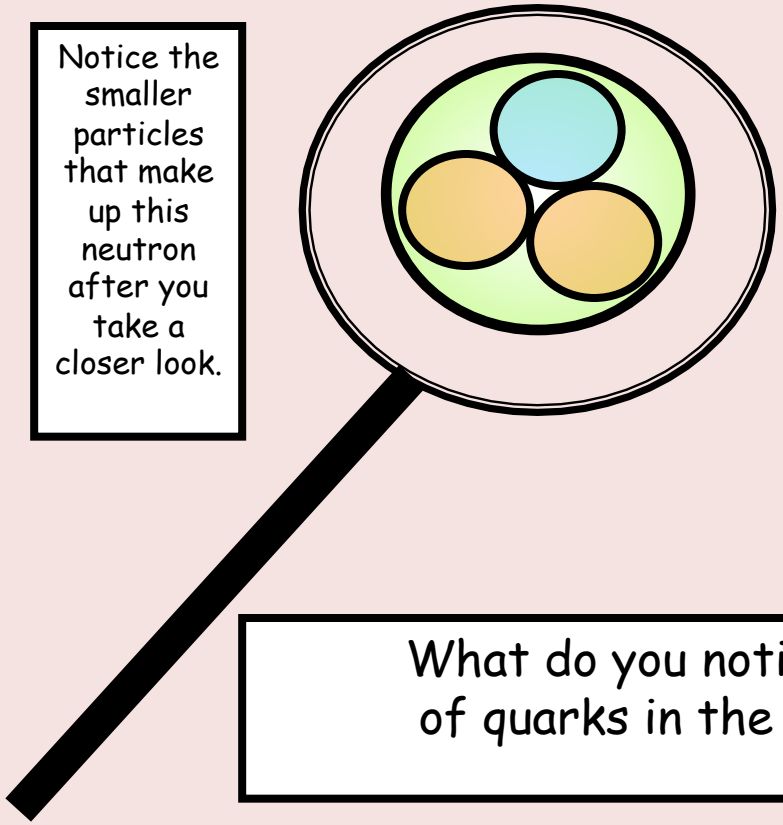
How do you think the mass of a neutron compares to that of a proton?

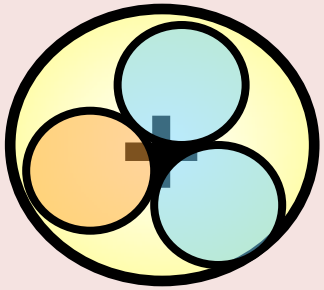
1 neutron ≈ 1 proton

QUARKS

- Particles that make up protons and neutrons

Notice the smaller particles that make up this neutron after you take a closer look.





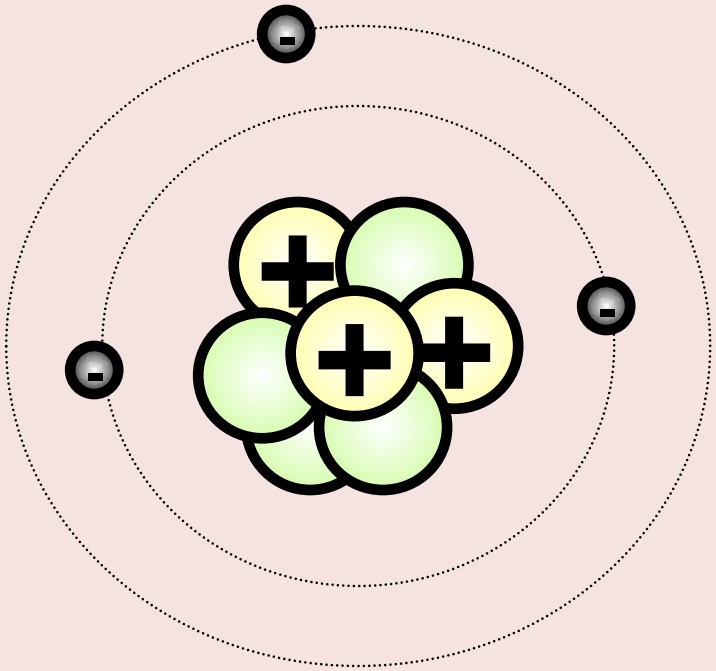
Notice the smaller particles that make up this proton after you take a closer look.

What do you notice about the number of quarks in the neutron and proton?

Write

Atomic Number

- The number of protons in the nucleus of an atom



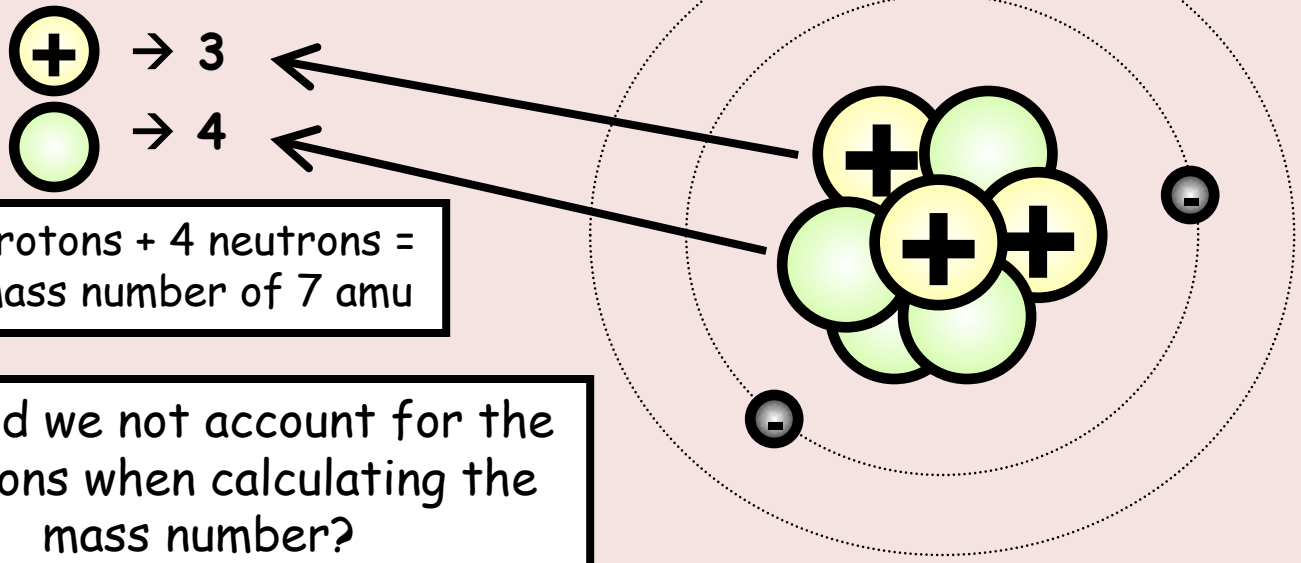
What would be the atomic number of this atom?

Write

Mass Number

- The total number of protons and neutrons in an atom's nucleus
- Expressed in **A**tomic **M**ass **U**nits (amu)
  - Each proton or neutron has a mass of 1 amu

What would be the mass number of this atom?



3 protons + 4 neutrons = a mass number of 7 amu

Why did we not account for the electrons when calculating the mass number?

Building Atoms

Using the whiteboard build the following atoms, AND determine their atomic and mass numbers.

Atoms	Protons	Neutrons	Electrons
Carbon	6	6	6
Beryllium	4	5	4
Oxygen	8	8	8
Lithium	3	4	3
Sodium	11	12	11

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Lead: *An atom's structure is like a _____ because _____*

Evidence: Make connections between the parts of an atom and the parts of your analogy (A proton is like a _____. An electron is like a _____. The nucleus is like the _____.)

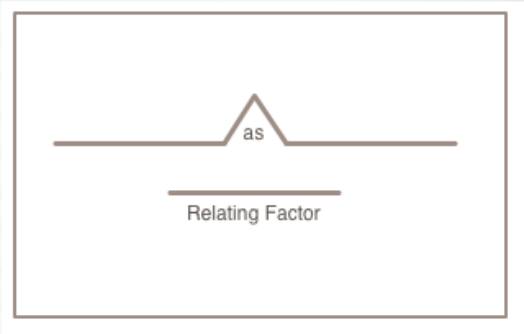
Analysis/Warrant: Explain the similarities between the subatomic particles and your analogy. (The proton is like the _____ BECAUSE…)

Finisher: Restating your claim in a new way to provide closure for your argument. (How is the atom like your analogy?)

Catalyst

What does everything in the universe have in common?

LEAF:



Create an analogy paragraph comparing the structure of an atom to something else.
(or a different analogy of your choice)

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