19.1 Atoms and Moles

Chemistry

Summarize main points from each video.

Video Title / topic ______________________________

Video Title / topic ______________________________

Video Title / topic ______________________________

Topic Introduction

Summarize your understanding of each paragraph.

Most of the mass of atoms comes from the protons and the neutrons. The number of protons DEFINES the element. The number of neutrons often equals the number of protons. BUT the number of neutrons in an atom might be slightly fewer or more than the number of protons.

If the number of neutrons were ALWAYS equal to the number of protons, then the average mass of an atom would be double the atomic number. But the number of neutrons is not always equal to the number of protons. (Recall these are called isotopes).

The average mass of an element is expressed in grams. A sample of an element with a mass equal to that element's average atomic mass contains 1 mol of atoms. For example, 1 mol of Aluminum (1 mol Al) has 6.023×10^{23} atoms with a mass of 26.98 grams.

One mole of something consists of 6.023×10^{23} units of that substance. That's a huge number, and somewhat difficult to imagine. A common way to visualize that big number is that one mole of marbles would cover the earth to a depth of 50 miles!

Read/Summarize Text

1. **Read the passage.**
2. **Underline key expressions in each sentence.**
3. **Re-write each word (or expression) you underlined.**
4. **Summarize the passage.**

Robert Millikan's Contribution to Avogadro's number

1

2

Accurate determinations of Avogadro's number require the measurement of a single quantity on both the atomic and macroscopic scales using the same unit of measurement. This became possible for the first time when American physicist Robert Millikan measured the charge on an electron.

Millikan made numerous momentous discoveries in the fields of electricity, optics, and molecular physics. His earliest major success was the accurate determination of the charge carried by an electron, using the elegant "falling-drop method"; he also proved that this quantity was a constant for all electrons (1910), thus demonstrating the atomic structure of electricity.

www.nobelprize.org
www.scientificamerican.com

Re-write words you underlined

3

______________ ______________ ______________

______________ ______________ ______________

Using a complete sentence, summarize or rephrase the passage

4

Read Text for Comprehension

Read this article for deeper understanding. No summary is required, although you may want to circle, underline, or mark key ideas and words.

Avogadro's number is a dimensionless quantity, and has the same numerical value of the Avogadro constant when given in base units.

The Avogadro constant is named after the early 19th-century Italian scientist Amedeo Avogadro, who, in 1811, first proposed that the volume of a gas (at a given pressure and temperature) is proportional to the number of atoms or molecules regardless of the nature of the gas.

The French physicist Jean Perrin in 1909 proposed naming the constant in honor of Avogadro. Perrin won the 1926 Nobel Prize in Physics, largely for his work in determining the Avogadro constant by several different methods

Accurate determinations of the Avogadro constant require the measurement of a single quantity on both the atomic and macroscopic scales using the same unit of measurement. This became possible for the first time when American physicist Robert Millikan measured the charge on an electron in 1910. The electric charge per mole of electrons is a constant called the Faraday constant and had been known since 1834 when Michael Faraday published his works on electrolysis. By dividing the charge on a mole of electrons by the charge on a single electron the value of Avogadro's number is obtained.

The Avogadro constant is a scaling factor between macroscopic and microscopic (atomic scale) observations of nature.

As may be observed in the table below, the main limiting factor in the precision of the Avogadro constant is the uncertainty in the value of the Planck constant, as all the other constants that contribute to the calculation are known more precisely.

Constant	Symbol	2014 CODATA value	Relative standard uncertainty	Correlation coefficient with N_A
Proton-electron mass ratio	m_p/m_e	1836.152 673 89(17)	9.5×10^{-11}	−0.0003
Molar mass constant	M_u	0.001 kg/mol = 1 g/mol	0 (defined)	—
Rydberg constant	R_∞	10 973 731.568 508(65) m^{-1}	5.9×10^{-12}	−0.0002
Planck constant	h	6.626 070 040(81) $\times 10^{-34}$ J s	1.2×10^{-8}	−0.9993
Speed of light	c	299 792 458 m/s	0 (defined)	—
Fine structure constant	α	7.297 352 5664(17) $\times 10^{-3}$	2.3×10^{-10}	0.0193
Avogadro constant	N_A	6.022 140 857(74) $\times 10^{23}$ mol^{-1}	1.2×10^{-8}	1

https://en.wikipedia.org/wiki/Avogadro_constant

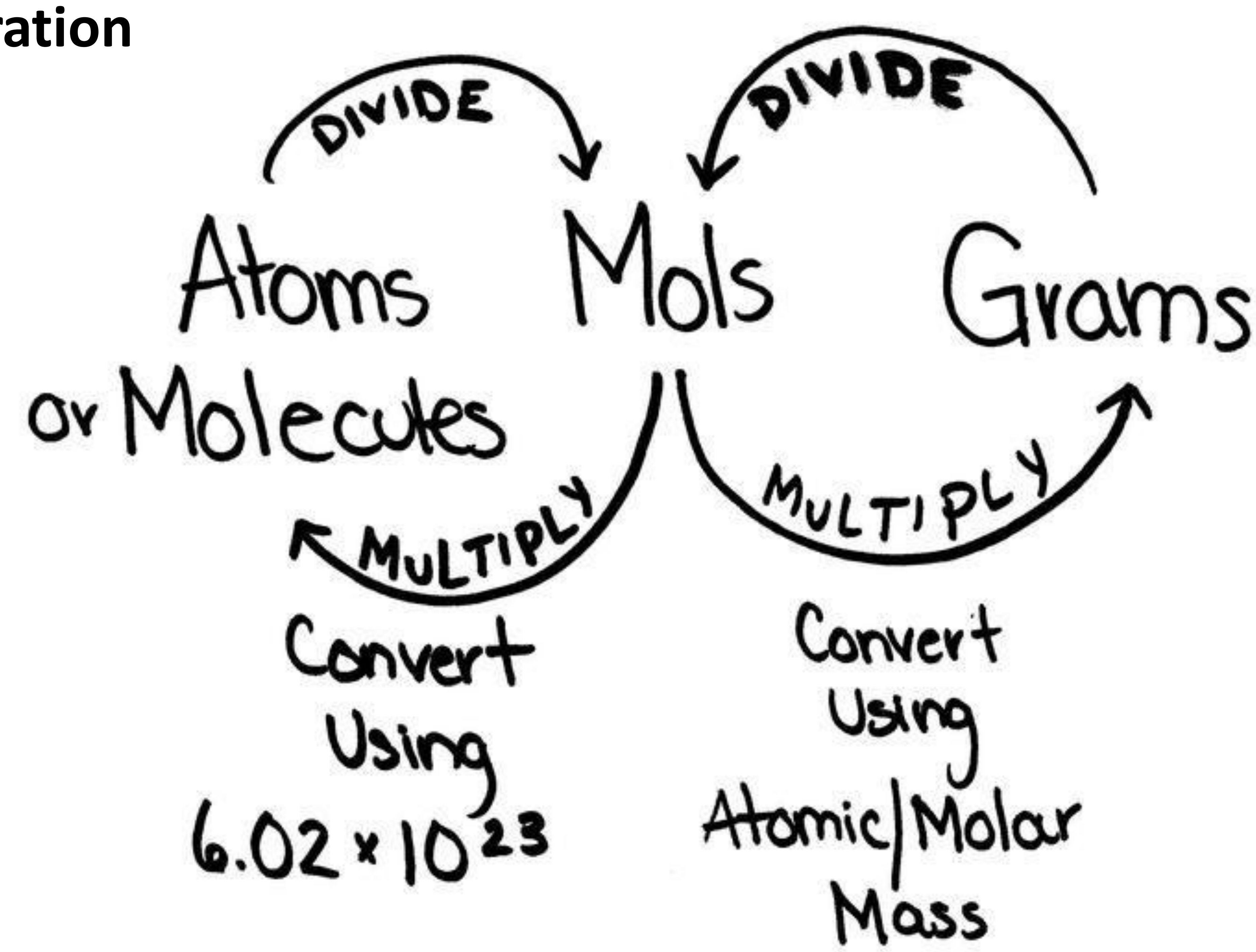
Fill-in the Missing Information

Atomic Number	**Element**	**Symbol**	**Atomic Mass**
1	___________	H	1.0079
2	Helium	He	___________
___	___________	Li	___________
4	Beryllium	Be	___________
5	___________	B	10.8110
6	___________	C	___________
___	Nitrogen	N	___________
___	___________	O	15.9994
___	Fluorine	F	18.9984
10	___________	Ne	20.1797
11	___________	Na	22.9897
12	___________	Mg	24.3050
13	___________	Al	26.9815
___	Silicon	Si	___________
___	Phosphorus	P	___________
___	Sulfur	S	___________
___	Chlorine	Cl	35.4530
___	Potassium	K	___________
___	___________	Ar	39.9480
20	___________	Ca	40.0780
21	Scandium	Sc	___________
___	Titanium	Ti	47.8670
___	Vanadium	V	50.9415
___	Chromium	Cr	___________
25	___________	Mn	54.9380

Draw Illustration

Copy and Label the Illustration in the Space Provided

Illustration



www.boundless.com

Draw (Copy) the Illustration Here

Interpret a Graph

Write the title of the graph ______________________________

Circle the type of chart this represents

Bar Chart *Line Chart* *Pie Chart* *Other*

If applicable,

What does the X-axis represent ____________

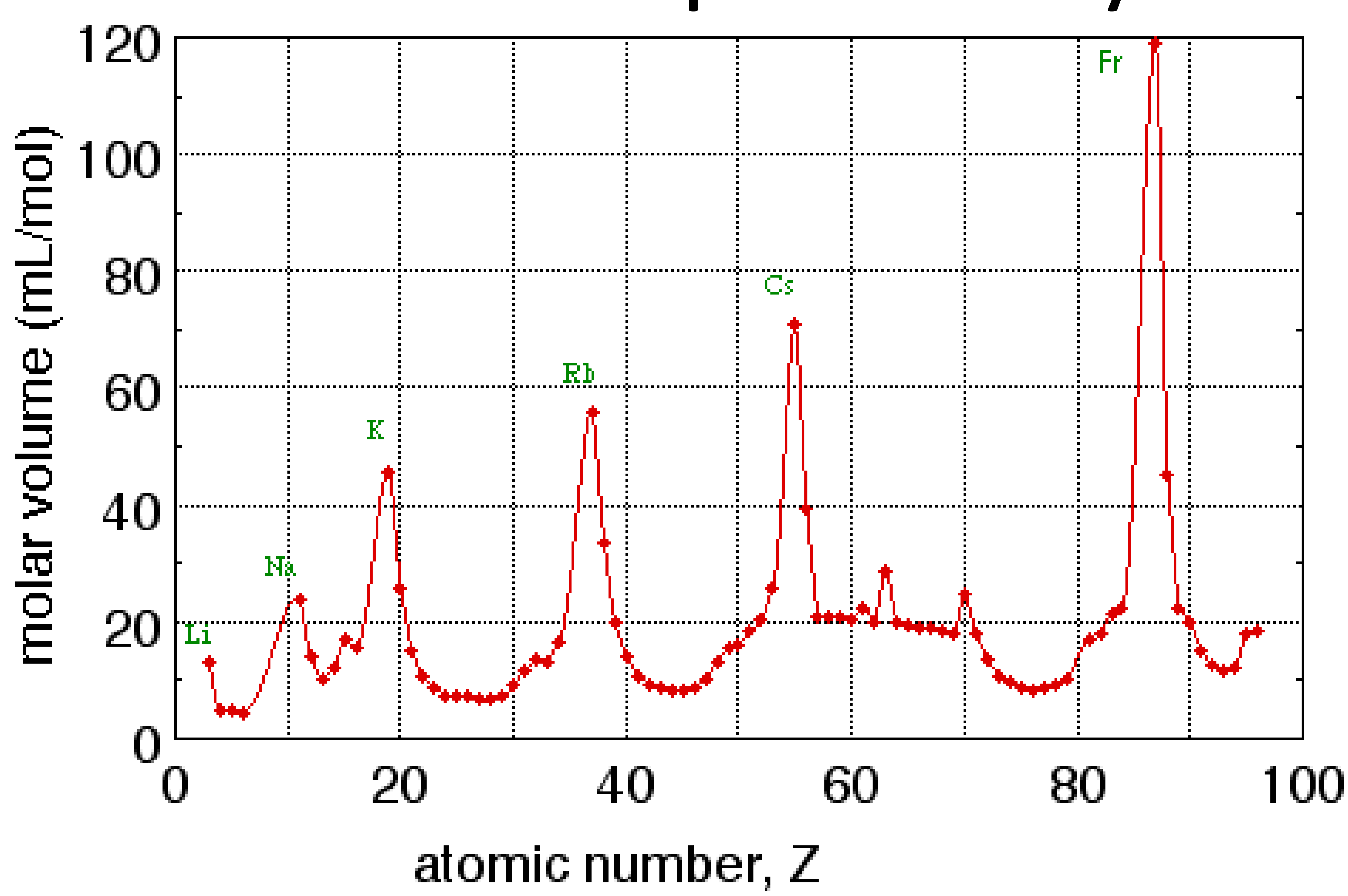
What does the Y-axis imply ____________

Summarize what this graph represents or conveys

____

http://web.lemoyne.edu

chemical periodicity



Show-Off Your Smarts!

Instructions

- Complete as an individual or small group.
- Discuss your ideas/answers/responses in a small group.
- Select one person to present your responses to the class.

Q1. How can this information be applied to a young-person's life?

Q2. How does this information apply to (or impact) communities?

Q3. When do scientists need to apply this information? How?

Q4. How would a person from 100 years ago view this information?

Q5. How does this topic connect to other science topics or math?

Write down at least three words introduced or covered by this topic.

1.
2.
3.
4.
5.
6.

Make a Poster

In the space provided here, create/draw a poster which conveys the concepts you have learned on this topic.

Teach a Third-Grader

In the space below, provide a simple explanation to each question posed. Write your response as if you are teaching this topic to a third-grade student. Use short sentences. Use simple words.

Q. How do you say that word again? (*Avogadro*)

Q. Why do we need to know this?

Q. How big is that number?

Q. How small is an atom?

Q. Is an element the same thing as an atom?

Q. What is a scientist?