

Teacher Notes- “Dot Diagramming-Understanding The Placement Of Protons, Neutrons, And Electrons”

Dot diagramming is an important bridge between 2 major chemistry concepts- atomic structure and then how these atoms combine into molecules.

At first, students may be timid about this activity. But it begins with a review of things they already know, then gradually builds. By the end, they’ll be comfortably using and applying the method of dot diagramming (also known as *Lewis Structure*).

#Protons	Symbol	Atomic Drawing	Dot Diagram
1. proton	H		$\overset{\cdot}{\underset{\cdot}{\text{H}}}$
2. protons	He		$\overset{\cdot}{\underset{\cdot}{\text{He}}}$
3. protons	Li		$\overset{\cdot}{\underset{\cdot}{\text{Li}}}$
4. protons	Be		$\overset{\cdot}{\underset{\cdot}{\text{Be}}}$
5. protons	B		$\overset{\cdot}{\underset{\cdot}{\text{B}}}$
6. protons	C		$\overset{\cdot}{\underset{\cdot}{\text{C}}}$

Materials:

Student handout

Periodic table- either a poster on the wall in plain view, or from the textbook

PowerPoint-Filling In The Dot Diagram Handout

Beforehand:

1. Take 15 minutes and fill out the worksheet yourself so you know what your students are about to experience. As you do this, notice what you’re thinking, and that will help you word things better.
2. Yes, there are a few steps to this activity, and the PowerPoint gives the impression that there’s a lot you’ll have to remember. But having done with worksheet yourself, you’ll notice all it does is move through the worksheet in an orderly way from beginning to end. After having done it yourself (point 1) you’ll be more than ready to lead your students through it.
3. If applicable, find what page(s) in your textbook mention dot diagramming so you can read this section together.
4. Number from 1-18 on your chalkboard so at the end students can come up and write their answers on the board.
5. This activity can adapt to be used with classes that run 25-45 minutes. It is presented in its barest form, so there’s plenty of room to add to it. At the end is a list of “accessories”, which are further topics you can add on which will lengthen and deepen the discussion.

Procedure:

1. Give students the handout and have them open their textbooks to a periodic table.

- Open the discussion by reviewing basic atomic structure (see dialogue that follows). This will help students who have forgotten what atoms are. As you ask the following questions, keep an eye on the slower learners. They're the ones you're waiting on before proceeding:

“Imagine I sat down in front of you and asked what the 3 parts of an atom are.*¹
 What would you say? (proton, neutron, and electron)
 What do you call that main structure in the middle? (nucleus)
 And which two particles can be found in the nucleus? (proton and neutron)
 Which of those 3 particles is most important? (proton).
 Good. And that's because the number of protons is also known as... (the atomic number).
 Right!


Now imagine you were the size of an atom, which is impossible, not only because we can't change our size but also because chances are mankind will never even see an atom. But if you *were* the size of an atom and could see in plain sight a nucleus of, say, an aluminum, which has an atomic number of 13, would you literally be able to count 13 protons in the nucleus? (yes? *students are unsure because most have only memorized that atomic number is the number of protons in the nucleus. Very few have ever thought of it this way before.*)*²


- If you are using the PowerPoint “Filling Out The Dot Diagram Handout”, start it now. It will guide you and your students through the class period.
- Tell students to look at numbers 1-18 on their worksheet and to not think of them as just a sequence, but to attach in their minds the word “protons” after each, as in 1 proton, 2 protons. Have them take a minute and write the word “protons” below each atomic number.
- Next, give students 2-3 minutes to fill in the symbols for 18 elements on the handout in column one using the periodic table in their book. If you've been using the periodic table recently in class, see how many they can put down from memory.
- Now it's time for the next column called “Atomic Drawing”. That's where students will be drawing an atom of each element. Use a closed circle for protons, an open circle for neutrons, and an “e-“ for electrons (see picture on next page). Have students put this key at the top of their papers, as shown on the PowerPoint.
- Do the first couple of atomic drawings together on the chalkboard:

#Protons	Symbol	
1 proton		
2 protons		
3 protons		

“Now onto drawing the atoms.
 Let's put some things together- hydrogen is atomic number... (one).
 Good. That means there is one... (proton) in the... (nucleus).

And our symbol for proton will be...this (point to closed circle on the chalkboard, and draw 1 proton on the board).



#Protons	Symbol	Atomic Drawing
1. proton	H	

And also in the nucleus this is going to be one... (neutron).^{*3}
 Just one? (yes, in this case; draw an open circle next to the closed one)
 Will the number of neutrons *always* be the same as the number of protons? (not sure, now that you're asking).
 The answer to that question for today will be "yes". Let's not worry about the exceptions right now.^{*4}

Just about done. Our nucleus is finished, so now it's time for electrons. Who remembers where we put them? I don't expect you to remember this, but I'll be very impressed if you do. (2 go on the first ring or energy level)"

- Advance the PowerPoint to the slide showing the rings with numbers on them. The star represents a nucleus and gives you a fixed point to refer to, so everyone knows where you're talking about. Have students copy this onto the top of their paper in the upper-left corner.

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Dot Diagramming

Understanding The Placement Of Protons, Neutrons, And Electrons

#Protons	Symbol	Atomic Drawing	Dot Diagram
1. proton			
2. protons			
3. protons			

...all the way to #18

● protons
○ neutrons
e- electrons

#Protons	Symbol	Atomic Drawing
1. proton	H	

#Protons	Symbol	Atomic Drawing
1. proton	H	
2. protons	He	
3. Protons	Li	

...stop after Carbon

7. protons	N	
8. protons	O	

...stop after Magnesium

Dot Diagram	
H	
He	
Li	

◆ Student Handout

#Protons	Symbol	Atomic Drawing	Dot Diagram
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			

◆ Answer Sheet

#Protons	Symbol	Atomic Drawing	Dot Diagram
1. proton	H		H ·
2. protons	He		He ·
3. protons	Li		Li ·
4. protons	Be		Be ·
5. protons	B		B ·
6. protons	C		· C ·
7. protons	N		· N ·
8. protons	O		· O ·
9. protons	F		· F ·

◆ Quick Notes

Teacher Quick Notes- "Dot Diagramming"

Materials:
Student handout
Periodic table

Procedure:

- Have students open their books to a periodic table.
- Review basic atomic structure.
- Have students write the word "protons" below numbers 1-18.
- Have students use their periodic tables to fill in the symbols for the 18 elements.
- Go through the symbols for protons, neutrons, and electrons.
- In the middle column students will be drawing an atom of each element. Do the first couple of atomic drawings together on the chalkboard.
- Let them work on their own and stop at carbon, #6.
- Tell students to now substitute the symbol for the protons and neutrons in the nucleus for #-12.
- For 13-18 allow students to now draw just the outer ring around the symbol.
- Now onto dot diagramming. If your textbook says anything about dot diagramming, read it together.
- Refer students back to #1, hydrogen, and do the dot diagram for it on the board.
- Have students do the rest.
- If you have 5 or more minutes left over put answers on the board.

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