# Unit 2 - Interactive Notebook
# Nuclear Chemistry

Name:
Period:

| | | | |
|---|---|---|---|
| Word Wall | Unit 1 Learning Tracker | Unit Opener | Task Set 2 |
| Task Set 3 | Task Set 4 | Task Set 5 | Task Set 6 |
| Task Set 7 | | Assignment Log | |

**Word Wall:**

| Term | Definition | Example | Picture |
|---|---|---|---|
| Fusion | | | |
| Fission | | | |
| Nuclear decay | | | |
| Half life | | | |
| Nuclear radiation | | | |
| Alpha radiation | | | |
| Beta radiation | | | |
| Gamma radiation | | | |
| instability | | | |
| Band of stability | | | |

**Unit 3 Learning Tracker:**

| |
|---|
| **Nuclear Processes** - Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. |
| **Anchoring Phenomenon/Dilemma:** Nuclear waste disposal is a problem locally and globally, but nuclear power is a bridge to reducing carbon dioxide emissions and nuclear weapons have had significant historical impacts. |
| **Unit Essential Question:** As a global society, should we continue to develop nuclear technologies? Do they have the potential to save more lives than harm them? |

| **How can we answer the task set EQ?** | **How does this help us explain the anchoring phenomenon?** |
|---|---|
| **TS1 EQ:** As a global society, should we continue to use nuclear power? | _____ *helps us explain...* |
| **Response:** | |
| **TS2 EQ:** Where do elements come from? | |
| **Response:** | |
| **TS3 EQ:** How can we predict if an element is stable or unstable? | |
| **Response:** | |
| **TS4 EQ:** Which type of nuclear reaction occurs in nuclear power plants and in nuclear waste? | |
| **Response:** | |
| **TS5 EQ:** How can we predict the outcomes of nuclear reactions? (also how do nuclear power plants work?) | |
| **Response:** | |
| **TS6 EQ:** Is this nuclear waste safe? | |
| **Response:** | |
| **TS7 EQ:** Should we, as a global society, continue to develop nuclear technology? | |
| **Response:** | |
| **TS8 EQ:** UNIT ASSESSMENT | |

| **Response:** | |
|---|---|
| **Unit Essential Questions:** As a global society, should we continue to develop nuclear technologies? Do they have the potential to save more lives than harm them? | |
| **Response to Unit Essential Question:** | |

**Unit Opener:** Why is nuclear waste a problem?

Is radiation dangerous? - Matt Anticole

| Notes from videos: | What do you **notice**?<br><br>What do you **wonder**? |
|---|---|
| Read this article from Forbes, "New Map Shows Expanse Of U.S. Nuclear Waste Sites"<br><br>**Figure 1. Nuclear Waste Storage Sites in the United States**<br>  <br> | What did you **notice**?<br><br>What do you **wonder**? |

**Reflect:**

- Why is nuclear waste a problem? What should we do with nuclear waste
- Can you answer the Task Set Essential Question: As a global society, should we continue to use nuclear power? *Unit 3 Learning Tracker*.

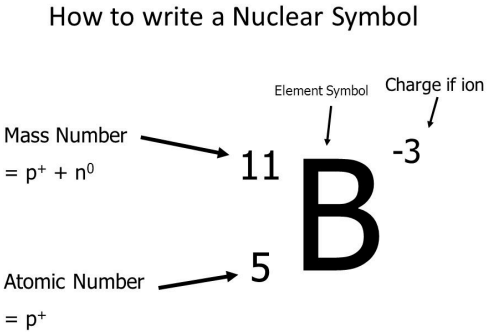
**Task Set 2 :** Where do elements come from?

If you had one sentence to explain where elements come from, what would you say?

| |
|---|
| |

Copy and paste this response above on the *Unit 3 Learning Tracker*.

**Task Set 3:** What makes an element stable or unstable?




How to write elements in nuclear notation

A selection of elements from the periodic table

| | | | | |
|---|---|---|---|---|
| C<br>6 | Co<br>27 | Sr<br>38 | U<br>92 | Pu<br>94 |

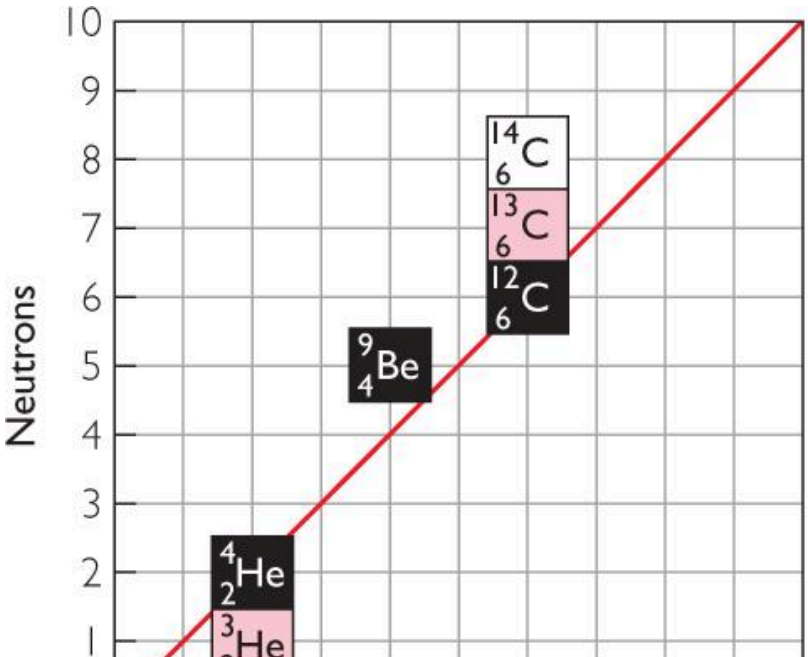
Practice writing elements in nuclear notation

*(Need help inserting nuclear notations? Click here!)*

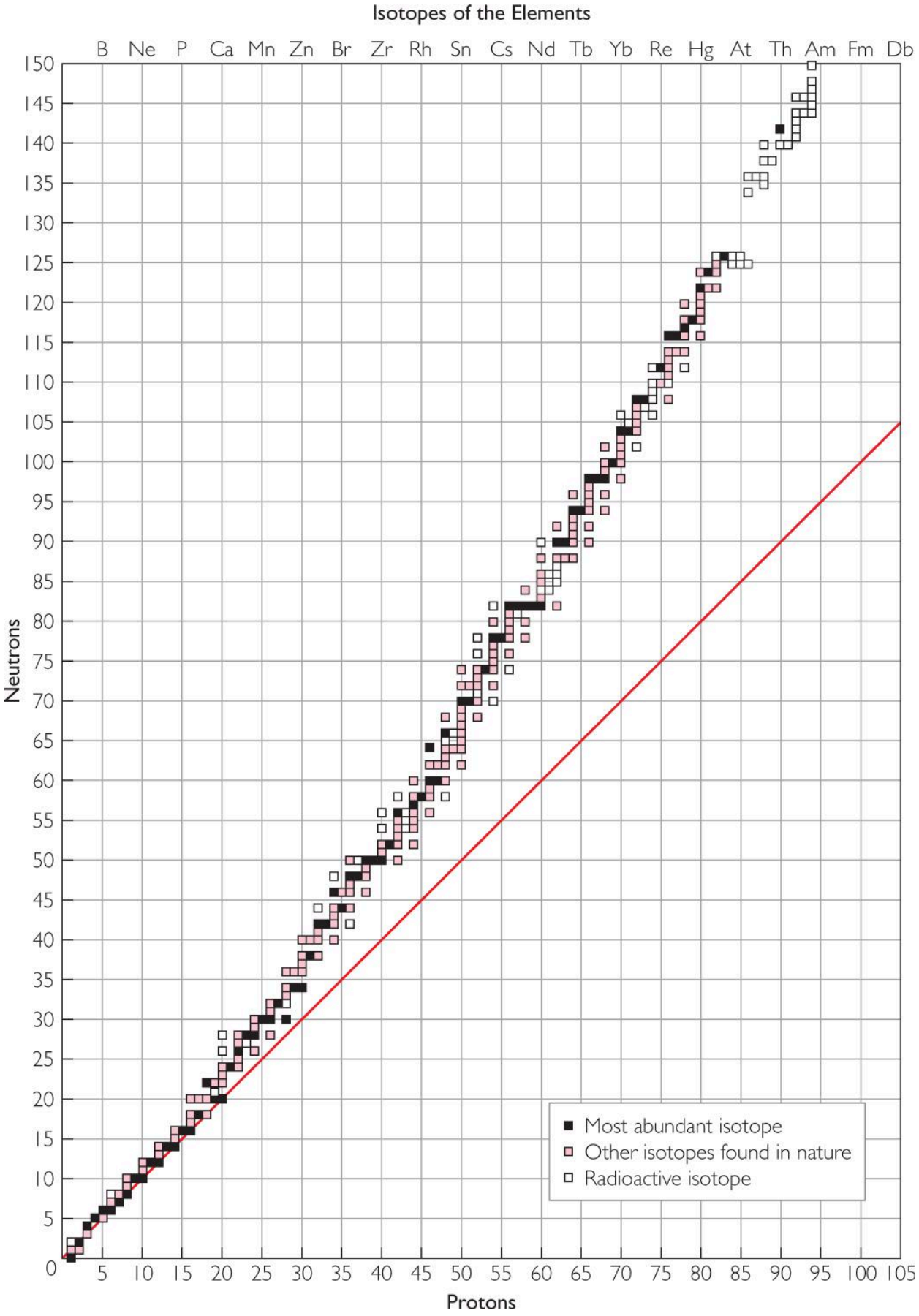
1. Element with 6 protons and 7 neutrons
2. Atom with 92 protons and 173 neutrons
3. Atom with 27 protons and a mass of 60
4. An element with 38 protons and 52 neutrons

**Isotopes: Navigating the Band of Stability**

In the graph below we see the same axes labels as in our Build An Atom lab. This copy is a zoomed in version of the same graph with some of the data points highlighted. The zoomed-in segment shown here shows a box for each isotope of each element. Helium has two boxes and so it has two isotopes. The black colored box is the most abundant isotope and the white boxes are radioactive isotopes. Carbon, therefore, has three naturally occurring isotopes. Carbon-12 is the most abundant and C-14 is radioactive. The intersection of the (X,Y) point gives information about how many protons and neutrons each isotope has. For carbons three isotopes, they all have _____ protons (the definition of Carbon), but each isotope has a different number of neutrons. Carbon-12 has _____ neutrons, Carbon-13 has _____ neutrons, and Carbon-14 has _____ neutrons.



If the graph were zoomed out, it would look like this next graph and would contain all of the known naturally-occurring elements. Use the larger graph to answer questions #1-5 below.

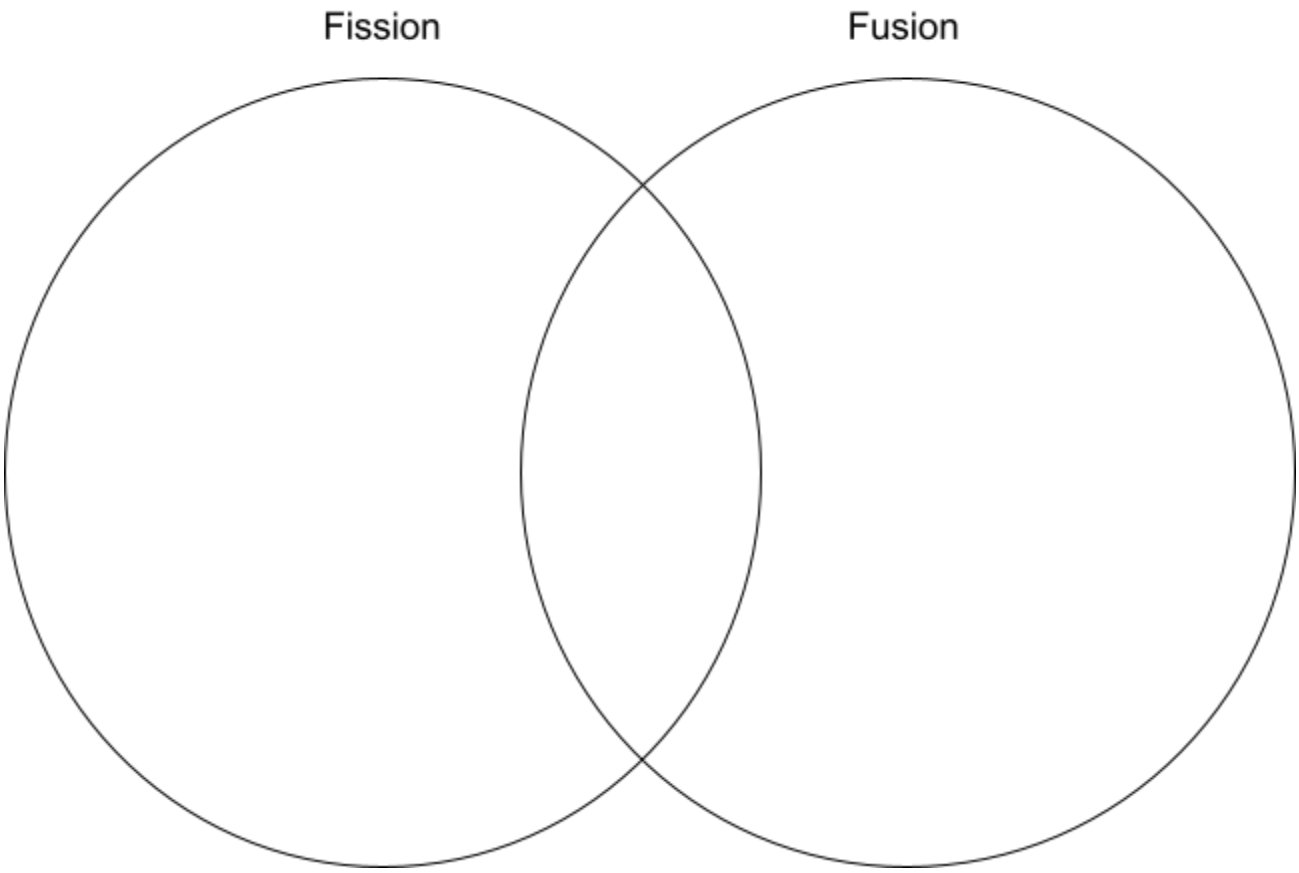



1. Would you expect to find the isotope Antimony-124 in nature? Why or why not?

2. Which element has the most isotopes? How many?
3. Do you expect to find an atom with 26 protons and a mass number of 52? Explain your answer.
4. Which elements have isotopes with the same number of protons and neutrons?
5. In our inquiry lab we learned that the N:P ratio was 1.2:1. Is it always that ratio?

**Fission & Fusion**

Use the drawing tool to complete the Venn diagram to compare fission and fusion.




**Task Set 4:** Which type of nuclear reaction occurs in nuclear power plants to create nuclear waste?

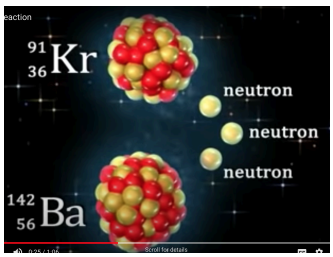
Links for task: Nuclear Fission Reaction Marie Curie's Lab Slides

5. How do radioactive materials show up in our lives?

| |
|---|
| |

6. Watch the video nuclear fission reaction

| | Before reaction | After reaction |
|---|---|---|

| | | |
|---|---|---|
| Images |  |  |
| Add mass and atomic number to elements | ${}^{1}_{0}n +$ U | $\Rightarrow$ $Kr +$ $Ba + 3$ ${}^{1}_{0}n$ |

The energy from this reaction comes out in the form of radiation. A group investigated radiation let off by some elements and made observations here (link to data). In a small group, look for similarities and differences between different kinds of radiation. Record the results below.

| **Group 1 (list a few elements)**<br>*What do these have in common?* | **Group 2 (list a few elements)**<br>What do all these have in common? | **Group 3 (list a few elements)**<br>What do all these have in common? |
|---|---|---|
| | | |
| Science name: | Science name: | Science name: |
| Additional info about this group | Additional info about this group | Additional info about this group |
| | | |

| | | |
|---|---|---|
| | | |

**Investigative Plan, Part 2:** Radioactive decay chain of uranium: Use the virtual lab at tinyurl.com/ydekymxd and choose 4 reactions to document. Of the 4 reactions, 2 should show alpha decay and 2 should show beta decay.

| Radiation Type / Model Type | Element / Isotope you Start with | Element / Isotope you end with | Ionizing Particle emitted |
|---|---|---|---|
| **Alpha** Decay Word Model | | | |
| **Alpha** Decay Picture Model | | | |
| **Alpha** Decay Equation Model | | | |

| Radiation Type / Model Type | Element / Isotope you Start with | Element / Isotope you end with | Ionizing Particle emitted |
|---|---|---|---|
| **Beta** Decay Word Model | | | |
| **Beta** Decay Picture Model | | | |
| **Beta** Decay Equation Model | | | |

| Radiation Type / Model Type | Element / Isotope you Start with | Element / Isotope you end with | Ionizing Particle emitted |
|---|---|---|---|
| **Alpha** Decay Word Model | | | |

| | | | |
|---|---|---|---|
| **Alpha** Decay Picture Model | | | |
| **Alpha** Decay Equation Model | | | |

| Radiation Type / Model Type | Element / Isotope you Start with | Element / Isotope you end with | Ionizing Particle emitted |
|---|---|---|---|
| **Beta** Decay Word Model | | | |
| **Beta** Decay Picture Model | | | |
| **Beta** Decay Equation Model | | | |

**CER - Claim, Evidence, Reasoning**

***Claim****: Answer the initial question, "What happens to uranium once it is used in a reactor? Is it still dangerous?" (Answer this yes or no question as a sentence)*

*I think uranium is ….*

***Evidence*** *from this activity: (usr evidence of what happens to the uranium after it gives off energy)*
*Talk about some of the decay reactions that*

*After uranium decays, it….*
*Uranium decays in ….. which….*
*The product of uranium decay….*

***Reasoning****: (why is this good or bad)*
*Describe all 3 types of radiation, what they do and whether they are dangerous or not*

*This gives off …. radiation which does ….*
*... radiation does … and … radiation does ...*

| |
|---|
| |

Need reaction writing practice and one slide explicit about writing reactions

**Task Set 5:** Is this nuclear waste safe?

Links for half life activity: student version of the slides  student handout for lab data discussion template  link to dice simulator

Optional extension for half life
Follow- up activities  Watch video  or read article

**Reflect:**

- What collaborative strategy worked the best for your group as you worked through sharing and analyzing data?
- What new vocabulary have you learned to help you better understand the stability of the nucleus? Add these words to the Word Wall.
- On the Unit 3 Learning Tracker answer the Task Set EQ:

**Task Set 6:** Should we, as a global society, continue to develop nuclear technology?

Which two Essential Questions will you choose to research to prepare for the flash debate?

1.
2.

Why did you choose these two questions?

Copy and Paste your completed **Table 3** and **Table 4** from the Nuclear Prep Assignment.

Link or Copy/Paste your completed Flash Debate Student Template.

**Task Set 7: Optional -** ask your teacher if you will be completing this activity.

**Test**

- **Reflect:** What do you need to do to be successful on your final summative test?

**Assignment Log:**

| Assignment | Due | Turned in on Google Classroom? |
|---|---|---|
| TS 1 - Participate in Unit Opener Discussion | | |
| TS 2 Elements and the Stars | | |
| TS 3 What makes elements stable? | | |
| TS 4 Nuclear Reaction Types | | |
| TS 5 Is Nuclear Waste Safe | | |
| TS 6 Nuclear Technology Essay and Debate | | |
| TS 7 **Optional** Earth Age Activity | | |
| Unit 3 Final Assessment | | |