**Data Analysis – Isotope Stability**

**Syllabus Reference**

* *Distinguish between stable and radioactive isotopes and describe the conditions under which a nucleus is unstable.*

The information below refers to *stable isotopes* of certain elements. If we examine the composition of these isotopes, we may be able to make predictions about other isotopes.

**What to do**

1. Use the Periodic Table of the elements to complete the table for the *stable isotopes*. Use nearest whole values for the mass number of the stable element.
2. On the grid provided, ***plot*** a *line graph* of neutron number vs. proton number. The grid is on the reverse side of the paper.
3. **Use a line-of-best-fit** to produce a *stability line* for the isotopes, and ***extrapolate*** the line past the end of the values.
4. Complete the table for the *test isotopes* listed below.

a) strontium-87 b) antimony-122 c) lanthanum-139 d) thulium-169 e) osmium-195

1. Use the graph to ***predict*** whether any of the test isotopes are unstable.

***The only isotope not “near” the stability curve is osmium-195***

1. If an isotope is unstable, ***suggest*** the *method(s) of decay* it could use to attain stability.

***Since it is above the stability line, it would be easiest if it undertook beta () decay to reach the line***

1. ***Suggest*** which of the decay methods (alpha, beta or positron) is more likely. Explain your answer.

***Beta decay is most likely as it would change a neutron into a proton and beta particle. It would probably involve the release of 2 beta particles to attain stability.***

1. ***Write decay equations*** to show the most likely method(s) of decay, and ***identify*** the daughter isotope(s) formed by the method.

**195Os 🡪  + 195Ir 🡪  + 195Pt**

# Answers

* 1. Stable Isotopes

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Quantity | Br | Cs | Pb | Sm | Nb | Hf | Gd | Pt |
| *Mass Number* | 80 | 133 | 207 | 150 | 93 | 178 | 157 | 195 |
| *Atomic Number* | 35 | 55 | 82 | 62 | 41 | 72 | 64 | 78 |
| *Number of neutrons* | 45 | 78 | 125 | 88 | 52 | 106 | 93 | 117 |

b) Test Isotopes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Quantity | Sr | Sb | La | Tm | Os |
| *Mass* *Number* | 87 | 122 | 139 | 169 | 195 |
| *Atomic* *Number* | 38 | 51 | 57 | 69 | 76 |
| *Number of neutrons* | 49 | 71 | 82 | 100 | 119 |

