Nuclear Radiation Shielding Lab Name: _____

Purpose: In **part 1**, you will measure background radiation using a digital Geiger counter. In **part 2** you will take radiation readings on an alpha (α), beta (β), and gamma (γ) source. You will attempt to block, or "shield" the radiations using air, paper, plastic, and lead. By comparing the measurements with no shield to measurements with a shield, you can determine which shields are most effective against various types of radiations.

Procedure: First we will measure background radiation, which is the amount of radiation naturally present.

1. Remove all radioactive material from vicinity of the counter.
2. Set the digital counter for 1 minute and record the number of counts per minute **(c.p.m.)** in the data table.
3. Repeat, and take the average of the 2 readings. This is your *average background radiation*.

Background Radiation

Reading 1	c.p.m.
Reading 2	c.p.m.
Average Background Radiation	c.p.m.

part 2: Now we will begin to measure our alpha (α), beta (β), and gamma (γ) sources.

α Alpha Readings (name of **alpha source**: _____)

no shield (shelf 2)	air shield (shelf 6)	paper shield (shelf 2)	plastic shield (shelf 2)	lead shield (shelf 2)

β Beta Readings (name of **beta source**: _____)

no shield (shelf 2)	air shield (shelf 6)	paper shield (shelf 2)	plastic shield (shelf 2)	lead shield (shelf 2)

γ Gamma Readings (name of **gamma source**: _____)

no shield (shelf 2)	air shield (shelf 6)	paper shield (shelf 2)	plastic shield (shelf 2)	lead shield (shelf 2)

Questions: (more on side 2...)

1. What was your average background radiation? _____
   Why were background radiation reading 1 & 2 not necessarily the same?

2. List several sources of background radiation:

3. Your measurement units are "**c.p.m.**", which stands for what? _____

4. Compare the effects of the **air shield** on alpha, beta, & gamma by calculating the ratio (quotient) of "**air shield**" to "**no shield**" for each: (see example...)

alpha ratio:

beta ratio:

gamma ratio:

no shield (shelf 2)	air shield (shelf 6)	paper shield (shelf 2)	plastic shield (shelf 2)	lead shield (shelf 2)
400	58	395	297	25

• the **lowest** ratio is the **most** affected. Which is most affected? _____

5. Compare the effects of the **paper shield** on alpha, beta, & gamma by calculating the ratio (quotient) of "**paper shield**" to "**no shield**" for each: (see example...)

alpha ratio:

beta ratio:

gamma ratio:

no shield (shelf 2)	air shield (shelf 6)	paper shield (shelf 2)	plastic shield (shelf 2)	lead shield (shelf 2)
400	58	395	297	25

• the **lowest** ratio is the **most** affected. Which is most affected? _____

6. Compare the effects of the **plastic shield** on alpha, beta, & gamma by calculating the ratio (quotient) of "**plastic shield**" to "**no shield**" for each: (see example...)

alpha ratio:

beta ratio:

gamma ratio:

no shield (shelf 2)	air shield (shelf 6)	paper shield (shelf 2)	plastic shield (shelf 2)	lead shield (shelf 2)
400	58	395	297	25

• the **lowest** ratio is the **most** affected. Which is most affected? _____

7. Compare the effects of the **lead shield** on alpha, beta, & gamma by calculating the ratio (quotient) of "**lead shield**" to "**no shield**" for each: (see example...)

alpha ratio:

beta ratio:

gamma ratio:

no shield (shelf 2)	air shield (shelf 6)	paper shield (shelf 2)	plastic shield (shelf 2)	lead shield (shelf 2)
400	58	395	297	25

• the **lowest** ratio is the **most** affected. Which is most affected? _____

8. Why do you think that **lead** is a better shield than **paper** or **plastic** in terms of blocking radiation?

9. Explain why smoke detectors, which contain radioactive americium, poses no health risk.

10. Nuclear reactor containment walls are lined with thick concrete, stainless steel, and sometimes even lead!! What type of radiation (**alpha**, **beta**, or **gamma**) do you suppose could be found inside which would warrant such extreme shielding measures?