Nuclear Lab—The ½ Life of an M&M or Pasta name: _____

In regents chemistry nuclear chemistry uses table N and O. We will cover the topic without actually touching any radioactive material, which is a good thing. We will examine nuclear energy, nuclear bombs, and medical uses for nuclear material. We'll learn about radioactivity and nuclear decay, and the decay process. All of our chemistry prior has been about the electron. Where they are, where they transfer to, how they're shared. This topic is about the NUCLEUS, that's why it's called NUCLEAR chemistry.

Nuclear chem focuses on the radioactive isotopes of elements. These are called radioisotopes, which are unstable forms of elements due to a different number of neutrons. Their nucleus is unstable. To become stable they will emit radioactivity (energy and/or particles) from their nucleus to get a more stable arrangement in their nucleus.

The process of gaining stability, or emitting radioactivity happens at different rates for different isotopes. They each undergo a particular process, at their own rate.

Table N lists many radioactive isotopes and their chemical formula and names. It also shows the time it takes to become more stable, called the half life. Finally it shows what sort of radioactivity it emits (decay mode) as it becomes more stable.

Table O shows us six kinds of radioactivity, five kinds of particles and one kind of pure energy. Different isotopes go through different ways to get stable, giving off different kinds of radiation.

Radioactivity can be very harmful, lethal even, but it's also a matter of how much you absorb, and what type. The various kinds of radioactivity have different strengths, and different effects on people. Doctors use radioactive material to diagnose and treat diseases all the time. That's clearly a different kind or amount of radioactivity than is given off in a nuclear bomb explosion. We'll be learning about all that, but today, let's focus on the process of half-life.

Half Life is define as: The half-life of a radioactive substance is the time it takes for half of an initial amount of the substance to decay. The half-live is independent of chemical activity, external pressure, and temperature.

Our lab is in two parts, the M & M part, and the ditalini pasta part. Both foods will allow us to see how half life works, without harming us in the process. You can do the pasta, or the candy part first.

M&M Candy Half Life Simulation

Count out 100 M&M candies, for four people in a group. Put them all in your pan. Turn all candies label down (they are only labeled on one side). These are radioactive. Carefully shake the pan for five to ten seconds. You can pull out all candy with the label showing, these have decayed into stable (edible) candy. Count how many are still radioactive. Repeat for six trials. Keep track of how many are still radioactive after each trial. Fill in your data, put it onto the board, and get class data. We will ONLY graph class data, in a graph showing radioactive M&M's as a function of number of trials. We will always do 6 trials for the candies.

	number of radioactive M&M's	trial 1	trial 2	trial 3	trial 4	trial 5	trial 6
your data							
class data							

Ditalini Pasta Radioactive Decay Simulation

We'll do the same process, but we will start with 400 pastas. Start them in the pan on their sides, which represents radioactive. Shake them, remove the upright pasta (decayed into a stable nucleus), and keep track of the number of radioactive pasta remaining. Track your data for 9 trials, then post on board. We'll only graph the class data showing radioactive pasta as a function of number of trials.

	radio-active pasta	trial 1	2	3	4	5	6	7	8	9
group data										
class data										

Nuclear radioisotopes are unstable, and to get stable they "decay" by giving off different kinds of radioactivity. The length of time it takes for one half of the isotope to decay is called its half life. Every radioisotope decays at its own rate, and has its own half life time frame.

Nothing affects half life, not increasing temperature, concentration, exposure to acids or bases. It just happens. And it happens randomly. If you have fifty atoms of any radioactive substance, in one half life you'll only have 25 atoms of that radioactive stuff left. 25 atoms will have decayed to something more stable.

If you watched each atom closely, you could not tell which ones were going to decay, or not decay. It's almost pure math or chance, totally unpredictable, except for the half decays in one half life.

Questions

1. What is the half life of an M&M candy? Use graph to determine half life measured in "trials".
2. What is the half life of a ditalini pasta? Use graph to determine half life measured in "trials".

3. What is the half life of carbon-14?
4. What uses does C-14 have?

5. Iodine-131 is used medically to diagnose thyroid gland issues. What's its half life?
6. If the ½ life of I-131 was the same as Kr-85, would using that isotope of iodine be medically sensible? Why or why not?

7. If you start with 144.0 grams of P-32, how much do you have left after 100 days? (with slight rounding at the end, no SF)
8. If you find 12.0 grams of radioactive cesium-137, how many years until your grand kids, or great grand kids will only have 0.75 grams?

9. If are injected with 50.0 grams of Polonium-210, which has a half life of 138 days, how much would be in you after 138 days? (a trick sort of question)
10. In a nuclear power plant, one byproduct is U-238. What are the problems with creating this isotope?

Nuclear Lab	40/1200 for year	point spread
Cover page	Title, short intro to what lab is about	1
2	both data tables	1+1
3+4	both graphs	4+4
5	10 questions	10
last	brief conclusion: explain half life, table N and table O	4