

Today

- Review of Decay Activity Sheet
- Half-life (using rock-paper-scissors)
- Half-life examples
- Half-life practice questions

	Isotope	Symbol	# of Neutron	# of Proton	Type of Decays Available	Isotope After Decay	New Isotope Symbol	# of Neutron	# of Proton	New Particle?
1	Hydrogen - 3									
2	Carbon - 14									
3	Chlorine - 36									
4	Chromium - 49									

Half life

Half life is the **amount of time** that it takes for a **decreasing quantity** to reach **half of its initial amount**.

We use this symbol:

$$t_{1/2}$$

Example: Caffeine - has a half life in the blood of about 5 h

Red Bull - 84 mg

So after 5h, $\frac{84\text{mg}}{2} = 42\text{mg}$ is left in the blood.

After 10h ($2 \times t_{1/2}$) $\frac{42\text{mg}}{2} = 21\text{mg}$ left.

After 15h ($3 \times t_{1/2}$) $\frac{21\text{mg}}{2} = 10.5\text{mg}$ left.

Why do we care?

All of the decays we talked about have half-lives!!

These radioactive isotopes can be used in medical applications, energy generation, household devices and many other practical applications!

Sample Activity - Rock Paper Scissors Tournament

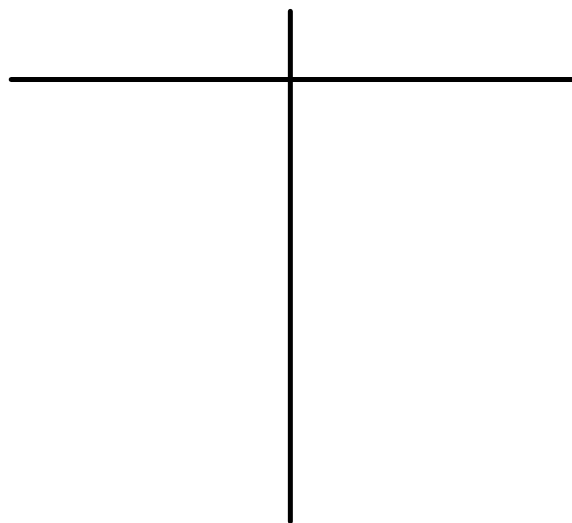
1. Count
2. Find a partner
3. Play RPS until someone wins
4. Loser sits, winner stands
5. Repeat

Round	# people
1	22
2	11
3	6
4	3
5	2
6	1

- What represents a half-life in this example?
- What patterns or trends do you notice about the number of people remaining?

Rock Paper Scissors Tournament #2

1. Count
2. Find a partner
3. Play RPS until someone wins
4. Loser sits, winner stands
5. Repeat



How many half-lives did it take to have ___ people remaining?

How many people were remaining after 4 half-lives?

How many half-lives did it take for $\frac{3}{4}$ of the people to lose?

Sample Problem

1000 atoms of hydrogen - 3 are left in a jar. Tritium (hydrogen-3) has a half life of about 12.3 years.

1) How many half lives will it take for there to be 125 atoms of hydrogen-3 remaining?

3

2) How many atoms of hydrogen-3 will remain after 2 half lives? 250

3) How many years will pass until there will be fewer than 35 atoms of hydrogen-3 remaining?

62 years ≈ 61.5 $t_{1/2} = 12.3$ years

Half lives	# atoms	time (# of half lives $\times t_{1/2}$)
☺	1000	☺
1	500 $\div 2$	$1 \times 12.3 \text{ y} = 12.3 \text{ y}$
2	250 $\div 2$	$2 \times 12.3 \text{ y} = 24.6 \text{ y}$ + 12.3
3	125 $\div 2$	$3 \times 12.3 \text{ y} = 36.9 \text{ y}$ + 12.3
4	63 $\div 2$	$4 \times 12.3 \text{ y} = 49.2 \text{ y}$ + 12.3
5	32 $\div 2$	$5 \times 12.3 \text{ y} = \underline{\underline{61.5 \text{ y}}}$ + 12.3

(we round because we can't have $\frac{1}{2}$ atom!)

Nuclear Decay practice problems - Due Thursday.

