

## UNIT 6 - RADIOACTIVITY AND NUCLEAR CHEMISTRY

### HONORS HOMEWORK 6.1C – NUCLEAR ENERGY

1.	Hydrogen has three isotopes: protium ( ${}^1_1\text{H}$ – 1.0073 amu), deuterium ( ${}^2_1\text{H}$ – 2.0136 amu) and tritium ( ${}^3_1\text{H}$ – 3.0160 amu),	
	(a)	Calculate the mass per nucleon of the three isotopes of hydrogen (in amu): (ie divide the mass in amu by the mass number)
		${}^1_1\text{H}$ : 1.0073/1 = 1.0073 amu ${}^2_1\text{H}$ : 2.0136/2 = 1.0068 amu ${}^3_1\text{H}$ : 3.0160/3 = 1.0053 amu
	(b)	Hence explain which of the three isotopes of hydrogen is the most stable.
		Tritium ( ${}^3_1\text{H}$ ), as it has the lowest mass per nucleon
2.	Write nuclear equations for the following reactions:	
	(a)	The fission of uranium-235 into rubidium-90 and caesium-143
		${}^{235}_{92}\text{U} \rightarrow {}^{143}_{55}\text{Cs} + {}^{90}_{37}\text{Rb} + 2{}^1_0\text{n}$
	(b)	The fusion of carbon-13 and protium (hydrogen-1) to give a single product
		${}^1_1\text{H} + {}^{13}_6\text{C} \rightarrow {}^{14}_7\text{N}$
	(c)	The reaction between deuterium and helium-3 to produce helium-4 and one other product
		${}^2_1\text{H} + {}^3_2\text{He} \rightarrow {}^4_2\text{He} + {}^1_1\text{H}$
3.	(a)	According to the Crash Course Video (or a google search), which atom has the most stable nucleus?
		Iron-56 ( ${}^{56}_{26}\text{Fe}$ )
	(b)	Consider the following elements: aluminium, carbon, gold, lead, nitrogen, silver
	(i)	Which of these atoms are most likely to take part in fission reactions, and why?
		Gold, lead and silver because they have more protons than iron so want to become smaller
	(ii)	Which of these atoms are most likely to take part in fusion reactions, and why?
		Aluminium, carbon and nitrogen because they have fewer protons than iron so want to become bigger
	(c)	Which country produces the greatest percentage of its energy through nuclear fission, and what percentage is this?
		France, 72%
	(d)	What percentage of energy production in the USA comes from nuclear fission?
	19%	
(e)	Who were “little boy” and “fat man”?	
	Code names for the atom bombs dropped on Hiroshima and Nagasaki	

(For 3c, 3d and 3e, just do a google search)