Name: _____

Class: _____

ACTIVITY SHEET

4.2 Energy from the nucleus

1 **a** Find the magnitude of the force of electrostatic repulsion between two protons inside a nucleus, when their centres are separated by:

i 2 fm (approximately) closest approach.

ii 4 fm (Round up your answer to part **i**, then use the inverse-square proportionality to find your answer.).

b Find the magnitude of the strong nuclear force at 2 fm.

2 What is the most likely reason that neutrons are able to moderate the electrostatic force of protons on protons?

3 The first eight elements have stable nuclides for $N = Z$, apart from beryllium-9, which is the only stable nuclide of beryllium. All the others have two stable nuclides, although oxygen has three. Except for ${}^{1}_{1}\mathrm{H}$ and helium-3, in all the stable nuclides the number of neutrons is equal to or greater than the number of protons.

a Place all these stable nuclides on the stability chart on the next page. Label the axes as well.

b Tritium is an unstable nuclide of hydrogen. Place this on the chart.

c Carbon nuclides range from $A = 9$ to $A = 16$. Place these on the chart.

16								
15								
14								
13	Stability chart							
12								
11								
10								
9								
8								
7								
6								
5				$^{9}_{4}$Be				
4								
3								
2								
1								
0	1	2	3	4	5	6	7	8

4 Show that $1\,\text{u} = 1.66 \times 10^{-27}\,\text{kg}$.

Hence, show that 1 u is equivalent to $931.5\,\text{MeV}\,c^{-2}$.

(Hint: Use $E = mc^2$) $m = E/c^2$ and the conversion between joules and electron-volts, $1\,\text{eV} = 1.602 \times 10^{-19}\,\text{J}$.)

5 Complete the table.

Particle	Mass		
	kg	u	MeV/c^2
Proton	1.673×10^{-27}		
Neutron		1.008 67	
Electron			0.511