AP Physics Snow Day 2



Review vocabulary:

Nucleus - the tiny, massive, positively charged central core of an atom.







Q: Compare and contrast the isotopes of carbon-12 and carbon-14.



Q: Identify the mass number and the electric charge of each Hydrogen nucleus in the slide above.



force is the

The strong same between all pairs of nucleons.



The energy equivalent of the mass of the individual nucleons is equal to the energy equivalent of the mass of the bound nucleus plus the binding energy.



Q: Describe the meaning of the equation E = 931.49 MeV/u, and explain why it is important.

ADDITIONAL	IN-CLASS EXAM	PLE	
<u>Use with Example Problem 1.</u> Problem Use the information in the table below to compare the mass defect and binding energy of deuterium, ² ₁ , with that of helium, 2 e.		UNKNOWN mass defect of deuterium = ? binding energy of deuterium = ? mass defect of helium = ? binding energy helium = ? SOLVE FOR THE UNKNOWN	
KnownMasses		Calculate the mass of the parts of deuterium.	
<i>M</i> hydrogen atom <i>M</i> neutron <i>M</i> deuterium atom	1.007825 u 1.008665 u 2.014102 u	mass of hydrogen: 1.007825 u mass of neutron: 1.008665 u mass of parts of deuterium: 2.016490 u	
<i>m</i> helium atom	4.002603 u	Calculate the mass defect of deuterium.	
Response SKETCH AND • List the unkno in the table	ANALYZE THE Pa wns. The knowns above.	ROBLEM mass of deuterium: 2.014102 u mass of para are listed of deuterium: 2.016490 u mass defect of deuterium: 0.002388 u	

The Strong	Nuclear Force	
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KnownMasses		SOLVE FOR THE UNKNOWN
Mhydrogen atom Mneutron Mdeuterium atom	1.007825 u 1.008665 u 2.014102 u	Calculate the mass of the parts of helium. mass of 2 hydrogen atoms: 2.015650 u mass of 2 neutrons: 2.017330 u mass of parts of helium: 4.032980 u
Mhelium atom Response SKETCH AND A PROBLEM	4.002603 u NALYZE THE	Calculate the mass defect of helium. mass of helium: 4.002603 u mass of narts of helium: 4.03280 u mass

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Copyright © McGraw-HI Education The Nuc	 KETCH AND A List the unkn the table above 	NALYZE THE PROBLE owns. The knowns are we.	 M • The binding end of the binding end	nergy and mass defect of heliun those of deuterium. listed in
	Copyright © McGraw-Hill Education			The Nucleus





The binding energy per nucleon changes as the number of nucleons (A) varies. Iron-56 has the most tightly bound nucleus and is the most stable isotope known.

131236Q: Infer which nucleus I or
52Pu, would you expect to have a larger-magnitude average binding
525294energy per nucleon?

Activity: Complete the following problems.

Use these values to solve the following problems: Mass of hydrogen = 1.007825 u Mass of neutron = 1.008665 u 1 u = 931.49MeV

- 1. The carbon isotope ${}^{12}C$ has a mass of 12.000000
 - u. 6
 - a. Calculate its mass defect.
 - b. Calculate its binding energy.

- 2. Deuterium (²H) has a mass of 2.014102 u. 1
 - a. Calculate its mass defect.
 - b. Calculate its binding energy.

 The nitrogen isotope (²H) has a mass defect of -0.113986 u.

1

- a. Calculate the mass of this isotope.
- b. Calculate the binding energy of the nucleus.