

(21.40) $A_t = 38$ $A_0 = 58.2$ $t_{1/2} = 5715 \text{ yr}$
 hold old is it? Find t .

$$\ln A_t = -kt + \ln A_0$$

$$\ln 38 = -(1.21 \times 10^{-4})t + \ln 58.2$$

$$t_{1/2} = \frac{0.693}{k}$$

$$k = \frac{0.693}{t_{1/2}}$$

Apr 11-7:28 AM

$0.257 \text{ mg } ^{206}\text{Pb}$
 $1 \text{ mg } ^{238}\text{U}$

$t_{1/2} = 4.5 \times 10^9 \text{ yr}$
 How old is the rock?

$$k = \frac{0.693}{4.5 \times 10^9} = 1.54 \times 10^{-10} \text{ yr}^{-1}$$

$$\ln A_t = -kt + \ln A_0$$

$$\ln(1) = -(1.54 \times 10^{-10})t + \ln 1.297$$

$U_{\text{start}} = U_{\text{U}} + U_{\text{Pb}}$
 $U_{\text{start}} = 1 \text{ mg} + \left(\frac{238 \text{ U}}{206 \text{ Pb}}\right) 0.257 \text{ mg Pb}$
 $= 1 \text{ mg} + 0.297 \text{ mg}$
 $= 1.297 \text{ mg U start}$

Apr 11-7:55 AM

NBE → Nuclear Binding Energy

holds nucleus together → STABLE

Actual Mass of Atom/Element

Calculated MASS

← Difference! →

MASS DEFECT

$E = \Delta m c^2$

Apr 11-8:41 AM

$E = m c^2$ $c = 3 \times 10^8 \text{ m/sec}$

$J = \text{Kg} \times \frac{\text{m}^2}{\text{sec}^2}$

$6 \times 10^{23} \text{ amu} = 1 \text{g}$

Carbon $12 \text{ amu} = 12 \times 6 \times 10^{23} \text{ amu} = 12 \text{g}$

$12 \text{g} = 12 \times 6 \times 10^{23} \text{ amu}$

$1 \text{ mol / } c$

Apr 11-8:45 AM

He 4.00150 amu } 2p, 2n, 2e

Find BE/nucleon

$2p \ 2(1.00728 \text{ amu}) = 2.01456 \text{ amu}$
 $2n \ 2(1.00866 \text{ amu}) = 2.01732 \text{ amu}$

4.03188
 $\Delta m = -4.00150$
 $\hline 0.03038 \text{ amu}$

$4.03188 \text{ amu. calculated}$

$E = mc^2$
 $= (5.023 \times 10^{-29} \text{ kg}) (3 \times 10^8 \text{ m/s})^2$
 $(4.557 \times 10^{-12} \text{ J})$

0.03038 amu	1g	1kg
	$6 \times 10^{23} \text{ amu}$	1000g

$4 \text{ Nucleons} \frac{4.557 \times 10^{-12} \text{ J}}{4 \text{ Nucleons}} = 1.139 \times 10^{-12} \text{ J/nucleon}$

Apr 11-8:53 AM

Large Binding Energy \Rightarrow STABLE!

P 913 TEXT

BE/nucleon

Fe

Fusion

Fission

incr. Mass Fusion

decreas Mass Fission

Apr 11-9:01 AM

${}^7_3\text{Li}$ mass = 7.01600 amu
 Find BE

$$3p = 3(1.00728)$$

$$4n = 4(1.00866)$$

$$7.05652$$

$$7.01600$$

$$\Delta m = 0.04052 \text{ amu}$$

$$\frac{0.04052 \text{ amu}}{6 \times 10^{23} \text{ amu}} \times \frac{1 \text{ kg}}{1000 \text{ g}} = \frac{6.75 \times 10^{-29}}{1} \text{ kg}$$

$$E = mc^2$$

$$= (6.75 \times 10^{-29}) (3 \times 10^8)^2 = 6.078 \times 10^{-12} \text{ J}$$

Apr 11-9:05 AM

HW

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Apr 11-9:14 AM