Assess Quizzes from the o-book – Explanations for the answers.

Chapter 4 Review – Support

Q	Reason
1	By definition. See page 137.
2	Electron is about 1/1800 times the mass of a proton, and a proton is a little bit less than a neutron. A 'nucleon' means either a proton or nucleon so can't be lighter than an electron. See Table 1 page 137.
3	Two points: the SNF is strong but only at very short distances (< nucleus diameter) and only between nucleons (that is, protons and neutron). Be careful that you recognise that the SNF operates between any type of nucleon. It operates between p-p, p-n, and n-n). Note that in Unit 4 you will learn that the strong nuclear force acts between quarks inside the nucleons and some of the force spills over to operate between nucleons. It is sometime called the 'strong force'.
4	Learn this as the correct answer. It is also the force holding the nucleons together but that is just another way of saying it. It doesn't include the electromagnetic force between the electrons and the nucleus.
5	See Figure 3 page 146. That's why we work out binding energy per nucleon instead of stopping at just binding energy.
6	There is a repulsive electromagnetic force between protons and this has to be balanced by the strong nuclear force. Adding more neutrons increases the SNF but doesn't increase the EM force.
7	O-16 has 8p, 8n. O-18 has 8p, 10n. So, they both have the same number of protons (8 = oxygen) but different numbers of neutrons. All the others just have the same number of nucleons (p + n).
8	The symbol is ${}_{Z}^{A}X$, so Z = number of protons, A = number of p + n. So, the number of neutrons (N) = A – Z.
9	Has 10 protons, 11 neutrons and (10 + 11 =) 21 nucleons. This is the mass number (top number).
10	To convert mass defect in 'units', u, to energy in MeV we multiply by 931.5 MeV/u. To work that out 'per nucleon' we divide by the number of nucleons in C-12 (6 p + 6 n = 12 nucleons).

Chapter 4 Review – Consolidate

Q	Reason
1	A nucleon can be either a proton (p) or a neutron (n). Note that if you add a proton you increase both *mass number* (top number A) and *atomic number* (p + n, Z) by one, and the symbol must change to reflect the new atomic number. If you add just one neutron, only the top number increases and the symbol stays the same. ${}_{93}^{239}Np + {}_{0}^{1}n = {}_{93}^{240}Np$ ${}_{93}^{239}Np + {}_{1}^{1}p = {}_{94}^{240}Pu$

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2	$^{37}Cl = {}^{37}_{17}Cl$ so, this has 17p, 20n and 17e. Note that the question says 'including electrons' so we must include the correct number of electrons in adding up the constituent particles. Recall that the number of electrons equals the number of protons for a neutral atom (which we assume this is).
3	2p = 2 × 1.007276 2n = 2 × 1.008665 2e = 2 × 0.000549 m_{cp} = 4.032980 - $m_{(nucleus\ \&\ e)}$ = 4.002603 Δm = 0.030377 u BE = 0.030377 u × 931.5 MeV/u = 28.296 MeV BE/nucleon = 28.296/4 = 7.074 MeV/nucleon (7.1 to 2 sf)
4	p = 30, n = 65 – 30 = 35. Thus n/p = 35/30
5	$\Delta m = 0.112356u$ $\Delta m = 0.112356 \times 1.66 \times 10^{-27} = 1.8651 \times 10^{-28} kg$ $E = mc^2$ $= 1.8651 \times 10^{-28} \times (3 \times 10^8)^2$ $= 1.68 \times 10^{-11} J$ Alternatively: $\Delta m = 0.112356u$ $BE = 0.112356 \times 931.5 MeV = 104.6596 MeV$ $= 104.6596 \times 10^6 eV$ $1 eV = 1.6 \times 10^{-19} J\ (see\ page 144)$ $BE = 104.6596 \times 10^6 eV \times 1.6 \times 10^{-19} J/eV$ $= 1.68 \times 10^{-11} J$

Chapter 4 Review – Extend

Q	Reason
1	${}^{239}_{93}Np + {}^{1}_{0}n = {}^{240}_{93}Np$ ${}^{239}_{93}Np + {}^{1}_{1}p = {}^{240}_{94}Pu$
2	26p = 26 × 1.007276

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	30n = 30 × 1.008665 26e = 26 × 0.000549 m_{cp} = 56.463400 - $m_{(nucleus\ \&\ e)}$ = 55.934936 Δm = 0.0528464 u BE = 0.0528464 u × 931.5 MeV/u = 492.264216 MeV BE/nucleon = 492.264216 /56 = 8.790 MeV/nucleon (8.79 to 3 sf)
3	Just do the correct substitution. Be careful that only the radius gets cubed.
4	Δm = 1.034417 u BE = 1.034417 u × 931.5 MeV/u = 963.5 MeV BE/nucleon = 963.5 /113 = 8.52 MeV/nucleon. This has a higher BE/nucleon than U-235 which has a value of 7.59 MeV/nucleon, so as the higher one is more stable that means
5	$\Delta m = m_{cp} - m_{nuclide}$ $m_{cp} = m_{nuclide} + \Delta m$ $= 3.024315 + 0.0008286$