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

Chapter 6 Review – Support

Q	Reason
1	'Units' means SI Units for the 'physical quantities' represented by the 'quantity symbols' E, m and c, namely energy, mass, and the speed of light. Energy is in joule, mass is in kilogram, and the speed of light is in metres per second. See top of page 193.
2	Mass of products has to be less than mass of reactants as some mass is converted into energy. Not all nuclear reactions involve energy being produced but a nuclear power plant sure does. See middle of page 193 in NCPQ U1&2.
3	Neutrons are slowed down so that they can react. Too fast and they go right through, and too slow they have insufficient energy. See bottom of page 192.
4	Definition of fission. See page 190.
5	Typically, you want about 3 neutrons to be produced by every neutron that causes fission. They aim for >2.2 or so, but <4.
6	Yes, it has to be at least one or it just dies out. Over 2 is best but not too many as it will be uncontrolled and explode. But that could be what you want if you're making a bomb (not 'you' personally but 'you' in general) such as if you are the US military.
7	Definition of fission and fusion. See page 190.
8	The reacting fuel (eg U-235) has to be dense enough that some neutrons will strike them and cause them to split. The ones released can then go on and cause other fissions. See Figure 3 page 191.
9	The neutron is striking the boron nucleus and causing it to undergo fission into two lighter fragments – a Li-7 and a He-4. This is just neutron bombardment and not a chain reaction as no neutrons are produced.
10	$E = mc^2$ $= 3.196\times10^{-28}\times(3\times10^8)^2$ $= 2.876\times10^{-11} J$ I know this doesn't sound much but remember that it is for one atom. In 1.0 kg of say U-235 there are about 10^{24} atoms so that's about 10^{14} J (a 100 million million joules)

Chapter 6 Review – Consolidate

Q	Reason
1	${}^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{94}_{36}Kr + 3{}^{1}_{0}n + {}^{139}_{56}Ba$

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2	Only 1 and III are correct. The others are false. See page 190
3	$m\,{}^1_1H = 1.007825u$ $m\,{}^7_2Li = 7.016003u$ $m_{\text{reactants}} = 8.023838u$ $m_{\text{products}} = 2\times 4.002603 = 8.005206u$ $\Delta m = m_{\text{products}} - m_{\text{reactants}} = 8.005206 - 8.023838 = -0.018622u$ As mass defect is a negative number it means that products are lighter than reactants and therefore mass is converted to energy (energy is given off).
4	Energy has no mass so is not used to balance the equation. Must be ${}^{139}_{54}X$. If we consult a periodic table to see what atom has an atomic mass of 54 we find it is xenon, Xe.
5	$E = mc^2$ $= 3.196\times 10^{-28}\times(3\times 10^8)^2$ $= 2.8764\times 10^{-11}J$

Chapter 6 Review – Extend

Q	Reason
1	$m(\text{U-235}) = 235u\times 1.66\times 10^{-27}kg/u$ $= 3.901\times 10^{-25}kg$ $\text{No. atoms} = \dfrac{1.0kg}{3.901\times 10^{-25}kg}$ $= 2.563\times 10^{23}atoms$ $E_{total} = 2.563\times 10^{23}atoms\times 2.88\times 10^{-11}J/atom$ $= 7.38\times 10^{13}J/kg$
2	$\Delta m = 0.019703u\times 1.66\times 10^{-27}kg/u$ $= 3.275\times 10^{-29}kg$ $E = mc^2$ $= 3.275\times 10^{-29}\times(3\times 10^8)^2$ $= 2.9\times 10^{-12}J$

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3	$m_R = 4.002603 + 14.003074 = 18.005677u$ $m_P = 16.999132 + 1.007825 = 18.006957u$ $\Delta m = m_P - m_R = 18.006957 - 18.005677 = +0.001280u$ $\Delta m = +0.001280u \times 1.66 \times 10^{-27} kg/u = +2.12480 \times 10^{-30} kg$ $E = mc^2$ $= 2.12480 \times 10^{-30} \times (3 \times 10^8)^2$ $= 1.91 \times 10^{-13} J$ The sign on Δm is positive (+) so the products are more massive than the reactants. This is, energy is <u>absorbed</u> by the reactants and it appears in the form of mass in the products.
4	$E = 12.4kt \times 7 \times 10^{25} MeV/kt$ $= 8.68 \times 10^{26} MeV$ $\Delta m = \frac{8.68 \times 10^{26} MeV}{931.5 MeV/u}$ $= 9.318 \times 10^{23} u$ $\Delta m = 9.318 \times 10^{23} u \times 1.66 \times 10^{-27} kg/u$ $= 1.5 \times 10^{-3} kg$
5	$E = mc^2$ $= (1u \times 1.6 \times 10^{-27} kg/u) \times (3 \times 10^8 m/s)^2$