Chapter 12 Quantum theory and matter. Revision Questions page 347-349 – Multiple Choice Answers

Q	Ans	Explanation
1	B	This is the only option that relates the *differences* between energy levels to the spectral lines. Learn this as a limitation of the Rutherford model that was overcome with the Bohr model.
2	C	The formula $\lambda = \frac{h}{p}$ suggests that if λ is the same for two particles then their momentum (p) will also be the same.
3	C	$\lambda = \frac{h}{mv} = \frac{6.626\times10^{-34}}{0.100\times50.0} = 1.33\times10^{-34}\ m$
4	D	Applies to all matter: electrons, protons and so on.
5	C	Six transitions: $4\rightarrow3,\ 4\rightarrow2,\ 4\rightarrow1,\ 3\rightarrow2,\ 3\rightarrow1,\ 2\rightarrow1.$
6	C	The highest wavelength means lowest frequency which represents the smallest energy difference and that is from level 4 to 3. The highest energy photons come from a transition is from n = infinity (∞) to ground state (n = 1).
7	D	The 3 → 1 transition is an energy difference of -1.56 - -5.54 = 3.98 eV. To convert to joules we multiply by 1.6 x 10^{-19} J/eV.
8	B	This was a key problem of the Rutherford model and would have meant the atom could not exist for more than a tiny fraction of a second (which is plainly untrue).
9	C	The Thompson model saw the positive charge spread throughout the nucleus and not concentrated in one spot (as the Rutherford experiment found). Hence, the alpha particles would have just passed through.
10	A	All options are true but Rutherford's experiment established just the first one.