F1-CT09: TWO MOVING PROTONS—DE BROGLIE WAVELENGTH
Two protons are moving through a vacuum. Proton A has a speed of $4 \times 10^4$ m/s, and proton B has a speed of $9 \times 10^4$ m/s.
Will the deBroglie wavelength for proton A be (a) greater than, (b) less than, or (c) equal to the deBroglie wavelength of proton B? _____
Explain your reasoning.

F2-RT12: ENERGY LEVEL TRANSITIONS—EMISSION WAVELENGTH
Shown are four energy levels for an atom along with six possible transitions between pairs of energy levels. Adjacent horizontal lines (light gray or dark) are separated by the same energy difference.

Rank the wavelength of the emitted photons for the labeled transitions.

Explain your reasoning.

F3-CT14: CARBON ISOTOPES—PROTONS, NEUTRONS, AND ELECTRONS
A carbon-14 atom has 6 electrons, 6 protons, and 8 neutrons.
(a) Will an atom of carbon-11 have (i) more electrons, (ii) fewer electrons, (iii) or the same number of electrons as an atom of carbon-14? _____
Explain your reasoning.

(b) Will an atom of carbon-11 have (i) more protons, (ii) fewer protons, or (iii) the same number of protons as an atom of carbon-14? _____
Explain your reasoning.

(c) Will an atom of carbon-11 have (i) more neutrons, (ii) fewer neutrons, or (iii) the same number of neutrons as an atom of carbon-14? _____
Explain your reasoning.