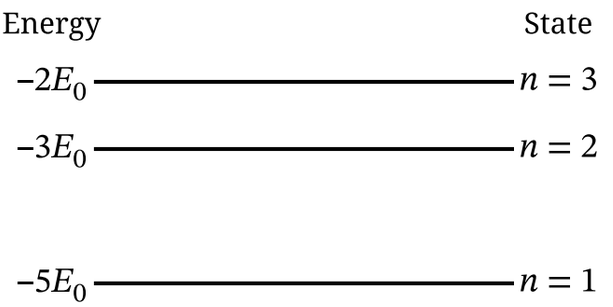
Question 2: Version J

2. Figure 1 represents the energy levels and their corresponding states for a hypothetical atom.

Figure 1



Part A

On Figure 1, **draw** arrows to represent all possible atomic transitions that could result in the emission of a photon.

Part B

Derive an expression for the wavelength of the highest-energy photon that can be emitted from the atom. Express your answer in terms of E_0 and physical constants, as appropriate. Begin your derivation by writing a fundamental physics principle or an equation from the reference information.

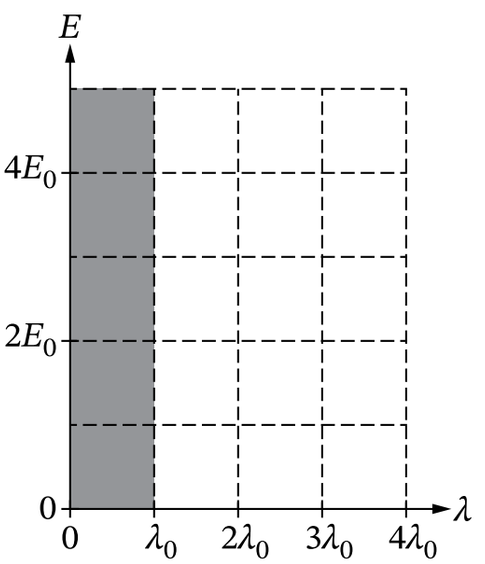
The following information applies to parts C and D.

A device can emit monochromatic electromagnetic radiation. The wavelength λ of the radiation can be varied over a continuous range of wavelengths.

Part C

On Figure 2, **sketch** the energy E of emitted photons from the device as a function of λ for $\lambda_0 < \lambda < 4\lambda_0$. Photons with wavelength λ_0 have energy $4E_0$. Sketches made in the shaded region will not be scored.

Figure 2



Part D

A student claims that, based on the energy states shown in Figure 1, the atom can emit a photon of wavelength λ_0 and energy $4E_0$ like the device described in part C.

Indicate whether the claim is correct or incorrect. Briefly **justify** your answer by referencing the representation in part A.