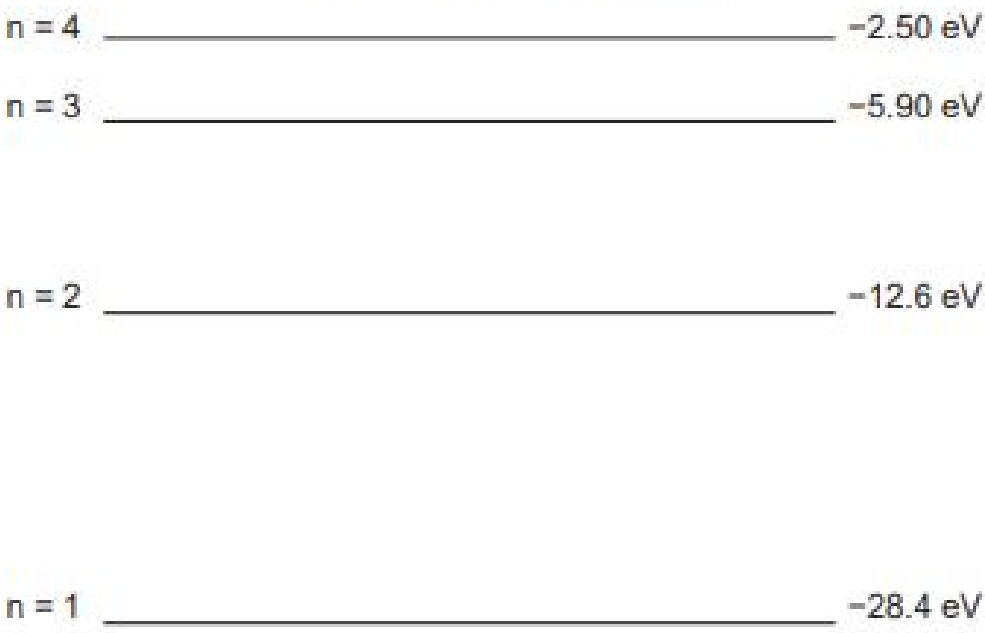
Question 14 **(15 marks)**

When gaseous mercury atoms are excited, they emit photons of varying wavelengths. Some of the energy levels in a mercury atom are shown in the diagram below.



A mercury lamp is used to produce light which is first fed through a filter that eliminates all wavelengths except those produced from the n = 2 to n = 1 transition. The resultant light is then shone onto a potassium metal plate whose work function is 2.00 eV.

(a) On the diagram above, show all the possible downward electron transitions that can occur in a mercury atom after a successful collision with an incoming electron with an energy of 23.0 eV. (4 marks)

(b) Calculate the wavelength of the photon from part (a) that strikes the potassium metal plate. (3 marks)

_____ m

(c) Calculate the maximum velocity of any electrons liberated from the potassium metal plate. Ignore relativistic effects. (5 marks)

_____ m s^{-1}

(d) State a formal definition of the term 'work function' and explain why part (c) refers to maximum velocity. (3 marks)

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