**5** An X-ray tube uses molybdenum as the target element and another X-ray tube uses tungsten. An accelerating potential of 35 kV is applied to both tubes, resulting in continuous spectrums being formed. The atomic number of molybdenum is 42 while that of tungsten is 74.

Characteristic peaks $K_\alpha$ and $K_\beta$ occur for molybdenum, but not for tungsten at an accelerating potential of 35 kV. To obtain the characteristic peaks for tungsten, the accelerating potential has to be increased beyond 35 kV.

**(a)** Explain

**(i)** why the intensity of the $K_\alpha$ X-ray is greater than that of $K_\beta$ X-ray for molybdenum.

……

…… [1]

**(ii)** why the characteristic peaks for tungsten only appear when the accelerating potential is greater than that necessary to produce characteristic peaks for molybdenum.

……

……

……

……

…… [2]

**(b)** The X-ray spectrum of molybdenum has a particular characteristic spectral line of wavelength $6.6 \times 10^{-11}$ m, produced by electrons making transitions between two energy levels of the molybdenum atom.

Calculate, in electron-volts, the energy of an X-ray photon of wavelength $6.6 \times 10^{-11}$ m.

energy = …… eV [2]

[Total: 5]