Question 5

The complete photoelectron spectrum of an element in its ground state is represented below.

![Photoelectron spectrum diagram]

(a) Based on the spectrum,

(i) write the ground-state electron configuration of the element, and

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^6 \ 4s^2) or ([\text{Ar}] \ 4s^2)</td>
<td>1</td>
</tr>
</tbody>
</table>

(ii) identify the element.

<table>
<thead>
<tr>
<th>Element</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca</td>
<td>1</td>
</tr>
</tbody>
</table>

(b) Calculate the wavelength, in meters, of electromagnetic radiation needed to remove an electron from the valence shell of an atom of the element.

\[
E = h \nu = \frac{hc}{\lambda} \quad \Rightarrow \quad \lambda = \frac{hc}{E}
\]

\[
\lambda = \frac{(6.626 \times 10^{-34} \text{ Js})(2.998 \times 10^8 \text{ ms}^{-1})}{0.980 \times 10^{-18} \text{ J}}
\]

\[
\lambda = 2.03 \times 10^{-7} \text{ m}
\]

1 point is earned for the correct identification of the energy required to remove an electron from the valence shell (may be implicit).

1 point is earned for calculating the correct wavelength.