A hydrogen atom is in the $\Psi_{5d}$ state.

(a) What is the principle quantum number? 5

(b) Find the energy of the atom. 0.54 eV

(c) What is the value of the orbital quantum number? 2

(d) What is the value of the orbital angular momentum $L$? $6^{1/2}\hbar$

(e) How many magnetic states exist? 5

(f) What are the possible values of the magnetic quantum number $m_L$?

<table>
<thead>
<tr>
<th>$m_L$</th>
<th>+2</th>
<th>+1</th>
<th>0</th>
<th>-1</th>
<th>-2</th>
</tr>
</thead>
</table>

(f) In the largest $m_L$ state, what is the angle that angular momentum vector makes with the z-axis? 38° degrees

\[ L = 2.45\hbar \]
\[ L_z = 2\hbar \]
\[ \cos \theta = 2/2.45 = 0.787 \]
\[ \theta = 38^\circ \]