2. **A)** The ATLAS detector is being built at CERN to exploit the physics from the Large Hadron Collider. One of the main aims of the physics programme is the discovery of the Higgs boson.

i) Sketch a cross-section of the ATLAS detector showing the principal components. Take care to place them in the correct order relative to the interaction point. **{4}**

ii) Sketch and describe the signatures of the following particles in the ATLAS detector:

1. electron
2. photon
3. muon
4. charged pion
5. a B-meson decaying by $B \to \pi^+\pi^-$ **{10}**

iii) Discuss why hadron colliders are often considered to be "discovery machines" and e^+e^--colliders precision machines. **{3}**

iv) What is the role of the Higgs boson in the Standard Model of particle physics? **{2}**

v) What would be the principal decay mode of a Higgs boson with mass (a) 120 GeV or (b) 250 GeV? Why would a lower mass Higgs boson be much harder to observe than a heavier Higgs? **{5}**