P1.1 Summary questions

1 a A is 2, B is 1, C is 3
b $10^{-10}$ m

2 a Geiger and Marsden fired alpha particles at a very thin piece of gold foil. The measured how many alpha particles were deflected in different directions to the foil.
b Most of the alpha particle went through but some were scattered backwards. This was surprising because they expected all of them to go through or all of them to come back.

3 There were no instruments that enabled scientists to see atoms OR The idea was very new and some people find it difficult to accept new ideas OR Any suitable response.

4 a Top left label: nucleus containing protons and neutrons
   Bottom right label: electrons moving around nucleus
b The Bohr model
c i There are the same number of protons and electrons. Protons are positive and electrons are negative, and the charges cancel out.
   ii Either the Thompson or the Rutherford model.

5 a 2, because you cannot have a molecule with only one atom, as this is an atom.
b i The length is $50 \times 10^{-10}$ m/atom
   $= 5 \times 10^{-9}$ m
   ii The atoms in the molecule may not be arranged in a straight line, so the molecule could be smaller.

6 a Estimate of one side of a cubic grain of sand = $0.25 \times 10^{-3}$ m – 0.5 $\times 10^{-3}$ m
   So the volume of the grain of sand = $(0.25 \times 10^{-3}$ m$)^3$
   $= 1.6 \times 10^{-11}$ m$^3$
b Volume of an atom = $(10^{-10}$ m$)^3$
   $= 10^{-30}$ m$^3$/atom
   So the number of atoms in a grain of sand = $1.6 \times 10^{-11}$ m$^3$/atom
   $= 1.6 \times 10^{19}$ atoms

7 The first model of the atom was a hard sphere. Then J. J. Thompson discovered that atoms contain smaller negatively charged electrons. So the model changed to a positive mass with electrons embedded in it. Then Rutherford discovered that most of the mass was concentrated in a central nucleus. So the new model was a positively charged nucleus with electrons in orbit. Then Bohr discovered that electrons could not be in any orbit. So the model changed to a positively charged nucleus with electrons in certain energy levels.