The Structure of Atoms

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1. Copy and complete the following table:

Element	Nucleon No.	Proton No.	Neutrons	Protons	Electrons
Nitrogen	14	7			
Sodium	23				11
Potassium	39			19	
Uranium	235	92			

2. An atom of cobalt has a proton number of 27 and a nucleon number of 59.

   (a) Simply describe the structure of the cobalt atom.

   Cobalt has several isotopes.

   (b) What are isotopes?

   (c) The symbol for the above isotope is written as ${}^{59}_{27}\mathrm{Co}$. Write down two other possible isotopes of cobalt.

   (d) Why are isotopes difficult to chemically separate?

3. Uranium-235 and uranium-238 are isotopes of uranium, and they both have the proton number 92.

   (a) What do the numbers 235 and 238 represent?

   (b) What does 92 tell you about the nucleus of uranium?

   (c) What else does 92 tell you about the atom?

   (d) In which two ways are the two isotopes different?

4. Which type of radioactive emission

   (a) is positively charger

   (b) is not deflected by magnetic fields

   (c) is the most penetrative

   (d) is the most intensely ionising

   (e) cannot pass through cardboard

   (f) does not cause a change in mass number or atomic number

   (g) has the greatest mass

5. Draw an $N - Z$ decay graph for thorium-232 using the following data. Draw alpha decays with a red line and beta decays with a blue one.

   thorium-232, radium-228, actinium-228, thorium-228, radium-224, radon-220, polonium-216, lead-212, bismuth-212, [polonium-212 (64%), thallium-208 (36%)], lead-208.

6. The isotope ^{235}U decays into another element, emitting an alpha particle. What is the element?

   This element decays, and the next, and so on until a stable element is reached. The complete list of particles emitted in this chain is:

$$^{235}_{92}\mathrm{U} \rightarrow [\alpha\beta\alpha\beta\alpha\alpha\alpha\beta\alpha\beta] \rightarrow \mathrm{X}.$$

   What is the stable element X? (You could write down each element in the series, but there is a quicker way.)