Y10 Radioactivity

Atomic Structure

a) The basic structure of an atom is a small central nucleus composed of protons and neutrons surrounded by electrons.

b) The relative masses and relative electric charges of protons, neutrons and electrons are as follows:

	Relative mass	Relative charge
proton	≈ 2000	1
neutron	≈ 2000	0
electron	1	-1

c) In an atom the number of electrons is equal to the number of protons in the nucleus. The atom has no overall electrical charge.

d) Atoms may lose or gain electrons to form charged particles called ions.

e) The atoms of an element always have the same number of protons, but have a different number of neutrons for each isotope.
The total number of protons in an atom is called its proton number or atomic number.
The total number of protons and neutrons in an atom is called its mass number.
Atoms can be represented as shown:

(Mass number) 23
Na
(Atomic number) 11

Atoms and radiation

a) Some substances give out radiation from the nuclei of their atoms all the time, whatever is done to them. These substances are said to be radioactive.

You should be aware of the random nature of radioactive decay.

b) Background radiation is around us all of the time. It comes from:
• natural sources such as rocks and cosmic rays from space
• man-made sources such as the fallout from nuclear weapons testing and nuclear accidents.

c) An alpha particle consists of two neutrons and two protons, the same as a helium nucleus. A beta particle is an electron from the nucleus. Gamma radiation is electromagnetic radiation from the nucleus.

d) Nuclear equations may be used to show single alpha and beta decay.

You will be required to balance such equations, limited to the completion of atomic number and mass number. The identification of daughter elements from such decays is ***not*** *required.*

e) Alpha and beta radiations are deflected by both electric and magnetic fields but gamma radiation is not.

You should know that alpha particles are deflected less than beta particles and in an opposite direction.
You should be able to explain this in terms of the relative mass and charge of each particle.
Properties of the alpha, beta and gamma radiations are limited to their relative ionising power, their penetration through materials and their range in air.

f) Gamma radiation is not deflected by electric or magnetic fields.

g) There are uses and dangers associated with each type of nuclear radiation.

You should be able to describe the dangers and some uses of each type of radiation.

h) The half-life of a radioactive isotope is defined as:
• the average time it takes for the number of nuclei of the isotope in a sample to halve
• or the time it takes for the count rate from a sample containing the isotope to fall to half its initial level.