AQA GCSE PHYSICS 1 (SCIENCE) 2007+ REVISION SHEET 6 of 7

P1b.6 RADIOACTIVITY
What are the uses and dangers of emissions from radioactive substances?

Using skills, knowledge and understanding of how science works:
- to evaluate the possible hazards associated with the use of different types of nuclear radiation
- to evaluate measures that can be taken to reduce exposure to nuclear radiations
- to evaluate the appropriateness of radioactive sources for particular uses, including as tracers, in terms of the type(s) of radiation emitted and their half-lives.

Skills, knowledge and understanding of how science works set in the context of:
- The basic structure of an atom is a small central nucleus composed of protons and neutrons surrounded by electrons.
- The atoms of an element always have the same number of protons, but have a different number of neutrons for each isotope.
- 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.
- Identification of an alpha particle as a helium nucleus, a beta particle as an electron from the nucleus and gamma radiation as electromagnetic radiation.
- Properties of the alpha, beta and gamma radiations limited to their relative ionising power, their penetration through materials and their range in air.
- Alpha and beta radiations are deflected by both electric and magnetic fields but gamma radiation is not.
- The uses of and the dangers associated with each type of nuclear radiation.
- The half-life of a radioactive isotope is defined as the 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.

1. Draw a labelled diagram of an atom that contains 3 electrons, 3 protons and 2 neutrons. Your diagram should show clearly which of these particles are in the nucleus of the atom.
2. Define what is meant by:
(a) atomic number; (b) mass number; (c) isotopes
3. A neon (Ne) nucleus contains 10 protons and 11 neutrons. What are its atomic and mass numbers?
4. (a) What are the atomic and mass numbers of the atom in Q1? (b) Draw another diagram showing an isotope of the atom in Q1.
5. State, in symbol form, another isotope of neon from that in Q3
6. Why is radioactivity described as a random process?
7. What do ionising radiations do to atoms?
8. How could you show in a laboratory that an isotope was only emitting: (a) alpha radiation; (b) beta radiation; (c) gamma radiation?
9. What is: (a) an alpha particle; (b) a beta particle; (c) a gamma ray?
10. What is meant by 'half-life'?
11. A source has a half-life of 3 hours.
If initially its activity is 320 counts per second what would you expect its activity to be after:
(a) 3 hours; (b) 6 hours; (c) 9 hours; (d) 12 hours
12. A source's activity falls from 1000 to 250 counts per seecond in 50 minutes. What is its half-life?
13. A source's activity falls from 8000 to 1000 counts per second in 1 hour. What is its half-life?
14. How long would it take the activity of a source, of half-life 4 days, to fall from 1600 counts per second to:
(a) 800; (b) 400; (c) 100; (d) 50 counts per second
15. Calculate the expected activity of an isotope of half-life 5 years after a period of 20 years if initially its activity is 4000 counts per second.
16. Calculate the expected activity of an isotope of half-life 6 weeks after a period of 30 weeks if initially its activity is 256 counts per second.
17. Describe a medical and a non-medical use of radioactivity.
18. (a) What is the danger of radioactivity?
(b) Why is it difficult to dispose of?