

P4: Radiation Fact sheet

Atomic structure – SAME AS IN CHEMISTRY C1	
1. What is most of the atom made of?	Empty space
2. What is the approximate size of the radius of an atom?	1×10^{-10} Metres
3. What is the approximate radius of a nucleus compared to the radius of the atom?	1/10000
4. When an electron moves closer to the nucleus, what is emitted by the electron?	Electromagnetic Radiation
5. When an electron moves further from the nucleus, what is absorbed by the electron?	Electromagnetic Radiation
6. The overall charge on an atom is	0
7. Name the type of particle which goes into shells in the atom	Electrons
8. Name 2 types of particle in the nucleus of an atom	Proton, neutron
9. State the mass and charge of a proton	Mass: 1 Charge: +1
10.State the mass and charge of an electron	Mass: 0 Charge: -1
11.State the mass and charge of a neutron	Mass: 1 Charge: 0
12.In an atom, the number of electrons is equal to the number of _____.	Protons
13.What does an atom become if it gains or loses electrons?	Ion
14.What do we call atoms of the same element with different numbers of neutrons	Isotopes
15.What is the mass number	Total number of protons and neutrons (in an atom)
16.What is the atomic number?	Number of protons (in an atom)
17. Before electrons were discovered atoms were thought to be what?	Tiny spheres that could not be divided.
18. What is the Plum Pudding model?	Ball of positive charge with electrons embedded in them.
19. What particle is involved in scattering experiment?	Alpha

20. Where is most the mass of an atom located?	Nucleus
21. Niels Bohr suggested that electrons orbited at specific _____?	Distances from the nucleus
Nuclear radiation	
22. Which type of nuclei give out radiation?	Unstable
23. What do nuclei give out as they change to become more stable?	Radiation
24. What do we call the rate at which a radioactive substance decays?	Activity
25. State the units for activity	Becquerel (Bq)
26. What do we call the number of decays per second?	Count rate
27. What can we use to measure count rate?	Geiger-Muller tube
Types of radiation	
28. Name 4 types of nuclear radiation	<ul style="list-style-type: none"> • Alpha • Beta • Gamma • Neutron
29. What is an alpha particle?	2 protons and 2 neutrons
30. Which nucleus is an alpha particle the same as?	Helium nucleus
31. What is a beta particle?	Fast moving electron
32. What happens to a neutron in beta decay?	It turns into a proton and an electron
33. What is gamma radiation	Electromagnetic wave
Properties of nuclear radiation	
34. What is meant by 'ionising power'?	How easily a type of radiation can make an atom into an ion
35. List the 3 types of nuclear radiation in order of their ionising power, starting with the most ionising	Alpha, beta, gamma
36. List the 3 types of nuclear radiation in order of their penetrating power, starting with the most penetrating	Gamma, beta, alpha
37. What can absorb most Beta radiation?	5mm of metal
38. What can absorb most Alpha radiation?	Few cm of air Sheet of paper

39. What can absorb most Gamma radiation?	Thick sheet of lead/metres of concrete
40. List the 3 types of nuclear radiation in order of their range in air, starting with the shortest range	Alpha, beta, gamma
41. State a use of alpha radiation	Smoke detectors
42. State a use of beta radiation	Testing the thickness of paper or thin sheets of metal
43. What disease can be caused by radiation entering living cells?	Cancer
44. How can radioactive isotopes be put into the human body?	Injection/swallowing
45. What forms of radiation is used to treat cancer/tumours?	Beta and gamma
Nuclear equations	
46. How does alpha decay change the atomic number?	Decreases by 2
47. How does alpha decay change the mass number?	Decreases by 4
48. How does a beta decay change the atomic number?	Increase by 1
49. How does a beta decay change the mass number?	It doesn't
50. How does a gamma ray change the atomic number?	It doesn't
51. How does a gamma ray change the mass number?	It doesn't
52. Complete this equation for alpha decay ${}_{98}^{200}X \rightarrow {}_{96}^{196}Y + He$	${}_{98}^{200}X \rightarrow {}_{96}^{196}Y + {}_2^4He$
53. Complete this equation for alpha decay ${}_{87}^{196}C \rightarrow \underline{\quad}D + {}_2^4He$	${}_{87}^{196}C \rightarrow {}_{85}^{192}D + {}_2^4He$
54. Complete this equation for beta decay ${}_{98}^{200}A \rightarrow {}_{99}^{200}B + e$	${}_{98}^{200}A \rightarrow {}_{99}^{200}B + {}_{-1}^0e$
55. Complete this equation for beta decay ${}_{88}^{180}C \rightarrow \underline{\quad}D + {}_{-1}^0e$	${}_{88}^{180}C \rightarrow {}_{89}^{180}D + {}_{-1}^0e$

Half lives	
56. What do we call the time it takes for the number of nuclei of the isotope in a sample to halve?	Half life
57. Are materials with a short or long half-life more dangerous?	Short
58. A radioactive source has an activity of 120Bq. After 12 days it has an activity of 15Bq. Calculate its half-life.	It has done 3 half-lives. This has taken 12 days, so half-life = $12 \div 3 = 4$ days
59. A radioactive source has an activity of 80Bq. After 30 minutes it has an activity of 20Bq. Calculate its half-life.	It has done 2 half-lives. This has taken 30 minutes, so half-life = $30 \div 2 = 15$ minutes
Contamination and irradiation	
60. How do we describe an object or area that has radioactive atoms on/in it?	contaminated
61. How do you reduce the risk of becoming contaminated with radioactive material?	<ul style="list-style-type: none"> • Use gloves and tongs • Wear protective suits.
62. What do we call it when we expose an object to nuclear radiation?	Irradiation
63. Does an irradiated object become radioactive?	No
64. How do you reduce the risk of being irradiated?	<ul style="list-style-type: none"> • Keep radioactive sources in lead lined boxes • Stand behind barriers or in a different room or use remote controlled arms
65. Which forms of radiation are the most dangerous when they are inside the body?	Alpha
66. Which forms of radiation are the most dangerous when they are outside the body?	Beta and gamma