Year 11 Physics Revision Checklist - Ionising Radiation and Nuclear Reactions

Science as a Human Endeavour:

Qualitative and quantitative analyses of relative risk (including half-life, absorbed dose, dose equivalence) are used to inform community debates about the use of radioactive materials and nuclear reactions for a range of applications and purposes, including:

- radioisotopes are used as diagnostic tools and for tumour treatment in medicine
  Pearson Physics 11 pp. 82-83
  WACE Study Guide pp. 44-45
  Exploring Physics pp. 68-69
- nuclear power stations employ a variety of safety mechanisms to prevent nuclear accidents, including shielding, moderators, cooling systems and radiation monitors
  WACE Study Guide pp. 55-57
  Exploring Physics pp. 86-87
  Pearson Physics 11 Section 4.2
- the management of nuclear waste is based on the knowledge of the behaviour of radiation.
  Pearson Physics 11 pp. 101-102
  WACE Study Guide pp. 49, 57

Science Understanding:

- the nuclear model of the atom describes the atom as consisting of an extremely small nucleus which contains most of the atom's mass, and is made up of positively charged protons and uncharged neutrons surrounded by negatively charged electrons
  WACE Study Guide pp. 33-34
  Pearson Physics 11 Section 3.1
  Exploring Physics p. 50 Set 5: 5.1, 5.2
- nuclear stability is the result of the strong nuclear force which operates between nucleons over a very short distance and opposes the electrostatic repulsion between protons in the nucleus
  WACE Study Guide pp. 33,36
  Pearson Physics 11 pp. 51-52
  Exploring Physics p.50
- some nuclides are unstable and spontaneously decay, emitting alpha, beta (+/-) and/or gamma radiation over time until they become stable nuclides
  WACE Study Guide pp. 31-37
  Pearson Physics 11 Sections 3.2, 3.3
  Exploring Physics Set 5: 5.5, 5.7, 5.9, 5.11, 5.13, 5.15, 5.17
- each species of radionuclide has a half-life which indicates the rate of decay
  This includes applying the relationship

$$N = N_0 \left(\frac{1}{2}\right)^n$$

  WACE Study Guide pp. 39-42
  Pearson Physics 11 Section 3.4
  Exploring Physics p. 61 Set 6: 6.1, 6.3, 6.5, 6.7, 6.9, 6.11, 6.13, 6.15, 6.17
  STILE: Half Life
- alpha, beta and gamma radiation have different natures, properties and effects
  WACE Study Guide p. 34-35
  Pearson Physics 11 Section 3.3
- the measurement of absorbed dose and dose equivalence enables the analysis of health and environmental risks
  This includes applying the relationships

$$\text{absorbed dose} = \frac{E}{m}, \qquad \text{dose equivalent} = \text{absorbed dose} \times \text{quality factor}$$

  Pearson Physics 11 Section 3.5
  WACE Study Guide pp. 47-48
  Exploring Physics p. 70 Set 7: 7.1, 7.3, 7.5, 7.7, 7.9, 7.11, 7.13, 7.15, 7.17
- Einstein's mass/energy relationship relates the binding energy of a nucleus to its mass defect
  This includes applying the relationship

$$\Delta E = \Delta m\, c^2$$

  WACE Study Guide pp. 51-53
  Pearson Physics 11 pp. 107-108
  Exploring Physics pp. 79-80 Set 8: 8.1, 8.3, 8.5, 8.7
  STILE: Nuclear Binding Energy
- Einstein's mass/energy relationship also applies to all energy changes and enables the energy released in nuclear reactions to be determined from the mass change in the reaction
  This includes applying the relationship

$$\Delta E = \Delta m\, c^2$$

  WACE Study Guide pp. 51-53
  Pearson Physics 11 pp. 91-93, 104-105
  Exploring Physics pp. 79-80 Set 8: 8.9, 8.11, 8.13, 8.15, 8.17, 8.19

- alpha and beta decay are examples of spontaneous transmutation reactions, while artificial transmutation is a managed process that changes one nuclide into another
  WACE Study Guide p. 44, 53
  Pearson Physics 11 pp. 49-50
- neutron-induced nuclear fission is a reaction in which a heavy nuclide captures a neutron and then splits into smaller radioactive nuclides with the release of energy
  WACE Study Guide pp. 51-54
  Pearson Physics 11 Section 4.1
- a fission chain reaction is a self-sustaining process that may be controlled to produce thermal energy, or uncontrolled to release energy explosively if its critical mass is exceeded
  WACE Study Guide p. 53-55
  Pearson Physics 11 Section 4.1
- nuclear fusion is a reaction in which light nuclides combine to form a heavier nuclide, with the release of energy
  WACE Study Guide pp. 56-57
  Pearson Physics 11 Section 4.3
- more energy is released per nucleon in nuclear fusion than in nuclear fission because a greater percentage of the mass is transformed into energy
  Pearson Physics 11 Sections 4.1, 4.3
  WACE Study Guide pp. 56-57

WACE Study Guide – Chapter 2 Review Questions pp. 58-61
WACE Study Guide – Trial Test 2 pp. 163-168
Pearson Physics 11 Chapter 3 & 4 Review Questions (pp. 85-86 & 111)

Past Stage 2 Physics WACE Exam Questions:

Year	**Questions**
2010	2,4,9,10,13,14,21
2011	1,13,16,21,23
2012	3,5,21,24
2013	1,6,10,15,16,20
2014	2,4,6,10,11,16,21