

Name: _____

Class: _____

CHAPTER TEST

Chapter 3 The nuclear atom

Time permitted: 35 minutes

	Section	Number of questions	Marks available	Marks achieved
A	Multiple choice	15	15	
B	Short answer	5	15	
	Total		30	

Grade: _____

Scale:

A+	29–30	A	26–28	B	23–25	C	19–22	D	15–18	E	9–14	UG	0–8
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Comments:

Section A Multiple choice (15 marks)

Section A consists of 15 questions, each worth one mark. Each question has only one correct answer. Circle the correct answer. Attempt all questions. Marks will not be deducted for incorrect answers. You are advised to spend no more than 15 minutes on this section.

- 1 Which of the following would be non-ionising radiation?
 - A Electromagnetic radiation of low energy
 - B Electromagnetic radiation of high energy
 - C Alpha rays
 - D Beta rays
- 2 Which of the following statements is not true?
 - A Background radiation consists of terrestrial radiation and cosmic radiation.
 - B Cosmic radiation is another word for cosmic rays.
 - C Cosmic radiation comes from space.
 - D Terrestrial radiation comes from Earth's crust.
- 3 Which of the following statements about atoms is not true?
 - A Atoms are mostly empty space.
 - B Most of the mass of the atom is contained in the nucleus.
 - C The nucleus has a positive charge.
 - D Electrons orbit the nucleus and can contain any amount of energy.
- 4 How would you know two nuclides are isotopes?
 - A They have the same number of protons
 - B They have the same number of neutrons
 - C They have the same number of electrons
 - D They have the same number of nucleons
- 5 What is an atomic mass unit?
 - A The mass of a proton
 - B The mass of a neutron
 - C The mass of a carbon-12 nucleus
 - D One-twelfth the mass of a carbon-12 nucleus
- 6 Which of the following would be most deflected by an electric or magnetic field?
 - A Alpha rays
 - B Beta rays
 - C Gamma rays
 - D Neutrons ejected from the nucleus

- 7 Which of the following would have the most penetrating power?
- A Alpha rays
 - B Beta rays
 - C Gamma rays
 - D Neutrons ejected from the nucleus
- 8 Which of the following would have the most ionising power?
- A Alpha rays
 - B Beta rays
 - C Gamma rays
 - D Neutrons ejected from the nucleus
- 9 An isotope of Osmium is named $^{187}_{76}\text{Os}$. Which statement below is true?
- A The isotope has atomic number 187.
 - B The isotope has 76 neutrons.
 - C The isotope has 76 protons.
 - D The isotope has mass number 263.
- 10 The number of nucleons refers to:
- A the number of protons in the nucleus.
 - B the number of neutrons in the nucleus.
 - C the number of electrons.
 - D the number of protons and neutrons in the nucleus.
- 11 How are beta rays produced?
- A Electrons escape from their orbit around the nucleus.
 - B Protons become neutrons and eject a positron.
 - C Neutrons become protons and eject an electron.
 - D Both B and C.
- 12 What is an alpha particle?
- A A hydrogen nucleus
 - B A helium nucleus
 - C An electron
 - D A positron

- 13 What particle is represented by the symbol $\bar{\nu}$?
- A A neutron
 - B A neutrino
 - C An antineutrino
 - D A positron
- 14 What would you look for in a diagnostic radiopharmaceutical?
- A Short half-life, high-quality image for low dose of radiation
 - B Long half-life, high-quality image for low dose of radiation
 - C Short half-life, very intense radiation
 - D Long half-life, very intense radiation
- 15 What is the effective half-life of a diagnostic radiopharmaceutical?
- A The time it takes for about half the atoms to decay
 - B The time it takes for half the chemical to be removed from the body
 - C A combination of A and B
 - D The time it takes for the radiation level to become safe

Section B consists of five questions. Write your answers in the spaces provided. You are advised to spend 20 minutes on this section.

1 Polonium-218 has a half-life of 3 minutes. A scientist has 480 μg of polonium-218. How much polonium-218 will be present in 15 minutes? (1 mark)

- 2** A certain sample of chlorine contains 75% ^{35}Cl and 25% ^{37}Cl . What is the atomic weight of this sample of chlorine? (1 mark)

- 3** Thorium-230 decays by emitting alpha particles.
- a** How many protons and neutrons are in a Thorium-230 nucleus?
- b** Write the equation for this decay, using the correct symbols.
- c** What is the name of the nuclide produced? Include the specific isotope produced. (5 marks)

- 4** Fluorine-21 decays by emitting an electron.
- a** Write the equation for this decay, using the correct symbols.
- b** What is the name of the nuclide produced? Include the specific isotope produced? (3 marks)

- 5 a Write the equation for the decay of technetium-99m.
- b What are two main properties of technetium-99m which make it an excellent diagnostic radiopharmaceutical?
- c Technetium does not occur naturally, as it has no stable isotope. Show how it can be produced from molybdenum-98 by neutron absorption. What would happen after the neutron absorption? There is no need for symbolic equations for this question. (5 marks)

End of test (30 marks)