At-a-glance unit content, assessment criteria and guidance

To help you with assignment writing as well as assessing assignments, this table maps the Unit 3 content against the Unit 3 assessment criteria and assessment guidance, taken from the specification. For further advice and help on writing and assessing assignments please contact TeachingScience@pearson.com.

Unit 3 Learning Aim A - Understand ionising radiation, its uses and sources

Unit content	Assessment criteria	Assessment guidance
A.1 The structure of nuclei using the terms 'atomic (proton) number' and 'mass (nucleon) number', and using symbols in the format: $^{7}_{3}Li$ **A.2** Alpha, beta and gamma radiations are emitted from unstable nuclei in a random process. **A.3** An alpha particle is equivalent to a helium nucleus, a beta particle is an electron emitted from the nucleus and gamma rays are high-frequency electromagnetic waves.	**1A.1** Describe the structure of atomic nuclei.	For **1A.1**, learners must show the structure of the atomic nuclei, most probably pictorially, using numbers and symbols.
	1A.2 Identify the types of ionising radiation.	For **1A.2**, the learner is required to **identify** types of ionising radiation; this could be done in the form of a list or table.
	2A.P2 Describe the different types of ionising radiation.	For **2A.P2**, the learner will need to show an understanding of atomic structure and the different types of ionising radiation, related to the structure described in 1A.1.
	1A.3 Identify the problems associated with the use of radioactive isotopes.	For **1A.3**, the learners could discuss the uses of radioactive isotopes with their teacher and identify at least two problems with these uses. This could, alternatively, be presented in the form of a table.
	2A.P3 Describe the problems associated with the use of radioactive isotopes.	For **2A.P3**, the learners would need to **describe** at least two problems with the use of radioactive isotopes.
	2A.M2 Compare the benefits and	For **2A.M2**, it is also expected that the learner can **compare**

A.4 Ionising radiations cause atoms to gain or lose electrons to form ions. **A.5** Alpha, beta and gamma radiations are compared in terms of their abilities to penetrate and ionise. **A.6** Effects of different radiations on living cells. **A.7** Uses of ionising radiations, including alpha, beta, gamma and X-rays. **A.8** Investigate radioactive decay in terms of reducing activity and amount of radioactive material. **A.9** Investigate half-life of radioactive isotopes in terms of reducing activity. **A.10** Calculations involving half-life and their graphical representations.	drawbacks of using radioactive isotopes in the home or workplace.	the benefits and drawbacks of using radioactive isotopes in the home (such as in smoke detectors) or in the workplace (such as for sterilising medical equipment, radioactive tracers and measuring the thickness of paper).
	2A.D2 Justify the selection of a radioactive isotope for a given use within the home or workplace.	For **2A.D2**, learners will need to **justify** the selection of one radioactive isotope.
	2A.P1 Describe half-life in terms of radioactive decay.	For **2A.P1**, only a **description** of half-life is required in terms of radioactive decay; there is no requirement for a qualitative or quantitative explanation.
	2A.M1 Use graphs to explain radioactive decay and half-life.	For **2A.M1**, learners are given the opportunity to describe, in words and mathematically, radioactive decay and half-life.
	2A.D1 Calculate the half-life of radioactive isotopes.	Following on from this, in **2A.D1** the learner is required to perform calculations involving the half-life of radioactive isotopes. The teacher and assessor should avoid providing learners with a series of questions that are just exercises in calculations. The problems should be set in context, perhaps using the results from simulations the learners have watched. The idea is to enable the learner to carry out calculations and, in doing so, understand how published figures for half-lives are arrived at.
A.11 Nuclear fission is large nuclei breaking down to form	**1A.4** Describe nuclear fission and fusion.	For **1A.4**, learners can use simple atomic nuclei structure diagrams to **describe** nuclear fission and fusion.

small nuclei. **A.12** Nuclear fusion is the creation of larger nuclei from smaller nuclei. **A.13** Energy release by the process of controlled nuclear fission. **A.14** Energy release by nuclear fusion in stars and the difficulty in harnessing energy from nuclear fusion on Earth. **A.15** Environmental issues associated with nuclear energy (storage of waste products, uncontrolled release of radioactive material).	**2A.P4** Describe how controllable nuclear fission and fusion reactions are.	**2A.P4** requires a **description** of how controllable nuclear fission and fusion reactions are, and it would be expected that learners would refer to examples from nuclear reactors and the Solar System to aid their description. They are not being asked to compare these two reactions.
	2A.M3 Describe the environmental impact of radioactive material from nuclear fission reactors released into the environment.	For **2A.M3**, learners need to **describe** the environmental impact of radioactive uncontrolled release from a nuclear reactor. This could be a recent event that has long-term effects on the environment.
	2A.D3 Evaluate the environmental impacts of a nuclear fission reactor accident, in terms of half-life.	For **2A.D3**, learners need to evaluate the impact of an accident in terms of using half-life diagrams.

Unit 3 Learning Aim B – Know how electrical energy produced from different sources can be transferred through the National Grid to homes and industry

Unit content	Assessment criteria	Assessment guidance
B.1 Electric circuits: a. the need for a complete circuit	**1B.5** Identify methods of producing electricity from different sources.	For **1B.5**, learners need to **identify** four different methods of producing electricity. This could be done after a discussion with the teacher or having been given a case study of

b. electrical symbols (battery, cell, switch, fuse, voltmeter, ammeter, resistor, filament lamp) c. current (A, mA) d. voltage (V, mV) e. resistance (Ω, kΩ) f. construct simple series and parallel circuits g. measure current and voltage using meters h. use the equation: voltage (volts) = current (amps) × resistance (ohms) $V = IR$ i. direct current (d.c.) and alternating current (a.c.). **B.2** Power supplies: a. types of batteries b. solar cell c. simple generators – rotating a coil in a permanent magnetic field d. production of electricity – basic alternating current generator, batteries as a source of direct current (rechargeable and non-rechargeable) e. environmental impact – comparison of environmental impact of electricity generation		methods of producing electricity, learners need to identify four different methods of producing electricity. This could be done after a discussion with the teacher or having been given a case study of methods of producing electricity.
	2B.P5 Describe methods of producing a.c. and d.c. electricity.	For **2B.P5,** learners will need to describe the four different methods identified for 1B.5.
	1B.6 Demonstrate building simple series and parallel circuits. **1B.7** Describe electrical power in terms of voltage and current.	For **1B.6** and **1B.7**, learners can be observed **carrying out the tasks** to gain these assessment criteria. Note that it is stipulated they must be done correctly. Observation sheets and/or witness statements are required as evidence.
	2B.P6 Use $V = IR$ to predict values in electric circuit investigations.	It is assumed that practical work has been done on circuit building etc. in order to underpin the learners' ability in **2B.P6** to **use** the equation $V = IR$.
	2B.P7 Describe how electricity is transmitted to the home or industry.	Teachers may feel that the assessment of **2B.P6** and **2B.P7**, where an understanding of a.c. and d.c. currents and the transmitting of electricity is required, can be linked together.
	2B.M4 Compare the efficiency and environmental impact of electricity generated by different sources.	**2B.M4** requires learners to carry out a **comparison** in relation to efficiency. More able learners could include calculations to aid their arguments, rather than just giving a description.
	2B.M5 Assess, in qualitative terms, ways to minimise energy losses when transmitting electricity.	**2B.M5** asks for qualitative **assessments** on minimising energy losses. In doing this, learners may well include quantitative arguments, which the assessor needs to look at

from renewable and non-renewable sources f. electrical power and the equation: power (watts) = voltage (volts) × current (amps) $P = VI$ g. efficiency of electricity generation from different sources h. National Grid – used to transmit electrical energy (power) i. step-up and step-down transformers and the reduction of energy losses during transmission.	**2B.D4** Assess, in quantitative terms, ways to minimise energy losses either when transmitting electricity or when transforming electricity into other forms for consumer applications.	for **assessment** as part of **2B.D4**.

Unit 3 Learning Aim C – Know the components of the Solar System, the way the Universe is changing and the methods we use to explore space

Unit content	Assessment criteria	Assessment guidance
C.1 The Universe: a. the structure and dynamic nature of the Universe (Solar System, stars and galaxies, large-scale structure) b. looking back in time.	**1C.8** Identify the components of our Solar System.	For **1C.8**, learners need to **identify** the components of our Solar System; this could be done in the form of a diagram or model, including planets, stars, natural satellites, etc.
	2C.8 Describe the structure of the Universe and our Solar System.	For **2C.P8**, learners need to **describe** the structure of the Universe and our Solar System. This can be done as a large-scale structure to include galaxies, stars and solar systems.
C.2 The Solar System:	**2C.M6** Describe how the Universe	To achieve **2C.M6**, learners need to give a simple **description**

a. composition – stars, planets, dwarf planets and natural satellites, comets and meteors, asteroids b. formation of the Solar System.	and the Solar System were formed.	of the Big Bang theory and formation of the Solar System.
C.3 Observing the Universe: a. optical, radio, infrared, UV, X-ray and gamma telescopes b. reflecting, ground-based and space-based telescopes c. space probes and robots.	**1C.9** Identify methods of observing the Universe.	For **1C.9**, learners must **identify** three different methods of observing the Universe.
	2C.P9 Describe the suitability of different methods for observing the Universe.	For **2C.P9,** learners need to **describe** the suitability of the three different methods provided for 1C.9.
C.4 The changing Universe: a. the Big Bang theory b. evidence for an expanding Universe (galaxies moving away from each other (red shift)) c. cosmic microwave background radiation as support for the Big Bang theory.	**1C.10** Describe the dynamic nature of our Solar System and Universe.	For **1C.10**, learners should provide a simple **description** of the dynamic nature of the Solar System and Universe, such as stars evolving and the Universe expanding.
	2C.P10 Identify evidence that shows the dynamic nature of the Universe.	For **2C.P10**, evidence needs to be **identified** by looking at the red shift of galaxies.
	2C.M7 Explain how evidence shows that the Universe is changing.	**2C.M7** can be achieved by using evidence of an expanding Universe and cosmic microwave background radiation.
	2C.D5 Evaluate the evidence leading to the Big Bang theory of how the Universe was formed.	For **2C.D5**, this may be covered by the learners in one answer. The assessor should ensure the answer in 2C.D5 is an **evaluation** as the expectation is that the ideas and evidence which led to the Big Bang theory are explored, not just described.