Cambridge Assessment International Education

Cambridge Pre-U

PHYSICS **9792/02**

Paper 2 Written Paper **October/November 2020**

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INSTRUCTIONS

- The question in Section 2 of Paper 2 will relate to the subject matter of the extracts within this insert.
- You will have received a copy of this booklet in advance of the examination.
- The extracts on the following pages are taken from a variety of sources.
- Cambridge International does not necessarily endorse the reasoning expressed by the original authors, some of whom may use unconventional physics terminology and non-SI units.
- You should use all your knowledge of physics when answering the questions.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

This document has **8** pages. Blank pages are indicated.

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Extract 1: Early Particle Accelerators

Rutherford's discovery of alpha particles, and his subsequent use of them with Geiger and Marsden to probe the nucleus of the gold atom, is justly well-known.

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This type of accelerator is still used but the limitations of length led to the development of the cyclotron.

Adapted from: Advance Notice Article for OCR A level Physics B, paper 2865, January 2009, OCR.

Extract 2: The Cyclotron

Many accelerators use magnets to deflect the charged particles into circular paths.

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The pushes increase their speed and kinetic energy, boosting them into paths of larger radius.

Adapted from: University Physics (10th Edition), Young & Freedman, Addison Wesley, 2000.

Extract 3: Synchrotrons

Synchrotrons, like cyclotrons, are cyclic accelerators and send particles into a closed-loop path, increasing their speed with each revolution. But unlike cyclotrons, the synchrotron's loop is not a spiral.

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With particles always circling the accelerator, researchers can send beams through each other repeatedly, creating a large number of collisions, events that could potentially reveal the building blocks of the Universe.

Adapted from: https://www.machinedesign.com/whats-difference-between/what-are-differences-between-linear-accelerators-cyclotrons-and-synchrotron

Extract 4: Electromagnetic Radiation

Stationary charges generate electric fields, but not magnetic fields. Charges moving at constant velocity – an electrical current – produce a magnetic field also.

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It can be minimised by making the accelerator radius *r* large. On the positive side, synchrotron radiation is used as a source of well-controlled high-frequency electromagnetic waves.

Adapted from: University Physics (10th Edition), Young & Freedman, Addison Wesley, 2000.

Extract 5: The Diamond Synchrotron

Synchrotrons fall into two major categories: high-energy physics machines and sources of synchrotron radiation.

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Newer synchrotrons like Diamond are built on more advanced technology, and so are capable of producing more stable and more intense radiation.

Adapted from: https://www.diamond.ac.uk/Home/About/FAQs/About-Synchrotrons.html

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