

**Western Australian Certificate of Education**

**ATAR course examination, 2019**

**Question/Answer Booklet**

11 PHYSICS

Name

**Evaluation 2 - Radioactivity**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Student Number: In figures |  |  |  |  |  |  |  |  |  |  |

**Mark:**  In words

#### Time allowed for this paper

Reading time before commencing work: 5 minutes

Working time for paper: 50 minutes

**Materials required/recommended for this paper**

To be provided by the supervisor

This Question/Answer Booklet

Formulae and Data Booklet

***To be provided by the candidate***

Standard items: pens, (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: non-programmable calculators satisfying the conditions set by the School Curriculum and Standards Authority for this course

one A4 page of notes - handwritten

**Important note to candidates**

No other items may be taken into the examination room. It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor before reading any further.

**Structure of this paper**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Section** | **Number of questions available** | **Number of questions to be answered** | **Suggested working time**  **(minutes)** | **Marks available** | **Percentage of exam** |
| **Section One:**  **Short Answers** | - | - | - | - | - |
| **Section Two:**  **Problem-solving** | 4 | 4 | 50 | 18 | 100 |
| **Section Three:**  **Comprehension** | - | - | - | - | - |
|  |  |  |  | **Total** | 100 |

**Instructions to candidates**

1. The rules for the conduct of examinations at Holy Cross College are detailed in the College Examination Policy*.* Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer Booklet.

3. Working or reasoning should be clearly shown when calculating or estimating answers.

4. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.

5. Spare pages are included at the end of this booklet. They can be used for planning your

responses and/or as additional space if required to continue an answer.

• Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.

• Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

6. Answers to questions involving calculations should be ***evaluated and given in decimal***

***form*.** It is suggested that you quote all answers to ***three significant figures***, with the

exception of questions for which estimates are required. Despite an incorrect final result, credit may be obtained for method and working, providing these are ***clearly and legibly set out***.

7. Questions containing the instruction "estimate" may give insufficient numerical data for their solution. Students should provide appropriate figures to enable an approximate solution to be obtained. Give final answers to a maximum of two significant figures and include appropriate units where applicable.

8. Note that when an answer is a vector quantity, it must be given with magnitude and direction.

9. In all calculations, units must be consistent throughout your working.

A sample of thorium-234 was placed in storage in a medical facility. While it was in storage, its activity was monitored regularly by an automatic sensor that was placed 10 cm from the sample. the data collected is shown below.

|  |  |
| --- | --- |
| **Time, *t* (days)** | **No. of nuclei of radioactive isotope (*N)*** |
| 0 | 8.0 × 1010 |
| 5 | 5.9 × 1010 |
| 17 | 2.4 x 1010 |
| 25 | 1.3 x 1010 |
| 38 | 5.5 x 109 |
| 44 | 3.0 x 109 |
| 50 | 2.0 x 109 |
| 54 | 1.0 x 109 |

1. On graph paper provided, plot the data. (4 marks)

2. What is the name for a curve of the shape shown in your graph? (1 mark)

3. What is the average half-life of thorium-234? (3 marks)

prac exam youngs mod 10 by 10

4. The absolute ages of recent carbonaceous fossils can be determined using radiocarbon dating. The half-life of carbon-14 (a radioactive isotope) is 5730 years. The following table shows how the percentage of C-14 present in a fossil decreases over time.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Time (years)** | 0 | 5730 | 11 460 | 17 190 | 22 920 | 28 650 |
| **% C-14 remaining** | 100 | 50 | 25 | 12.5 | 6.25 | 3.125 |

(a) Plot a line graph of this data on the grid below. (4 marks)

prac exam youngs mod 10 by 10

(b) The C-14 content of a fossil was found to have decreased by 36% since the organism died. Determine the approximate age of the fossil from the graph.

(1 mark)

(c) A fossil is approximately 10 000 years old. What percentage of C-14 still remains, according to the graph?

(1 mark)

(d) Do a calculation using the appropriate formula to check your answer to (c).

(3 marks)

(e) Explain why it is difficult to date fossils that are more than 60 000 years old using radiocarbon dating. (1 mark)