# End of topic quiz

# Topic P4: Waves and radioactivity

## Instructions and answers for teachers

These instructions cover the learner activity section which can be found on [page 9](#_Topic_P3:_Electricity). This end of topic quiz supports OCR GCSE (9–1) Combined Science A (J250), Topic P4.

**When distributing the activity section to the learners either as a printed copy or as a Word file you will need to remove the teacher instructions section.**

### The Activity

This end of topic quiz is a teaching and learning resource comprised of 40 marks covering a range of question types. The quiz starts with some multiple choice questions (MCQs) and then moves on to some short answer questions and then finally on to some longer answer questions.

This resource can be used to test and consolidate understanding at the end of teaching the topic or to revisit and refresh knowledge at a later point in the course.

### Learning Outcomes

This end of topic quiz relates to the specification learning outcomes in Topic P4: Waves and radioactivity. The questions in this quiz cover a range of the following topics:

P4.1 Wave behaviour

P4.2 The electromagnetic spectrum

P4.3 Radioactivity

### Topic: P4 of J250 - Answers

### Total marks: 40

|  |  |  |
| --- | --- | --- |
| **1.** | Which of the following definitions are true? **[1 mark]**   1. Wavelength is the length a wave travels in one second. 2. Wavelength is the length of one wave. 3. Frequency is the number of waves that occur in one second. 4. Frequency is time it takes for one wave to occur. | |
|  |  | |
|  | **A** | 1 and 3 |
|  | **B** | 1 and 4 |
|  | **C** | 2 and 3 |
|  | **D** | 2 and 4 |
| **C** | Your answer | |

|  |  |  |
| --- | --- | --- |
| **2.** | Which type of radiation is missing from the following list? **[1 mark]**  X Rays  ---------------  Visible Light | |
|  |  | |
|  | **A** | Radio waves |
|  | **B** | Infra-Red |
|  | **C** | Ultraviolet |
| **C** | **D** | Microwaves |
|  | Your answer | |

|  |  |  |
| --- | --- | --- |
| **3.** | Which of the following is the least penetrating? **[1 mark]** | |
|  |  | |
|  | **A** | Alpha |
|  | **B** | Beta |
|  | **C** | Gamma |
|  | **D** | X-Rays |
| **A** | Your answer | |

|  |  |  |
| --- | --- | --- |
| **4**. | What is the speed of a wave of wavelength 4 mm and a frequency of 10 Hz? **[1 mark]** | |
|  |  | |
|  | **A** | 0.04 m/s |
|  | **B** | 0.4 m/s |
|  | **C** | 4 m/s |
|  | **D** | 40 m/s |
| **A** | Your answer | |
| **5.** | The diagram below shows light being passed through a glass block.  Diagram showing light being passed through a glass block  What property of waves is shown above? **[1 mark]** | |
|  |  | |
|  | **A** | Reflection |
|  | **B** | Refraction |
|  | **C** | Diffraction |
|  | **D** | Dispersion |
| **B** | Your answer | |

**[1]**

**[1]**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **6.** | Plutonium undergoes radioactive decay to become Uranium. The incomplete decay equation for this is shown below. | | | |  |
|  | **(a)**  92✓  4✓  α✓ | **(i)** | Complete the above decay equation. **[3 marks]** | |
|  | Beta✓ | **(ii)** | What is the other type of particle radiation? **[1 mark]** | |
|  | **(b)**  An atom of an element with a different ✓ number of neutrons.✓ | **(i)** | Plutonium- 239 is an isotope. What is an isotope? **[2 marks]** | |
| **7.** | Light travels at a speed of 300,000,000 m/s. | | |  | |
|  | **(a)**  Transverse✓ | **(i)** | What sort of wave is light? **[1 mark]** |
|  | Transverse waves particle movement is perpendicular✓  to transfer of energy✓  Longitudinal waves it is parallel✓ | **(ii)** | What are the main differences between transverse and longitudinal waves in terms of energy and particle movement? **[3 marks]** |
|  | **(b)**  Frequency used 300 GHz✓  300,000,000 ÷ 300,000,000,000  = 0.001 m ✓ | **(i)** | Radio waves have a frequency which ranges from 3 kHz to 300 GHz. What is the smallest possible wavelength they could have? **[2 marks]** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **8.** | Microwave ovens use microwaves to heat food.  Microwave oven | | |  |
|  | **(a)** | **(i)**  Microwaves gives energy to water molecules✓  Water molecules vibrate✓  Water molecules cause nearby molecules to vibrate✓  Energy transfers causes temperature to rise.✓ | How does this happen? **[4 marks]** |
|  |  | **(ii)**  300000000 ÷ 2450000000✓  = 0.12 m✓ | Microwaves have a frequency of 2,450 MHz. What is their wavelength? **[2 marks]** |
|  | **(b)** | **(i)**  Communication/radar✓ | Name another use of microwaves. **[1 mark]** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **9.**  Activity | The graph below shows the decay curve of a radioactive substance.  Graph showing the decay curve of a radioactive substance  Time / days | | |  |
|  | **(a)** | **(i)**  Lines drawn on graph to find time for half starting number✓  2 days✓ | Use the above graph to work out the half-life of this isotope. **[2 marks]** |
|  |  | **(ii)**  Time taken✓  For number of atoms/activity to drop by half.✓ | What is meant by half life? **[2 marks]** |
|  | **(b)** | **(i)**  Gamma can be recorded outside the body✓  It will drop to harmless levels of radiation quickly✓  But not so quickly that readings cannot be taken.✓ | The above isotope is a gamma emitter. Why would it be suitable for use as a tracking isotope in a human? **[3 marks]** |
|  |  | **(ii)**  No particles are released/Only energy given out✓  So no change to structure.✓ | When an isotope emits gamma radiation it does not change to a different atom or isotope. Why not? **[2 marks]** |
| **10.** | | X Rays and Gamma Rays are both ionising Electromagnetic Waves. | | |  |
|  | | **(a)** | **(i)**  Damages DNA✓  Can cause mutation/cancer.✓ | Why is ionisation dangerous to humans? **[2 marks]** |
|  | |  | **(ii)**  Leave the room/stand behind lead shielding✓  Minimises amount of radiation reaching body✓  Film badge to check total exposure✓  Minimises amount of radiation reaching body over a period of time.✓ | What safety precautions can be taken by medical staff to minimise their exposure to this radiation? **[4 marks]** |
|  | | **(b)** | **(i)**  Risk of developing cancer from ionisation✓  Less than the risk of not knowing what is inside the chest.✓ | A chest CT scan exposes the patient to a large amount of ionising radiation. Why are chest CT scans used, even though they are risky? **[2 marks]** |

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# End of topic quiz

# Topic P4: Waves and radioactivity

## Learner Activity

**Topic: P4 of J250**

**Total marks: 40**

|  |  |  |
| --- | --- | --- |
| **1.** | Which of the following definitions are true? **[1 mark]**   1. Wavelength is the length a wave travels in one second. 2. Wavelength is the length of one wave. 3. Frequency is the number of waves that occur in one second. 4. Frequency is time it takes for one wave to occur. | |
|  |  | |
|  | **A** | 1 and 3 |
|  | **B** | 1 and 4 |
|  | **C** | 2 and 3 |
|  | **D** | 2 and 4 |
|  | Your answer | |
|  |  | |

|  |  |  |
| --- | --- | --- |
| **2.** | Which type of radiation is missing from the following list? **[1 mark]**  X Rays  ---------------  Visible Light | |
|  |  | |
|  | **A** | Radio waves |
|  | **B** | Infra-Red |
|  | **C** | Ultraviolet |
|  | **D** | Microwaves |
|  | Your answer | |
|  |  | |

|  |  |  |
| --- | --- | --- |
| **3.** | Which of the following is the least penetrating? **[1 mark]** | |
|  |  | |
|  | **A** | Alpha |
|  | **B** | Beta |
|  | **C** | Gamma |
|  | **D** | X-Rays |
|  | Your answer | |
|  |  | |

|  |  |  |
| --- | --- | --- |
| **4.** | What is the speed of a wave of wavelength 4 mm and a frequency of 10 Hz? **[1 mark]** | |
|  |  | |
|  | **A** | 0.04 m/s |
|  | **B** | 0.4 m/s |
|  | **C** | 4 m/s |
|  | **D** | 40 m/s |
|  | Your answer | |
|  |  | |

|  |  |  |
| --- | --- | --- |
| **5.** | The diagram below shows light being passed through a glass block.  Diagram showing light being passed through a glass block  What property of waves is shown above? **[1 mark]** | |
|  |  | |
|  | **A** | Reflection |
|  | **B** | Refraction |
|  | **C** | Diffraction |
|  | **D** | Dispersion |
|  | Your answer | |
|  |  | |

**[**

**[1]**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **6.** | Plutonium undergoes radioactive decay to become Uranium. The incomplete decay equation for this is shown below. | | |  |
|  | **(a)** | **(i)** | Complete the above decay equation. **[3 marks]** |
|  |  | **(ii)** | What is the other type of particle radiation? **[1 mark]** |
|  | **(b)** | **(i)** | Plutonium- 239 is an isotope. What is an isotope? **[2 marks]** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **7.** | Light travels at a speed of 300,000,000 m/s. | | |  |
|  | **(a)** | **(i)** | What sort of wave is light? **[1 mark]** |
|  |  | **(ii)** | What are the main differences between transverse and longitudinal waves in terms of energy and particle movement? **[3 marks]** |
|  | **(b)** | **(i)** | Radio waves have a frequency which ranges from 3 kHz to 300 GHz. What is the smallest possible wavelength they could have? **[2 marks]** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **8.** | Microwave ovens use microwaves to heat food.  Microwave oven | | |  |
|  | **(a)** | **(i)** | How does this happen? **[4 marks]** |
|  |  | **(ii)** | Microwaves have a frequency of 2,450 MHz. What is their wavelength? **[2 marks]** |
|  | **(b)** | **(i)** | Name another use of microwaves. **[1 mark]** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **9.**  Activity | The graph below shows the decay curve of a radioactive substance.  Graph showing the decay curve of a radioactive substance  Time / days | | |  |
|  | **(a)** | **(i)** | Use the above graph to work out the half-life of this isotope. **[2 marks]** |
|  |  | **(ii)** | What is meant by half life? **[2 marks]** |
|  | **(b)** | **(i)** | The above isotope is a gamma emitter. Why would it be suitable for use as a tracking isotope in a human? **[3 marks]** |
|  |  | **(ii)** | When an isotope emits gamma radiation it does not change to a different atom or isotope. Why not? **[2 marks]** |
| **10.** | X Rays and Gamma Rays are both ionising Electromagnetic Waves. | | |  |
|  | **(a)** | **(i)** | Why is ionisation dangerous to humans? **[2 marks]** |
|  |  | **(ii)** | What safety precautions can be taken by medical staff to minimise their exposure to this radiation? **[4 marks]** |
|  | **(b)** | **(i)** | A chest CT scan exposes the patient to a large amount of ionising radiation. Why are chest CT scans used, even though they are risky? **[2 marks]** |