T-LEVELS | Institute for Apprenticeships & Technical Education

T Level Technical Qualification in Science

Occupational specialism assessment (OSA)

Laboratory Sciences

Assignment 2 - Part A

Mark scheme – Post standardisation

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Part A

Contents

Task 1(a)

Task 1(a): assessor observation checklist

Criteria	**Assessor check**	**Marks awarded**	**Essential criteria** (All essential criteria must be awarded to pass)
Validation of balance calibration, escalating if appropriate		1 mark	
Safe handling and transport of rice samples		1 mark	Yes
Well-organised workstation to facilitate the completion of the task		1 mark	
Safe handling of equipment during the task		1 mark	Yes
Use of appropriate personal protective equipment (PPE) in preparation and completion of the task		1 mark	Yes
Performed scientific techniques effectively: • measuring out the mass of rice • moving around the laboratory to measure the background radiation • measuring the count rate for samples of rice, ensuring the Geiger counter is an appropriate distance away		1 mark for completing technique effectively **and** 1 mark for completing techniques accurately **(maximum 6 marks)** **Guidance** – assessor must check accuracy of recorded measurements and observations on at least 2 occasions during the task	
Total awarded*		11 marks	

Task 1 (a): following the standard operating procedure (SOP)

Level	Mark	Descriptor
4	10–12	The student has demonstrated autonomy and judgement in following the multi-step standard operating procedure (SOP), carrying out all instructions in full and carrying out the task logically in a time efficient manner to produce accurate results.
3	7–9	The student has followed the multi-step SOP, carrying out most instructions in full, with only occasional minor omissions or errors, for example not taking into account radiation from smoke detectors, and carried out the task in the correct order of steps to produce accurate results.
2	4–6	The student has followed the multi-step SOP to produce results, but in some areas attention to detail is lacking, and carried out all major steps in the correct order, although there may be some errors or omissions within some of the steps. For example, not taking background radiation readings in a number of places around the laboratory.
1	1–3	The student has followed parts of the multi-step SOP correctly to produce results, carrying out most of the major steps, but may omit a key step and complete some of the steps in the wrong order, compromising the validity of results.
0	0	No creditworthy material as described in levels 4–1.

Indicative content

Students should:

- be able to set up a Geiger counter so as they are able to determine counts per minute (cpm) for background radiation and for potential radioactive decay from a food source (rice samples)
- have knowledge of the hazards and risk of working with potentially radioactive samples

Students should be able to record data collected in appropriate tables, with appropriate column headers and units.

Students should follow safety protocols and adhere to the risk assessment.

Students should work with proper and appropriate PPE.

Content mapping

K1.1 How practices are applied when performing scientific techniques:

- safely performing a scientific technique
- completing a scientific technique

K1.47 When scientific and mathematical skills may be applied when completing scientific tasks:

- measuring
- manual dexterity
- observing
- analysing:

- calculations

K1.55 How physics laboratory techniques are applied in different fields

K1.61 The purpose of the following physics laboratory equipment:

- Geiger counter: used to detect ionising radiation

K1.63 The principles of producing reliable and verifiable results:

- recording in a clear and unambiguous way (for example, use of tables, indelible ink, not using sticky notes or loose papers and ensuring that writing is legible)
- using appropriate units, notation and correct number of significant figures

K1.67 The purpose and importance of SOPs within the laboratory environment

S1.68 Work safely in a laboratory when performing specific scientific techniques

S1.69 Comply with relevant health and safety legislation and regulations, including COSHH and biosafety containment levels, when handling and disposing of solids, liquids and gases relevant for the scientific technique being performed

S1.71 Use appropriate PPE when performing scientific tasks (for example, suitable eye protection and gloves)

S1.75 Apply a range of science and mathematical skills when performing practical scientific techniques

S1.76 Use the following practical scientific techniques to measure a range of physical properties:

- radioactive count rate using Geiger counter:
  - measuring the background count rate

S1.81 Use appropriate international system of units (SI) and be able to work with a range of appropriate scales when conducting scientific tasks

S1.82 Convert between SI and non-SI measurement units when conducting scientific tasks

S1.84 Select appropriate equipment to complete practical scientific techniques:

- top pan balance
- Geiger counter

S1.85 Demonstrate practical technical competence in the use of equipment:

- taking accurate measurements
- correctly manipulating the equipment
- using equipment safely and for intended purpose

S1.86 Calibrate scientific equipment and check it is fit for use

- balances

S1.87 Produce data from scientific techniques, which are reliable and verifiable, by:

- recording data and records in a clear and unambiguous way:
  - using appropriate units, notation and correct number of significant figures
  - organising ideas logically and coherently
- selecting and using appropriate digital technology (for example, PC-connected data logger, multimeter):

  - to gather data evidence efficiently (for example, using a temperature data logger instead of multiple manual recordings)
  - demonstrating a secure level of competence and confidence in configuring and using digital devices
- critically reviewing data obtained and repeating investigations where appropriate

Task 1(b)

Task 1(b): applying statistical techniques

Level	Mark	Descriptor
4	10–12	The student has used relevant and appropriate methods to calculate mean background radiation and mean counts per minute (cpm) for the rice samples, presenting a complete, identifiable, and relevant set of results in an entirely suitable format that is fit for purpose, including the following elements: • mean background calculated • mean rice cpm calculated • mean rice cpm – mean background calculated • standard deviation for background radiation calculated • number of standard deviations from mean counts for rice samples is calculated • comment on whether there is a need for further investigation is fully substantiated by the data gathered and subsequent analysis
3	7–9	The student has used appropriate methods to calculate mean background radiation and mean counts per minute (cpm) for the rice samples, presenting an identifiable set of results in a valid format, including the following elements: • mean background calculated • mean rice cpm calculated • mean rice cpm – mean background calculated • standard deviation for background radiation calculated • number of standard deviations from mean counts for rice samples is calculated • comment on whether there is a need for further investigation is mostly substantiated by the data gathered and subsequent analysis
2	4–6	The student has used some relevant methods to calculate mean background radiation and radiation from the rice samples, presenting a set of results that includes some data in a suitable format, although is incomplete and sometimes unclear, or unnecessary data is used. Work may include the following elements: • mean radiation for the rice samples is calculated although some inappropriate results may be included in the calculation • mean background radiation is calculated, some anomalous results are included in the calculation • background radiation has been subtracted from the radiation for rice samples, but answers are incomplete

Level	Mark	Descriptor
		• there is some evidence of an attempt to calculate standard deviation • there is a basic statement on whether further investigation is required but this is not clearly linked to the analysis undertaken
1	1–3	The student has calculated mean background radiation and radiation from the rice samples, presenting a set of results that includes some but limited data in a format that is not the most suitable for the purpose. Data is incomplete and sometimes unclear, or unnecessary data is used.
0	0	No creditworthy material as described in levels 4 to 1.

Indicative content

- knowledge of background radiation and beta radiation
- correct and appropriate use of tables to record data
- record data using cpm
- how to calculate means and exclusion of anomalous results
- calculations of means shown in furthest right column
- knowledge of the purpose and use of standard deviation
- decision on whether further investigation is justified using relevant results, such as the calculated count rate for the rice samples, as well as the comparison of the initial count rates with the background count rate

Content mapping

K1.47 When scientific and mathematical skills may be applied when completing scientific tasks:

- measuring
- manual dexterity
- observing
- analysing:
  - calculations

K1.63 The principles of producing reliable and verifiable results:

- recording in a clear and unambiguous way (for example, use of tables, indelible ink, not using sticky notes or loose papers and ensuring that writing is legible)
- using appropriate units, notation and correct number of significant figures

K2.6 How the following considerations inform data processing and subsequent analysis of the results in a laboratory environment:

- regulatory requirements (for example, validation, conformity to known analytical standards)
- relevant calculations (for example, magnification and Rf values)
- conversion of units (for example, consistent use of units across different data sets)

- appropriate statistical techniques to determine the validity or significance of the results (for example, standard deviation, p value, uncertainty values)
- customer requirements for the presentation of data (for example, graphs)
- using complementary experimental methodologies from existing peer-reviewed studies to confirm results (for example, by the use of online databases)
- using laboratory control charts and trend charts (for example, to confirm equipment and/or protocols are within tolerance)

S1.75 Apply a range of science and mathematical skills when performing practical scientific techniques

S1.81 Use appropriate international system of units (SI) and be able to work with a range of appropriate scales when conducting scientific tasks

S1.82 Convert between SI and non-SI measurement units when conducting scientific tasks

S1.87 Produce data from scientific techniques, which are reliable and verifiable, by:

- recording data and records in a clear and unambiguous way:
  - using appropriate units, notation and correct number of significant figures
  - organising ideas logically and coherently
- selecting and using appropriate digital technology (for example, PC-connected data logger, multimeter):
  - to gather data evidence efficiently (for example, using a temperature data logger instead of multiple manual recordings)
  - demonstrating a secure level of competence and confidence in configuring and using digital devices
- critically reviewing data obtained and repeating investigations where appropriate

S2.20 Select appropriate statistical techniques to analyse and interpret results from scientific tasks:

- mean
- standard deviation
- Chi-square test
- T-test

S2.22 Use the results of calculations and statistical analysis to interpret and evaluate data from scientific tasks to:

- determine trends
- assess statistical validity
- support technical arguments
- draw conclusions
- communicate effectively to a range of stakeholders

Performance outcome (PO) grid

Task	PO1	PO2	PO3	Total
1(a)	23	0	0	23
1(b)	7	5	0	12
Total marks	30	5	0	35
% weighting	86%	14%	0%	100%

Document information

Owner: Head of Assessment Design