

Pearson BTEC Level 3 Nationals Extended Certificate

Applied Science

Unit 3: Science Investigation Skills –
Teacher/Technician notes and guidance –
Confidential

Part P

June 2017

Paper Reference

31619H

Instructions

- This document contains confidential information for centres on the preparation and administration of the **Part A** practical investigation.
- This document should be opened once it is received to allow centres to prepare for the **Part A** practical investigation.
- This document is confidential. It must be stored securely and must not be disclosed to learners.
- This document should not be returned to Pearson.

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Guidance for Teachers/Tutors

Set task

The set task requires learners to carry out a practical investigation in **Part A** and then complete a taskbook in **Part B**.

Both **Part A** and **B** of the task must be completed in the assessment period timetabled by Pearson.

The teacher/technicians notes provided in this document give information on the method for the practical investigation. It is the responsibility of centres to resource and trial the practical investigation prior to it being undertaken by learners in the assessment period.

Any assessment material not required by learners for submission must be collected and held securely by the Exams Office until the EAR deadline at which point they may be recycled or destroyed.

Part A Practical investigation

Learners must not see the teacher/technician notes. A separate **Part A** will be available for learners at the beginning of the assessment period.

The **Part A** task brief provides all the necessary information for learners to conduct the practical investigation and includes a notes page for learners to record their results/observations.

Centres will be required to supervise learners when they carry out the investigation.

Teachers cannot provide guidance during the practical investigation. The practical investigation may take up to three hours depending on the nature of the investigation and it should be completed in the first section of the assessment period.

Learners may work in pairs to conduct the practical investigation, however they must record their set of results/observations independently.

Once learners have completed the practical investigation, teachers must keep the **Part A** taskbook containing learner results/observations secure.

This must be returned to learners when they start **Part B** in the third week of the assessment period.

Learners will need to refer to their results/observations obtained from **Part A** when they complete **Part B**.

Teachers/Technician Notes for the Practical Investigation

Learners must observe safe practice when carrying out practical scientific investigations.

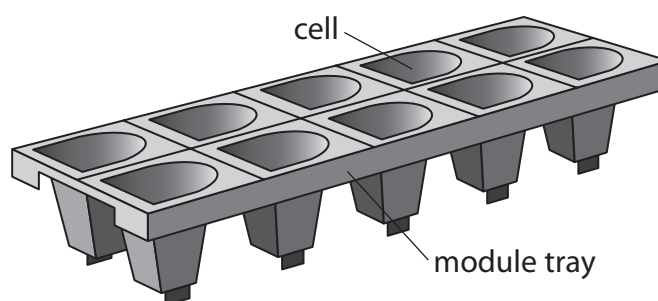
It is the responsibility of centres to carry out risk assessments for all practical investigations.

Technician's list of equipment needed

- Ericaceous compost
- Garden lime (ground limestone)
- Seed plug module trays (minimum of ten cells per pH)
- Seeds, e.g. cress, radish, marigold or all-year round lettuce

Learner's list of equipment needed

- Module trays, labelled A–F
- A calibrated pH probe
- Six boiling tubes and bungs
- Spatula
- Distilled water
- 30 cm ruler with mm increments



Method for technicians

Each learner/pair of learners will need a set of six compost samples with a range of different pH values. These will be the 'soil samples from the small, inner city nature reserve' the learners use in **Parts A and B**.

To make up the samples:

1. Measure the pH of a sample of ericaceous compost.
2. Fill one set of module trays with this ericaceous compost. Label these module trays A.
3. Prepare an additional five samples of ericaceous compost by adding varying amounts of garden lime to give a range of pH values between approximately pH 3 and pH 8.
4. Fill five sets of module trays, labelled B–F, with these additional compost samples.

For each soil pH:

1. Place one seed on top of the compost in each cell.
2. Cover the seeds with a thin layer of the same compost.
3. Water each cell so that the compost is moist.
4. Place the module trays in a suitable light place, e.g. near a window.
5. Ensure the compost remains moist until required by the learners (minimum seven days).

NB Some seeds may not germinate.

Learners will measure and record:

1. the height of the plants
2. the pH of the compost
3. any relevant observations.

Method for measuring the height of the plants

1. Cut each plant off at compost level.
2. Measure the height of each plant using a 30 cm ruler.

Method for measuring the pH of the compost

1. Fill a boiling tube to a depth of 2 cm with compost from module tray A.
2. Add distilled water to the boiling tube until it is two thirds full.
3. Place a bung in the boiling tube and shake ten times.
4. Place a pH probe in the boiling tube and record the pH.
5. Rinse the pH probe with distilled water.
6. Repeat steps 1-5 with compost from module trays B-F, using a clean boiling tube each time.

Write your name here

Surname

Other names

Pearson BTEC Level 3 Nationals Extended Certificate

Applied Science

Unit 3: Science Investigation Skills

Part A

June 2017

Paper Reference

31619H

Instructions

- **Part A** contains material for the completion of the preparatory work for the set task.
- **Part A** should be undertaken over approximately 3 hours across a period of 2 weeks (term time) as timetabled by Pearson.
- **Part A** is specific to each series and this material must only be issued to learners who have been entered to undertake the task in the relevant series.
- **Part B** materials for the set task will be issued prior to the start of the supervised assessment period according to the guidance in the specification.
- This taskbook should not be returned to Pearson.

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Instructions for Teachers/Tutors

This paper must be read in conjunction with the teacher/technician notes and guidance, the unit information in the specification and the BTEC Nationals Instructions for Conducting External Assessments (ICEA) document. See the Pearson website for details.

This taskbook contains the instructions for learners and the set task brief and should be issued to learners at the start of the practical investigation. This taskbook must not be taken out of the classroom.

The practical investigation outlined in the set task brief must be undertaken by learners over approximately three hours during the first section of the assessment period. The practical investigation must be undertaken in supervised conditions.

Centres are free to arrange the supervised assessment period how they wish provided the three hours for completing the practical investigation are under the level of supervision specified, and in accordance with the conduct procedures.

Learners will be expected to conduct a practical investigation and record their results/observations in this taskbook.

Teachers/Tutors cannot give any support to learners during the practical investigation and recording of results/observations.

Learners can work in pairs for the practical investigation, however they must record their own results and observations independently.

Once the practical investigation is completed and learners have recorded their results/observations in the spaces provided, teacher/tutors must keep the taskbooks secure until the start of **Part B**.

Any assessment materials not required by learners for submission must be collected and held securely by the Exams Office until the EAR deadline at which point they may be recycled or destroyed.

Refer carefully to the instructions in this taskbook and the Instructions for Conducting External Assessments (ICEA) document to ensure that the preparatory period is conducted correctly and that learners have the opportunity to carry out the required activities independently.

Instructions for Learners

Read the set task information carefully.

This contains **Part A** of the information you need to prepare for the set task. You will carry out a practical investigation over a period of up to three hours.

You may work in pairs, however you must record your set of results/observations independently in the spaces provided.

Your teacher/tutor may give guidance on when you can complete the practical investigation.

Your teacher/tutor cannot give you feedback during the practical investigation.

You must not take this taskbook out of the classroom at any time and you must hand it in to your teacher/tutor on completion of the practical investigation and write up of any results/observations.

You will use your results/observations recorded in this taskbook, and they will be given back to you when you begin the set task in **Part B**.

Set Task Brief

Please read the following brief carefully before completing the practical investigation.

You must observe safe practice when carrying out the practical investigation.

You are an assistant groundskeeper for a small, inner city nature reserve.

You have been asked to investigate how pH affects plant growth.

You have been given six module trays, labelled A-F.

Each module tray contains soil taken from different areas of the nature reserve.

Each module tray was sown with ten seeds that were left to grow.

Safety information

You may have allergies to plants. Take necessary precautions and make sure you wash your hands after carrying out the investigation.

You will measure and record:

1. the height of the plants
2. the pH of the soil
3. any relevant observations.

Method for measuring the height of the plants

1. Cut each plant off at soil level.
2. Measure the height of each plant using a 30 cm ruler.

Method for measuring the pH of the soil

1. Fill a boiling tube to a depth of 2 cm with soil from module tray A.
2. Add distilled water to the boiling tube until it is two thirds full.
3. Place a bung in the boiling tube and shake ten times.
4. Place a pH probe in the boiling tube and record the pH.
5. Rinse the pH probe with distilled water.
6. Repeat steps 1-5 with soil from module trays B-F, using a clean boiling tube each time.

Record your results/observations in the space provided.

Write your name here

Surname					Other names				
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Pearson BTEC Level 3
Nationals Extended
Certificate

Centre Number					Learner Registration Number									

Applied Science

Unit 3: Science Investigation Skills

Part B

Window for supervised period: Tuesday 2 May 2017 – Monday 8 May 2017 Supervised hours: 1 hour 30 minutes	Paper Reference 31619H
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	Total Marks
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Instructions

- You will need your results/observations from the practical investigation in **Part A**.
- **Part B** contains material for the completion of the set task under supervised conditions.
- **Part B** must be undertaken in 1 hour and 30 minutes during the final week of the assessment period timetabled by Pearson.
- **Part B** is specific to each series and this material must only be issued to learners who have been entered to undertake the task in the relevant series.
- **Part B** should be kept securely until the start of the 1 hour and 30 minute supervised assessment period.
- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

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**Answer ALL questions in Section 1 and Section 2.
Write your answers in the spaces provided.**

SECTION 1

- 1** (a) Record your experimental results of pH, plant height and average plant height in a suitable table, using the space provided.

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(b) State **two** other observations you made about the plants you measured.

(2)

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(c) Describe how you made sure the heights of the plants were measured accurately.

(3)

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(d) Explain how rinsing the pH probe with distilled water made sure you obtained accurate pH measurements.

(3)

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(e) Calculate the percentage error of a plant height measurement you made.

(1)

Percentage error =

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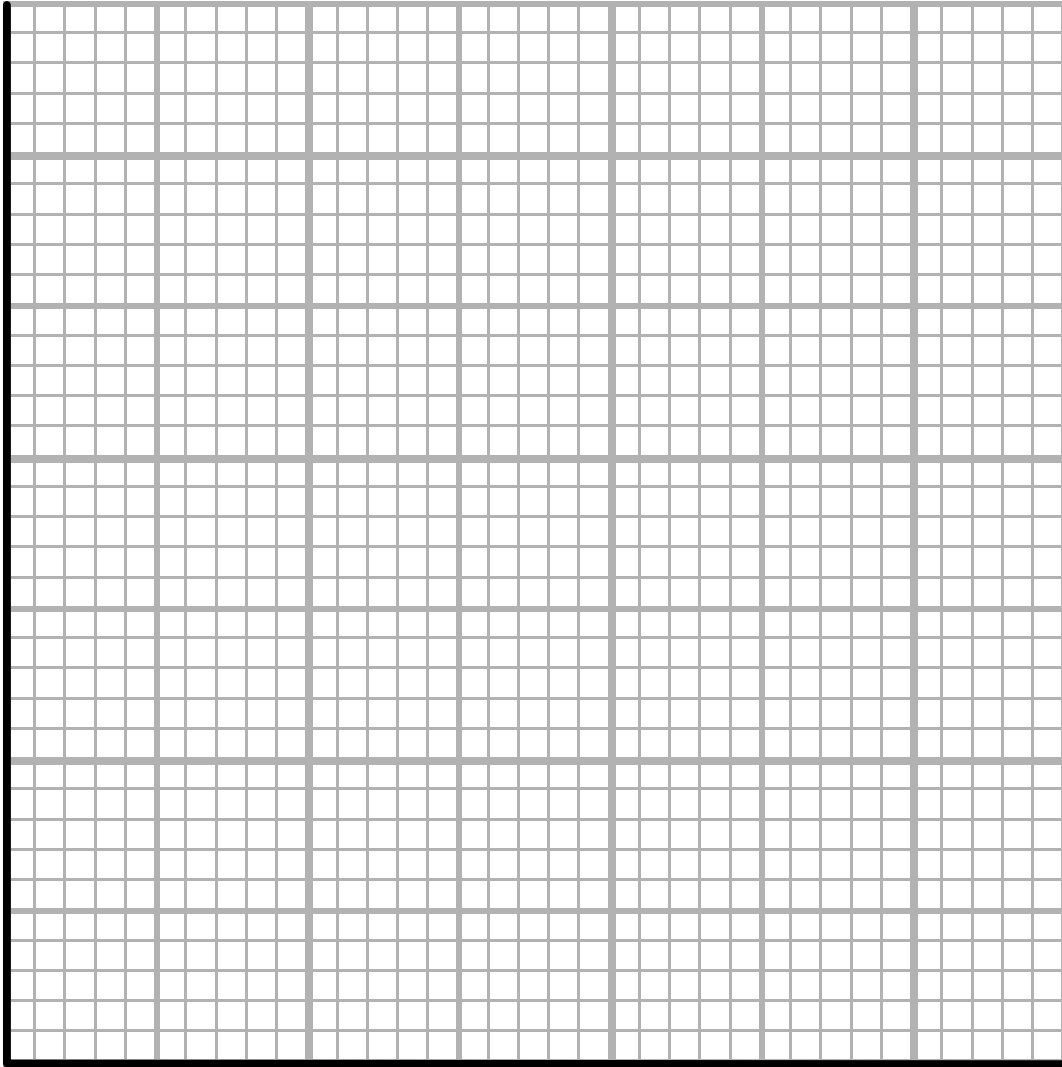
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(f) Plot a line graph of average plant height against soil pH.

(3)



(g) Describe, using the graph, how the change in soil pH affected the height of the plants you measured.

(3)

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(Total for Question 1 = 18 marks)





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- 2 (a) Your colleague carried out a similar investigation on soil from three other areas in the small, inner city nature reserve.

Your colleague planted three seeds in each soil sample.

The table shows the height of the plants grown in these soil samples.

	height of plant (mm)			
	test 1	test 2	test 3	mean
area 1	7.0	9.0	8.0	8.0
area 2	22.0	24.0	26.0	
area 3	12.0	10.0	15.0	12.3

- (i) Calculate the mean for area 2.

Show your working.

(1)

Mean =

- (ii) Calculate the standard deviation for area 2.

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{N - 1}}$$

Show your working.

(5)

Standard deviation =



(b) Your colleague used a quadrat to estimate grass cover in each area.

The percentage grass cover for the three areas is shown in the table.

area	grass cover %
1	25
2	80
3	30

(i) Give **two** reasons why the grass cover might be different in each area.

(2)

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(ii) Your colleague carries out an investigation into grass cover in the small, inner city nature reserve every year.

Their results from previous years meant they expected area 1 to have 35% grass cover.

Complete the table.

(1)

	grass cover %	no grass cover %
observed		
expected	35	

(iii) Determine, using the chi squared test, if the results are consistent with those expected.

$$\text{Use } X^2 = \sum \frac{(O - E)^2}{E}$$

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The chi squared distribution table is given.

		<i>p</i>
		0.05
degrees of freedom	1	3.841
	2	5.991
	3	7.815
	4	9.488
	5	11.070

Show your working.

(5)

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(Total for Question 2 = 14 marks)



3 (a) (i) Weather is a variable that you cannot control.

Explain why this was not a factor in your investigation when comparing the different areas of the small, inner city nature reserve.

(2)

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(ii) Identify **two** other variables in your investigation that cannot be controlled.

(2)

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(b) Explain **two** ways you could extend your investigation to provide stronger support for your conclusions about the effect of soil pH on plant growth.

(4)

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(Total for Question 3 = 8 marks)

TOTAL FOR SECTION 1 = 40 MARKS

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Question 4 begins on the next page



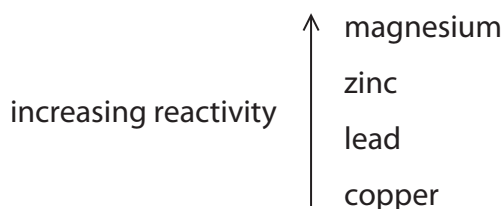
SECTION 2

4 Reactivity of metals.

A more reactive metal will displace a less reactive metal in solution.

This displacement reaction can release thermal energy.

Part of the reactivity series of metals is shown.



You have been asked to write a plan to investigate whether the displacement reactions between these metals and different metal salt solutions release thermal energy.

The metal salt solutions are magnesium sulfate, zinc sulfate, lead nitrate and copper sulfate.

Your plan should include the following details:

- a hypothesis
- selection and justification of equipment, techniques or standard procedures
- health and safety associated with the investigation
- methods for data collection and analysis to test the hypothesis including:
 - quantities to be measured
 - number and range of measurements to be taken
 - how equipment may be used
 - control variables
 - brief method for data collection analysis.

(12)

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Question 5 begins on the next page



5 When metals react with hydrochloric acid, a salt and hydrogen gas are produced.

A learner investigated the reactivity series by reacting metals with hydrochloric acid.

Here is the learner's method:

- place magnesium ribbon in a boiling tube
- add hydrochloric acid
- count the number of bubbles of hydrogen produced
- repeat for aluminium, calcium granules, copper, iron and zinc.

The results of the learner's investigation are shown in the table.

metal	number of bubbles
magnesium	72
aluminium	6
calcium	97
copper	0
iron	19
zinc	46

The learner concludes that the metals in order of reactivity are:

Most reactive calcium
 magnesium
 zinc
 iron
 aluminium
Least reactive copper

Evaluate the learner's investigation.

Your answer should make reference to the:

- method of the experiment
- results collected
- conclusion made.

(8)

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(Total for Question 5 = 8 marks)

TOTAL FOR SECTION 2 = 20 MARKS

TOTAL FOR PAPER = 60 MARKS



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