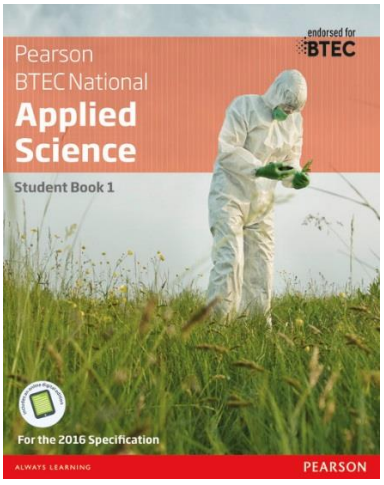
BTEC Level 3 Nationals in Applied Science: Unit 3

Your free sample of the student book: preparation for assessment

(BTEC National Applied Science: Student Book 1 (with ActiveBook),
ISBN: 9781292134093)



Getting ready for assessment

This section has been written to help you do your best when you take your final assessment test. Read through it carefully and ask your tutor if there is anything you are not sure about.

About the test

Before you take the test, you will need to carry out a practical task. You will be given a learner brief, explaining what the investigation is about. Read this carefully so that you fully understand what you are investigating before starting the practical. The learner brief will include a list of instructions for the practical task which you will need to follow in order to obtain a set of results for your final assessment test.

You will not be assessed on your practical competence, but you will need to produce a results table to record all your quantitative data and observations. Make sure that your results table is neat and easy to read, with appropriate headings and correct units. If you have taken repeat readings, calculate averages and record these in your results table.

After the practical session, your tutor will collect in your results table, but this will be returned to you for the final assessment test.

The assessment test will last 1 hour and 30 minutes in total and there will be a maximum of 60 marks available.

For Section A, which will be worth around 50 marks of the 60, you will need to use your results table. This section will consist of a series of structured questions based on the practical task. You will need to process your results, which may include using suitable mathematical techniques and plotting suitable graphs or charts. The structured questions will guide you through what you need to do. You will also be given some secondary data to analyse and evaluate, along with the primary data you have collected.

Section B will involve writing a plan for an investigation. This will not be related to the practical task you carried out for Section A.

All the questions are compulsory and you should attempt to answer them all.

Sitting the test

Read the questions carefully. It is often useful to underline key words in a question to make sure that you do not miss anything important. Lots of marks are lost through not reading questions properly or misunderstanding what the question is asking. Most questions contain command words. Understanding what these words mean will help you to understand what the question is asking you to do. The command words that you are most likely to come across in the test for this unit are shown in the table below.

Command word	Definition
Assess	Consider all the factors which apply and identify which are the most important or relevant. Make a judgement on the importance of something and come to a conclusion about it.
Calculate	Obtain a numerical answer, showing relevant working and if the answer has a unit this must be included.
Compare	Look for similarities and differences between two or more things. The answer must relate to both or all things mentioned and include at least one similarity and one difference.
Complete	Fill in the gaps in a table or on a diagram.
Convert	Refers to conversion of units, e.g. g to kg.
Deduce	Draw or reach a conclusion from information provided.
Estimate	Give a numerical value expected, based on data given.
Evaluate	Review information and bring it together to form a conclusion, drawing on evidence including strengths, weaknesses, alternative actions, relevant data or information. Come to a supported judgement based on scientific reasoning.
Explain	An explanation requires justification of a point. The answer must contain some element of reasoning. This can include mathematical explanations.
Give, state, name	Recall one or more pieces of information.
Give a reason why	When a statement has been made, and you only need to give a reason why.
Identify	Usually requires some information to be selected from given data or resource.
Plot	Produce a graph by marking data points accurately on a grid with a suitable scale and labelled axes. A line of best fit should be drawn through the points.
Predict	Give an expected result.
Record	Write down results or observations, usually in an appropriate results table.
Write	When a question asks for a word or symbol equation.

Revising for the test

The questions in the test are based on skills rather than knowledge, so you will not be expected to recall information.

The best way to revise for this test is to work through the skills sections in this unit, making sure you know the following.

- Everything you need to include when planning an investigation.
- How to record your results in an appropriate table.
- What type of chart or graph is appropriate for each type of investigation, and how to plot a graph with the correct labels and units.
- How to process data using mathematical techniques, including rearranging equations and conversion of units.
- How to evaluate the investigation, by considering the strengths and weaknesses of the method and be able to suggest improvements and further investigations which will improve the reliability of your conclusion.

The following examples will give you an idea of what sort of questions you are likely to get in the test.

A good way to use these would be to try and answer the questions without looking at the model answers. Then look at the model answers and assess your work, making notes on anything you answered incorrectly or omitted from your answers.

Worked example 1, Section A

James is a college student who is taking a foundation diploma in Applied Science. He has been given a practical task to do in preparation for his final assessment test. The following information includes the learner brief explaining the task, the results he obtained and some of the questions he was required to answer in the final test.

Learner brief

You are working for a company which makes light bulbs. You have been asked to do an investigation to see how the resistance of a 6 volt, 6 Watt filament torch bulb varies as the potential difference across the bulb is increased.

You have been given the following equipment:

a variable power pack, a 6 V bulb in a component holder, an ammeter, a voltmeter, 5 connecting leads.

Follow this method to obtain a set of results.

1. Set up a circuit using the equipment provided to measure the current and the potential difference across the bulb.
2. Set the power pack voltage so that the reading on the voltmeter is 1.0 V. Record the reading on the ammeter.
3. Repeat step 2 with potential differences of 2.0, 3.0, 4.0, 5.0, and 6.0 V.

Here are James's results.

1.0 V, 0.52 A, 2.0 V, 0.75 A, 3.0 V, 0.68 A, 4.0 V, 0.92 A, 5.0 V, 0.97 A, 6.0 V, 1.00 A.

Questions

1. Record James's results in a suitable table. Include an extra column for resistance, but leave it blank. (3 marks)
2. Identify a hazard and a risk associated with this practical. What should you do to minimise the risk? (2 marks)
3. Plot a graph of current against potential difference. Draw a circle around any anomalous point. (5 marks)
4. Calculate the percentage errors on the voltmeter and the ammeter for this investigation, assuming the voltmeter measures to the nearest 0.1 V and the ammeter to the nearest 0.01 A. State which measurement would be most likely to affect the accuracy of the results. (3 marks)
5. Use the equation: potential difference = current × resistance ($V = I \times R$) to calculate the resistance in ohms (Ω) for each of James's results and add these values to your results table. (2 marks)
6. Describe the relationship between the potential difference and the resistance for the filament bulb. (1 mark)
7. A graph of current against potential difference for a fixed resistor is a straight line, where the gradient is the resistance. Explain why this is not the case for the filament bulb. (2 marks)

8 The purpose of a light bulb is to convert electrical energy into light energy. Do you think the 6 V filament bulb used in this investigation is energy efficient? Give a reason for your answer. (1 mark)

9 Assess the method for this investigation and suggest improvements you could make to the method, including an explanation as to how you should deal with any anomalous results. (4 marks)

10 Describe how you could extend this investigation, stating how this would improve the reliability of your conclusion. (2 marks)

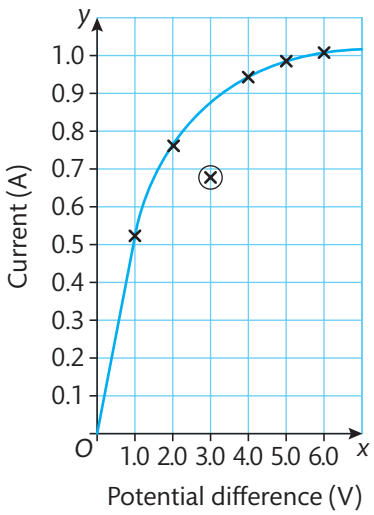
Sample answers

1 and 5

Potential difference / V	Current / A	Resistance / Ω
1.0	0.52	1.92
2.0	0.75	2.67
3.0	0.68	4.41
4.0	0.92	4.35
5.0	0.97	5.15
6.0	1.00	6.00

2. Hazard – the hot light bulb. Risk – may cause skin burns. To minimise the risk do not touch the hot bulb. (Answers referring to the risk of electric shock are also acceptable.)

3.



4. The uncertainty on the voltmeter is ± 0.05 V, so % error = ± 0.05 × 100 ÷ 1.0 = 5.0 %. (Remember to use the ***smallest*** *measurement taken when finding % error.)*

The uncertainty on the ammeter is ± 0.005 A, so % error = ±0.005 × 100 0.52 = 0.96%.

Therefore the voltmeter measurement would be most likely to affect the accuracy of the results.

5. See table. (Note resistance values given to either 1 or 2 decimal places are acceptable.)

6. As the potential difference across the filament bulb increases the resistance increases, but the two variables are not directly proportional.

7. *This is not the case for the filament bulb, because the greater the potential difference across the filament the hotter it becomes. It is more difficult for an electric current to pass through the hot filament so its resistance increases.*
8. *I do not think the 6 V filament bulb is energy efficient because too much energy is wasted as heat.*
9. *I think the method could be improved by increasing the number of measurements taken, e.g. the current could be measured at intermediate voltages of 1.5 V, 2.5 V, etc. This would provide more points for the graph and a more precise best fit line could be drawn. Also two more sets of repeat readings should be taken for all measurements, allowing the bulb filament to cool down between sets of readings. Averages should be taken before plotting the graph and error bars could then be included when plotting the graph. If a particular result appears to be anomalous, a further current measurement at this voltage should be taken. The anomalous result should be ignored when working out the average.*
10. *I could extend this investigation by repeating it using different filament bulbs with different voltages and powers, e.g. I could use a 2.5 V torch bulb and a 12 V ray box bulb. If these bulbs follow the same pattern and give graphs with the same shape, this would improve the reliability of my conclusion.*

Worked example 2, Section B

You have been provided with the following fuels:

petrol, paraffin, engine oil, cooking oil, runny honey.

A small ball bearing dropped through a liquid will travel at different speeds depending on the viscosity of the liquid.

You are to plan an investigation to compare the viscosity of the different fuels. (10 marks)

Your plan should include the following details.

- A hypothesis.
- Selection and justification of equipment or techniques or standard procedures.
- Hazards and risks associated with the investigation.
- Independent, dependent and control variables.
- A method for data collection and analysis to test the hypothesis, including:
  - the quantities to be measured
  - the number and range of measurements to be taken
  - how apparatus may be used.

Sample answer

Hypothesis

The greater the viscosity of the fuel the less runny it is and the more slowly the ball bearing will travel through it.

Equipment

A long tube (or tall measuring cylinder) to contain the fuel. This needs to be long enough so that the ball bearing does not reach the bottom too quickly making timing inaccurate.

A stopwatch to time how long it takes for the ball bearing to fall through the fuel.

A small ball bearing, which will not travel too quickly through the fuel.

Hazards and risks

The fuels are a hazard as they are flammable and could irritate the eyes.

Risk of fire and irritation if they get into the eyes.

Keep the fuels away from naked flames.

Wear safety goggles so that the fuels do not get into the eyes.

Variables

Independent variable – the type of fuel

Dependent variable – time taken for ball bearing to travel through fuel

Control variables – size and mass of ball bearing, height of fuel in tube, temperature of fuel

Method for data collection

1. Make a mark near the top of the tube (or measuring cylinder).
2. Fill the tube up to the mark with the first fuel.
3. Drop the ball bearing into the fuel and at the same time start the stopwatch.
4. Stop the stopwatch when the ball bearing reaches the bottom of the tube.
5. Repeat this twice more with the same fuel to make sure results are reliable.
6. Repeat steps 2 to 5 with the other four fuels.
7. Take averages of repeat readings and plot a bar chart of the results.