Practical lesson 9.9 Acceleration due to gravity by linearising time-displacement graphs

Recommended teaching time for this lesson: 1 x 60 minute period

• 25 minutes of explicit teaching (including suggested classroom activities)

• 35 minutes of practical work

• 15 minutes homework

Curriculum links

Science understanding

* Interpret experimental data to determine the value of acceleration due to gravity on the Earth’s surface.

Science inquiry

* Linearise a dataset that suggests a non-linear relationship (e.g.$ t^{2} versus s$) and calculate the equation of the linear trend line.

Advice for teaching this lesson

Things to know before you start teaching

A risk assessment and lab technician notes are available for this practical.

Risk assessment

Lab technician notes

A video demonstration is also available.

Video demonstration

Preparation

Consult with your lab technician on the minimum time required by your school prior to teaching this lesson, as materials may need to be ordered or prepared.

Ask students to read through the practical and risk assessment as homework prior to the practical class. You may also ask students to watch the video demonstration.

Potential difficulties

* Students should practice several times with recording when the ball starts and stops. Teamwork for dropping the ball can make for a good start accuracy, however the end point can have some error due to ‘predicting’ when the ball will land and hitting stop preemptively.

Other considerations

Suggest that students prepare a spreadsheet with a graph ready for data entry, including the linear transformation in Step 5 of the analysis. This will allow students to observe if their data shows any anomalies as they perform the experiment.

Expected results

Displacement vs time squared should be a linear relationship. This means that the larger times will increase displacement exponentially. Sub 1 metre displacements will have very low time values.

Starter activity: Practical overview

Approximate time: 5 minutes

**Activity placement:** Place directly above “Aim”

**Activity summary:** An overview of the purpose of the practical.

Notes for the teacher

Read the aim out loud and relate it to the science understanding subject matter students have been learning about.

Instructions for students

* Think about what you will learn by doing this practical activity.

Practical: Method and safety discussion

Approximate time: 10 minutes

**Activity placement:** Place directly above “Method”

**Activity summary:** A run through of the practical method and discussion of any safety considerations.

Notes for the teacher

Run through the method with students.

Students should have reviewed the risk assessment as homework prior to this lesson. Ask them to identify the safety considerations. Prompt students until all considerations have been identified.

Remind students of best practice to ensure safety in the laboratory or classroom.

Instructions for students

* Listen to your teacher run through the practical method.

Discussion questions

1. What are the key safety considerations for this practical?
2. What measures should you take to protect yourself and others?
3. What are the disposal methods for the materials you will be using?

Helpful hints

* Refer to this practical’s risk assessment to help you answer the questions.

Risk assessment

Answers

1. Objects may be falling from large distances and could hit someone.
2. Dropper or student on the ground should be able to visually confirm no-one is about to walk into the drop zone.
3. No disposals.

Practical: Results discussion

Approximate time: 10 minutes

**Activity placement:** Place directly above “Discussion”

**Activity summary:** A class discussion about the results.

Notes for the teacher

Instruct students to complete the discussion questions in their logbooks.

During the last five minutes of class come together to discuss the results of the practical, including identification of errors, mistakes and anomalies, and clarification of any misconceptions.

Assign any incomplete questions for homework.

Instructions for students

* Answer the Results and Discussion questions.
* Consider your results and identify any suspected errors, mistakes and anomalies.
* Discuss these with the rest of the class.