

# WJEC (Eduqas) Physics A Level

## SP1.6a - Measurement of $g$ with a Pendulum

### Practical Flashcards

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What is the name given to motion of a simple pendulum?



What is the name given to motion of a simple pendulum?

Simple pendulums oscillate with simple harmonic motion.



# What is 'g'?



## What is 'g'?

'g' is the gravitational field strength, in our case on the surface of Earth.

The accepted value for 'g' is  $9.81 \text{ N/kg}$



What is relationship between a pendulum's time period and its mass?



What is relationship between a pendulum's time period and its mass?

The time period of a pendulum is independent of its mass.



State the equation used to calculate the time period of a pendulum.





State the equation used to calculate the time period of a pendulum.

$$T = 2\pi \sqrt{\frac{l}{g}}$$



If the length of a pendulum is quadrupled, how will its time period change?



If the length of a pendulum is quadrupled, how will its time period change?

The time period of pendulum is directly proportional to the square root of its length. This means that if the length is quadrupled, the time period will double.



What two conditions must be met when carrying out a simple harmonic motion experiment involving a pendulum?



What two conditions must be met when carrying out a simple harmonic motion experiment involving a pendulum?

1. The amplitude of oscillation should be small
2. The pendulum should oscillate in a straight line



Why must the oscillations only be small when carrying out this experiment?



Why must the oscillations only be small when carrying out this experiment?

The equations are derived using a small angle approximation ( $<10^\circ$ ) and so only apply for relatively small displacements.



How should you measure the time period of an oscillating simple pendulum?





How should you measure the time period of an oscillating simple pendulum?

Measure the time taken for the pendulum to complete 10 full oscillations. Repeat this measurement three times and then calculate an average time. Divide this average by 10 to ascertain the average time period for one oscillation.



What could be added to your apparatus to help measure the time period more accurately?



What could be added to your apparatus to help measure the time period more accurately?

A fiducial marker, such as a small pin, could be added at the centre of oscillation to show exactly when an oscillation has been completed.



When plotting a graph of  $T^2$  against  $L$ , what does a straight line passing through the origin demonstrate?



When plotting a graph of  $T^2$  against  $L$ , what does a straight line passing through the origin demonstrate?

A straight line through the origin shows that  $T^2$  is directly proportional to  $L$ .



How could gravitational field strength be estimated from a graph of  $T^2$  against  $L$  for a simple pendulum?



How could gravitational field strength be estimated from a graph of  $T^2$  against  $L$  for a simple pendulum?

$$T^2 = \frac{4\pi^2 L}{g}$$

'g' is therefore given by  $4\pi^2/\text{gradient}$



How can the uncertainty of  $T^2$  be calculated from the uncertainty in  $T$ ?





How can the uncertainty of  $T^2$  be calculated from the uncertainty in  $T$ ?

When raising a variable to a power, the new percentage uncertainty equals the percentage uncertainty of the original variable, multiplied by the power. This means that the percentage uncertainty for  $T^2$  is twice that of  $T$ .



How can the percentage uncertainty in your graph gradient be calculated?



How can the percentage uncertainty in your graph gradient be calculated?

$$\frac{| \textit{best gradient} - \textit{worst gradient} |}{\textit{best gradient}} \times 100\%$$

Where the 'best gradient' is the line of best fit for your results and the 'worst gradient' is the most unlikely line of best fit that is still plausible.



How can you calculate the percentage difference between your value of 'g' and the true value?



How can you calculate the percentage difference between your value of 'g' and the true value?

$$[\text{Your Value} - 9.81]/9.81 \times 100\%$$



What safety precaution should be taken when hanging a pendulum from a clamp stand?



What safety precaution should be taken when hanging a pendulum from a clamp stand?

A counterweight or G-clamp should be used to provide a counter moment on the clamp stand so as to prevent it from toppling.

