

# WJEC (Wales) Physics A-level

## SP3.2b - Investigation of the Damping of a Spring

### Practical Flashcards

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# What is damping?



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Damping is the removal of energy from a system, resulting in the amplitude of the oscillations reducing.



What equation demonstrates how the amplitude of a damped spring's oscillations vary with time?



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$$A = A_0 e^{-\lambda t}$$



What is the advantage of taking logarithms before plotting the graph of an exponential relationship?



What is the advantage of taking logarithms before plotting the graph of an exponential relationship?

If logarithms are taken, exponential trends are plotted as straight line graphs. This makes these trends more easily identifiable. Furthermore, the equation of a straight line can then be used to ascertain results that have not been experimentally determined.



What logarithmic equation links the amplitude of oscillations and time?





What logarithmic equation links the amplitude of oscillations and time?

$$\ln A = -\lambda t + \ln A_0$$



What is the expected shape of a graph of  $\ln(A)$  against time?



What is the expected shape of a graph of  $\ln(A)$  against time?

A graph of  $\ln(A)$  against time should form a straight line graph with a gradient of  $\lambda$  and a y-intercept of  $\ln(A_0)$ .



When hanging a mass-spring system from a clamp stand, what safety precaution should be taken?



When hanging a mass-spring system from a clamp stand, what safety precaution should be taken?

A counterweight or G-clamp should be attached to the base of the clamp stand to provide a counter moment preventing the stand from toppling.



What safety precaution should be taken when adding masses to a spring?



What safety precaution should be taken when adding masses to a spring?

Safety goggles should be worn in case the spring snaps. It is also important to ensure you never stand with your feet directly below the masses in case they fall.



How can additional damping be added to a mass-spring oscillator?





How can additional damping be added to a mass-spring oscillator?

A piece of card can be added to the mass hanger. This will damp its oscillations by increasing the air resistance that acts on it.



In what direction does a damping force act?



In what direction does a damping force act?

Damping forces act to oppose motion.

Therefore they act in the opposite direction to the direction of movement of the oscillating system.



If a system experiences no damping, how will the oscillations vary over time?



If a system experiences no damping, how will the oscillations vary over time?

Without damping, the oscillations of a system would carry on infinitely and the amplitude would remain constant.



Why does the amplitude of the oscillations in our experiment decrease even without a damping card attached?



Why does the amplitude of the oscillations in our experiment decrease even without a damping card attached?

The oscillating system will still experience some damping in the form of air resistance and friction.

These forces remove energy from the system over time, and causes the amplitude of oscillation to decrease.



Describe the difference in the decay of amplitude for a system with and without a damping card attached.





Describe the difference in the decay of amplitude for a system with and without a damping card attached.

Both systems will decay over time, but the system with the damping card will experience greater damping and so its amplitude will decrease at a faster rate.



How can technology be used to improve the accuracy of your amplitude measurements?



How can technology be used to improve the accuracy of your amplitude measurements?

Instead of reading the amplitudes from a metre ruler, a motion sensor connected to a data logger could be used. This will increase the accuracy of your amplitude measurements.



How can the uncertainty in your repeat readings for amplitude be calculated?



How can the uncertainty in your repeat readings for amplitude be calculated?

The uncertainty in oscillation amplitude can be estimated as half the range of the repeat readings.

