



Getting Ahead – Pre-course Work

#ThinkBrock

Physics A Level

Welcome to **Physics**. In preparation for the start of the course, please complete these tasks and have them with you to hand in during your first week of college in September.

These tasks should take you approximately four and a half hours to complete and are designed to give you an introduction to the subject, and the expectations we have for you to complete at least four and a half hours of independent study, per subject, per week.

Mechanics

One of the first topics we will study is mechanics.

Check out these **Minute Physics YouTube videos** which will really get you thinking about how things move! (...and don't worry if you cannot follow all the theory because these videos go beyond the scope of the A Level syllabus.)

The physics of car crashes

<https://www.youtube.com/watch?v=v9ML4GA47Rg>

After watching this video, try to answer these questions:

1. It states in the video that a 2 tonne car, moving at 60kph has a kinetic energy of 280 kJ. Look up the SI unit for mass and speed and convert the data given into SI units. Then use the formula for kinetic energy ($\frac{1}{2}mv^2$) to confirm this value.
2. How much kinetic energy does the same car have when driving at half the speed? It is not half the previous energy – why not?
3. It states in the video that an elephant which falls from a height of 10m will also have 280kJ of energy. What is the mass of the elephant that they are referring to?

How do bikes stay up?

<https://www.youtube.com/watch?v=oZAc5t2lkvo>

In the video they described how the front wheel turns when the bicycle leans, steering the lower part of the bicycle back underneath the centre of mass. The stick person in the picture below is leaning into a turn at constant speed when skiing. Think about:

1. What forces act on the person?
2. Whether those forces are balanced?
3. Whether the person accelerates and if so...
4. In which direction and why leaning over is unstable when at rest, but necessary when turning at speed.



Even if you don't come up with definite answers, thinking about all this will make you a better physicist.

Hitting the Sun is hard

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<https://www.youtube.com/watch?v=LHvR1fRTW8g&t=9s>

This video should make you think about orbits.

1. What causes planets to orbit the Sun and why do planets further from the Sun orbit more slowly?
2. To move a satellite from a low orbit into a higher orbit requires an energy input, so where has this energy gone if it ends up moving more slowly?

How long to fall through the Earth?

This is a slightly harder video to follow but will give you an idea of how we will incorporate gravitational fields into our mechanics in the second year:

<https://www.youtube.com/watch?v=urQCmMiHKQk>

You probably didn't follow all the maths in this video (although you will be able to by the end of A-Levels if you study hard!). However, what you can appreciate is the way they made simplifying assumptions so they could model the situation to see what could happen (they assumed the Earth had constant density) and then refined their model afterwards. In physics we do this all the time!

1. Think of some assumptions you have made when working on physics problems (you probably ignored air resistance sometimes, for example) and how you know when it is OK to make these simplifications.
2. Can you ignore air resistance on a ball being thrown in the air by a juggler, and still get a fairly accurate answer if you calculate the maximum height the ball can reach?
3. What about a ball hit by a professional tennis player?
4. What about ignoring the air resistance on a parachute or an aeroplane?

Getting Equipped

Textbooks

We recommend the CGP books for AQA A Level Physics as shown below. These will be available to purchase from us at the start of term and are an essential requirement of the course.

