

## Engineering – Cambridge Technical Extended Certificate

Engineering involves the application of both maths and physics to solve problems in the real world. It would be advisable to brush up your maths skills (with a special focus on rearranging equations) before starting the course. Work through some of the areas you are less confident about at a GCSE revision site, for example, BBC bitesize below:

<https://www.bbc.co.uk/bitesize>

### Online courses

The following free online courses from the University of York give a good introduction to engineering.

- Learn more about the fascinating world of engineering, and discover where an engineering degree could take you. **(12 hours)**  
<https://www.futurelearn.com/courses/creating-the-amazing-engineering-the-future>
- Discover how critical raw materials are found and used, and explore their role in contributing to a more sustainable future **(16 hours)**  
<https://www.futurelearn.com/courses/technology-metals-for-a-green-future>
- Learn how to make flexagons - beautiful and unique paper constructions - and explore the math behind them. **(6 hours)**  
<https://www.futurelearn.com/courses/flexagons>

### Online Videos

A search on YouTube for “theengineerguy” will get you his superb general engineering videos. Particularly the ones listed below which are worth watching a few times:

- Black box: Inside a flight data recorder  
<https://www.youtube.com/watch?v=xIY5W7be5jU>
- How smoke detectors work  
<https://www.youtube.com/watch?v=oFUUQcpGR3k>
- NERF Blaster: Air Restriction Mechanism  
<https://www.youtube.com/watch?v=qCxco6227xo>
- Plastic Injection Molding  
<https://www.youtube.com/watch?v=RMjtmsr3CqA>
- Apollo: The Alignment Optical Telescope  
<https://www.youtube.com/watch?v=hVCNS2jQQ6g>
- Careers In Engineering  
<https://www.theengineer.co.uk/careers-engineering-first-steps/>

## Engineering – Cambridge Technical Extended Certificate

These are to be completed before your first Engineering lesson in September. You will need your answers in that first lesson, so don't forget to bring them in with you!

3.1 Rearrange the following equations to make the variable in brackets the subject:

(a)  $p = mv$  ( $m$ ) (f)  $M = Fd$  ( $d$ )

(b)  $Q = It$  ( $I$ ) (g)  $V/R = I$  ( $R$ )

(c)  $v = s/t$  ( $s$ ) (h)  $P/I = V$  ( $P$ )

(d)  $F = ma$  ( $a$ ) (i)  $v = f\lambda$  ( $\lambda$ )

(e)  $W = mg$  ( $m$ ) (j)  $\rho = m/V$  ( $V$ )

3.2 Rearrange the following equations to make the variable in brackets the subject:

(a)  $E = mgh$  ( $m$ )

(b)  $P_1V_1 = P_2V_2$  ( $P_2$ )

(c)  $v^2 = u^2 + 2as$  ( $a$ )

(d)  $\sin(c) = 1/n$  ( $n$ )

(e)  $V_p/V_s = N_p/N_s$  ( $N_s$ )

3.3 Make  $v$  the subject of the following equation:

$$E = \frac{1}{2}mv^2$$

3.4 If  $u = 0$ , make  $t$  the subject of the following equation:

$$s = ut + \frac{1}{2}at^2$$

3.5 Make  $\sin(r)$  the subject of the following equation:

$$n = \frac{\sin(i)}{\sin(r)}$$

3.6 Make  $x$  the subject of the following equation:

$$10(x + y) = 5(x - y)$$

3.7 Make  $\lambda$  the subject of the following equation:

$$t = k/\lambda$$

3.8 Make  $r$  the subject of the following equation:

$$F = \frac{kQ_1Q_2}{r^2}$$

3.9 Make  $T$  the subject of the following equation:

$$r \left( \frac{2\pi}{T} \right)^2 = \frac{GM}{r^2}$$