

RIVERS TRANSITION CHALLENGE 2025

SUBJECT: Engineering

Course details: City and Guilds

Qualification: Level 3 Advanced Technical Certificate in Engineering

Minimum entry requirement is: Grade 4 English, Grade 4 Maths.

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YOUR CHALLENGES:

**Challenge 1: Classes and Properties of Materials**

This is a research and report task.

1. Research the following types of materials, give any information you find about their properties and their typical applications in engineering

Ferrous metals:

low, medium and high carbon steels

stainless steels

cast irons

Non-ferrous metals:

aluminium and its alloys

copper, brass and bronze

nickel

titanium

Non-metallic materials:

plastics (thermosetting, thermoplastic and elastomers)

composites

ceramics

Smart materials:

shape memory (metal alloys and polymers)

thermochromic and photochromic pigments

piezoelectric.

1. Research these properties and terms and write a definition for each of these and give the unit if there is one. For each property and term please give an example of a material or application where it is important

I have completed the first one as an example

Strength (tensile). **Tensile strength** is a measurement of the force required to pull something such as rope, wire, or a structural beam to the point where it breaks. The **tensile strength** of a material is the maximum amount of **tensile stress** that it can take before failure, for example breaking. Unit is N/m2. It is very important in material science. It is also vital for construction safety and personal safety, both during and after the building is completed.

Mechanical properties:

strength (tensile)

strength (compressive)

hardness

toughness

brittleness

malleability

ductility

elasticity

plasticity

Physical properties:

conductivity (thermal)

conductivity (electrical)

density

specific gravity

specific heat capacity

Key terms:

corrosion resistance

creep

fracture

hardenability

magnetism

fluidity

fusibility

weldability

porosity

**How this links to the specification: Unit 301**

**1. Know the properties and characteristics of engineering materials**

**Time guide: 4 hours**

**Assignment deadline: first day of term.**

**EXEMPLARS: There is an example on the document**

**SUPPORT:** [**https://mechanicalc.com/reference/engineering-materials**](https://mechanicalc.com/reference/engineering-materials)

**Challenge 2**: **Engineering Design**

Complete an investigation into each of the following topics. You must select one specific item from each topic and explain how it has contributed to social and economic development since it was invented. You must make reference to when and who invented/developed it, how it is made and current and possible future developments we see in the sector. This covers a range of engineering principles and theories from the 19th, 20th and 21st centuries.

Topics:

* steam engine and railways
* development of steelmaking
* electrical power and the light bulb
* the internal combustion engine
* replaceable parts and mass production
* television and radio
* automated machines and robotics
* computer and internet
* nanotechnology

**How this links to the specification: Unit 305: Engineering Design, Topic 4.1**

**Time guide: 6 hours**

**Assignment deadline: first day of term.**

**EXEMPLARS:** You will be tested on your research ability and your presentation skills, as well as accurate content knowledge. You can use any means of presentation for this task (paper, google docs, slides, video, posters, this list is not exhaustive). For this reason, I will not be providing an exemplar as I wish to see your current level of ability and the level at which you will be putting effort into the work. If you require guidance, please email.

**SUPPORT:** Use the internet to search for your information. YouTube will also have many documentaries and clips to aid you. Example: <https://www.youtube.com/watch?v=Hz-wh_TvIug>

HOW DO I HAND IN?

Your work must be handed in on the first day of term so that it can be assessed and marked accordingly.

HOW AM I MARKED?

You are graded using Pass, Merit and Distinction and Distinction\*. The tasks are tricky because it’s Sixth Form and KS5 study and there is a big jump. You will need to spend significant time learning the concepts and techniques.

We would expect new students to any course to be sitting at the bottom of the grading structure, but there are certain activities that you will be familiar with and will do better with even though it's just the start of the course.

WHAT IF I GET STUCK?

Then email me, our emails are in the title of this sheet, we know some things are tricky and are here to help!

WHAT IF I MISS A DEADLINE OR DON’T HAVE I.T?

We are giving you the summer to complete this.  Time management is important if you are going to be successful at Key Stage 5.  Enjoy your summer but also remember that these tasks are to prepare you for September and make sure you feel confident on the courses you have chosen.  Do not leave it until the last minute.  Throughout the school year, you must speak to us in advance if you are going to miss a deadline.  We know people are sick, and sometimes we have other commitments but usually work that isn’t complete is down to students waiting until the last minute and then not having enough time to understand or complete the task. If you email us in advance, we can support you.