Dear 6M,

Great to hear from you again.

You tested rockets? That is very cool. What kind of rockets did you make and how heigh did you manage to get them? I enjoyed watching the SpaceX launches, the space exploration company run by Elon Musk, which shows that even the best designed rockets have varying degrees of success.

This is a link to the only Falcon 9 failure to date (<https://www.youtube.com/watch?v=OAX7UFd70M8>). This was just a cargo run so nobody was hurt but it’s an interesting explosion and it took a long time for engineers to work out what happened.

I have done my best to answer your questions:

• Do you have to wear any special type of clothing for your work?

I do. I wear safety boots which have a metal cap to protect my feet if I drop something heavy. When I’m making circuits, I wear goggles to protect my eyes from bits of wire or hot bits of metal. If I’m working with very hot metal (which is quite rare) I wear heat proof gloves. I do not need to wear a lab coat in my job because we don’t work with chemicals that will spill.

• What special equipment to do use? [I have included some pictures to illustrate]

I use A LOT of special equipment and a lot of my job is made up of learning how to use special equipment and computer programs.

The key piece of equipment (apart from my computer) that I use a lot is a **soldering iron** [solderingiron.jpg]. I use this to add metal called solder to circuit boards like the one in the picture or prototyping boards. The soldering iron melts the metal onto the “pads” of the board. This means that electricity can then flow through this joint. Another soldering tool I use is a **solder bath** [solderbath.jpg]. This is a lot of solder (the silver material in the image), that is melted all at once. You then dip your board in there and it solders all the exposed pads all at once. This is a dangerous machine, and you need to wear goggles and heatproof gloves.

I also use a **multimeter** [multimeter.png]. This can be used to measure electrical properties like resistance, voltage, current and connectivity. Perhaps you used one for making your circuits? For example, to measure voltage in a battery: you press the black probe (the black stick shown in the picture) to the ground of the circuit (where there is the least voltage), in a battery this is the negative end and the red probe to the positive end of the battery. This will then tell you how many volts the battery has. Voltage (as you may know) is the force that pushes electricity around the circuit.

I also use an **oscilloscope** [oscilloscope.png]which shows you the shape of an electrical signal and how it changes over time. For example, to know when a button was pressed.

Because I work at a company that makes **drives**, I use a **drive** and **motor** a lot at work [drive.png]. The drives are on the left of the image and the motor on the right. The drive spins the motor in a specific way so that it can perform precision tasks and make the system more efficient. The motor can spin very quickly so hair needs to be tied up when using it. The large amounts of electricity that some motors use means they need to be placed inside a safe box where they can’t be touched to avoid an electric shocked.

• What inspired to you embark on an engineering career?

I remember watching documentaries and hearing presentations at school about climate change which inspired me to care a lot about the environment which I still do today. When I thought about what I wanted to do with my career I knew I wanted to do something which would mean I saved more energy than I used. I used to live in the shadow of 3 power stations (Drax, Eggborough and Ferrybridge) and I would see them pumping out CO2 all day long and it frustrated me. I decided I wanted to work on renewable electricity and to do that you need to be an electrical engineer. I also really enjoyed science and maths at school which means that I enjoy the work I do as well as feeling that it is morally right.

• What is the best thing you have designed as an engineer [car.mp4 and remote.jpg]?

When I was in university, I designed a remote-control car that used a camera to follow a line shown in the video. It worked well and went very fast. We then used the cars to play football by remote controlling using the remote in the picture them which was very fun.

• How many years do you need to train to become an engineer?

There are many ways to become an engineer but the way I did was: GCSEs (2 years), A-Levels (2 years), master’s degree at university (4 years), Chartership Program (5 years). To become a chartered engineer (which I am working towards), you need to get an extra qualification that says you have a certain amount of experience called Chartership. You don’t need this to be an engineer though but it just verifies that you’re experienced enough to work on the cooler projects. If you do all that starting from GCSEs through to chartered engineer it would be 13 years.

• What has been your toughest challenge yet and how did you overcome it?

There are not many women in my line of work at the moment, in fact the UK has the fewest number of female engineers in Europe (only 12% of all engineers are women). This did cause me some problems at university and high school where men questioned how good I was at my work, commented on my appearance and ignored my input. This was by no means the majority of the people on my course but the bad apples always stand out the most. I overcame this by continuing to work hard and getting good marks, ignoring comments, and looking for support from members of staff at the school who where always kind and understanding.

• Are you scared to make mistakes?

I am always a bit dubious when I turn on the power switch. When smoke comes out a component you can’t put the smoke back in. However, I always work in a safe manner, so I don’t feel scared for my safety. My manager is very supportive and nice, and he understands that mistakes are part of the learning process and that if something does go wrong, if I am safe, that it is just a teaching opportunity. Any designs I make are checked and double checked, first by me and then by senior engineers, this means any product you use will be very safe so I’m not scared my mistakes will hurt anyone else.

• Is engineering still a male-dominated career or are more women now going into it?

It is but more women are going into it 25.7% more to be precise compared to 2017. My branch of engineering (electrical and electronic) as the worst gender divide: There are only 4 female engineers in my office out of 60 engineers and I was one of 10 women out of 110 at university. I’m not sure why my job isn’t more popular with women because I really enjoy my job. The women that I have met through my engineering career are some of my best friends and I work with a couple of them. We support each other to make sure we all continue with our engineering careers. The culture in my office is very supportive and everyone I have met is encouraging, and always has the time to explain something to you. I do not feel like a stand out or people think I am worse at my job because I am a woman. I hope perhaps that some of you, men or women, would consider being an engineer who could support women engineers especially during school and university.

I know this is a bit of a long letter and I hope you found it interesting. I look forward to hearing back from you and hearing more about what you get up to in your science and maths classes.

From Kitty 😊