**Script – Game 3 (Chemistry)**

**Welcome**

Welcome to the chemistry lab, today you are going to be creating different types of fuel for an aeroplane. You have 3 options: Sustainable Aviation Fuel (SAF), hydrogen, or a lithium battery. You will be learning about the different types of energy and finding out more about aviation! Head through the doors for the next step.

**Task**

Behind each door is a different fuel type that you will be making. Pick which one you want to try and head into that room. Each type is made in a different way, maybe you will be constructing the element, or breaking down an existing item to see what it is made of. Go ahead a pick your door.

**Job Role NPCs**

**Liquid Hydrogen System Engineer –**

I design the hydrogen systems and the related components such as pumps, valves, or heat exchangers. I drive the integration while ensuring safety when using cryogenic liquid and pressurised gaseous hydrogen.

Ways in –

Degree in engineering, science, or Level 6 Apprenticeship

Relevant school subjects –

Chemistry, Sciences, English, Maths

Key skills –

Research, Experimentation, Cryogenics, Technology, Communication, Project Management,

Habitat –

Laboratory

**Sustainable Aviation Fuel Engineer –**

I design and develop sustainable fuels and systems including all the related components for the aircraft industry.

Ways in –

Degree in engineering, science, or Level 6 Apprenticeship

Relevant school subjects –

Chemistry, Sciences, English, Maths

Key skills –

Research, Experimentation, Technology, Communication, Project Management

Habitat –

Process plants, Laboratory

**Airport Technician –**

I am responsible for checking the aircraft when it comes into land. I clean the windscreen, check for damage and defects, check the oils, and refuel the plane. I am also the person who marshals the aircraft by waving the flags in the air that you see at airports.

Ways in –

Direct application, vocational qualifications, apprenticeship.

Relevant school subjects –

No minimum requirement.

Key skills –

Good eye for detail, enjoy working outdoors in all weathers, documentation and reporting.

Habitat –

Airport, runway.

**Electrical Engineer –**

I produce system diagrams and circuit diagrams. I perform detailed computer aided designs in specialised software whilst ensuring that they are all designed to electrical safety guidelines and engineering design rules.

Ways in –

Apprenticeship, Degree in Electrical Engineering.

Relevant school subjects –

Maths, Science, T Levels, Electrical Engineering.

Key skills –

Research, Technology, Testing, Innovation, Curiosity, Analysis, Applied Mathematics.

Habitat –

Manufacturing Plant, University, Research Centre.

**HYDROGEN TASK**

Hydrogen task NPC –

You are going to be finding out about and making hydrogen. Hydrogen is the most abundant chemical substance in the universe! It is also the lightest element in the periodic table. To begin with we need you to go and get some water. Click the button for the next step!

Did you know –

Hydrogen is the chemical element with the symbol H and atomic number 1. It was discovered by English chemist and physicist Henry Cavendish in 1766. Our Sun produces energy by fusing hydrogen into helium.

Hydrogen task NPC –

Use the ‘bucket’ button below to get a bucket and go and collect water for us. Once you have some, return here and click the ‘Next Step’ button to continue!

Hydrogen task NPC –

Place the water into this material reducer to see what elements make water. Take the elements out and put them into your inventory, and when you are done click the button below to go to the next step. Hint – you may need more than you think!

Did you know –

The chemical formula for water is H2O, meaning each molecule contains one oxygen and two hydrogen atoms, connected by covalent bonds.

Hydrogen task NPC (by plane) –

Now you have Hydrogen and Oxygen, you can place these into the fuel cell behind you. Climb the stairs and read the instructions. If it has all been done correctly, you will be able to see the turbine spin on the engine of the plane behind me. You can also explore this room to see how it works!

Board –

Put the Hydrogen and Oxygen into the chest above, to get the turbine running.

Hint – You may need more than you think. You can use the NPC in here to go back to the beginning and get more water, then more elements!

Insert fuel in the chest and then pull to activate Hydrogen Fuel Cell.

The fuel cell has enough fuel when the two torches under the glass go dark.

Look below to see if the torches have gone dark!

Warning! Clean zone all items will be removed

You can check the progress of the fusion by going in here.

Back to start

Click the button to go back to the beginning of the game.

Back.

**SAF TASK – (Sustainable Aviation Fuel)**

SAF task NPC –

You are going to be creating SAF, which is a fuel produced through contemporary processes from biomass, rather than by geological processes involved in the formation of fossil fuels. Biomass is the raw material the fuel is made of, such as wood logs. Go and collect biomass by clicking the button.

Did you know –

SAF is a biofuel that can be produced from plants, or from agricultural, commercial, domestic, and/or industrial waste. The greenhouse gas mitigation potential varies considerably, from emission levels comparable to fossil fuels in some, to negative emissions in others.

SAF task NPC –

You need to collect some wood logs from trees, and some water, which you will break down to make SAF. Use the bucket button below to get a bucket, then go and get water and wood! Once you have some, click the button below for the next part.

SAF task NPC –

Place the logs in the material reducer next to me and take out the carbon elements. Then place the water in the material reducer and take out the hydrogen elements! Once you have your carbon and hydrogen, use the compound creator to create SAF. You will need 9 carbon and 20 hydrogen.

SAF task NPC –

Once you have the SAF, click the button below for the next step.

SAF task NPC –

Well done on getting the fuel, now place it into the item hopper and that will power the turbine on the plane engine behind me!

Back to start

Click the button to go back to the beginning of the game.

Back.

**LITHIUM BATTERY TASK**

Lithium NPC 1 –

We need you to make Lithium, Iron, Oxygen, Phosphorus and Silicon using the element constructor here. Have a look on the walls to find out how to make each one. Once you have them all click the button to go and build a battery!

Ah ha I remember that Lithium is as follows:

Proton = 3

Electron = 3

Neutron = 3

Good work! Off to the element constructor I go.

To construct silicon, I need to understand what number of electrons, protons and neutrons I need.

This is frustrating hmmm… if only someone could work it out for me?

Iron

The proton amount in the element constructor of Iron is 26.

My old professor taught me that for Iron the Proton = Neutron = Electron

What could the Neutron and Electron be?

Electrons = Protons

Neutrons = 16

Proton Number = 15

But what could the protons and neutrons be in the first place?

If only there was a clue around here…

Again all I can remember when Oxygen is mentioned is to construct it the formula is:

Proton = Neutrons = Electrons

Element Constructor

Answers –

3 3 3 = Lithium

26 26 28 = Iron

8 8 9 = Oxygen

15 15 16 = Phosphorus

14 14 14 = Silicon

Lithium NPC 2 –

Well done on getting all the elements. You should have lithium, iron, oxygen, phosphorus, and silicon. Now you are going to use those elements to create a battery and power the plane turbine. Behind me you can find out your next step.

Lithium NPC 3 –

You need to build the battery using this diagram on the wall as a guide. In the chests next to it you will find the last of the items you need. Once you have correctly built the battery, the turbine on the plane outside will start to spin. Good luck!

Signs –

Separators separate the anode and the cathode. It allows the positively charged lithium ions to move through the electrolyte from the anode to the cathode during discharge.

The current collectors carry the current from the anode to the positive terminal and from the cathode to the negative terminal, to be used by the plane.

Build your battery in here!

ANODE

Anode current collector

Circuit breaker – pull once you have filled the battery

Separator

Cathode

Cathode current collector

**Back to start NPC –**

Click the button to go back to the beginning of the game.

Final Task –

Now that you have completed this game it’s time to reflect on your learning and give me some feedback!  You’ll also be able to watch a short video showing how even landfill waste can become a sustainable aviation fuel! Plus, other surprising sources like algae in the sea and cooking oil from our houses.

Learn More

NOT TO BE TRANSLATED:

**Co-ordinates –**

Spawn: 37 83 94

Hydrogen world: 99 128 799

Hydrogen Part 2: 59 83 80

Hydrogen by plane: 278 4 -57

SAF world: 95 132 736

SAF Part 2: 59 83 71

SAF by the plane: 269 17 -59

Lithium room: 53 83 61

Lithium by the plane: 270 4 -63

Plane: 275 5 -66