Chemistry course 1 for KITSAT

It was a shocking day. Screaming headlines, news flashes, reports, talk shows and leaders of the world commenting on the matter. All of them circulating the same topic. Earth will be uninhabitable sooner than anyone has expected. There was nothing left to do. Earth's climate will be uninhabitable in 20 years. First panic spread, people denied the facts while others fell into desperation.

Then one day all of a sudden out of the blue a lifeline is cast. Reports about a newly found planet emerged. Planet that could well be reached with a little bit more advanced space technology and research. The first reports are looking promising but more research of the planet is needed so we can be absolutely sure that in the future we can call this new planet our home. For now we call the planet Hope.



Bliiip! The sound of your phone awakens you from your thoughts. It's a message. The Message is from commander Niemi.

"Don't be late. Big day today. And don't forget to check yourself in when you arrive at the Kitsat compound."



Kitsat. It's a new kind of satellite that mankind has put a lot of hope into. Researchers found a new planet by accident. It's pretty close and the preliminary findings are very promising. Maybe this is a new home for mankind. Kitsat will be the satellite to start the investigations if the planet would be fitting to support life on it.



The bus reaches the compound and you approach the gate. You have been chosen for this project to research this planet from a chemistry point of view. There are also other teams intensely preparing to research the planet. And each team has their own specific approach. and you've been chosen to the chemistry research team.





You reach the gate and the terminal asks you to log in.

ASSIGNMENT 1: Logging in

The terminal states you to write down the following information and a face scan:

Name:

Age:

Family:

Appearance:

Personality traits:

Points of interest:

Strengths:

Expectations and personal goals for the mission ahead:



The gate buzzes when it opens. You continue towards the main entrance. Behind the info desk sits a man. He smiles at you and welcomes you to the compound. He guides you towards the labs. And gives you five pieces of paper. What it this!? Each paper has a number and a word.

- 1. Aluminium
- 2. Mercury
- 3. Iron
- 4. Silver
- 5. Gold



You follow the lab signs and it's not easy to navigate as the compound feels like a gigantic maze. Finally you find yourself in front of a door. Next to a door there is a terminal. Terminal asks you to input a code. What code? No one hasn't mentioned anything about a code!? What now? You only have the five pieces of paper that the man behind the info desk gave to you. You start browsing through the papers. How can these different substances be a code?



Desperately you start opening your phone. As your phone opens an app opens automatically. It has been somehow automatically installed to your phone. The app is called GUIDE. You click it and it introduces itself to you and tells you that it will help you on your assignments. First it tells you about the Table of Elements. Heureka! All the substances at the papers the info desk gave you are from the Table of Elements! And each element in the table has their own symbol. That's it! That's the code. Each element has their own symbol and inputting these symbols in the correct order might be the code! It must be!

ASSIGNMENT 2: The elements Find out he symbols of the following elements: Aluminum Mercury Iron Silver Gold



You press the code into the terminal. It bleeps and a green light appears on top of the door. Door slides open and you walk through it.

You enter into a small lobby. There is another door. No terminal in sight. Phew! You feel relaxed. You push the other door open and you enter into a chemistry lab. You let your eyes wander around the lab.

ASSIGNMENT 3: The Lab

Draw, write or discuss what you see? What does a chemistry lab look like? What items are there to be seen? What separates a chemistry lab from a normal room or a classroom?



On one end of the lab you notice a group of people in white coats gathered around a screen. They seem to be laughing. One of the white coats turns around and gives you a smile.

"Hello! Welcome to the Kitsat compound. This is our chemistry department and of course this is our lab. I see that you managed to solve our little test for you at the door. Nicely done! It took you a while though (you can hear laughter among the other white coats). But don't worry. You are here and everything ready. My name is professor Koivunen. And next you can solve my first name. It's nickel, iodine, iodine, lanthanum - uranium, nitrogen, titanium, oxygen. Do the same thing as you did with the door. Try to be faster this time. Oh, and here's your first satellite piece!"

ASSIGNMENT 4: The name

Solve professor Koivunen's first name by using the symbols of the elements given. Elements in Koivunen's first name are:

nickel, iodine, iodine, lanthanum - uranium, nitrogen, titanium, oxygen



"As you already know we are using the Kitsat satellite to explore the newly discovered planet. We don't have a name for the planet yet but the project is called Hope. You will help us with the chemistry side of the satellite and the research. We have a few problems that need answering before we can launch Kitsat to explore Hope."



"But first let's get down to basics. In order to work in this lab you need to complete a safety tutorial first. We are extremely cautious about our research and test we are doing here. We don't want anyone to hurt themself or ruin our research by doing something stupid and unintentional." Koivunen says with a hint of strictness in his voice



ASSIGNMENT 5: Be safe

Take a closer look at the following picture that Koivunen shows you. Try to find out what's wrong in them or could something be done in a different and safer matter. Remember to check GUIDE also.





"Congratulations! You passed the tutorial with flying colors! Now let's get you suited for our first research." Koivunen says with enthusiasm in his voice. "Have yourself a lab coat, goggles and gloves. You can customise them if you want. And as you can see others have embraced that opportunity. And of course here is your second piece of the satellite

BONUS ASSIGNMENT: Customise the lab coat, goggles and gloves.



Koivunen approaches you and you tuck your phone away. "I have some questions for you. And leave your phone." You start sweating! Did he notice? Is it allowed to have a helping app on your phone? Am I in trouble?

You leave your phone on the table. "It's totally fine. Don't be scared. We all have the same app as you. We install it automatically to every member of our research team. Download started as you entered the building. Standard procedure."



ASSIGNMENT 6: Heat

Write down the answers for Koivunen's questions.

Koivunen's question are tough but not impossible:

- What is the coldest temperature you've been to? How cold was it?
- What is the warmest temperature you've been to? How warm was it?
- What is the coldest temperature measured on the Earth?
- What is the warmest temperature measured on the Earth?
- What explains the difference between the hottest and coldest temperature measured?
- What kind of temperatures the Kitsat satellite can handle?
- How could you use the satellite for heat related research?



"Interesting!" Koivunen says scratching his chin. "Next we are going to do our first experiment. GUIDE will give you the details. When you have passed this assignment you will get your third piece of the Kitsat satellite."

GUIDE is beeping in your pocket. You take out your phone and read the info about carrying out a basic scientific research.

ASSIGNMENT 7: The experiment

Make a hypothesis on what is the air temperature where you are right now. Then do a test and measure the temperature with a thermometer or using the satellite. Write a conclusion of your experiment. Remember to write down your hypothesis and the measured temperature.

Make a hypothesis on what the air temperature is outside right now. Then do a test and measure the temperature with a thermometer or using the satellite. Write a conclusion of your experiment. Remember to write down your hypothesis and the measured temperature.

Make a hypothesis on what temperature the water from the faucet is when the faucet is turned into the coldest. Then do a test. Take some water into a cup and measure the temperature with a thermometer. Write a conclusion of your experiment. Remember to write down your hypothesis.

Make a hypothesis on what temperature the water from the faucet is when the faucet is turned into the hottest. Then do a test. Take some water into a cup and measure the temperature with a thermometer. Write a conclusion of your experiment. Remember to write down your hypothesis.

Try out the Kitsat satellite's temperature sensor. Take the satellite outside and write down the temperature. Take it back inside and write down the temperature it gives. If you have a hair dryer at your disposal try to heat the satellite with it. What kind of other temperature related researches you could do with the satellites heat sensor?



"Congratulations! Nicely done! Here is the third piece of the satellite. As you can see we have gathered an international research team. People come from all over the world and we have a few different temperature units in use. We are using celsius, fahrenheit and kelvin. Thus we need to be prepared to convert different temperatures and function between different temperature units. GUIDE will give you the correct conversion formulas. You can practice by converting the temperatures you measured in your previous assignment." Koivunen says.



ASSIGNMENT 8: Misters Celsius, Kelvin and Fahrenheit

Take out the temperatures you used in the previous assignment. First make an estimate how much the temperatures would be if a different temperature unit would be used. After your estimation use the formulas found in GUIDE to calculate and convert the temperatures from your previous assignment.



"Nicely done! Now the whole team can understand our measurements and understand different temperatures. Thank you! Next we need to review what kind of temperatures the Kitsat satellite will face during its voyage to space. We need to know what kinds of temperatures to expect so that the satellite can handle them and function properly." Koivunen says with a hint of worry in his voice.

"As you may already know the satellite will be only launched under perfect conditions. Weather must be flawless. Here are some documents about the launch site and the launch itself. Examine them carefully and then come back to me so we can begin our research." Koivunen hands you a neat pile of papers. You read through the papers and you list your findings.

Temperature at the launch site will be 20 degrees celsius.

Weather will be nice and clear with a slight breeze.

Launch will happen at noon.

This first test launch will take the Kitsat satellite to stratosphere.

Stratosphere is a part of Earth's atmosphere.

Stratosphere is located between 15 kilometers and 50 kilometres above sea level.

Kitsat satellite will fly to an altitude of 35 kilometers.





You write down your findings to GUIDE and start to look for Koivunen. But Koivunen is nowhere to be seen. He was just there. The lab is empty. Where is everyone?

Your phone beeps. It's a message. "Come to the info desk!" You run through the corridors, doors and halls and you finally reach the info desk. The man behind the desk looks worried and stressed. You introduce yourself and show him the message you received a while ago. "Follow me" the man says. You pace through another set of doors, corridors and halls when you've reached a small room.

"This is our surveillance and security department as you can see it's not that big because we usually don't have these kind problems" You look around and see only a handful of people working intensively on their computers. "They've been kidnapped" the man says with a stern voice. What?! But why and by who? How did I not notice it? "It was a cleaver and well executed plan and it was almost impossible to stop or notice that something was wrong. They were going to replace your team with human cyborgs and the cyborg would sabotaged the research. Or at the worst case scenario the whole project. But we have received some intel about the situation and we need your help for the plan to save them. We have picked up their trail and we are 100% sure that it's your actual research team. This is what we know about the situation.

The research team has been kidnapped by a corporation called Universe Order

Universe Order wants to use the Kitsat satellite to explore and ruthlessly exploit the natural resources of the newly found planet.

There has been no messages about the possible ransoms or anything else

Research crew has all the previously acquired satellite pieces with them

If the Universe Order has the remaining pieces they can send the satellite to the newly found planet and start to exploit and sell it's natural resources.



The Kitsat department of security and intelligence has some more intel about the case. Throw a six sided dice to find out what. Start out with the location.

Place where the research team is being held:

- Normal generic prison cell with bars.
- Modern mansion in a room with thick glass walls, ceiling and floor. Door is locked with a sturdy lock



In the woods handcuffed to a tree



Abandoned run down building with their hands tied to a metal pipe.



Underground bunker with a hidden entrance.



Abandoned oil drilling platform in the middle of the sea.

The Kitsat department of security and intelligence has some more intel about the case. Throw a six sided dice to find out what. Continue to the guard

Guards of the place where the research team is being held:



Team of hired security personnel



Vicious guard dogs patrolling the area



Helicopter with a powerful spotlight flying around the area. Readiness to alert moore guards to the premises



Electric fence around the premises and video surveillance



Robots with different scanners ready sound the alarm when detecting something suspicious



Set of hidden traps on the way to a house. Sturdy door with a password opening mechanism.

The Kitsat department of security and intelligence has some more intel about the case. Throw a six sided dice to find out what. Continue to the guard

Special items you can use in your plan. (The Kitsat intelligence and security department are way beyond their time):



Anti- gravity device



Device that can slow down time



Invisibility suit that makes the uset invisible for 1 minute. Takes 5 minutes to charge and to be used again.



X-ray vision goggles



High speed shoes. Doubles the running speed of the user.



Device that can shrink or enlarge the user for 1 minute. Takes 5 minutes to charge and to be used again.

The Kitsat department of security and intelligence has some more intel about the case. Throw a six sided dice to find out what. Continue to the guard

List of elements you must utilize in some phase of your plan.



Choose your own element from the list above.

The Kitsat intelligence and security department insists that you must not hurt anyone in your plan. And this is crucial! They refer to this ancient TV-show called MacGyver where a guy rescues the day using physics and chemistry. And at the end of the day no one is harmed. In your plan you must have the following topics covered.

- How to get to the research team?
- How to avoid/sneak past/disable/ the guards
- How are you using your special item?
- How do you utilize your element in your plan?

Is it possible to utilize some of the Kitsat satellite's functions in your plan? Camera, flying abilities, GPS, accelerometer, gyroscope, temperature sensor or pressure sensor?



The plan is ready and the department of intelligence and security start to execute it right away.

Time slows down. Minutes seem like hours as you wait for the information on how the mission went down. Finally you phone beebs. It's a message. "Everything worked out perfectly! Good job! We are on our way to the compound and we have a missing satellite piece with us. It's the fourth piece! Some spy from Universe Order had stolen it from our storage.



The research team is back and joyous laughter and conversation flow around the chemistry lab. Suddenly Koivunen clears his throat and everybody is waiting silently. "We must hurry our research so that Universe Order won't reach the planet first. That would be disastrous. Let's continue our work and beat them to it. Good luck everyone!" Koivunen states with pride in his voice.



"So where were we?" Koivunen says as he approaches you. Yes, the effect of temperature to the satellite during takeoff, flight and landing." Koivunen recaps a few key points of the research and GUIDE gives you the rest of the information needed. "Temperature on the launch site will be 20 degrees celsius. But we must find out what happens to the temperature when the satellite reaches new heights after the launch."



In this part of the research the Kitsat satellite will reach the stratosphere. You must observe and calculate what kinds of temperatures the satellite will face during its journey. And also how the satellite can cope with these temperatures. Is there some ways to improve the satellite's functionality in different temperatures?

Calculate what is the temperature in different parts of the satellite's flight towards the stratosphere.

First checkpoint is halfway to the troposphere which is 5 kilometres above sea level. What is the temperature at 5 kilometres **if** the temperature drops 6,5 degrees per kilometre? The temperature at the launch site is +15 degrees celsius.



Second checkpoint is the troposphere which is the lowest layer of Earth's atmosphere. The troposphere is 10 kilometres above sea level. What is the temperature at the troposphere **if** temperature drops 6,5 degrees celsius per kilometre?



Third checkpoint is the beginning of the stratosphere. The stratosphere starts approximately at 10 kilometres above sea level. Our checkpoint is at 15 kilometres above sea level. What is the temperature at 15 kilometres above sea level **if** the temperature drops 6,5 degrees celsius per kilometer?



Fourth and final checkpoint is the last part of stratosphere which is located at 35 kilometres above sea level. What is the temperature at 35 kilometres above sea level **if** the temperature drops 6,5 degrees celsius per kilometer?

Does the temperature drop 6,5 degrees celsius in all parts of the Earth's atmosphere?

How can the Kitsat satellite function in these different kinds of temperatures?

How could you use the satellite to study different altitudes?

How the Kitsat satellite could be launched high into the atmosphere? What if rockets would not be an option?



"Thank you for these calculations. They will help us to predict what kinds of temperatures the satellite will face on it's way. And here is your fifth part of the satellite" Koivunen says with pride in his voice. You are just about to leave for lunch when Koivunen sees you. "Can I join you for lunch? Don't look so stressed. Our work stays here. We can have a relaxed lunch and just unwind. It's been kind of stressful lately, don't you agree? And of course I'm paying for the lunch.



BONUS ASSIGNMENT: The lunch

Draw or write what you and Koivunen are having for lunch. When you are waiting in line at the restaurant your phone beeps. It's GUIDE and it's giving you info about eating healthy and nutritious food.

You must choose:

You can ignore GUIDE and have whatever you want for lunch OR check out the info and eating accordingly.



You are back from lunch and Koivunen recaps the next research.

"Next let's think about how the satellite can cope with different kinds of temperatures." Koivunen says.



ASSIGNMENT 11: Resist and operate

- Write or draw a plan how the satellite can cope in:
- High temperature situations
- What kinds of materials can endure high temperatures? Is the satellite somehow able to resist high temperatures?
- How will the satellite manage high temperatures?
- What materials in the satellite are most vulnerable to high temperatures?

Write or draw a plan how the satellite can cope in:

- Low temperature situations
- What kinds of materials can endure low temperatures?
- Is the satellite somehow able to resist low temperatures?
- How will the satellite manage low temperatures?
- What materials in the satellite are most vulnerable to low temperatures?

"Great!" Koivunen states as you hand out your notes to him. " As this research is done we are ahead of our schedule and can relax a bit. Oh, before that I ask you to do me a favor. Could you get me a set of blueprints and plans from our engineering department. I need to take a look at the. After that we can go and grab some coffee and dessert."

You rush through the endless hallways and countless doors. You finally reach the right door and you rush in. You try to flip the light switch but nothing happens. It's almost pitch black. You see some papers on the laboratory table. You grab them and you stumble on a cord and fall down. Something clicks, hums and fizzes. What kind of machine does that? Suddenly a bright light turns on. You have to cover your eyes because it's too bright and it keeps getting brighter and brighter. Static noise forces you to clamp your hands on your ears. What is going on?! You feel like you're falling down.



Noise dies down and the light fades as you fall. You open your eyes slowly and see that the world around is getting bigger and bigger. The falling sensation was you getting smaller and smaller. After a few minutes you're so small that you can see the atoms! This is an absolutely brilliant opportunity to examine these mysterious things closer! GUIDE beeps in you pocket.

ASSIGNMENT 12:

Draw what you see. Draw what an atom looks like? What kind of a structure does an atom have? How the world looks on an atom level? What would be the best way to visualize the structure of an atom?



As you try to memorize all that you've seen you feel a flying sensation. Everything around you is getting smaller and in a blink of an eye you are back to your normal size. You're still at the same lab. Lights are on and your team is staring at you. They look shocked.

You convince them that everything is fine. You explain what happened and what you saw. Everybody is shaking their heads in disbelief. Koivunen asks you about the design blueprints you were supposed to get. Where are they?! You had them in your hands just before you were shrunken. No! They shrunk also but they never turned back to normal. You check your pocket. Phew! Your phone is still there and back to its normal size. Somewhere on the floor amongst other atoms and substances are the design blueprints.



You tell Koivunen that the blueprints are the size of an atom on the floor now. He looks furious! Those must have been really important blueprints. You feel ashamed and you ask Koivunen what the blueprints were and what they were all about.

Koivunen reluctantly tells you that a plan was to send a certain type of miniature stations to space. The Idea is to support and help the future space flight to the new planet.





The stations would act as a pit stop on halfway of
the journey. Spaceships will be refueled and
maintained. Stations would store food supplies so
the people onboard will survive from the rest of
the journey to the new planet.

Suddenly Koivunen's eyes light up. "Could you and your team make some new blueprints for the stations? Of course it will have a chemistry point of view also with storing food and maintaining the spaceships. I think this would be your last task during this part of our work. Yes! I have the utmost confidence and trust that you can handle this one! After the blueprints and the plan is ready you can present them to our engineering department so that they can start the manufacturing process.

ASSIGNMENT 13: The stations

Make a plan for a space station that can handle the following tasks:

Maintaining spaceships. They rust easily during long flights. What can be done so that the spaceships would not rust during their long flights? How can you avoid it?

Storing food. Food is a vital part of the long flight through space to the new planet. What kind of food would be the most nutritious for the humans onboard? What happens in the human body when they eat? What can be done to avoid the food getting bad and turning inedible?

Fueling the spaceships. What kind of fuel or energy the spaceships use? How the station stores the fuel or the energy that the spaceships need? How the fuel or energy is created at the space station?

You can draw, write or talk about the plan. Make sure that you are ready to give a presentation of your plan to the engineering department. Check GUIDE for additional information.

Absolutely amazing! Brilliant! Superb!" Koivunen is so happy and proud that he sounds like he is about to run out of praising adjectives. "Here are the rest of the satellite pieces! Let's get this one operating and prepare the launch. Hope. Here we come!" Koivunen says with a smile on his face

