This is your own personal guide to the world of Kitsat.

Start your journey by reading the table of contents before you begin the course with your students.

Next read through the main topics of this course and the main learning goals before you begin the course with your students.

After this read through the section number 3 ("How to set up and execute the course) before you start the course with your students.

Next make sure you have printed out the printables needed during the course. These printables include the information sheets for students and other printable materials that you and the students are going to need during the course.

Or if you want the students to go through the course at their own pace print out the printable version of the course and have it ready as you start the course.

In section 4 it is time to start the course. This section is the walkthrough of the game. This section will tell you what to do in different stages of the course and what the students will do and how. This section is your guideline on how to implement the course. This section also includes the correct answers to each assignment and task the students will face during the course.

TABLE OF CONTENTS:

In this teacher material you will find the following

1) **The main topics of this course are:**

- Basics of lab work and safety
- Setting up and executing a simple scientific test and reporting it accordingly (setting hypothesis, testing it and reporting if their hypothesis was right and explaining why it was right or wrong.)
- Basic chemical reactions
- Basics of elements and atomic structure
- Heat

2) **The main learning goals of this course**

- Students gets an understanding of the topics listed above
- Student knows how to work safely in a chemistry lab
- Students can set up a simple scientific test and know how to report it.
- Basic understanding of chemical reactions and effects of these reactions
- Students will get to know how the periodic table works and understand what are the basic elements of it.
- Students get to know how nutrients and food affect the human body from a chemical point of view.

The main 21st century skill goals of this course are:

- Thinking and learning to learn skills
- Participation, involvement and building a sustainable future
- Cultural competence, interaction and expression
- Multiliteracy
- Taking care of oneself and managing daily life

3) **How to set up and execute the course**

Topics listed above are divided into lessons. Each lesson's minimum duration is 45 minutes. Duration of the lesson can vary depending on the topic. And also you as a teacher can decide if you want to go deeper into some of the topics listed above.

Course is built on a story which continues towards the end as students solve problems, tasks and assignments. Assignments are done by searching, reading and applying knowledge they have acquired. Information can be found in the information material provided with the course or you can use different kinds of information sources during this course.

Green colour indicates an assignment. More detailed information is provided when you

Red colour indicates the time when students should look for information from the informational material provided
Blue colour indicates when it's time to give the students a satellite piece.

The course can be teached by the lead of the teacher or the teacher can share the course with students so that they can progress at their own pace. You are free to choose how you will approach the course.

4) Implementation of the course

Present the students with the course's main topics and main learning goals. Have the students discuss the learning goals. You can help them out with the following question to guide their discussion.

- What do you think is the most important topic of this course?
- What do you think is the most important learning goal of this course?
- What topics are you most interested in?
- What topics of this course do you already know something about?
- What topics are completely new to you?

Have a discussion about what the students think about the topics and learning goals of this course.

Open the Kitsat chemistry course 1 student version on your computer and project it on a screen. You can also print out the student version of the course and hand it out to the students.

Start by reading the story at the beginning of the student version (slide 2). Continue with the story. You can read the story yourself or let the students read it by themselves. Continue the story until you reach slide 6.

Assignment 1: In this assignment the students will create their own character. You can use the printable character sheet found in this material. Emphasize that their character has to be credible. Point out that the goals and expectations of this course are the goals and expectations the students have in real life for this course. Later on you can use these expectations and goals to reflect or evaluate the course.

After the students have created their characters you can let the students introduce themselves as the characters of the game. Give them a time limit so that the introduction doesn't take that much time.

After the introductions you can divide the students into groups. Divide the groups so that each group will get a satellite later on. How you divide the groups is up to you to decide. So the number of groups is the same as the number of satellites you have. After this hand out five pieces of paper to each student. Have the students write down the elements introduced in slide number 7.

Continue the story until you reach slide number 9. In this slide introduce the students to the information material provided with the course. The information material in this game is called GUIDE. Students can use this information material to solve the assignments and problems in the game. In the students material use of information material (GUIDE) is marked with a red highlighting.

Continue the story until you reach slide number 10.

Assignment 2: In this assignment the students need to solve a code so they can get into the chemistry lab in the game's Kitsat compound. Students need to solve the chemical symbol for the five elements that the person behind the info desk provided them with. Students can use GUIDE for help. Ask the students to provide you the code to open the door.

The correct answer is: AiHgFeAgAu

Assignment 3: In this assignment the students enter the lab and they have to describe what they see. You can have the students draw, write or talk about what they see. Give the students a time limit so that they can come up with quick solutions and answers. Have the students shortly introduce what they see to the others.

Continue the story to slide number 12. In this phase of the game the students get their first piece of the Kitsat satellite. You can choose which part of the actual satellite they will get and will each group get the same part or not. Blue highlighting in the student version tells you when to provide the students with a satellite piece.

Assignment 4: In this assignment the students will solve professor Koivunen's first name. They can use GUIDE and the provided Table of elements to solve the problem. Have the students provide you the name until you continue with the story.

The correct answer is: Niila-Untio

Continue the story until you reach slide number 16.

Assignment 5: In this assignment the students will have to look at some situations happening in the chemistry lab and find out what's wrong in these situations. Students can use GUIDE for help and

they can write down their answer or provide it by telling you what is wrong in these situations. Every situation has something to do with safety and working safely in the lab.

The correct answers are:

Character on the left:

- *He is not supposed to eat or drink in the chemistry lab*
- *He should be wearing protective gloves and goggles*

Character at the middle:

- *She should be wearing a lab coat*
- *She should be wearing protective gloves and goggles*
- *She should not be listening to music but fully concentrating on what she is doing*
- *She should be careful when handling different chemicals and substances*

Character on the right:

- *He should not smell the chemical in his hand*
- *He should be wearing protective goggles*
- *He should be more careful when handling chemicals*

General remarks:

- *Lab equipment should be handled carefully and not to let the chemicals in them spill on the table.*
- *Untidiness of the desk in front of the characters*

Continue to the next slide and provide the students with their next part of the satellite. You can choose which part you want to give them.

Bonus assignment: This assignment is optional. The students can customize their imaginary safety equipment. The blank safety equipment can be found amongst the printable materials provided.

Continue with the story until you reach slide number 20.

Assignment 6: In this assignment the students will answer some questions about heat. The questions take into account their own experiences so there are no correct answers to the first two questions. For the rest of the question the students can use different sources of information.

Correct answers are:

What is the coldest temperature measured on the Earth?
-89 degrees celsius. Measured by a weather station in Antarctica.

What is the warmest temperature measured on the Earth?

+ 56,7 degrees celsius. Measured in Death Valley in the United States.

What explains the difference between the hottest and coldest temperature measured?
The temperatures on Earth are controlled mainly by the sun and the solar heat coming from it. Solar heating turns on at dawn and then off at sunset. Earth surface heats during the day and cools off at night. Depending on the geological location different regions get different amounts of solar heating. Solar warming is generally greater at the equator where the sun shines directly. And much less at the poles where the sun is low in the sky. Surfaces that are straighter to the sun's ray path heat faster than those at an angle. Polar regions are far more colder than the ones located near the equator.

What kind of temperatures the Kitsat satellite can handle?
- 30 degrees celsius to +60 degrees celsius.

How could you use the satellite for heat related research?
Students can have their own answers. Make sure that the research could be really implemented and that the research is somehow related to heat or temperatures.

Continue the story until you reach slide number 23

Assignment 7: In this assignment the students get to conduct their own simple research. Students can read through the GUIDE's information material first. Make sure that the students follow the correct path while they are conducting their research. Have the students represent their research briefly.

Continue the story to the next slide and provide the students with a piece of the satellite. You can decide which part you want to give.

Assignment 8: In this assignment the students use the temperatures measured in the previous assignment and convert them to kelvins and fahrenheits. You can also have the students convert the temperatures from **assignment 6** but this is optional. Let the students use calculators to convert the temperatures. Have the students provide you with the converted temperatures. Or you can have the students to present their conversions to other students briefly. Make sure that the students have used the conversion formulas correctly.

Continue the story until you reach slide number 30.

Assignment 9: In this assignment the students need to come up with a plan to save a research team from the evil Universe Order that has captured the research team and hold them in captivity. Have the student throw a six sided dice four times to set different variables to their plan. Let the

students be creative in this assignment but make sure that they utilize their element in some part of their plan. Also point out that the plan must not be violent and no one should be harmed badly. Students can draw, write or combine both ways in this assignment. Let the students present their plan to the others and you.

Continue the story until you reach slide number 35. Provide the students with a piece of the satellite. You can decide which part you want to give.

Continue the story until you reach slide number 38.

Assignment 10: In this assignment the students will have to calculate the temperature in different parts of the atmosphere. They can use GUIDE for additional information. You can choose whether to have the students use calculators or not. Have the students provide you with the correct answer to the calculations or have them presenting the answers to the others.

Correct answers:

First checkpoint: 15 - (5 x 6,5) = -17,5 degrees celsius
Second checkpoint: 15 - (10 x 6,5) = - 50 degrees celsius
Third checkpoint: 15 - (15 x 6,5) = -82,5 degrees celsius
Final checkpoint: 15 - (35 x 6,5) = -212 degrees celsius

Continue to the next slide and provide the students with the next piece of satellite. You can choose which part you want to give.

Bonus assignment: In this assignment the students will get to be creative and decide what they are having for their imaginary lunch. Have the students draw or write what they are going to have. Make the students think what kind of lunch would be the most nutritious and would have a positive impact on them and their studying. The students can check GUIDE for additional information. Have the student present their lunches to other students or to you.

Continue the story until you reach slide number 45.

Assignment 11: In this assignment the students need to think about how different kinds of materials can cope in high or low temperatures. Let the students be creative in this assignment. Emphasize the fact that they use correct materials in correct temperatures. Correct them if they are using a material that can't withstand high or low temperatures.

Continue the story until you reach slide number 47.

Assignment 12: In this assignment the students are shrunken into a size of an atom. The students need to draw a model of an atom. They can use GUIDE for further information. Make sure that the students have the correct parts in correct places in their drawing. Otherwise let the students be creative in this assignment. Have the students present their models to others or you.

Continue the story until you reach slide number 51.

Assignment 13: In this assignment the students need to plan a space station that can maintain the space ships travelling to the newly found planet. The station should be also able to retain food for the passengers on board. The students can use GUIDE for additional information.

Let the students be creative in this assignment. Focus on these important topics and make sure that the students use real world solutions on these:

- How the space ships are maintained and how they protect the ships from rust.
- How the students' plan takes into account how the food at the space station is preserved so that the food won't spoil.
- How can the space station create energy and store it for the incoming space ships?

Continue to the next slide and hand out the rest of the missing satellite parts to the students. Congratulate them for passing the course.

Assessment:

Below you'll find a few tips on how to assess a gamified course.

When assessing the course you can use different kinds of digital platforms to gather the student's solution to different assignments. Through these platforms you can give them feedback and evaluate their answers. You can evaluate every assignment as an individual assignment or view and evaluate them as a whole.

You can also use group assessment so that every group assesses how they worked together as a group during the course. It's good to also add a self-assessment for every student so that you get the group's opinion and the individual opinion on how they managed the course.

If you want to gamify your assessment also you can add a value to each assignment. For example on a grade scale from 4-10 (4 being failed and 10 excellent) each accomplished assignment can raise the groups or the student's grade by for example maximum 0,5 (half a grade). Every group or a student starts from grade 4 and assignment by assignment they begin to raise their grade. If the assignment is not done that good you can give them a smaller raise to their grade.