**The carillon mechanical clock**

**Age group/class:** 14 years old

**Lesson title:** The carillon mechanical clock

**School Discipline:** Physics

**Key concepts:** Carillon mechanism, lever and pulley system

**Aims:**

* What is a carillon clock?
* What is the physics behind a clock?
* How does the mechanical clock work?

**Skills developed**: observation, analysis and research

**Materials/Equipment needed**:

* VR headset
* VR video / link  [https://eloquent-ramanujan-887aa5.netlify.app/palat.html](https://eloquent-ramanujan-887aa5.netlify.app//mediterranean-vegetation%20%20)
* External links Isaac Habrecht's Carillon Clock: The Rolls-Royce of Renaissance clocks - <https://youtu.be/M8sFjXeGPSI> (The British Museum)

**Lesson plan:**

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| **Stages** | **Description of activity** | **Time** |
| **Preparation before the lesson** | If this is a first VR experience for students – go through the safety rules:   * Learners are to sit down whilst using the VR glasses and not hold anything in their hands, unless the experience is of such a nature that it requires you standing, in which case, ensure enough space is allowed around all students. * Learners will be told to expect a feeling of vertigo. If it gets worse, students must remove VR glasses. * Learners need to know how to adjust the viewing focus before using the headsets. * Learners must not use the headset when they are: tired, need sleep, under emotional stress or anxiety, when suffering from cold, flu, headaches, migraines as this can worsen their susceptibility to adverse reactions. * Learners should be given the choice to opt out of using VR. |  |
| **Introduction** | Share Learning Intentions with students  The aims of the current lesson plan are the following:   * What is a carillon clock? * What is the physics behind a clock? * How does the mechanical clock work?   Teacher is asked to provide students with some basic information about the carillon clock, clarifying what a carillon clock is.  ”the Carillon clock; weight-driven musical clock; originally controlled by balance wheel, movement converted to pendulum in 18thC; outer case of gilded brass, engraved with figures personifying the three theological virtues (Faith, Hope and Charity), the three worldly virtues (Wisdom, Fortitude and Justice) and the three fates of man on the back”  The following video could be useful for the purpose: <https://youtu.be/M8sFjXeGPSI> | 5 min. |
| **Initial Immersive Experience** | “Let’s immerge into the Palace of Culture in Iasi, Romania and discover together a carillon mechanical clock”:  https://eloquent-ramanujan-887aa5.netlify.app/palat.html  Learners put on the VR headsets and explore the video at their own pace for about 10 minutes. | 10 min. |
| **Guided Immersive Experience** | After a free exploration of the VR resource, the Guided Immersive Experience is aimed at identifying some features  https://coltisorderomania.ro/wp-content/uploads/2019/05/palatul-culturii-13-ceasornic.jpg  *What is the physics behind a clock?*  The timekeeping element in every modern clock is a harmonic oscillator, a physical object (resonator) that vibrates or oscillates at a particular frequency. This object can be a pendulum, a tuning fork, a quartz crystal, or the vibration of electrons in atoms as they emit microwaves.  *How does the mechanical clock work?*  Unlike their digital and quartz counterparts, mechanical clocks don't depend on a battery to keep time. Instead, they harness the energy stored in a wound spring. ... The escapement regulates the release of stored energy into a predictable curve, which translates into the motion of the hands around the dial.  *The Structure of a Carillon*  Example for an arrangement of the bells in the bell tower  Then, teacher asks students to watch the video again and to identify the above mentioned features. | 20 min. |
| **Follow up** | Once students have a clearer idea about the carillon mechanical clock, it’s time to improve their skills.  Teacher presents the following text:  *“The Clock of the Palace is a clock with three dials, with a diameter of 3.24 m. The hands of the clock measure 1.25 m and 0.90 m, respectively. dials of the clock. The mechanism is loaded automatically, at 12 hours, with a weight of 120 kg, which rises to a height of 8 m. Through an ingenious system, the clock in the tower operated synchronously 25 clocks in various rooms of the Palace; they disappeared during the war. At every exact hour, the clock in the tower of the Palace of Culture sings "Hora Unirii". The song, recorded on a drum with a diameter of 35 cm, through a number of 69 pins, is played by a system of eight tuned bells, which make up the mechanism of the carillon, located on the fourth floor of the tower.”.*  *The shape of a true bell*  Graphic of a bell with the clapper inside and a "broek"- or breech connection for the baton keyboard  Graphic of a bell with the clapper inside and a "broek"- or breech connection for the baton keyboard  Bell with a hammer at the outside, connected with a "tuimelaar" or tumbler for the automatic playing  Bell with a hammer at the outside, connected with a "tuimelaar" or tumbler for the automatic playing  the tuimelaar- or bell-crank system  In the tuimelaar- or bell-crank system each clapper is connected to the right as well as to the left side with its neighboring bell's clapper to prevent them from swinging sideways. | 15 min.  . |
| **Formative Assessment** | * Which is the structure of a Carillon | 5 min. |