


Escape Room in Physics: Train Experiment

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We are demonstrating an example how simple an experimental puzzle of an escape room in physics can be, indeed, experiments and puzzles of a 2-hours-escape room should take minutes rather than hours compared to a conventional experimental course for students in education. We have used a miniaturized train for the purpose of gamification in kinematics driving in a circle (radius r) on a rail road. To calculate the velocity, one uses simply $v = \frac{l}{t}$ (l length; t time, v velocity) with length of distance of $l = 2\pi r$. The entire puzzle is able to remember on childhood or early life, respectively. Nevertheless, the train experiment can be understood as substitution of a similar toy as well, however, a train on railroad is an equipment in nurseries and a famous topic in comics and animated cartoons touching a - hopefully - peaceful early lifetime. A possible extension by an error calculation is proposed and presented.  DOI: https://doi.org/10.15487/tiho.7_2023.2


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I. INTRODUCTION

Escape rooms are team-based games where players solve puzzles, experiments, and accomplish tasks^{1,2}. The interest in building escape rooms has grown since the last years¹. In 2021, C. Lathwesen *et al.* had requested: *Nevertheless, we were able to identify some gaps in the research and development on this topic. First of all, there is still a need for new proposals mainly in the subjects of physics and biology.*³

To fill this gap, we have built up an escape room in physics for students in veterinary medicine founded by Niedersächsisches Ministerium für Wissenschaft und Kultur (Innovation plus). To build up the escape room in physics, we have introduced a subdivided concept of two rooms, for details see S. A. Bräuninger *et al.*⁴.

II. EXPERIMENTAL

To stop the time, we have used a historical clock of the company Junghans from Germany, see figure 1 (grey clock). Additionally, the experiment contains a miniaturized train with rails (scale 1:120) produced by Berliner Bahnen TT Hobby with a trail of 12 mm. The presented specimen is a historical one produced in GDR (German Democratic Republik). The voltage source is a Voltcraft Regulated Power Supply with a preset voltage of $U \approx 8.1 \text{ V} \pm 0.05 \text{ V}$. 

III. CALCULATION

A. Main part

To calculate the velocity, one uses the main equation

$$v = \frac{l}{t} \quad (1)$$

with

$$l = 2\pi r \quad (2)$$

where r is the radius of the circle of around $r = d/2$ with $d \approx 57.5 \text{ cm}$ and $t \approx 16 \text{ s}$ the time per circle of the train. This yields:

$$v = \frac{l}{t} \approx \frac{180.6 \text{ cm}}{16 \text{ s}} \approx 11.3 \text{ cm/s}. \quad (3)$$

The norm of the velocity $|\vec{v}| = v$ is assumed to be constant. It is an accelerated movement (change of direction of \vec{v}), but the total value (norm) is constant over time. This should be mentioned in the didactic explanation for clearness.



FIG. 1: Entire equipment of the experiment containing a clock and a train on rails (voltage source excluded being below the table).

