

CaYPT 2021 Problem Selection Justification

This document outlines the reasons behind selecting each of the CaYPT 2021 problem. The justifications reflect the opinions of the Problem Selection Committee (PSC).

For safety information, please go to the CaYPT 2021 Safety Guide for Team Leaders document.

Problem 1. Invent Yourself

Selected: No

Justification:

There are many variables that the students can investigate and not a single physical principle that the participants can focus on. In the current conditions, the student's lack teacher supervision. It will be challenging for them to narrow down the physics of interest and to test their ideas.

Problem 2. Circling Magnets

Selected: Yes

Justification:

Battery and button magnets are easily accessible for the students. The phenomenon is simple and elegant. There should be little challenge for the students to reproduce the phenomenon. The problem is a great chance for students to explore electricity and magnetism to a variety of depths. This problem has to potential to be solved relatively "fully" at the CaYPT.

Problem 3. Proximity Sensor

Selected: No

Justification:

There are concerns about the feasibility for students to attempt this problem with minimal supervision. This problem can be more of an electronics project and could require equipment that the students do not have access to outside of school.

Problem 4. Wind Speed

Selected: Yes

Justification:

This problem provides an introduction to topics in thermal physics and can be approached theoretically and experimentally. It is possible to demonstrate the phenomenon while keeping the electrical power low. If the students can build an accurate apparatus, it can be used in future fluid dynamics problems to measure air speed.

Problem 5. Synchronized Candles

Selected: No

Justification:

Although the phenomenon not expensive to reproduce and the physics is interesting, this experiment can be dangerous for students to perform. For the candle flame enter the synchronized state, a relatively thick

wick is required. The resultant flame can be as tall as 10-15 cm. Students may want to perform the experiment in an enclosure to minimize the effect of air currents. The combination of tall flames and a confined space may start a fire or cause carbon monoxide poisoning.

Problem 6. Irreversible Cartesian Diver

Selected: Yes

Justification:

The experimental apparatus should not be too difficult to construct. The tube does not need to be too long (2m should be more than sufficient). This problem can be investigated computationally and experimentally, and it is likely that teams will have a complete solution at the CaYPT.

Problem 7. Bead Dynamics

Selected: Yes

Justification:

Classical mechanics problems are generally easier for student to model theoretically. The experimental aspect of this problem will involve some engineering effort. This problem should offer the students a good opportunity to overcome some engineering challenges through their creativity.

Problem 8. Fuses

Selected: No

Justification:

The nature of the problem requires a length wire to be heated by an electric current until it breaks. There is a real safety concern of burns, fire and electric shock. This experiment is not suitable for students to try at home.

Problem 9. Light Whiskers

Selected: No

Justification:

Although this phenomenon is fascinating, students likely do not have access to lasers. They are also not knowledgeable enough to use lasers safely. Thus, this problem is not suitable for CaYPT.

Problem 10. Spin Drift

Selected: Yes

Justification:

Students can investigate this problem experimentally or computationally. There are no significant safety concerns. Students may have to get creative of where to find a parabolic bowl.

Problem 11. Guitar String

Selected: Yes

Justification:

Electromagnets and driving circuits are widely available (speaker amplifier). Students can explore the

validity of the assumptions for simple models and develop better models to describe the motion of the string. There many parameters that the students can vary.

Problem 12. Wilberforce Pendulum

Selected: Yes

Justification:

This problem is easily built. It is a classic problem is well documented. Students can find a lot of good resources to support their research.

Problem 13. Sponge

Selected: No

Justification:

Although the material for this problem is easily obtainable, students may face challenges with repeatability. We hope to have problems that are more closely related to fundamental physics.

Problem 14. Dynamic Hydrophobicity

Selected: Yes

Justification:

There are little safety concerns with this problem. Students can think of creative ways of making a horizontally moving surface. There are lots of published research on drop-surface interaction. Although this problem might not be as straightforward as other problem, it is still an interesting problem for the students to investigate.

Problem 15. Bead Dynamics

Selected: Yes

Justification:

Students can start from very basic kinematics and explore much more complicated phenomena. There are lots of interesting experimental measurements that can be made.

Problem 16. Ultrasonic Pump

Selected: No

Justification:

The students will have challenges getting the equipment required for this experiment.

Problem 17. Hand Helicopter

Selected: Yes

Justification:

Should be a very interest experiment to construct and perform. Students will definitely have to do some engineering to get goof experimental control. There's also lots of parameter for students to investigate experimentally and theoretically.

