Conclusion

This final problem set wraps up some loose ends and points out a way forward.

1 Extra Problems

The following questions contain applied physics topics. They were not included in the main problem sets mostly because they used a variety of topics about equally, but they're great review practice.

[5] **Problem 1.** IPhO 2013, problem 2. A rather long but straightforward problem, with many numerical calculations, illustrating a real practical setup in detail. Use the data sheet of physical constants provided in the folder.

[5] **Problem 2.** IPhO 2013, problem 3. A solid question on an ice sheet, using thermo and data analysis. Use the data sheet of physical constants provided in the folder.

[5] **Problem 3.** IZhO 2022, problem 2. A practical problem on estimating the greenhouse effect.

Solution. See the official solutions here. Note that there's a minor typo in the marking scheme, as pointed out here.

[5] **Problem 4.** IPhO 2018, problem 3. Some models in biophysics, using fluids and thermo.

[5] **Problem 5.** IPhO 2021, problem 1. The basics of geophysics, using fluids and waves.

[4] **Problem 6.** GPhO 2022, problem 2. Some simple estimates involving renewable energy.

Solution. See the official solutions here.

[5] **Problem 7.** APhO 2014, problem 1. A very hard problem on atmospheric convection.

[5] **Problem 8.** APhO 2012, problem 3. A somewhat technical problem that combines polarization and interference, to derive a neat effect called a "geometric phase".

2 Extra Theoretical Exams

If you've made it this far, you're probably training for the IPhO. I've reserved questions from a few Olympiads you can take as full-length exams for practice. Note that NBPhO exams are usually 2 days long, with 5 hours per day. However, they include experimental questions that you can't do at home, and they're somewhat easier than the IPhO, APhO, or EuPhO, so I've adjusted the time limits accordingly. (If you've been very observant, you might notice that I've omitted some years entirely. I don't think it's worth looking at IPhO 2017 because of its many errors. IPhO 2024 isn't necessary either, as it has a lot of straightforward subparts, and overlap with other questions in these handouts. Out of the past 7 years of APhOs, I only recommend doing 2019. As for the others, 2018 is tedious, 2020 was cancelled, 2021–2023 are tedious, and 2024 is far too easy.)

[8] **Problem 9.** USAPhO 2003.

[8] **Problem 10.** USAPhO 2005.

[10] **Problem 11.** USAPhO 2001.

[10] **Problem 12.** USAPhO 2000.

[12] **Problem 13.** NBPhO 2021.

[12] **Problem 14.** NBPhO 2019.

[12] **Problem 15.** GPhO 2019.

[15] **Problem 16.** IPhO 2015.

[15] **Problem 17.** NBPhO 2022.

[18] **Problem 18.** EuPhO 2020.

[18] **Problem 19.** APhO 2017.

[20] **Problem 20.** IPhO 2019.

[20] **Problem 21.** EuPhO 2021.

[20] **Problem 22.** APhO 2019.

Once you finish this and get your IPhO medal, you've outgrown Olympiad physics. The stuff covered in Olympiads *is* real physics – the rough estimates and calculations a physicist would do when exploring a new idea actually resemble what you see in IPhO and APhO problems. But the IPhO and APhO are restricted by a syllabus that assumes very little mathematical background. There is a whole lot more beautiful, fascinating stuff you can do once you pick up vector calculus and linear algebra, the two most important pieces of the physicist's toolkit. For more advice on what you can do next, see my second advice file. You have a lot of options, and you've earned it.