The Theoretical Minimum

I love flipping through new textbooks at the university bookstore, and reading through several in parallel to get multiple perspectives when learning a new field. That's why I compiled a big list of physics resources to use after learning introductory physics. But if you're self-studying with limited time, you might prefer to get straight to the point. In that case, you can also get a deep understanding of physics with a more direct route, through a small set of canonical textbooks.

The Undergraduate Minimum

The following books are well-written and beloved by students. They are particularly useful for self-studying students because they are self-contained, anticipate possible misconceptions, and most importantly, contain lots of good problems. If you work through them, doing most of the problems on your own, then you'll know the core content of an undergraduate physics degree.

1. Any introductory calculus-based physics book, as listed here. They're all about equally good.
2. *Classical Mechanics* by Taylor.
3. *Thermal Physics* by Schroeder.
4. *Introduction to Electrodynamics* (4th edition) by Griffiths.
5. *Introduction to Quantum Mechanics* (3rd edition) by Griffiths and Schroeter.

Upper division students often loudly complain about these books to signal that they've used more "hardcore" books, such as Landau and Lifshitz for mechanics and Shankar for quantum mechanics. These are also great books, but not as suitable for self-study because they omit context a beginner lacks, lack rich practice problems, and take mathematical background for granted. Like any book, reading them will certainly enrich your understanding, but I recommend mastering the five books above first. After you do, they'll be easily approachable if you want to read them.

Electives

Here are some excellent, gentle first books in several subfields of physics. None of them will get you all the way, but once you finish one, you'll have a clearer idea of what to do next. All of them should be readable after completing the undergraduate minimum.

- Astrophysics: *An Introduction to Modern Astrophysics* by Carroll and Ostlie.
- Cosmology: *Introduction to Cosmology* by Ryden.
- Condensed matter: *The Oxford Solid State Basics* by Simon.
- Complexity theory: *Nonlinear Dynamics and Chaos* by Strogatz.
- Particle physics: *Introduction to Elementary Particles* by Griffiths.
- Plasma physics: *Introduction to Plasma Physics* by Chen.
- Quantum computers: *Quantum Computation and Quantum Information* by Nielsen and Chuang.
- String theory: *A First Course in String Theory* by Zwiebach.

The Graduate Minimum

A graduate degree in physics typically begins with seeing all the undergraduate material again, but at a higher level. In this context, there's a standard set of recommendations based on the books that boomers used when they went to graduate school. I think most of these "classics" have been improved upon by more modern sources, written in this century. Today's sources are simultaneously deeper, more relevant to current research, and easier to understand. My recommended list is:

6. *Modern Classical Mechanics* by Helliwell and Sahakian. (Improved version of Goldstein.)
7. *Modern Electrodynamics* by Zangwill. (Improved version of Jackson.)
8. *Statistical Physics* (two volumes) by Kardar. (Improved version of Pathria/Huang/Reif.)
9. Quantum Mechanics lecture notes by Littlejon. (Improved version of Sakurai.)

One can give a similar minimum for a specialization in theoretical particle physics, though aiming for it is kind of like trying to sail across the Pacific in the world's cheapest boat. Anyway, it is:

10. *Spacetime and Geometry* by Carroll.
11. *An Introduction to Quantum Field Theory* by Peskin and Schroeder.
12. *Geometry, Topology, and Physics* by Nakahara.

I'm told that if you want to do string theory, the next books in the sequence would be *String Theory* (two volumes) by Polchinski and *Conformal Field Theory* by Di Francesco, Mathieu, and Senechal.