The Apprentice's Guide to Physics

An Introductory Quest Through the Mechanics of the Universe

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M. E. Spellwing

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Contents

Part I

Physics Skills Primer

Chapter 1

Scientific Notation

In the land of science, numbers can grow as vast as a dragon's hoard or shrink as small as a fairy's footprint. But wise scholars and clever spellcasters don't waste time counting endless zeros, they use a magical cantrip called scientific notation.

With just one enchanted rule: write a number between 1 and 10, then multiply by a power of ten, you can tame even the wildest figures. A beast like 5,000 becomes 5×10^3, and a whisper-small 0.0002 transforms into 2×10^{-4}.

It's the secret spell of alchemists, astronomers, and magic folk everywhere. Use it wisely, and even the stars won't feel out of reach.

Chapter 2

Scientific Notation Prep

2.1 Prep Text: Scientific Notation

To wield scientific notation properly, follow these arcane guidelines:

1. *Find the coefficient.* Move the decimal point so the number becomes at least 1 but less than 10. This becomes the *coefficient*. For example, 32,700 becomes 3.27.

2. *Count the decimal steps.* Count how many places you moved the decimal. That number becomes the exponent on your power of ten. If you moved the decimal to the left, the exponent is *positive*. If you moved it to the right, the exponent is *negative*.

3. *Check your form.* The final expression should look like $a \times 10^n$, where $1 \leq |a| < 10$ and n is an integer.

Checkpoint 2.1.1 Convert $32,700$ to scientific notation.

Hint. The decimal point would need to move to the left by 4 places.

Answer. 3.27×10^4

Solution. Move the decimal 4 places to the left: $32,700 = 3.27 \times 10^4$.

Checkpoint 2.1.2 Convert 0.000089 to scientific notation.

Hint. The decimal point would need to move to the right by 5 places.

Answer. 8.9×10^{-5}

Solution. Move the decimal 5 places to the right: $0.000089 = 8.9 \times 10^{-5}$.

Why Use It?

Imagine trying to write the mass of the Earth ($\sim 5.97 \times 10^{24}$ kg) or the mass of an electron ($\sim 9.1 \times 10^{-31}$ kg) without magical shorthand! Scientific notation saves parchment, keeps calculations neat, and makes comparison of large and small values easier.

Bonus Trick: Comparing Powers

Scientific notation reveals *orders of magnitude*. Two numbers differ by one order of magnitude for every tenfold difference. A dragon's hoard of 1×10^6 gold coins is *three orders of magnitude* larger than a goblin's pouch of 1×10^3.

A Final Word from the Grand Mathemagician

With scientific notation in your spellbook, you can navigate the vast realms of physics, chemistry, and cosmic measurement. Write your numbers with care, check your powers of ten, and let no zero go unwielded.

2.2 Prep Questions: Scientific Notation

Checkpoint 2.2.1 What is the value of 2^3?

A. 6

B. 7

C. 8

D. 9

Answer. C.
Solution.

A. *Incorrect.*
Not quite. That's 2×3, not 2^3.

B. *Incorrect.*
Close, but not correct. Try multiplying 2 by itself three times.

C. *Correct.*
Correct! $2^3 = 2 \times 2 \times 2 = 8$.

D. *Incorrect.*
Nope. That's 3^2, not 2^3.

2.3 Explore

Text of section.

2.3.1 Explore

This is the Prep SubSection in this chapter.

Checkpoint 2.3.1 The statement is required if a hint, answer, or solution is present.

Hint. Just a suggestion of what to try.

Answer. Just the final answer.

Solution. All the gory details.

Checkpoint 2.3.2 The statement is required if a hint, answer, or solution is present.

Hint. Just a suggestion of what to try.

Answer. Just the final answer.

Solution. All the gory details.

2.4 Practice

Text of section.

2.4.1 Practice

This is the Prep SubSection in this chapter.

Checkpoint 2.4.1 The statement is required if a hint, answer, or solution is present.

Hint. Just a suggestion of what to try.

Answer. Just the final answer.

Solution. All the gory details.

Part II

Scalars and Vectors

Chapter 3

Chapter Title

Text before the first section.

3.1 Section Title

Text of section.

3.2 Section Title

Text of section.

Colophon

This book was authored in PreTeXt.