

# Requirements for Major

## 1 Other Science Departments

To set the stage for a discussion of possible requirements in Physics, first consider what is required in other science departments at the UW:

### Chemistry: 91 credits minimum for B.S.

Chem 142,152,162	15 credits
Chem 237,238,239,241 (organic)	14 credits
Chem 312,317,321 (inorganic)	12 credits
Math: 124,125,126 + one 300-level	18 credits
Phys 121,122,123 or 114,115,116+lab	15 credits
Additional chem labs	5 credits
Additional chemistry or math (if GPA $\geq 3.3$ may substitute up to 6 credits of research)	11 credits
Minimum 2.0 grade in every chemistry class	
Minimum 2.8 GPA in chemistry, math and physics	

Chemistry B.A. requires 84 credits, with minimum 2.0 GPA, 3 quarters math, slightly fewer required 200 and 300 level chemistry classes.

### Biology: 90 credits minimum

Biol 180,200,220	15 credits
Chem 120,220,221 or 142,152,223,224 or 142,152,162,237,238,239.	$\geq 15$ credits
Math 124,125 or 144,145 or Qsci 291,292 or ...	10 credits
Phys 114,115 or 121,122	$\geq 8$ credits
Genome 371	5 credits
Natural history/biodiversity	3 credits
300 & 400 level options	$\geq 34$ credits
Must include 15 credits of 400-level bio electives	
Must include two 300/400 level labs	
Minimum 2.5 grade in Biol 180, $\geq 2.0$ for intro sequence	
Minimum 2.0 grade in all major coursework.	

Five B.S. tracks (general, ecology/evolution, molecular/cellular/development, enviro, physiology, plant).

Biology B.A. requires 90 credits, has almost the same requirements but omits physics requirement.

### Neurobiology: 86–91 credits minimum

Biol 201,202,203 or 180,200,220	15 credits
Chem 120,220,221 or 142,152,162,223,224 or ...	15–27 credits
Math: 2 qtrs calculus + 3rd calculus or statistics	10–15 credits
Phys 114,115 or 121,122	8–10 credits
Neurobio 301,302,401,402,403,404	22 credits
Electives in biological sciences	$\geq 16$ credits
Max 7 credits of electives may be research.	
$\geq 2.0$ grade for each intro bio class	
$\geq 2.5$ GPA in required physics, math and chemistry	

### **Biochemistry: 106 credits minimum**

Minimum 2.8 GPA in all required chemistry, biology and biochemistry courses, minimum 2.5 GPA in biochem sequence, minimum 2.0 grade in every course. Three quarters math, three quarters physics, lots of chemistry, four required biochem classes, 11 credits of upper division science electives.

### **Microbiology: 94 credits minimum**

Requirements: Long list of biology, chemistry, microbiology courses. Two quarters physics, one quarter math. Virtually no electives.  $\geq 2.25$  GPA for all required courses,  $\geq 1.8$  in every course.

### **Earth and Space Sciences: 90 credits minimum**

35 core science credits, including Math 124,125, Phys 114,117, Chem 142, and basic ESS sequence. 55 more credits in four options: standard, biology, environmental, or physics. ESS B.A. also requires 90 credits.

## **2 Physics Major Requirements**

### **Current requirements: 86 credits minimum**

Minimum 2.0 grade in all physics courses needed for requirements.

Math 124,125,126,324 (calculus)	18 credits
Math 308, 318 or Amath 352 (linear algebra)	3 credits
Phys 121,122,123	15 credits
Phys 224,225 (thermal, modern)	6 credits
Phys 227,228 (math methods)	6 credits
Phys 321,322 (E&M)	8 credits
Phys 334 (circuits)	3 credits
Phys 315 or 324 (QM)	3 credits
Phys 33X or 43X (adv. labs)	6 credits
Phys 40X, 48X or 49X (research or seminar)	3 credits
Physics or related electives	6 credits
Related science electives	9 credits

## Alternative I (the works): 108 credits

If we were to require all of our proposed core courses, and keep the same advanced lab and elective requirements as currently, total credits for a physics degree would add up to 108. Explicitly:

Math 124,125,126,324 (calculus)	18 credits
Math 308, 318 or Amath 352 (linear algebra)	3 credits
Introductory physics	15 credits
Statistical physics	3 credits
Math methods and classical dynamics	9 credits
Electromagnetism and radiation	4 credits
Quantum mechanics	12 credits
Particles & symmetries	3 credits
Kinetics and early universe	3 credits
Macroscopic EM and condensed matter	6 credits
Intro computational physics	3 credits
Sophomore labs	5 credits
Advanced labs	6 credits
Physics or related electives	6 credits
Research or seminar	3 credits
Related science	9 credits

This is surely not going to be judged acceptable. To trim this down to something more reasonable, one could:

Trim or drop the related science requirement.	-3 to -9 credits
Or merge and trim the physics electives and related science requirements.	-3 credits
Make Quantum I/II/III three credits instead of four.	-3 credits
Require 3 of 4 from {Particles,Kinetics,MacroEM,CondMat}.	-3 credits
Require 6 credits of {advanced labs, computational physics}.	-3 credits
Not require Quantum III.	-4 credits
Drop the research or senior seminar requirement.	-3 credits

Something else to consider is the math requirement. We require linear algebra (Math 308) but not differential equations (Math 307), but then teach both pretty much from scratch in 227/228. We require multivariate calculus (Math 324), but only list it as a prerequisite 321, not for 228. Should Math 324 be a co-requisite for 228?

Is the senior seminar/research requirement accomplishing something vital for students who are not graduate school bound? Is the senior seminar working? Should it be turned into a senior thesis option (which could substitute for the senior seminar and perhaps some of the related science or elective credits). We could, similar to Chemistry, make research/thesis a substitute for some of the elective credits, but only for students with GPA above a threshold (perhaps 3.3).

## Alternative II (not quite everything): 99 credits

Here is one possibility which is more reasonable:

Math 124,125,126,324 (calculus)	18 credits
Math 308, 318 or Amath 352 (linear algebra)	3 credits
Introductory physics	15 credits
Statistical physics	3 credits
Math methods and classical dynamics	9 credits
Electromagnetism and radiation	4 credits
Quantum I/II/III	12 credits
Three of Particles, Kinetics, MacroEM, CM	9 credits
Intro computational physics	3 credits
Sophomore labs	5 credits
Advanced labs	6 credits
Physics or related science electives	12 credits
(may substitute 3 credits research/seminar/thesis if GPA $\geq 3.3$ )	
$\geq 2.0$ grade in all major coursework	
$\geq 2.2$ grade in 227 & 228	
$\geq 2.3$ GPA in physics and math	

## Alternative III (applied physics): 92 credits

Here is an alternative (modeled after Oscar's suggestions) which would emphasize applications of physics and could define a distinct B.S. in Applied Physics.

Math 124,125,126,324 (calculus)	18 credits
Math 308, 318 or Amath 352 (linear algebra)	3 credits
Introductory physics	15 credits
Statistical physics	3 credits
Math methods and classical dynamics	9 credits
Electromagnetism and radiation	4 credits
Macroscopic EM	3 credits
Quantum I & II	8 credits
Quantum III	recommended, not required
One of Particles, Kinetics, CM	3 credits
Intro computational physics	3 credits
Sophomore labs	5 credits
Optics lab	3 credits
Appl. of computers	3 credits
Other advanced labs	3 credits
Physics or related science electives	6 credits
Thesis project	$\geq 3$ credits
$\geq 2.0$ grade in all major coursework	
$\geq 2.2$ grade in 227 & 228	
$\geq 2.3$ GPA in physics and math	