An introduction to great twentieth-century discoveries in physics including the wave-particle duality of light and matter, quantum effects, special relativity, nuclear physics, and elementary particles.

The reading and problems below go with the topic for the date. The underlined problem is repeated from the previous assignment and should be passed in at the start of class on the date it is underlined.

WAVE OPTICS
Readings and Exercises in Huggins

Sep 4 M  Overview of Course
Skim Huggins pages Int-1 to Int-10, Int-17 to Int-18, Int-22
Describing Waves
Read Huggins pages 15-1 to 15-11
Do Exercises 1, 3 and 4 on pages 15-4 and 15-9

Sep 6 W  Periodic Waves
Read Huggins pages 15-12 to 15-17
Background information on pages 14-2 to 14-7
Interference
Read Huggins pages 33-1 to 33-8
Do Exercises 6 and 7 on pages 15-15 and 15-16, Problem A;
Exercise 2 on page 33-8; 4 on page 15-9

Sep 8 F  Young’s Double Slit Experiment
Read Huggins pages 33-8 to 33-11
Diffraction and the Single Slit
Read Huggins pages 33-26 to 33-28
Do Problems B and C; Exercise 14 on page 33-28; Problem A

Sep 11 M  The Diffraction Grating
Read Huggins pages 33-12 to 33-19; skim pages 32-20 to 32-22
Do Exercises 5 (page 33-13), 7 (on 33-16) & 8 (on 33-18); Problem B

Sep 13 W  Laboratory: Interference and Diffraction

Sep 15 F  Laboratory: Interference and Diffraction

Sep 18 M  Standing Waves
Read Huggins pages 15-18 to 15-22, 16-3 and 16-20 to 16-21
Do Exercises 8, 9 (a) and 10 on page 15-22; and
Exercise 1 (a), (b) and (c) on page 16-21; 5 on page 33-13

Sep 20 W  review session
Do Exercise 1 (a), (b) and (c) on page 16-21
SPECIAL RELATIVITY
Readings and Problems in Taylor, Zafiratos and Dubson (TZD)

Sep  25  M  Classical Relativity and the Michelson-Morley Experiment
Read TZD Sections 1.1, 1.2, 1.3, 1.4 and 1.5
Do Problems 1.9, 1.12, 1.15 and Problem D

Sep  27  W  Observers, Reference Frames, Time Dilation, Length Contraction
Read TZD Sections 1.6, 1.7, 1.8, 1.9 and 1.10
Do Problems 1.19, 1.27 (see note), 1.29 & 1.33(a),(b),(c);  Problem D
Note for Problem 1.27:  Do not answer their question. Instead
  a) What is the muon half-life measured by people on earth?
  b) On earth we measure the muons traveling 2000 meters.
     What is the distance as measured by the muons?

Sep  29  F  Do Problem 1.27 (see note above)
Laboratory:  Michelson Interferometer

Oct  2  M  The Lorentz Transformation
Read TZD 1.11 and 1.12
Do Problems 1.23, 1.35, 1.39, 1.42 and 1.43;  1.33 (a),(b),(c)

Oct  4  W  Laboratory:  Michelson Interferometer

Oct  6  F  Velocity Addition; The Doppler Effect
Read TZD 1.13 and 1.14
Do Problems 1.45, 1.46, 1.49 and 1.50;  1.39

Oct  9  M  Momentum and Energy in Relativity
Read TZD 2.1, 2.2, 2.3 and 2.4
Do Problems 2.1, 2.7, 2.8 and 2.9;  1.46

Oct 11  W  Conversion of Mass to Energy
Read TZD 2.5, 2.6 and 2.9
Do Problems 2.19, 2.20, 2.23 and 2.27;  2.8

Oct 13  F  review session
  Do Problem 2.20

Oct 16  M  Exam Two
Fall Recess
<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Topic</th>
<th>Reading and Problems</th>
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<tbody>
<tr>
<td>Oct 23</td>
<td>M</td>
<td><strong>Atoms and Quantization</strong></td>
<td>Read TZD Sections 3.1 through 3.6, 3.10 and 3.11</td>
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<td>Do Problems 3.8, 3.13, 3.20 (c) and 3.44</td>
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<td>Oct 25</td>
<td>W</td>
<td><strong>Laboratory: Electron Charge-to-Mass Ratio</strong></td>
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<td>Oct 27</td>
<td>F</td>
<td><strong>Laboratory: Electron Charge-to-Mass Ratio</strong></td>
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<td>Oct 30</td>
<td>M</td>
<td><strong>The Photoelectric Effect</strong></td>
<td>Read TZD 4.1, 4.2 and 4.3</td>
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<td>Do Problems 4.5, 4.7, 4.12 and 4.17; 3.20 (c)</td>
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<tr>
<td>Nov  1</td>
<td>W</td>
<td><strong>Laboratory: The Photoelectric Effect</strong></td>
<td>Do Problem 4.12</td>
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<td>please schedule with me a time to finish</td>
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<td>Nov  3</td>
<td>F</td>
<td><strong>X-Rays; The Compton Effect</strong></td>
<td>Read TZD 2.8, 4.4, 4.5, 4.6 and 4.7</td>
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<td>Do Problems 2.37, 4.20, 4.23 and 4.25</td>
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<td>Nov  6</td>
<td>M</td>
<td><strong>Atomic Spectra and Bohr’s Explanation</strong></td>
<td>Read TZD 5.1, 5.2, 5.3, 3.12 (through Equation 3.45), 5.4, 5.5 and 5.6</td>
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<td>Do Problems 5.1, 5.4, 5.7 and 5.8; 4.20</td>
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<td>Nov  8</td>
<td>W</td>
<td><strong>Successes of the Bohr Model</strong></td>
<td>Read TZD 5.6, 5.7, 5.8 and 5.10</td>
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<td>Do Problems 5.10 (last denominator is $\hbar c$, not $\hbar^2$), 5.12, 5.13, 5.15 and 5.16; 5.7</td>
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<td>Nov 10</td>
<td>F</td>
<td><strong>Quiz One</strong></td>
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<td><strong>Matter Waves, Electron Diffraction</strong></td>
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<td>Read TZD 6.1, 6.2 and 6.3; Figures 6.5 and 6.6 (pp 175-176)</td>
<td>Do Problems 6.3, 6.8 (for photons use $E = h f$), 6.9 and 6.15; 5.16</td>
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<td>Nov 13</td>
<td>M</td>
<td><strong>Standing Waves in Quantum Mechanics; Quantization</strong></td>
<td>Read TZD 7.1, 7.2 and 7.4</td>
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<td>Do Problems 7.3, 7.17 and 7.18; 6.8 (see note above)</td>
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<td>Nov 15</td>
<td>W</td>
<td><strong>Quiz Two</strong></td>
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<td><strong>Laboratory: Electron Diffraction</strong></td>
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<td>Nov 17</td>
<td>F</td>
<td><strong>Laboratory: Electron Diffraction</strong></td>
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<td>Thanksgiving Recess</td>
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<td>Nov 27</td>
<td>M</td>
<td><strong>More on the Hydrogen Atom; Electron Spin</strong></td>
<td>See TZD Figs 8.14 (p 267) and 8.16 (p 272); boxed Eqs on pp 267-272 and read Sections 9.1, 9.2, 9.3 and 9.5</td>
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<td>Do Problems 8.25, 9.4, 9.5 and 9.10; 7.17</td>
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Nov 29 W  Multielectron Atoms and the Pauli Principle
Read TZD Sections 10.1, 10.3, 10.4 and 10.6
Do Problems 10.5 (b), 10.7, 10.16 and 10.18: 9.5
### Dec 1 F  **Nuclear Properties**
- Read TZD 16.1, 16.2 and 16.3
- Do Problems 16.1, 16.8 and 16.17; 10.7

### Dec 4 M  **Radioactivity and the Decay Law; Radioactive Dating**
- Read TZD 17.1, 17.2 and 17.3
- Do Problems 17.1, 17.4, 17.17 and 17.18; 16.8

### Dec 6 W  **Nuclear Reactions; Fission and Fusion**
- Read TZD 17.6, 17.7, 17.8 and skim 17.9
- Do Problems 17.36, 17.39, 17.42, 17.47 and 17.50; 17.18

### Dec 8 F  **review session**
- Do Problem 17.47

### Dec 14 Th @ 10:30 am  **Final Exam**