




**▼ Homeworks**

Please see Gradescope for posting and submission of homeworks. The assignments and answer keys will be posted here for reference, but homework administration will be through Gradescope

 **HW1.pdf** **HW1 Answer key.pdf** **HW1Q1**  (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=0f84157f-2790-4c7e-a40e-b36e013ec862>) **HW1Q2**  (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=e05a19d0-4b2a-478a-9031-b36e0141eef4>) **HW1Q3**  (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=976d1e28-00cc-4ccb-a5a1-b36e01435a20>) **HW1Q4**  (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=3c24d103-7d4c-422b-9dad-b36e01471449>) **HW2.pdf** **HW2 Answer Key.pdf**



**[HW2Q1](https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=95ed1ad9-1fb4-49b3-b81e-b375010dca7f)** (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=95ed1ad9-1fb4-49b3-b81e-b375010dca7f>)



**[HW2Q2](https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=a17581ee-6258-4f7d-98c4-b3750110cfdd)** (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=a17581ee-6258-4f7d-98c4-b3750110cfdd>)



**[HW2Q3](https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=b1e6cec0-62f4-4a20-9624-b3750116069e)** (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=b1e6cec0-62f4-4a20-9624-b3750116069e>)



**HW3.pdf**



**HW3 Answer Key.pdf**



**HW4.pdf**



**HW4 Answer key.pdf**



**[HW4 overview](https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=bc7b8c21-3907-4928-a2cf-b39c01428e44)** (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=bc7b8c21-3907-4928-a2cf-b39c01428e44>)



**HW5.pdf**



**HW5 Answer Key.pdf**



**[HW5Q1](https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=68bc95db-9329-4d34-a7c9-b3a1011f78bd)** (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=68bc95db-9329-4d34-a7c9-b3a1011f78bd>)

## ▼ Midterm Exam 1



**MT1 Answer Key.pdf**



**MT1Q2** (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=6f6f1e13-d527-4788-94be-b39300f9c1b2>)



**MT1Q3** (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=f5e1f1bf-103a-448d-9479-b39300fedc6f>)



**MT1Q4** (<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=45c90bcd-54e6-4b67-ae16-b39301037e63>)



**MT1 front page.pdf**

## ▼ Introduction

### 00 - Introduction



**00 - Intro.pptx**



**00 - Intro.pptx.pdf**

## ▼ Chemical Kinetics: Enzymes, Blood, and Dynamics

## 01 - Chemical Kinetics and Equilibria

### Reading: Keener & Sneyd Chapter 1 (Coursepack / eBook)



01 - Kinetics.docx



01 - Kinetics.docx.pdf



01 - Kinetics.pptx



01 - Kinetics.pptx.pdf



[K&S electronic resource](https://link.springer.com/book/10.1007%2Fb98841)  (<https://link.springer.com/book/10.1007%2Fb98841>)

## 02 - Enzymes

### Reading: Keener & Sneyd Chapter 1.2.1-1.2.3, Boron & Boulpaep Chapter 58



02 - Enzyme Kinetics.docx



02 - Enzyme Kinetics.docx.pdf



02 - Enzyme Kinetics.pptx



02 - Enzyme Kinetics.ppt.pdf



02 - Enzyme Kinetics - example.pdf

**02 - Enzyme Kinetics - example.docx****03 - O2 and CO2 Transport in Blood**

**Reading: Keener & Sneyd Chapter 1.2.4 (Coursepack / eBook), Boron & Boulpaep Chapters 28&29**

**03 - O2 and CO2 transport in blood.docx****03 - O2 and CO2 transport in blood.docx.pdf****03 - O2 and CO2 transport in blood.pptx****03 - O2 and CO2 transport in blood.pptx.pdf****06 - Dynamics****06 - dynamics.docx****06 - dynamics.docx.pdf****06 - dynamics.pptx****06 - dynamics.pptx.pdf****06 - KS glycolytic oscillations.pdf**

**[SEAS MATLAB portal \(https://cuit.columbia.edu/content/matlab\)](https://cuit.columbia.edu/content/matlab)**



**MATLAB Introduction**  (<https://www.mathworks.com/help/matlab/getting-started-with-matlab.html>)

## ▼ Diffusion at Cellular and Molecular Scales

### 04 - Diffusion at Cellular and Molecular Scales

**Reading: Nelson Chapter 4 (Coursepack)**



**04 - Diffusion.docx**



**04 - Diffusion.docx.pdf**



**04 - Diffusion.pptx**



**04 - Diffusion.pptx.pdf**



**04 - Diffusion examples.pdf**

### 05 - Entropy



**05 - Entropy.docx**



**05 - Entropy.docx.pdf**

## ▼ Membrane Physiology

### 07 - Membrane Structure

Reading K&S Chapter 2, B&B Chapter 5

 07 - Lipid membrane structure.pptx

 07 - Lipid membrane structure.pptx.pdf

### 08 - Bioelectric Potentials

Reading: Nelson Chapter 7 (Coursepack), K&S Chapter 2  
(Coursepack), B&B Chapter 6

 08 - bioelectricity and membrane potentials.docx

 08 - bioelectricity and membrane potentials.docx.pdf

 08 - Membrane potentials.pptx

 08 - Membrane potentials.pptx.pdf

### 09 - Resting Potential

Reading: K&S Chapter 2 (Coursepack)

 09 - Resting potential and the Pump-leak model.docx



**09 - Resting potential and the Pump-leak model.docx.pdf**



**09 - Resting potentials.pptx**



**09 - Resting potentials.pptx.pdf**

## **10 - Excitable Membranes**

### **Reading: B&B Chapter 7**



**10 - excitable membranes.docx**



**10 - excitable membranes.docx.pdf**



**10 - excitable membranes.pptx**




**10 - excitable membranes.pptx.pdf**



**10 - Nelson cable equation.pdf**

### **Reading on electronic circuits and components**




**[Voltage divider, components in series](https://www.electronics-tutorials.ws/dccircuits/voltage-divider.html)**  (<https://www.electronics-tutorials.ws/dccircuits/voltage-divider.html>)



**[Current divider, components in parallel](https://www.electronics-tutorials.ws/dccircuits/current-divider.html)**  (<https://www.electronics-tutorials.ws/dccircuits/current-divider.html>)



**[Kirchhoffs two laws for circuit analysis](https://www.electronics-tutorials.ws/dccircuits/dcp_4.html)**  ([https://www.electronics-tutorials.ws/dccircuits/dcp\\_4.html](https://www.electronics-tutorials.ws/dccircuits/dcp_4.html))





**Capacitors, see setions 1 and 4** ([https://www.electronics-tutorials.ws/capacitor/cap\\_1.html](https://www.electronics-tutorials.ws/capacitor/cap_1.html)).



**RC Charging circuit** ([https://www.electronics-tutorials.ws/rc/rc\\_1.html](https://www.electronics-tutorials.ws/rc/rc_1.html))



**Thevenin theorem** (<https://www.allaboutcircuits.com/technical-articles/thevenin-theorem-dependent-source-circuits/>)



**Thevenin-Norton Equivalents** (<https://www.allaboutcircuits.com/textbook/direct-current/chpt-10/thevenin-norton-equivalencies/>)

## ▼ Cytoskeletal Physiology

### 11 - Cytoskeleton

#### Reading: B&B Chapter 2



**11 - Cell cytoskeleton.docx**



**11 - Cell cytoskeleton.docx.pdf**



**11 - cell cytoskeleton.pptx**



**11 - cell cytoskeleton.pptx.pdf**

### 12 - Motors and Muscle

## Reading: B&B Chapter 9



**12 - Motors and muscles.docx**



**12 - Motors and muscles.docx.pdf**



**12 - motors and muscle.pptx**



**12 - motors and muscle.pptx.pdf**



**[The Inner Life of the Cell Animation](https://xvivo.com/examples/the-inner-life-of-the-cell/)** **[\(https://xvivo.com/examples/the-inner-life-of-the-cell/\)](https://xvivo.com/examples/the-inner-life-of-the-cell/)**

### ▼ Cellular Engineering



**Cell culture.pptx**



**Cell culture.pptx.pdf**



**[HeLa Cells: A Lasting Contribution to Biomedical Research](https://osp.od.nih.gov/scientific-sharing/hela-cells-landing/)** **[\(https://osp.od.nih.gov/scientific-sharing/hela-cells-landing/\)](https://osp.od.nih.gov/scientific-sharing/hela-cells-landing/)**



**[The Henrietta Lacks Foundation](http://henrietalacksfoundation.org/)** **[\(http://henrietalacksfoundation.org/\)](http://henrietalacksfoundation.org/)**



**[The Legacy of Henrietta Lacks](https://www.hopkinsmedicine.org/henrietalacks/)** **[\(https://www.hopkinsmedicine.org/henrietalacks/\)](https://www.hopkinsmedicine.org/henrietalacks/)**



**[The Immortal Life of Heniretta Lacks \(book, via CLIO\)](https://clio.columbia.edu/catalog/15806559)**  
**[\(https://clio.columbia.edu/catalog/15806559\)](https://clio.columbia.edu/catalog/15806559)**



[A culture of consent](https://www.nature.com/articles/498407a)



[Paying Patients for Their Tissue: The Legacy of Henrietta Lacks](https://www.science.org/doi/10.1126/science.1216888)   
(<https://www.science.org/doi/10.1126/science.1216888>)



[Paying for Tissue: The Case of WI-38](https://www.science.org/doi/10.1126/science.337.6100.1292-a)   
(<https://www.science.org/doi/10.1126/science.337.6100.1292-a>)



[Paying for Tissue: Net Benefits](https://www.science.org/doi/10.1126/science.337.6100.1292-b)   
(<https://www.science.org/doi/10.1126/science.337.6100.1292-b>)



**Mechanobiology.pptx**



**Mechanobiology.pptx.pdf**



**Microscale cell physiology.pptx**



**Microscale cell physiology.pptx.pdf**



**Analysis with computers.pptx**



**Analysis with computers.pptx.pdf**



**WTSKAB.pdf**



**Microscopy.pptx**

[Video of microscopy lecture](https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=f2787790-5811-4a99-8f46-)

(<https://cvn.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=f2787790-5811-4a99-8f46->



[b1db016fa022\).](#)



**Microscopy.pptx.pdf**