PY106 Honor Code

I agree to act with complete honesty in PY106. This includes, but is not limited to, the following:

All work I turn in will be my own, and not copied from any other source.

For in-class questions I will submit answers/responses based on my own work.

I will not submit answers/responses for anyone else.

I will not sign in for anyone else.

In addition to being reported to the Academic Conduct Committee, examples of grading penalties might include:

Zero on an assignment if you copy the assignment, or let someone copy from me.

Zero on a test if there are copying issues, or other examples of misconduct.

I will read the PY106 course syllabus. There is a link to the Academic Conduct Code on the PY106 learn.bu.edu web site, and I will read that, too. I will take all three exams on the dates provided in the syllabus.

Name (please, print): _____

BU ID: _____ BU Username:_____

Signature: _____ Date: _____

ELEMENTARY PHYSICS II PY106 SUMMER II 2018

(***all numbers*** **below are subject of possible change depending on the circumstances)**

Lecture	Professor	Contact Info.	Office hours
SB1 MTWRF 9-10:30 AM in SCI 113	Dr. Valentin Voroshilov Office: SCI 260	Phone: 617- 353-2634 E-mail: valbu@bu.edu	**SCI 121**

Required Text	College Physics, by openstaxcollege.org (free download at **https://openstax.org/details/college-physics** or buy from AMAZON)
Web site	http://learn.bu.edu (PY106s B1 Elementary Physics 2)
Calculator	You will need a standard scientific calculator for homework and labs. Calculators are **ALLOWED** on the tests or the final exam.
Internet Access	When at a lecture you need to have a device, which can be used to access the Internet (specifically, webassign.net)
Homework	online assignments delivered via WebAssign (you will need to purchase the access code)
Exams	Test 1 July 16; 9 – 11:00 am, Test 2 July 30; 9 – 11:00 am, Test 3 August 10; 9 – 11:00 am,
Course Grade	14 % homework + pre- and post- surveys 16 % unit sections 7 % lecture participation: in-lecture quizzes, class participation 20 % test 1, 21 % test 2, and 22 % test 3
Grading Scale ***(slight deviations up to 1.5 points in either directions are possible)***	We will use the following scale for grades (the scale is not relative but absolute; students are *not* competing with each other, collaboration is advisable): A: 95 - 100 A-: 90 – 94.9999 B+: 85 – 89.9999 B: 80 – 84.9999 B-: 75 – 79.9999 C+: 69 – 74.9999 C: 60 – 68.9999 C-: 55 – 59.9999 D: 45 – 54.9999 < 45 for F

Disclaimer

It is a well-known fact that different people might have different taste in food or art, or anything else.

Your friends might love horror movies but you might hate them, or you might like sushi but your friends will never eat it.

The same is true for choosing your instructor. There is no ideal teacher who would be equally good for everyone. Different people have different learning stiles, students have different backgrounds, different instructors have different teaching styles, and it is just impossible to equally accommodate every student in a classroom by offering the same lectures, exercises, questions, demonstrations, etc. That is why some students might find instructions as too fast but others as too slow; too easy or too challenging. This course is not for everyone, in the past some students liked it and some didn't. Everyone is welcomed to check what previous students thought of my teaching (more at **http://GoMars.xyz/cr.htm**)

In this disclaimer, I need to point out that summer courses are ***always*** more intense than fall or spring courses because the same amount of material is to be covered over a shorter period of time. The success in taking this course depends mostly on the effort put into the study, including lectures, home work, investigative laboratories, and, if needed, office ours.

Students should expect spending on average at least two hours every day on reading and homework (in addition to lectures and investigative laboratories).

It is advisable to distribute the homework uniformly over a week (not waiting until the deadline for HW will be approaching; solving all the problems in one seating is impossible).

About this course

It is advisable to sign up for the both PY 105 and PY 106 summer courses, in that case you will be using the same textbook for two courses and save on the access to WebAssing.

Please, note: PY105 and PY106 courses cover no more than 80% of a standard MCAT prep course, hence do not represent a full equivalency to a MCAT prep course but rather can be seen as a prerequisite to that.

This course might be perceived differently from traditional courses by its main philosophy and structuring. It is built upon the principles of constructivism and employs inquiry-based strategies of teaching.

In this course students develop the fundamental concepts and ideas while working through combined discussion/lab activities named Investigative Laboratories (IL), or Units. Investigative Laboratories are designed in such a way that every student will be developing a deep understanding of fundamental physical concepts via hand-on experience of building connections between experimental realization and theoretical descriptions of physical phenomena (this is the why some of the study material comes first at IL, and later at a lecture).

Our lectures will ensure the correct understanding of the fundamental principles and will guide students through problem solving techniques and procedures to help them to achieve a deeper understanding of how to apply the fundamental physical concepts to solving specific physics problems. During lectures, delivered in the form of Active Learning Group format, students are encouraged to form collaborative groups to discuss problem-solving strategies. Ideally, lectures become a place for a scientific communication between peers and for knowledgeable individual decision making in the field of physics.

The ultimate goals of the course are 1) helping students to grasp the understanding of fundamental physical concepts, 2) helping students to learn how to apply those concepts for solving specific physical problems, 3) helping students to advance the ability to think critically about physical phenomena, and 4) to support positive attitudes toward study physics.

Taking this course does not require taking physics before, but requires **fluency in basic arithmetic, algebra, and trigonometry, and also common knowledge about everyday natural phenomena.**

Everyone is encouraged to use as many office hours as possible to ensure the full understanding of the subject, and to collaborate with the fellow students via piazza.com.

Class Links:
https://piazza.com/bu/summer2018/py106s
https://piazza.com/bu/summer2018/py106s/home

Using WebAssign

WebAssign is a web-based homework system we will be using for the homework. The name of the course is "PY106 Summer II 2018". Please contact Prof. Voroshilov if you have any problems, particularly if you have problems logging in. The web address for WebAssign is: **http://www.WebAssign.net/student.html**

WebAssign will become available **on June 28th at 10 am** and for two weeks you can use it for free. During that time you will need to buy the access directly from WebAssign with a credit card. To do this, log into WebAssign using the information below and then hit the button for registering with a credit card. Note that you can do the first assignment without paying for access - you get free access for the first two weeks of using WebAssign. **NOTE:** If you are confident you will take both PT105 and PY106 courses, you can purchase the lifetime subscription. **To resolve any issues with using webassign on a mobile device, please, contact 1-800-354-9706** *You will have to self register using the following class key*: **bu 0223 0613.**

Important (!!!):

1. While registering you need to choose as you username your regular BU login name: for example, if your BU email is abcd123@bu.edu => your username must be **abcd123** (just drop @bu.edu).
2. Institution name: BU .
3. As your password you need to use your BU student number in the form **U12345678**. No dashes or spaces, ***must*** *start from capital* ***U*** !
4. As an email you have to use your BU email address (yourusername@bu.edu)

Failing to fulfill the requirements above might lead to losing points on your homework assignments (!!!).

** Note that if you have used WebAssign previously at BU, such as in Chemistry, then WebAssign might be looking for your old account, but for this course you have to have the new access code and change your account credentials according to the requirements above.

Getting the most out of WebAssign

You have six chances to submit each answer to each question of each problem of each homework assignment. Use your submissions wisely. Note that *you can submit the answers to each question individually* - you do not need to fill in answers for the whole problem or the whole assignment first. Each time when you click on SUBMIT, WebAssign tells you whether you are right or wrong (unless an assignment specifically designed not to give you a feedback).

Things to keep in mind when using WebAssign:

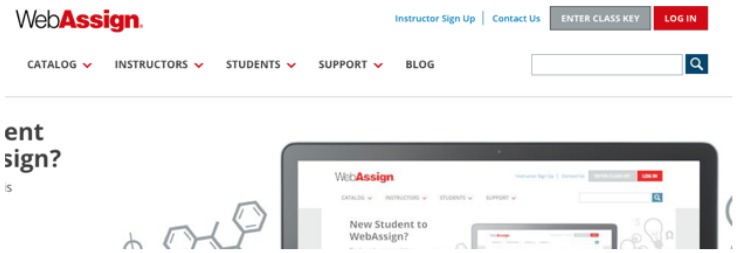
- Start early.
- Come to office hours for help; if you have left just two trials for a particular question, it is advisable to stop and seek some help.
- Feel free to work together with other students, but try to do as much as you can on your own.
- Do not hit the refresh button on your browser - that can count as a submission.

It is not very critical which textbook you would use for your reading (the theory is the same!) that is why we use a free textbook from Openstax.org. Additional useful sources are books by A. Duffy, Cutnell and Johnson, Giancoli, Ohanian, Halliday, Resnick, Walker. Also you can use online resource like Wikipedia.org; http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html; physics.bu.edu/demos; etc.

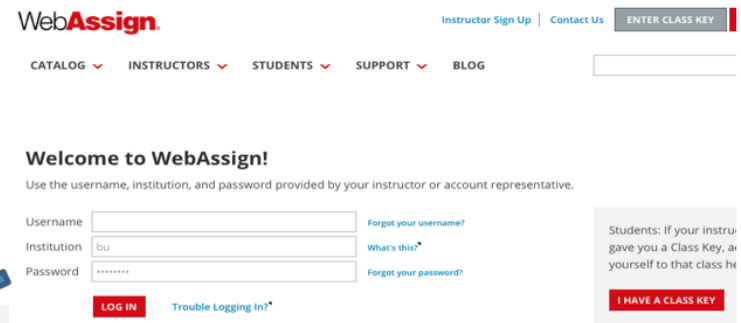
Most of the exam problems will be based on problems from lectures, homework problems (which comes form the textbook), and problems solved during discussions and labs.

Please, **login into your webassign account** (*pages 4, 5*)

webassign.net/



LOG IN



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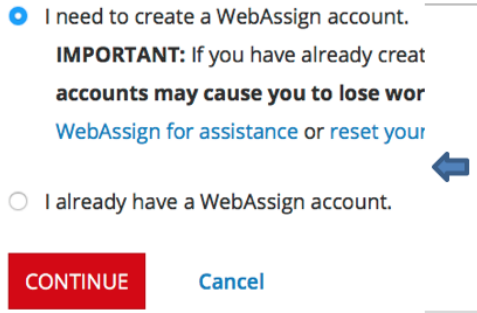
2. Institution name: BU.
3. As your password you need to use your BU student number in the form **U12345678**. No dashes or spaces, *must start from capital U!*
4. As an email you have to use your BU email address (yourusername@bu.edu)

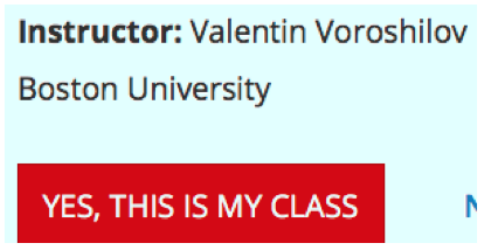
I HAVE A CLASS KEY

(class key: **bu 0223 0613**

BU | **0223** | **0613**

SUBMIT





Name
LectureMCQ_L1 (PY106)

Course web site: http://learn.bu.edu

Your login name is your regular BU login name and your password is your BU kerberos password. In case of any problems, please contact Dr. Voroshilov (valbu@bu.edu). **If you do not have a BU kerberos account you must get one**. You can *start* the application process on-line at **http://www.bu.edu/computing/accounts/acsaccounts/creating/** (BU students should use the "Individual" instructions; non-BU students should use the "Guest" instructions); and you will *need* to go to IT Help center at 771 Commonwealth Ave (Mugar Library, 1st floor) to *complete* the process (please, call 617-353-4357 for more information). You may need to synchronize your BU account to have access to all BU websites.

The web site contains all course information. You will also be able to check all your grades. **It is your responsibility to regularly check your grades and make sure they have been recorded correctly; about any grade related issues contact Prof. Voroshilov as soon as possible** (a standard period for addressing any grade issues is a week after the grade has been posted). In order to watch lectures non-BU students might go to **www.bu.edu/kpw**, select the 'Log In' button to authenticate and sync BU credentials.

Homework: To pass the course you must get *at least 50%* of the maximum homework score (not including the ore- and post- survey grades). All homework assignments will be delivered via WebAssign. The numbers in the on-line assignments might be randomized so everyone gets a unique version of any problem. These assignments usually are due at 6 pm on the due dates, adjusted somewhat for schedule peculiarities. ***All* homework assignment will be accounted for the final grade.**

You are strongly encouraged to obtain help (if needed) during lab sections and office hours, and from your fellow classmates using piazza. In addition to Dr. Voroshilov's office hours, you can use office hours of any TF of the class (the schedule and other course information is posted on the course board in the Science Building on the first floor by the undergraduate resource room SCI 121).

Lectures: Participation provides 7 % of the total grade. Students are allowed to miss up to 5 lectures due to legitimate reasons (every emergence case has to be reported as soon as possible). To get the most out of the lectures you are encouraged to read the material ahead of time and prepare questions (below you find the list of topics and concepts with which you should be familiar when coming to an exam).

Discussion sections and traditional laboratories are combined together in 9 Investigative Laboratories (or shortly, IL, or units): These begin on **July 5th**. Much of the time in IL will be spent working with your partner on discovering, analyzing and applying fundamental physical concepts and relationships. Laboratory activities are combined with problem solving activities. The best 8 unit scores out of 9 will be counted toward the final grade. **To pass the course students must complete at least 7 IL.** Unit assignments are only complete when your personal report is checked by your TF/LA during and at the end of the unit session. Your unit report will consist of copies of your data together with your answers to questions on a sheet(s) handed out at the beginning of the unit session. Each student must have an individual report.

All sections are usually held in rooms SCI 134/128 but occasionally can be relocated. The room assignments for a particular week will be posted on all lab doors - please, pay attention to the information provided on learn.bu.edu.

Exams: Three closed-book no-notes exams will be given during the course. *Although formally exams are not accumulative, due to internal connections between the topics, some of the new exam problems WILL be related to the previous ones*. Equation sheets with the most common equations will be provided, but it is advisable to memorize the most important physical laws and definitions. Concerns about grading must be brought to Dr. Voroshilov's attention *within one week after the tests are returned* (the final exam will not be returned due the BU policies). A random sample of tests will be photocopied before being returned to discourage cheating on re-grade issues.

In exceptional (unforeseen, like unexpected illness or accident) circumstances an arrangement may be made to take a make-up test. In a case when due to unforeseen circumstances a student might loose more than 10 % of the possible total grade, the best approach would be taking an Incomplete for the course and finishing it later. **If any accommodation may be needed, the request must be processed within the first week of the course and be supported by the required paperwork.**

Makeup policy: It is your responsibility to take all exams, and do all homework and lab assignments according to the posted schedules. ***There are NO makeups***. In exceptional circumstances please contact Dr. Voroshilov as soon as possible.

Switching sections: We encourage your to switch from a full to less occupied unit sections. For any section change you need Dr. Voroshilov's signature on a drop/add form.

Getting help: The best way to get help is to come to office hours and using piazza for collaboration. Between the professor and the teaching fellows there are about 20 office hours per week - please come and see any of us. All office hours are held in SCI 121 (unless rescheduled due to room unavailability).

Ethics Policy: You are expected to be familiar with and adhere to the College of Arts and Sciences Academic Conduct Code, in particular, cheating in any form will not be tolerated. Evidence of cheating will be reported immediately to the Academic Conduct Committee. **Students found guilty of cheating on exams may be penalized by reducing the grade, by suspension or even expulsion.**

All students will have to sign an honor code on the first day of class

At the beginning of every lecture, every student will have to access the Internet and login to wenassign.net. In order to have this option every student has to bring a device with the Internet access (a laptop, a tablet, a smartphone). It is highly recommended to check the access to WebAssign before the beginning of the course.

Schedule for PY106 - Summer 2 – 2018					
Day	**Date**	**Lecture on**	**IL**	**HW issued**	**HW due**
M	7/2	Electric Charge	NO IL	HW1 (I, II, III, IV)	
T	7/3	Coulomb's Law, Electric Field	NO IL		
W	7/4	**NO CLASSES**	NO IL		
R	7/5	Electric Potential Energy	B3		
F(**W**)	7/6	Electric Potential	B2, B4, B5		
Weekend	Weekend	Weekend Weekend Weekend			
M	7/9	Capacitance; Capacitors	B2, B4, B5		
T	7/10	Current; Resistance; Batteries	B3		
W	11	Resistors; Resistor Combinations	B2, B4, B5		
R	12	Resistor Combinations;	B3		
F	13	Magnetic Field; Charges in Magnetic Field	NO IL	HW2 (I, II, III, IV)	HW1
Weekend	Weekend	Weekend Weekend Weekend			
M	16	**Exam 1; 9 am – 11:0 am;**	NO IL		
T	17	Force (Ampere's Law)	NO IL		
W	18	Sources of Magnetic Field.	B2, B4, B5		
R	19	Torque on a loop with *I*	B3		
F	20	Magnetic Flux Faraday's Law; Lenz's Law, Motional emf	NO IL		
Weekend	Weekend	Weekend Weekend Weekend	NO IL		
M	23	eddy currents; Generators; Transformers	B2, B4, B5		
T	24	Waves and Sound, Superposition of Waves	B3		
W	25	Standing Waves; Music	B2, B4, B5		
R	26	Propagation of Sound	B3		
F	27	Doppler Effect; Geometrical Optics	NO IL	HW3 (I, II, III, IV)	HW2
Weekend	Weekend	Weekend Weekend Weekend			
M	30	**Exam 2; 9 am – 11:0 am;**	NO IL		
T	31	Reflection; Mirrors, Refraction; Lenses	NO IL		
W	8/1	Diffraction and Interference of Light	B2, B4, B5		
R	2	Thin-film interference	B3		
F	3	EMW, Polarized light			
Weekend	Weekend	Weekend Weekend Weekend			
M	6	Quantum Hypothesis; Photons	B2, B4, B5		
T	7	Atom Models	B3		
W	8	Radiation; Radioactivity	B2, B4, B5		
R	9	Nuclear Reactions	B3		
F	10	**Exam 3; 9 am– 11:0 am;**	NO IL		HW3

Chapters

Lecture on	Textbook
Electric Charge	18.1-18.2
Coulomb's Law	18.3
Electric Field	18.4 -18.5, 18.7
Electric Potential Energy and Potential	19.1-19.4
Potential; Capacitance; Capacitors	19.5 19.7
Current; Resistance; Batteries	20.1-20.4, 21.2
Resistors; Resistor Combinations	21.1-21.2
Resistor Combinations;	21.1-21.2
Magnetic Field; Charges in Magnetic Field	22.1,22.3 -22.5
Force (Ampere's Law) and Torque	22.7 22.10
Sources of Magnetic Field. Magnetic Flux	23.1
Faraday's Law; Lenz's Law, Motional emf	23.2 -23.3
Eddy currents; Generators; Transformers	23.4 -23.5, 23.7
Waves and Sound	16.9,16.11
Superposition of Waves	16.10
Standing Waves; Music	16.10
Propagation of Sound; Doppler Effect	17.1 17.6
Reflection; Mirrors	25.1-25.2, 25.7
Refraction; Lenses	25.3 -25.4, 25.6, 26.1
EMW, Polarized light	27.8
Diffraction and Interference of Light	27.1-27.5
Thin-film interference	27.7
Quantum Hypothesis; Photons	29.1-29.2
Atom Models	29.5,29.3,30.1,30.3
Radiation; Radioactivity	30.2,31.1-31.5
Reactions	31.6,32.5 -32.7

PY 106 Lab schedule

Days	IL
July 5, 6	Properties of electric charge
July 9, 10	Electric field and potential
July11, 12	Capacitors and Resistors
July 18, 19	Measuring e/m ratio for an electron
July 23, 24	Lenz’s law and Faraday’s law
July 25, 26	Sound and standing waves
Aug 1, 2	Properties of light I
Aug 6, 7	Properties of light II
Aug 8, 9	Quantum properties of matter (radioactive decay and electron diffraction)

Taking a physics course	Becoming a physician
When study physics, students have to memorize definitions and laws.	To become a doctor, students have to memorize a lot of stuff (*way* more than when taking a physics course), for example names of all mussels, bones, diseases, and treatments.
When solving a physics problem students have to be able to recognize the underling model.	A doctor has to recognize a disease, i.e. make a diagnosis.
For solving a physics problem students have to formulate the sequence of steps leading to the solution.	A doctor has to formulate the course of treatment for treating a disease.
If the proposed solution of a problem did not work, a student has to reflect on the own work and to make a correction, and to try a new approach.	If the treatment did not work a doctor has to reflect on possible reasons for that and to offer a correction.

More at
http://www.Cognisity.How/2016/12/handbook.html
and
http://www.Cognisity.How/2018/02/thinkphy.html

Concepts, definitions, and laws/relations to learn

week 1:

electric charge ***(the first topic of test 1)***

neutral

charging and discharging

charging by a contact

charging by induction

grounding

conductors and insulators

elementary charge

triboelectric series

1 C

isolated system

conservation of charge

electrostatic force

coulomb's law

the principle of superposition

calculating the net electrostatic force

electric field

electric field of a single charge

electric field vectors; electric field lines

calculating the net electric field

electric field near and inside conductors

kinetic and potential energy

work–kinetic energy theorem and law of conservation of energy

electric potential energy for two charges

electric potential energy for the system of charges

electric potential; electric potential energy of a charge in a field

1 V; electric potential of a single charge

electric potential of a system of charges

equipotential

uniform electric field

potential in a uniform electric field and relation with electric filed

week 2:

capacitor

capacitance

1 F

relation of charge and capacitance

parallel plate capacitor with and without dielectric

dielectric constant

capacitance for a parallel plate capacitor

energy of a capacitor

manipulations with a capacitor

electric current

1 A

EMF

electric circuit

electrical resistivity

electrical resistance

Ohm's law

junction rule

loop rule

application of Ohm's law to circuits

resistors in series and parallel

circuits with bulbs and switches ***(the last topic of test 1)***

week 3:

magnetism ***(the first topic of test 2)***

magnetic field

1 T

magnetic field vectors and lines

magnetic force on a charge

properties of a circular motion of a charge in a magnetic field

mass spectrometer and other applications

magnetic force on a wire with current

Ampere's law

magnetic force on a loop

torque of magnetic force acting on a loop

magnetic field generated by a wire

the net magnetic field

magnetic filed in coils and loops

a solenoid

magnetic flux

normal (area vector) of a loop

ways to change magnetic flux

Lenz's rule of induction

Faraday's law of induction

Pictorial method and its applications

electromotor

motional EMF

eddy currents

electric generators

harmonic EMF

transformers

ideal transformer relations

transmission of electricity

week 4:

a pulse and a wave

harmonic wave

amplitude, wavelength and period

wave speed and wave number

wave equation

maximum speed of oscillations

wave speed for a wave on a string

sound waves, frequency spectrum (range)

speed of sound

intensity for spherical wave

intensity and loudness, dB

the Doppler Effect for moving source

the Doppler Effect for moving observer

the Doppler Effect in general

sonic boom

superposition of waves

interference

beats

1D interference

wave reflection: opened and closed ends

standing waves: on strings and in pipes

fundamental and higher harmonics ***(the last topic of test 2)***

week 5:

ray model of light ***(the first topic of test 3)***
diffuse and specular reflection
law of reflection (both parts!)
ray diagrams; images in plane mirrors
images in spherical mirrors: concave and convex
radius and focal distance of a spherical mirror
ray diagrams; magnification; mirror equation
properties of a wave crossing a boundary
speed, wavelength and frequency in different media
refraction; index of refraction
law of refraction (Snell's law)
total internal reflection
light traveling through several media
dispersion; a rainbow
thin lens; focal distance for a thin lens
image formation by thin lens
ray diagrams; thin lens equation; magnification
optical devices (an eye, a camera, a microscope, a telescope)
interference from two sources (2D interference)
path length difference
constructive and destructive interference
interference from two light sources
diffraction grating
single slit interference; double slit interference
wave reflection on a boundary
effective path length difference
thin film interference; 5-step method
Coating, Newton's rings, soap films, air wedges
electromagnetic induction; electromagnetic waves
EMW speed in vacuum; EMW spectrum
a plane (linearly polarized) EMW
speed, intensity, field amplitudes in a plane EMW
wave pressure
point source and intensity for spherical wave
sources of EM field
unpolarized and polarized light
Malus' law; system of two or three polarizers

week 6:

quantum objects; Planck's constant
phot**ons; ene**rgy of a photon
photoelectric effect
Einstein law for photoelectric effect
work function and maximum kinetic energy of electrons
1 eV
graphs for photoelectric effect
photon mass and momentum
wave-particle duality; de Broglie wavelength
electron diffraction
light spectrum; line spectra
line spectrum of the hydrogen atom
Rydberg equation; energy levels
Bohr's model
the nucleus
strong force
nucleons
neutrons
protons
atomic mass number
atomic number, isotopes
$E = mc^2$
atomic mass unit, 1 MeV
mass defect, binding energy
radioactive decay (α, $\beta+$ and $\beta-$, γ)
conservation of charge and energy
stability-instability graph
radioactivity
law of radioactive decay
decay constant and half-life
carbon dating
graph of binding energy per nucleon
nuclear fusion and fission
chain reaction and atomic plant ***(the last topic of test 3)***