PY105 Honor Code

I agree to act with complete honesty in PY105. 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 PY105 course syllabus. There is a link to the Academic Conduct Code on the PY105 **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: _____

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**).

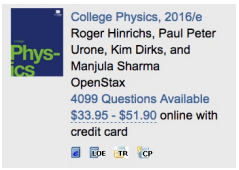
In this disclaimer, I need to point out that summer courses are ***always*** more intense than fall or spring courses because the same amount of material is to be covered over a shorter period of time. The success in taking this course depends mostly on the effort put into the study, including lectures,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

ELEMENTARY PHYSICS I PY105 SUMMER I 2018

Lecture	Professor	Contact Info.	Office hours
SA1 MTWRF 8:30-10:00 AM in SCI 109	Dr. Valentin Voroshilov Office: SCI 260/111	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 (PY105 A1 Elementary Physics 1 (Summer 1 201))
Calculator	You will need a standard scientific calculator for homework, labs, lectures, and all exams.
Internet Access	For every lecture you will need to have a device which can be used to access the Internet (specifically, WebAssign.net)
Homework	homework assignments will be delivered via WebAssign (you will need to purchase the access code; follow the instructions below)
Exams (no makeups!)	Test 1 June 4; 8:30 am – 10:30 am, LSE B01 Test 2 June 18; 8:30 am – 10:30 am, LSE B01 Test 3 June 29; 8:30 am – 10:30 am, LSE B01
Course Grade	14 % homework + pre- and post- surveys 16 % unit sections (IL2 – IL10) 7 % lecture participation: in-lecture quizzes, class participation, IL1, IL11 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

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 about 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). 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/py105s
https://piazza.com/bu/summer2018/py105s/home

Using WebAssign

WebAssign is a web-based homework system we will be using for the homework. The name of the course is "PY105 Summer I 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 May 18th 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 subscribtion.

You will have to self register using the following class key: **bu 1694 4391**

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 (**yourbuusername@bu.edu**)

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

**** NOTE:** 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 (6) 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).

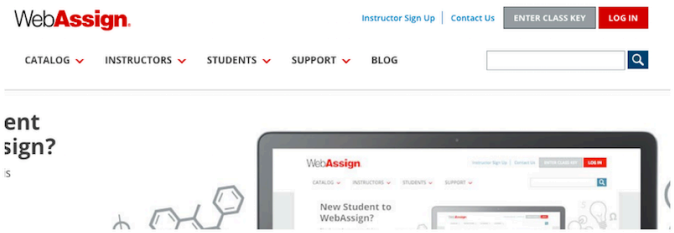
Things to keep in mind when using WebAssign: - Start early. - Come to office hours for help; if you have left just two trials for a particular question, it is advisable to stop and seek some help.
- Feel free to work together with other students, but try to do as much as you can on your own.
- Do not 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.

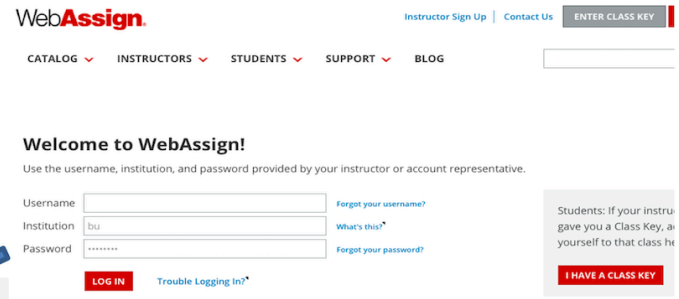
Most of the exam problems will be based on problems from lectures, homework problems (which comes form the textbook), and problems solved during discussions and labs.

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

webassign.net/



LOG IN



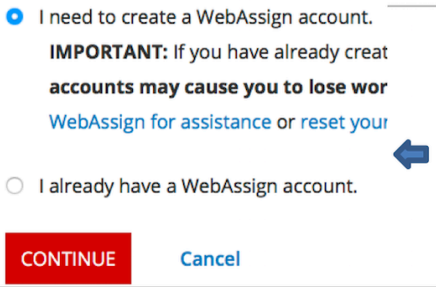
1. While registering you need to choose as you username your regular BU login name: for example,
if your BU email is abcd123@bu.edu => your username must be **abcd123** (just drop @bu.edu).
2. Institution name: BU.
3. As your password you need to use your BU student number in the form **U12345678**.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

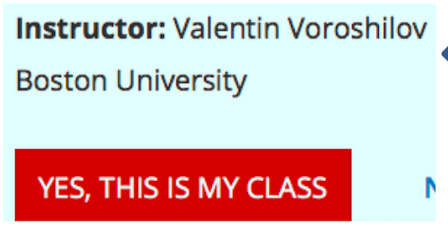
I HAVE A CLASS KEY

(class key: **bu 1694 4391**

BU | 1694 | 4391

SUBMIT





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 11 Investigative Laboratories (or shortly, IL, or units – which are 50 minutes *longer* thatn a traditional lab): These begin on **May 22nd.** 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 *first* (IL1) and the *last* (IL11) ILs are *mandatory* (with the grade to be a part of the attendance grade). From the *other* 9 ILs the best 8 scores out of 9 will be counted toward the final grade. **To pass the course you must complete at least 7 IL (**from IL2 to IL10**).** 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 unit sections are usually held in rooms SCI 134/128 but occasionally can be relocated (e.g. SCI 130, B9). The actual room assignments for a particular week will be posted on all lab doors.

Exams: Three closed-book no-notes exams are required for the course. Formally *exams are not accumulative, but due to internal logical connections imposed by physics some of the new exam problems WILL be related to some the previous ones*. Equation sheets 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 lose 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 you 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.

Concepts, definitions, and laws/relations to learn

week 1

a scalar (***the first topic of test 1***)
a vector
a component
a right triangle
sin, cos, tan
the Pythagorean theorem
Coordinate system
Cartesian coordinate system
an axis
an origin
a coordinate
Cartesian vector components
linear equation
quadratic equation
quadratic formula
a unit
fundamental (base) units
SI system of units
unit conversion
conversion factor
prefix words
etalon
measurement
significant figures

motion
1 D motion
2 D motion
translational motion
linear motion (LM)
position
position vector
displacement
distance
elapsed time
velocity
speed
average velocity
average speed
instantaneous velocity
motion equation
motion diagram
position graph
velocity graph
meaning of the slope
meaning of the area
constant velocity motion (CVM)
properties of CVM

acceleration
average acceleration
instantaneous acceleration
motion with constant acceleration (MCA)
properties of MCA

relative motion
velocity addition
"crossing the river"
projectile motion (PM)
properties of PM
range, maximum height, flight time

week 2

inertia
force
list of forces
Newton's 1st law
Newton's 2nd law
Newton's 3rd law
principle of superposition of forces
FBD

force of gravity vs. apparent weight
weightless
kinetic friction vs. static friction
coefficient of friction
a pulley
an ideal string
an Atwood's machine
methods for applying Newton's laws (***the last topic of test 1***)

week 3

circular motion (CM) (***the first topic of test 2***)
circumference
radius
uniform circular motion (UCM)
period
frequency
centripetal acceleration
properties of horizontal UCM
properties of vertical UCM
properties of vertical CM

kinetic energy
work
work-force connection
force-position graph
power
power-force connection
work-kinetic energy theorem
conservative force
potential energy
gravitational potential energy
mechanical energy
non-conservative force
law of conservation of energy

impulse of a force
linear momentum
force-tine graph
closed (isolated) system
law of conservation of linear momentum

a collision
elasticity
four types of collisions
methods for solving collision problems

center of mass (COM)
calculating COM

week 4

a solid object
rotational motion
axis of rotation
an arc
angular displacement
angular velocity
angular acceleration
degrees vs. radians
connections RM to LM

torque
lever arm
calculating torque
rotational inertia (RI)
Newton's 1st law for RM
Newton's 2nd law for RM

static equilibrium
conditions for static equilibrium
solving problems on static equilibrium

Table of RI
parallel axis theorem
applications of Newton's laws for RM

angular momentum
rotational kinetic energy
rotational impulse
rotational work
work-kinetic energy theorem
rolling
rolling without slipping
special cases of rolling (a spool, racing objects, Atwood's machine)
law of conservation of energy
law of conservation of angular momentum (***the last topic of test 2***)

week 5

stable equilibrium
unstable equilibrium
restoring force
oscillations
small oscillations
Hooke's law
Newton's 2nd law for SHM
simple harmonic motion (SHM)
SHM for horizontal spring
analogy between SHM and UCM
motion equation for SHM
S, V, A graphs for SHM
period
frequency
angular frequency
amplitude
elastic potential energy
energy graphs
conservation of energy
SHM for a vertical spring
a simple pendulum
SHM for a simple pendulum
a physical pendulum

SHM for a physical pendulum

fluids
density
pressure
pressure in a static fluid
atmospheric pressure
gauge pressure
absolute pressure
the Pascal's law

the buoyant force
Archimedes' principle
A static equilibrium for objects in liquid
solving buoyancy problems

fluid dynamics
an ideal fluid
streamline flow
an incompressible fluid
mass flow rate
volume flow rate
the continuity equation
the Bernoulli's equation
solving fluid dynamics problems
gravity (***the first topic of test 3***)
force of gravity
Newton's law of gravitation
principle of superposition
gravitational field
gravitational potential energy
bound system
energy of a bound system
orbits
escape speed

week 6
temperature
temperature scales
thermal contact
thermal conduction
thermal equilibrium
measuring temperature
heat
internal energy
meaning of temperature
meaning of heat
thermal expansion
coefficient of thermal expansion (CTE)
linear, areal, and volumetric CTE
heat capacity
specific heat (capacity)
thermally insulated system
heat balance equation (an equation for thermal equilibrium)
phase transition
critical temperature
latent heat (capacity)
method for solving thermal equilibrium problems
convection, thermal radiation
thermal conduction
thermal conductivity

the ideal gas
absolute temperature
a mole
the Avogadro's number
the universal gas constant
RMS values
the ideal gas law
iso - laws
graphs for gas processes (PV, VT, PT diagrams)
the Boltzmann's constant
the meaning of the absolute temperature
the meaning of the pressure
degree of freedom
the equipartition theorem
monatomic, diatomic, polyatomic gas
calculating internal energy
the first law of thermodynamics
work done by gas
calculating specific heat (Cv, Cp)
isothermal process
adiabatic process
thermodynamic cycle
work done over a cycle
heat engine
entropy
second law of thermodynamics
heat engine efficiency
the Carnot cycle
maximum (ideal) heat engine efficiency
a heat pump and a refrigerator
(***the last topic of test 3***)

Some helpful questions for solving physics problems
(more at www.GoMars.xyz/general_algorithm.htm)

1. What objects are involved? What processes are happening to them? (use your imagination - make a picture showing the objects and the processes they are involved into)

2. What properties of the objects and the processes might be important?

3. What physical quantities should be used for describing those properties, what connections might be important?

5. What laws or definitions should be used to describe important connections mathematically?

6. How can I solve my equations mathematically?

8. Does it make a sense?

9. Could I solve a similar problem again? How much time would it take? Who could help me (if I need it)?

Day	Date	Schedule for PY105 - Summer 1 - 2018 (adjustments might be done over the course of the class; Lectures: M – F 8:30 – 10:00; IL sections: M, T, W, R 11 – 2:30, 2:30 – 6, 6 – 9:30)					
		Chapter	**Topic**	**IL Section Topic**	**HW Issued**	**Homework Due**	**Section**
M		**NO CLASS**	**NO CLASS**	**NO CLASS**			
T	5/22	1.1 – 1.2, 3.2 –3.3	Introduction, Math, Measurement, Units, 1D, and 2D motion	Collecting data (online)	HW 1 (P1, 2, 3,4)		A2 - A6
W	23	2.1 – 2.4		Introduction into Kinematics			A2, A4, A5
R	24	3.1, 3.5	MCA, free fall				A3, A6
F	25	2.5 - 2.9, 3.4	Vectors, Relative motion,	NO IL sections			
M	28	Holiday					
T	29	4.1 – 4.7, 5.1	Projectile motion, Newton's Laws	2 D Kinematics			A3, A6
W	30		Newton's Laws, Application of NL				A2, A4, A5
R	31		Newton's Laws, Application of NL	Newton's Laws			A3, A6
F (M)	6/1	7.1 – 7.9	Work Energy, Power		HW 2	HW 1	A2, A3, A5
M	4	Exam 1	8:30 – 10:30 am; LSE B01 (No IL sections)		(P1, 2, 3, 4)		
T	5	8.1 – 8.3	Conservation of energy	No IL sections			
W	6	8.4 – 8.6	Impulse and Momentum, Law of conservation of linear momentum, Collisions	Work and Energy			A2, A4, A5
R	7						A3, A6
F	8	6.2 – 6.4	Circular Motion	No IL sections			
M	11	6.1, 10.1 – 10.5, 9.1 – 9.6	Torque, Equilibrium, Rotational kinematics and dynamics, Rotational Inertia, Rotational KE Angular Momentum, Rolling	Collisions and Center of Mass			A2, A4, A5
T	12						A3, A6
W	13			Torque and Rotational Dynamics			A2, A4, A5
R	14						A3, A6
F	15	16.1 – 16.5	Hook's law, Properties of SHM	No IL sections	HW 3	HW 2	
M	18	Exam 2	8:30 – 10:30 am; LSE B01 (No IL sections)		(P1, 2, 3, 4)		
T	19	16. 6 – 16.9	Hook's law, Properties of SHM	No IL sections			
W	20	11.1 – 11.7	Statics and Dynamics of Fluids	SHM			A2, A4, A5
R	21	12.1 – 12.3					A3, A6
F	22	6.5 – 6.6	Gravity, Orbital Motion	No IL sections			
M	25	13.1, 13.2, 14.1 – 14.7	Temperature and Heat, Expansion, Heat Capacity, Heat Balance Equation	Fluids			A2, A4, A5
T	26						A3, A6
W	27	13.3 – 13.4	Ideal Gases	Temperature and Heat and Ideal Gases			A2, A4, A5
R	28	15.1 – 15.6	Heat Engines				A3, A6
F	29	Exam 3	8:30 – 10:30 am; LSE B01/ Online IL section: IL11			HW 3	A 2,3,4,5, 6

PY 105S Lab Schedule

Days	IL
May 22	IL1: Collecting data (online)
May 23, 24	IL2: Introduction into Kinematics
May 29, 30	IL3: 2D Kinematics
May31, June 1 (F=M)	IL4: Newton's Laws
June 6, 7	IL5: Work and Energy
June 11, 12	IL6: Collisions and Center of Mass
June 13, 14	IL7: Torque and Rotational Dynamics
June 20, 21	IL8: SHM
June 25, 26	IL9: Fluids
June 27, 28	IL10: Temperature and Heat and Ideal Gases
June 29	IL11: Online: Collecting data

IL1, and IL11 are *mandatory*; they require an access to the Internet.

For other 9 IL (from IL2 to IL 10): any seven must be finished to graduate from the course.

For other 9 IL (from IL2 to IL 10): 8 best grades will be accounted toward the final grade.

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