This is **Physics PY 105 course!**

Please, (1) **take** Lab 1 manual, **(2) the syllabus, *read* the first page, *sign* it, detach it,** *and* ***leave the page on the table*** (*and* read the full syllabus at home)**, *and* *(3) sign in using any available sign-in sheet. Thank you.***

Welcome!

(4) Please, **login into webassign.net** (refer to pages 4, 5 of the syllabus) **class key**: **bu 1694 4391**

Locate LectureMCQ_L1 (PY105), open it, and answer the *first* question.

Name
LectureMCQ_L1 (PY105)

What time is NOW? (What time does your timing device show?)

0. less than 8:03, or it is exactly 8:03
1. after 8:03 but less than 8:06, or it is exactly 8:06

, or it is exactly 8:09

, or it is exactly 8:12

for t > 8:00 am

Thank you!

Др. Валентин Викторович Ворошилов

Закончил Пермский Государственный Университет по специальности «Теоретическая Физика»

Защитил диссертацию в Московском Академическом Институте Педагогических Инноваций

Др. Валентин Викторович Ворошилов

Dr. Valentin Voroshilov

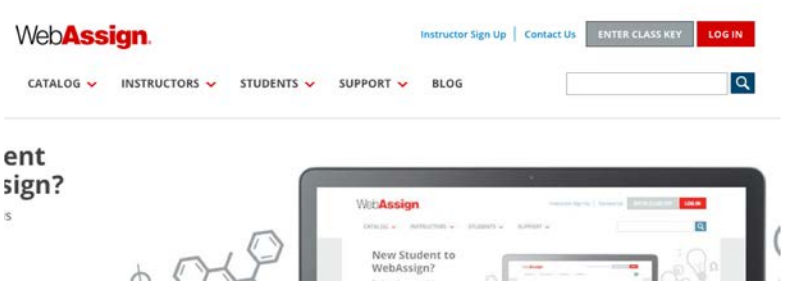
Prof. …

Mr. …

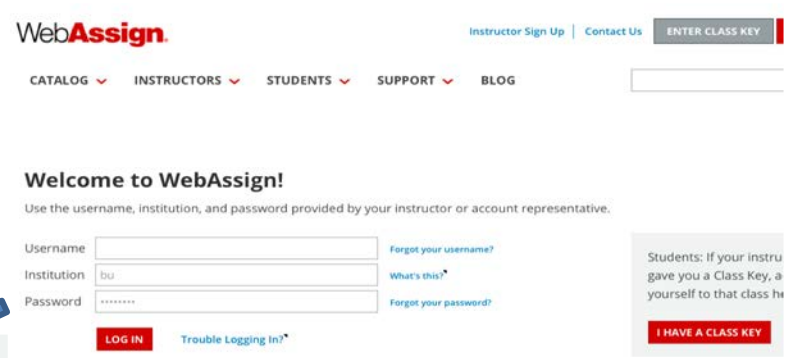
Mr. V

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

webassign.net/



LOG IN

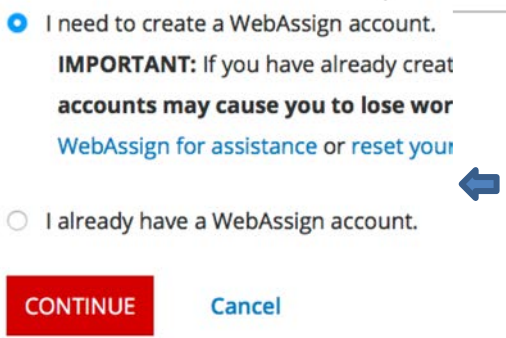


1. While registering you need to choose as you username your regular BU login name: for example,
if your BU email is abcd123@bu.edu => your username must be **abcd123** (just drop @bu.edu).
2. Institution name: BU.
3. As your password you need to use your BU student number in the form **U12345678**. 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**

SUBMIT



Love Know your teacher!

1. Russian (please inform me of any typos)

2. In the U.S.; teach Physics and Math since 2007, including

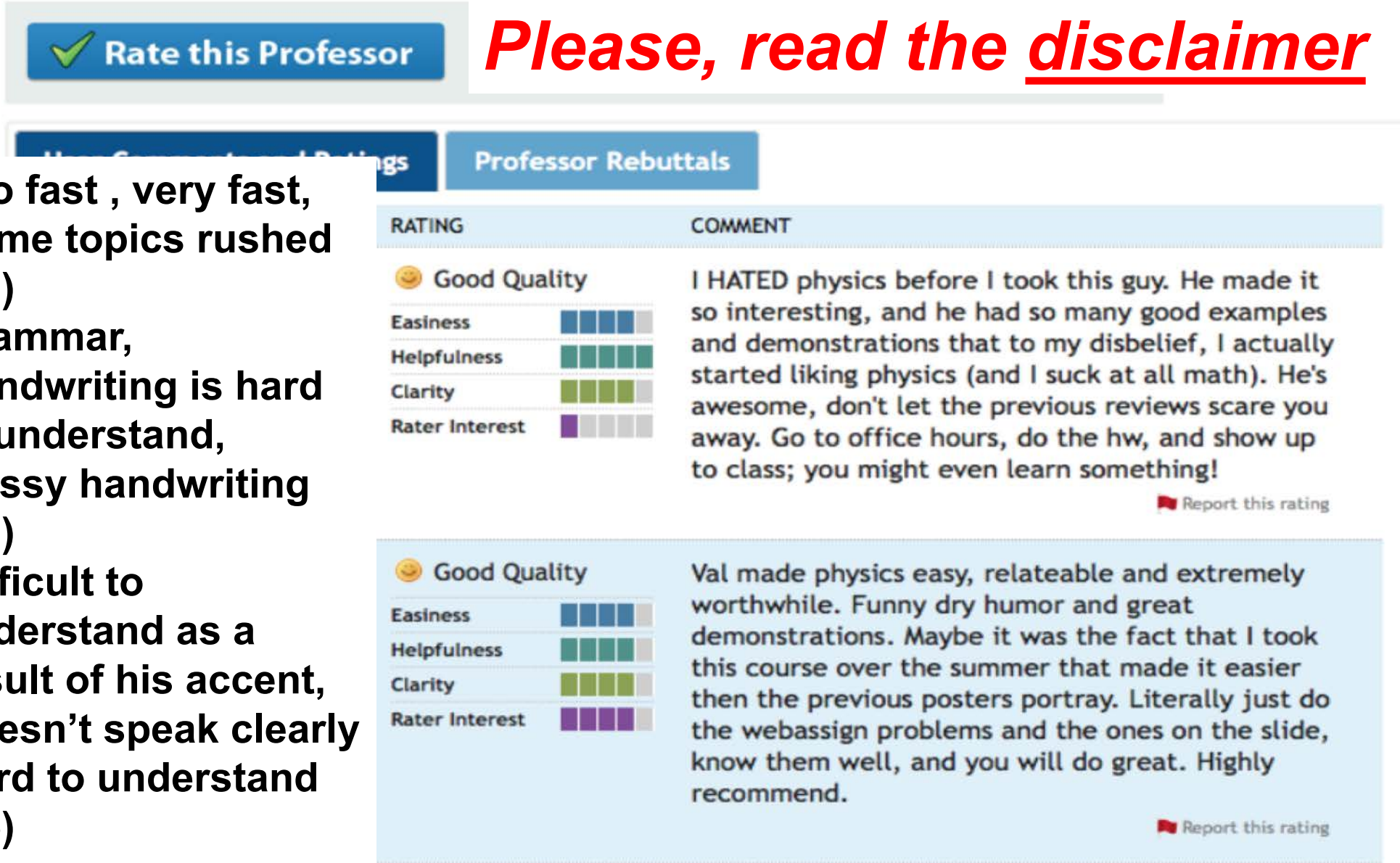
BU PY105/106 courses.

Please, ignore the way I sound (accent, tone).

http://www.GoMars.xyz/vv.htm

http://www.GoMars.xyz/evvv.html

Looking for a student to be hired for help with bringing the equipment in and out the class room. Class time included.



Too fast , very fast,
Some topics rushed (12)
Grammar,
Handwriting is hard to understand,
Messy handwriting (17)
Difficult to understand as a result of his accent,
Doesn't speak clearly
Hard to understand (15)

104 students => 59 comments

Strengths and positive general comments	Weaknesses and negative general comments
Good pace.	too fast , very fast, Some topics rushed (12)
Fun course, Relatively funny, Good sense of humor (11)	Very boring lecturer, Monotone, Occasionally mumbles
Uploads lecture videos. Good to post notes/videos online	Grammar Handwriting is hard to understand Messy handwriting (17)
Examples are helpful There were a ton of examples during lecture which were extremely helpful Does relevant problems Many examples, discussion and labs were good Good at explaining concepts Concepts are clear, explanations for problems clear Explained concepts really well.	Sometimes can't explain the question clearly He has a strong accent, Accent thick Weird accent Difficult to understand as a result of his accent Doesn't speak clearly Hard to understand (15)

Do not read this slide

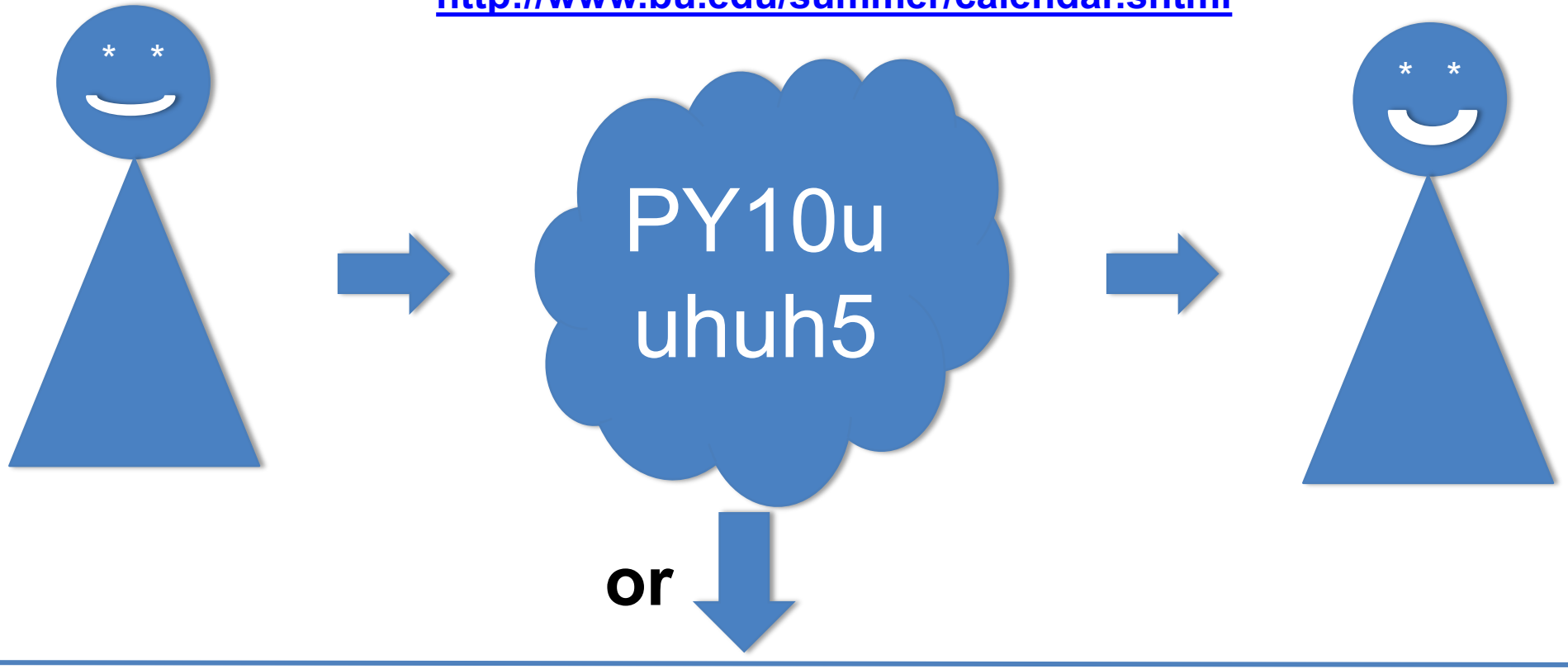
much more is on the WWW

constantly asks for feedbacks	Not willing to meet with students outside of office hours
Engaging	Sometimes mean when we don't respond to the lecture well, rude
Cares about students	Sarcastic, dry sense of humor
Very nice, wants best for students	doesn't listen to students
Knows the material well and is open to discussion	Be more approachable
Knows physics	refused to meet with students one-on-one to talk about the exam
He really enjoys physics	Horrible at taking criticism, makes it the students fault.
So interesting	
I really enjoyed taking Prof Val and would def sign up to take another on of his courses.	
You can tell he wants his students to understand and do well.	Never felt like he cared for his students
I really like Mr. V's humor and his demonstrations are always fun. I didn't like physics before taking his class and now it's one of my favorite classes.	When we performed poorly on an exam he blamed it on the students, not his lack of teaching ability
Fantastic professor, hilarious, great and enthusiastic. Nice guy.	He is good at physics but not good at teaching physics

Do not read this slide

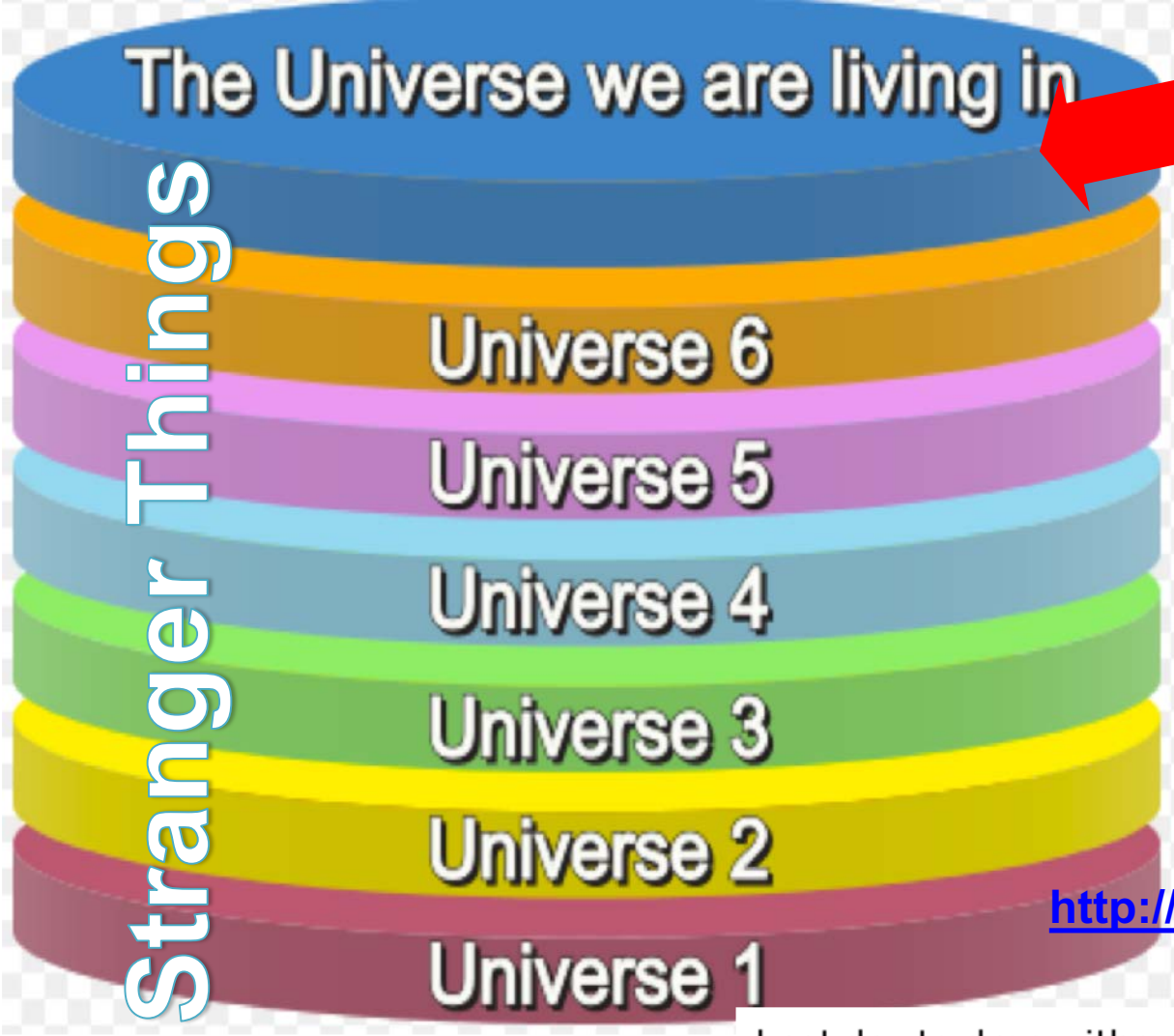
much more is on the WWW

http://www.bu.edu/summer/calendar.shtml



Last day to *Drop*: May 29

Last day to *Withdraw*: June 14



The highest grade

7 days to make your mind!

http://www.bu.edu/summer/calendar.shtml

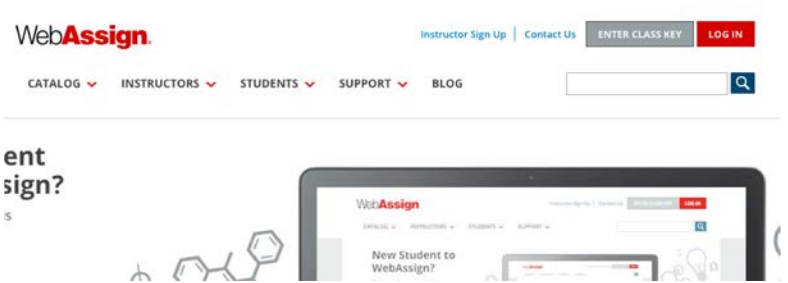
Tuesday, May 29, 2018

Last day to drop without a 'W' grade

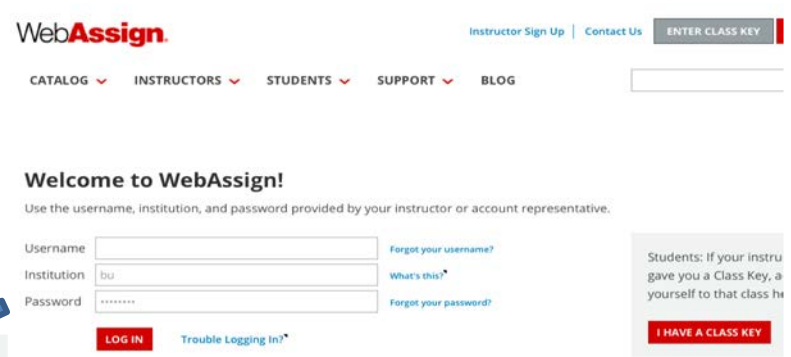
(tuition charges remain after this date)

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

webassign.net/



LOG IN



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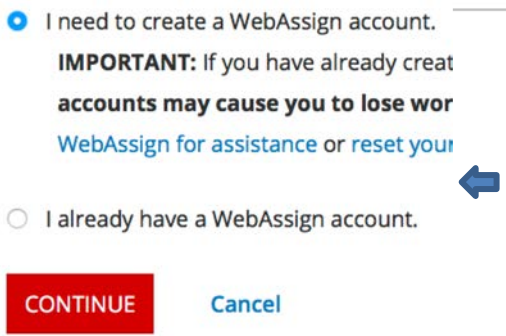
I HAVE A CLASS KEY

(class key: **bu 1694 4391**

SUBMIT



LectureMCQ_L1 Question 2

On a scale from 1 (strongly disagree) to 9 (strongly agree) how would you assess the following statement?

"I am very good at physics! (I think)"

or select 0 if you are not sure.

"I am very good at physics"

1. Strongly disagree (meaning, "I am very BAD at physics")
2.
3.
4.
5. More or less agree (meaning, "I'm OK")
6.
7.
8.
9. Strongly agree (meaning, "I am very GOOD at physics")

- 1 Strongly disagree (meaning, "I am very bad at physics")
  5.13% 4
- 2
  6.41% 5
- 3
  10.3% 8
- 4
  8.97% 7
- 5 More or less agree (meaning, "I'm OK")
  26.9% 21
- 6
  10.3% 8
- 7
  5.13% 4
- 8
  1.28% 1
- 9 Strongly agree (meaning, "I am very good at physics")
  2.56% 2
- 0 not sure what to say
  23.1% 18

- 1
  5.26% 4
- 2
  3.95% 3
- 3
  13.2% 10
- 4
  5.26% 4
- 5
  32.9% 25
- 6
  7.89% 6
- 7
  11.8% 9
- 8
  11.8% 9
- 9 none of the above
  1.32% 1
- 0 I do not understand this question
  6.58% 5

Learning is like building a pyramid; every next level is based on a solid background

PY1

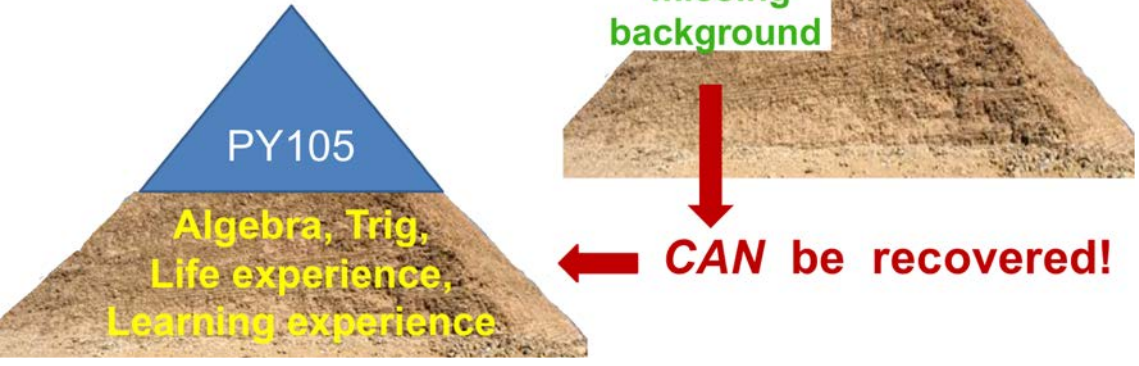
missing background

PY105

Algebra, Trig,
Life experience,
Learning experience

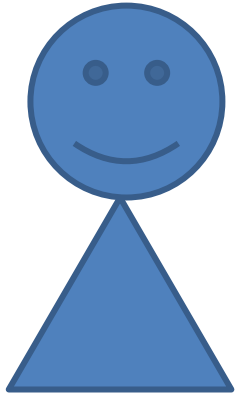
CAN **be recovered!**

Learning is like building a pyramid; every next level is based on a solid background

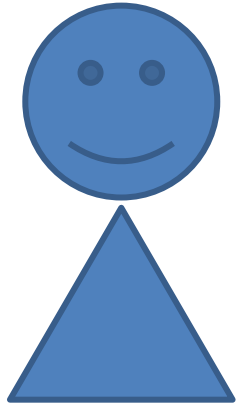


EVERYONE can get an *A* !

But the amount of time is based on the background



vs.



"Took AP physics"

"Never took any physics"

In 2014 Boston University was been named 37th of 500 "Best Global Universities".

http://www.bu.edu/today/2014/bu-ranks-37-of-top-500-global-universities/

Things you need to know about learning

Everyone can get an A ! (in principle)

Be active

The tale of two frogs

https://www.youtube.com/watch?v=fJA8IGP6q4Y

Success = effort + background (= expectations)

- Be organized

$$\text{grade} = 100 \cdot \frac{\text{actual plannig}}{\text{required planning}} \cdot \frac{\text{actual amount of work}}{\text{required amount of work}} \pm \frac{\text{good}}{\text{bad}} \text{luck}(5\%)$$

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)

Day	Date	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, A3, A4, A5
W	23	2.1 – 2.4		Introduction into Kinematics			A2, A4, A5
R	24	3.1, 3.5	MCA, free fall				A3
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
W	30		Newton's Laws, Application of NL				A2, A4, A5
R	31		Newton's Laws, Application of NL	Newton's Laws			A3
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
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
W	13			Torque and Rotational Dynamics			A2, A4, A5
R	14						A3
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
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
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
F	29	Exam 3	8:30 – 10:30 am; LSE B01/ Online IL section: IL11			HW 3	A 2,3,4,5

Small correc-tions are possible

Do not read this slide

The components of the course:

Lectures

***Investigative* Laboratories**

HW

Exams

Intense course!

Don't mix with other intense courses

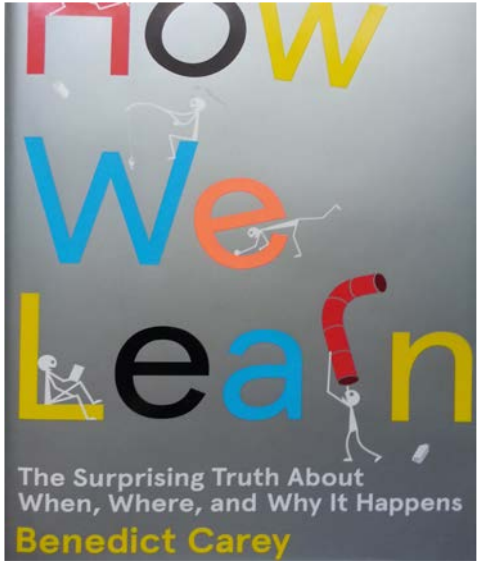
Exam 1:	**LSE B01**	**8:30 – 10:30**	**June 4**
Exam 2:	**LSE B01**	**8:30 – 10:30**	**June 18**
Exam 3:	**LSE B01**	**8:30 – 10:30**	**June 29**

during a lecture: (20—60—20)

Taking notes = writing down what needs *further* clarification!

Participating (drawing, writing, asking, etc.) = activating brain cells!

Fundamental Laws of TeachOlogy



What Does It Mean "Thinking as a Physicists"?

Cognisity.How/2016/12/handbook.html

Cognisity.How/2018/02/thinkphy.html

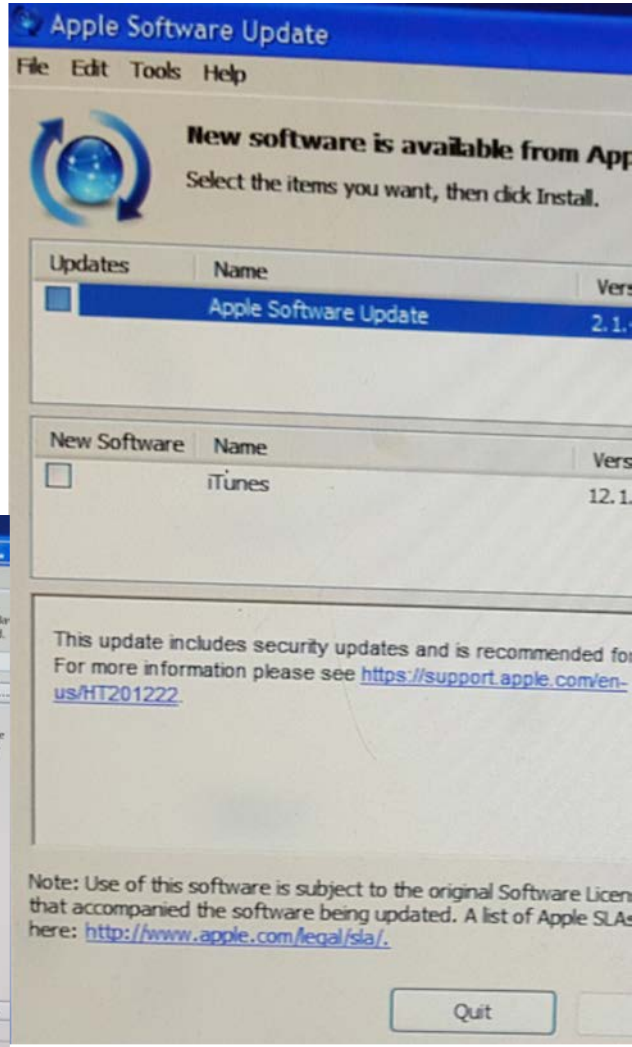
Unit sections:
begin **TODAY**. A usual lab room is SCI 134, but sometime labs may be held in different rooms.
Today all you need is the access to the **Internet**.

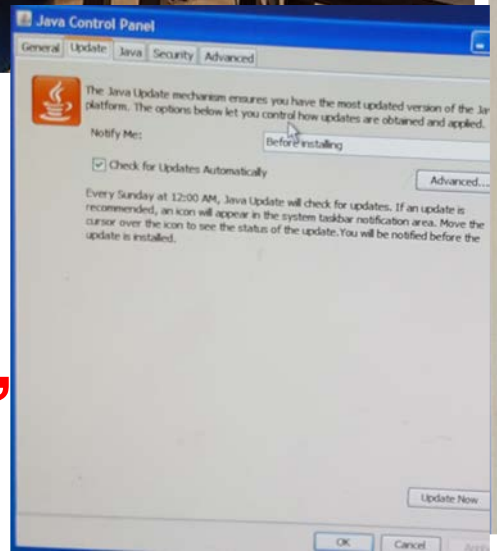
Days	IL
May 22	IL1: Collecting data (online)
May 23, 24	IL2: Introduction into Kinematics
May 29, 30	IL3: 2D Kinematics
May31, June 1 (F=M)	IL4: Newton's Laws
June 6, 7	IL5: Work and Energy
June 11, 12	IL6: Collisions and Center of Mass
June 13, 14	IL7: Torque and Rotational Dynamics
June 20, 21	IL8: 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.
From the *other* 9 IL (from IL2 to IL 10) any 7 must be finished to graduate from the course.
From the other 9 IL (from IL2 to IL 10) 8 best grades will be accounted toward the final grade.

Room location

Investigative laboratories





Please, do *not* use computers for anything *not* related to your study, Thank you.

Lectures: up to 5 lectures are allowed to be missed due to unforeseen circumstances.

IL2 – IL9: 8 best grades will be used.

Homework: To pass the course a student must have at least 50% of the maximum homework grade.

All homework assignments will be accounted for the final grade.

Recommended timeline for HW1 P1– 4.

Solving on average 3 or 4 problems EVERY day.

In addition to Lectures, labs, notes => HW, notes ~ 3 hours a day (on average)

5/22	5/23	5/24	5/25-26	5/28	5/30	5/31-6/1	6/2-3
HW1 P1 #1,2	HW1 P1 #3,4	HW1 P1 #5,6,7	HW1P1 #8,9,10 HW1P2 #1,2,3	HW1P2 #4,5,6,7	HW1P2 #8,9,10	HW1P2 #11,12 HW1P3 #1,2,3,4	HW1P3 #5,6,7 HW1P4 #1,2,3,4

HW1P2 deadline: 6/2 11:pm

HW1P1 deadline: 5/31 11:pm

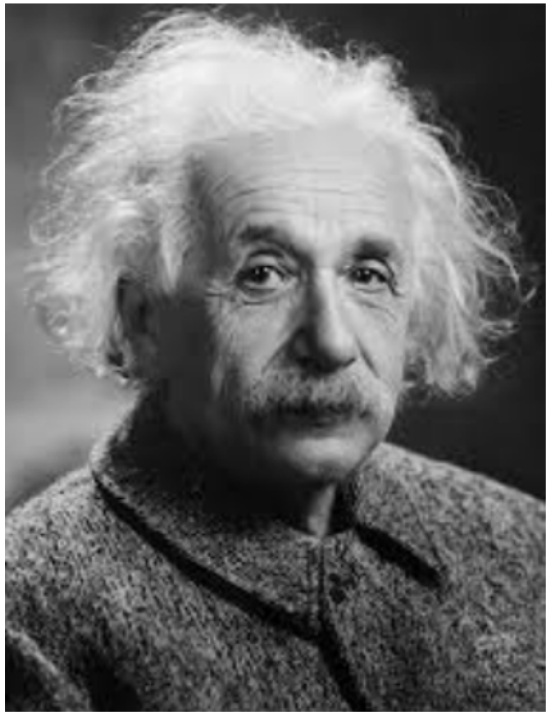
HW1P3,4 deadline: 6/3 10:pm

https://www.umflint.edu/advising/surviving_college.htm

for more reading

http://college.usatoday.com/2014/08/18/how-much-do-you-study-apparently-17-hours-a-week-is-the-norm/

in *special* cases HW deadline can be moved



To solve a problem EVERYONE goes through the same set of steps.

1. Reading
2. Visualizing
3. Describing in a text
4. Describing in a picture
5. Relating to a similar situation
6. Comparing to a similar situation
7. Selecting relevant (mathematical) description (definitions or laws)

Don't READ This slide!

Some helpful questions for solving physics problems

(page # 12)

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)?

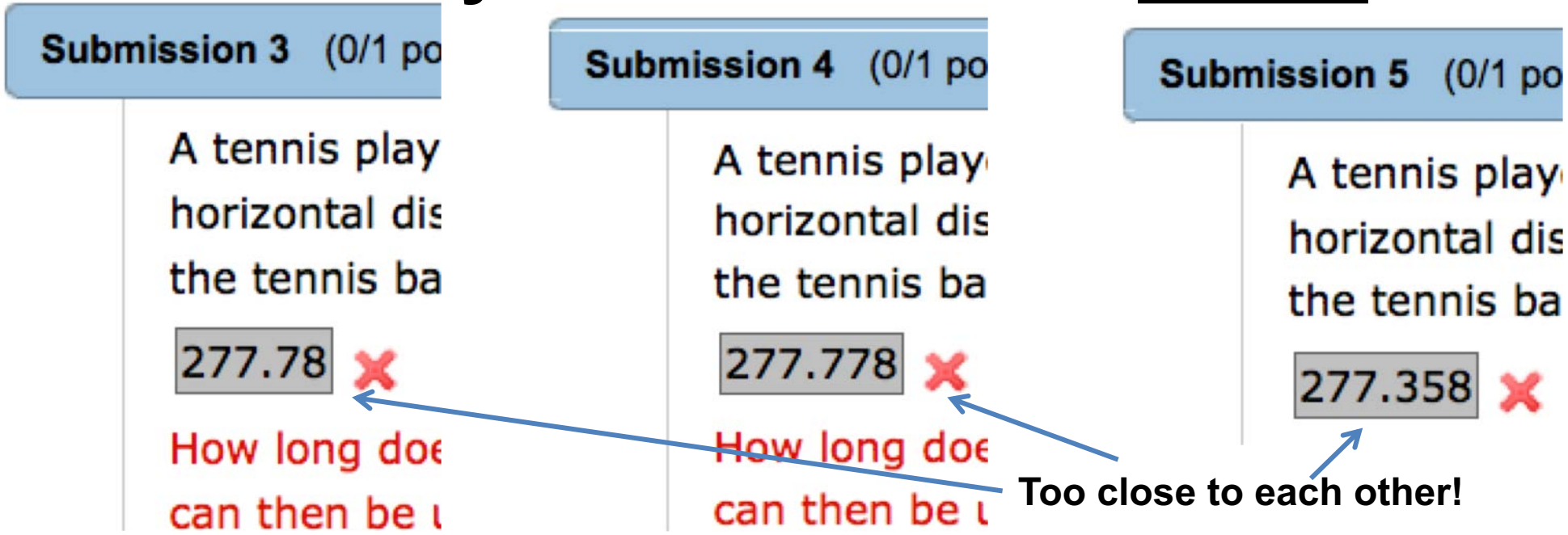
More at: http://www.Cognisity.How/2018/02/Algorithm.html

All homework assignments will be delivered via webassign.net => 4 is your magic number

Keep 4 digits after decimal point.

After 4th insufficient submission - attend OH.

Use your submissions *wisely*!



PY 105 Office Hours (SCI 121; *no* OH on a day of an exam)

	M	T	W	R	F
10:00-10:30					
10:30-11:00					
11:00-11:30					
11:30-12:00					
12:00-12:30					
12:30-1:00					
1:00-1:30					
1:30-2:00					
2:00-2:30					
2:30-3:00					
3:00-3:30					
3:30-4:00					
4:00-4:30					
4:30-5:00					
5:00-5:30					

The actual OH schedule is posted on BB

The components of the grade:

lectures – 7 %;

IL/units – 16 %;

HW – 14 %

exams – 20 %

21 %

22 %

Usually 8 problems

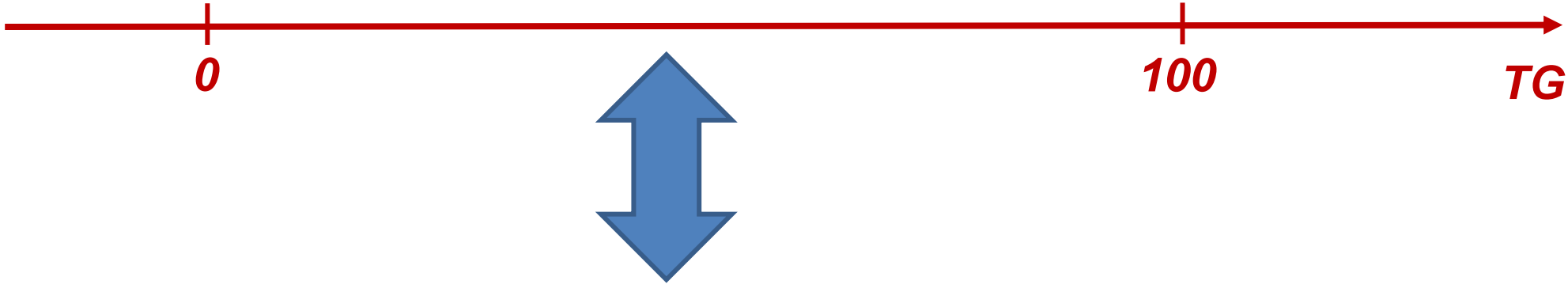
NO MAKEUPS!

BU policy

http://www.bu.edu/academics/cas/policies/

$$TG = 7 * \frac{Lact}{L\max} + 16 * \frac{ILact}{IL\max} + 14 * \frac{HWact}{HW\max} + 20 * \frac{E1act}{E1\max} + 21 * \frac{E2act}{E2\max} + 22 * \frac{E3act}{E3\max}$$

$$TG = 7 * \frac{Lact}{L\max} + 16 * \frac{ILact}{IL\max} + 14 * \frac{HWact}{HW\max} + 20 * \frac{E1act}{E1\max} + 21 * \frac{E2act}{E2\max} + 22 * \frac{E3act}{E3\max}$$



A A- B+ B B- C+ C C- D F

Decimals matter!

For ANY boundary someone is ALWAYS close to it!

"I am 0.3 points away from a 90"

This is JUST an example, actual boundaries may vary.

Absolute Scale (we reserve the right to be slightly more or less generous than this)	We will use an absolute grading scale 90 – 100 for A– and A 75 – 90 for B– , B, and B+ 55 – 75 for C– , C, and C+ 45 – 55 for D < 45 for F

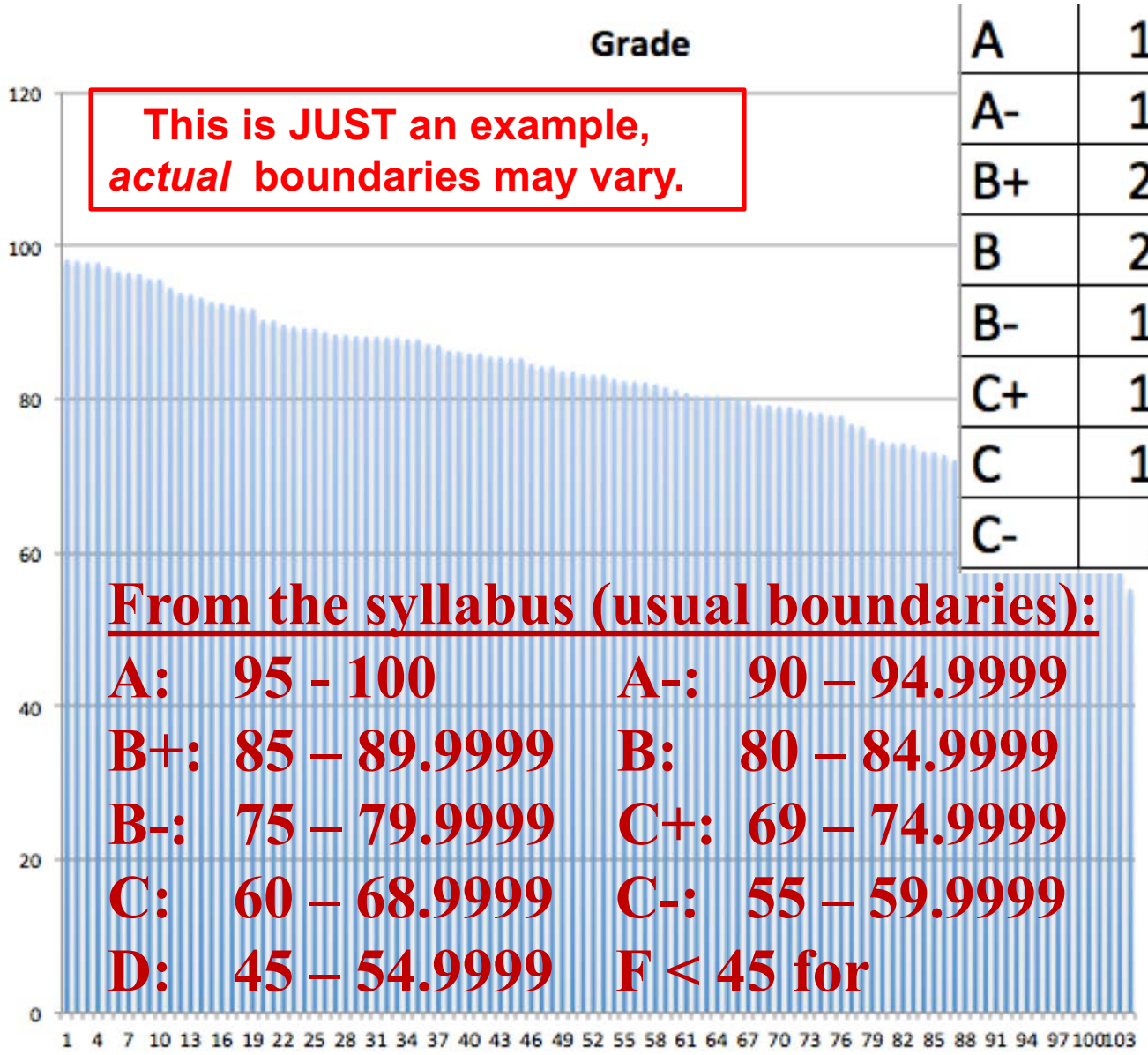
96.261	A	0.011
96.25	A	0.106
96.144	A	0.119
96.025	A	0.022
96.0027	A	0.471
95.5312	A-	0.159
95.3722	A-	0.151
95.2208	A-	0.025
95.1958	A-	0.119
95.077	A-	0.177

Used boundaries: A > 96; A- > 90;
B+ > 84; B >80; B- > 75; C+ > 70

A	32
A–	31
B+	13
B	17
B–	4
C+	3
C	1
D–	1
F	0

"I was in your PY105 Summer class and I received a 94.5% (A-) as my grade. Would you please round my grade to a 95% so I can receive an A in the class? I had 100% attendance, 100% on all unit sections, and 100% on all my homework assignments."

Grade	Gap	LettG	
95.644	1.1438	A	>95
94.5		A-	
90.241	0.5347	A-	>90
89.706		B+	
85.307	0.7509	B+	>85
84.556		B	
80.309	0.3842	B	>80
79.925		B-	
76.421	1.513	B-	>75
74.908		C+	
69.506	1.1307	C+	>69
68.375		C	
60.759	1.3264	C	>60
59.433		C-	
55.254		C-	>55



This is JUST an example, *actual* boundaries may vary.

A	10
A-	11
B+	24
B	20
B-	13
C+	12
C	11
C-	3

From the syllabus (usual boundaries):

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 **F < 45 for**

This is JUST an example actual boundaries may vary.

"My estimated final grade on Blackboard is a 74.43, and when I doubted checked the calculations using the method you described I got the same thing more or less (74.56). I'd like to ask if there's anything, anything at all, that I can do to earn 0.5 of a point so as to make the cutoff for a B-, since I don't imagine you round grades to the whole number."

A > 95
A- > 90
B+ > 85
B > 80
B- > 75
C+ > 69
C > 60
C- > 55

A	10
A-	11
B+	24
B	20
B-	13
C+	12
C	11
C-	3

TotalGrade — Edited

Statistics

Count	104
Minimum Value	55.25
Maximum Value	98.15
Range	42.90
Average	81.90
Median	83.15
Standard Deviation	10.04

Grade Distribution

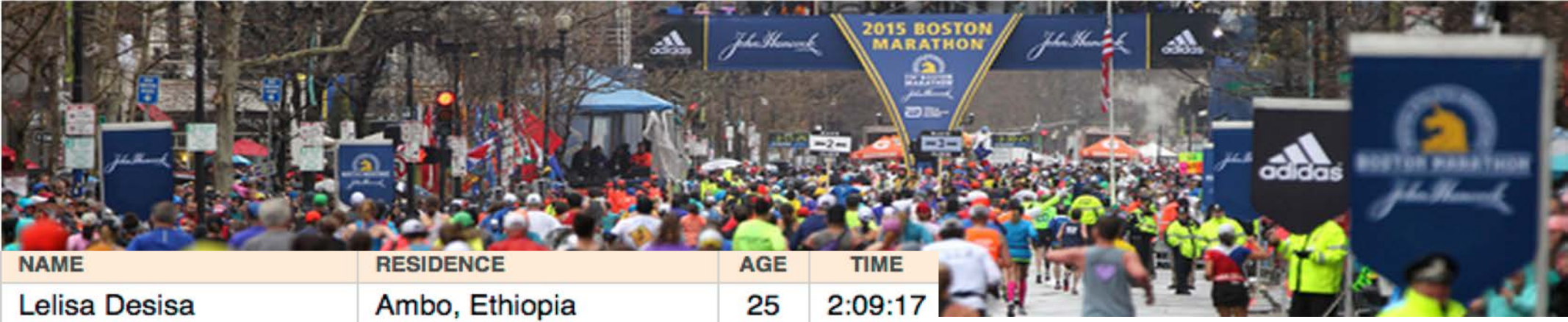
Greater than 100	0
90 – 100	21
80 – 89	44
70 – 79	25
60 – 69	11
50 – 59	3

$$TG = 7*\frac{Lact}{L\max}+16*\frac{ILact}{IL\max}+14*\frac{HWact}{HW\max}+20*\frac{E1act}{E1\max}+21*\frac{E2act}{E2\max}+22*\frac{E3act}{E3\max}$$

"I feel that given all of this my final grade should be an A-, which is what I expected when you said that doing the surveys at the end would potentially move "on the fence" grades one way or the other. I am 0.3 points away from a 90, which I consider an "in between" or "on the fence" and given the clear effort I put into this class, I think my grade should reflect that. I am asking you to move my grade up to an A-, which I feel is a reasonable ask given the reasons I listed before"

$$TG = 7*\frac{Lact}{L\max}+16*\frac{ILact}{IL\max}+14*\frac{HWact}{HW\max}+20*\frac{E1act}{E1\max}+21*\frac{E2act}{E2\max}+22*\frac{E3act}{E3\max}$$

??

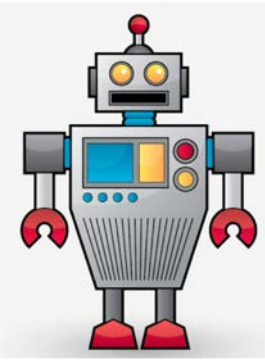


NAME	RESIDENCE	AGE	TIME
Lelisa Desisa	Ambo, Ethiopia	25	2:09:17
Yemane Adhane Tsegay	Addis Ababa, Ethiopia	30	2:09:48
Wilson Chebet	Marakwet, Kenya	29	2:10:22
Bernard Kipyego	Eldoret, Kenya	28	2:10:47
Wesley Korir	Kitale, Kenya	32	2:10:49
Frankline Chepkwony	Koibatek, Kenya	30	2:10:52
Dathan Ritzenhein	Rockford, Mich.	32	2:11:20
Meb Keflezighi	San Diego	39	2:12:42
Tadese Tola	Addis Ababa, Ethiopia	27	2:13:35
Vitaliy Shafar	Lutsk, Ukraine	33	2:13:52
Matt Tegenkamp	Portland, Ore.	33	2:13:52
Jeffrey Eggleston	Boulder, Colo.	30	2:14:17
Lusapho April	Uitenhage, South Africa	32	2:16:25

Decimals matter!

Grading-wise

=



The components of the grade:

lectures – 7 %;

IL/units – 16 %;

HW – 14 %

exams – 20 %
21 %
22 %

7 + 16 + 14 = 37 %
of "easy money"

The best strategy is NOT losing any points!

$$TG = 7 * \frac{Lact}{L\max} + 16 * \frac{ILact}{IL\max} + 14 * \frac{HWact}{HW\max} + 20 * \frac{E1act}{E1\max} + 21 * \frac{E2act}{E2\max} + 22 * \frac{E3act}{E3\max}$$

Exam problems

similar

Problems:

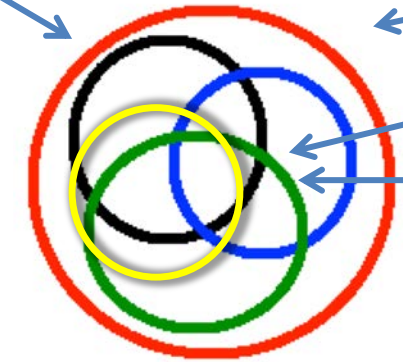
1. HW
2. Lectures
3. Units (IL)

Train yourself in recognition!

Some helpful questions for solving physics problems (page # 12)

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)?

http://teachology.xyz/general_algorithm.htm



Practice HW
Practice exams

After a lecture: (videos, notes)

Clarification = HW (solving + reflecting)
+ IL (doing + reflecting)
+ office hours, piazza (collaborating)

Demystifying Physics

WA: L1, Question ~~3~~ 4: Select *one* word which fits the best for finishing this statement.

Physics is _____ .

1. Strange 2. Done 3. Simple

4. Boring 5. Old 6. Fun

7. Mysterious 8. Hard 9. Soft

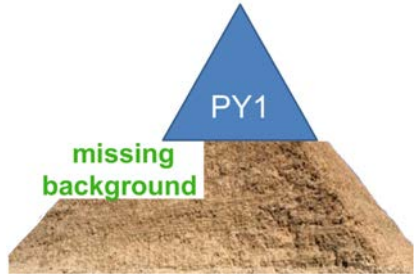
- 1
  6.58% 5
- 2
  2.63% 2
- 3
  2.63% 2
- 4
  5.26% 4
- 5
  6.58% 5
- 6
  10.5% 8
- 7
  32.9% 25
- 8
  31.6% 24
- 9 none of the above
  1.32% 1

"Can't learn physics without a big math"

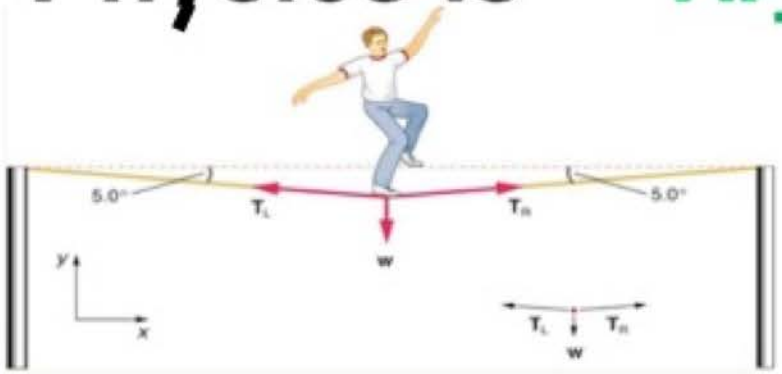
Demystifying Physics

The most common *myth* about physics:

Physics is HARD.



- Be active
- Be organized



(Picture is from **College Physics,** by OpenStax College)

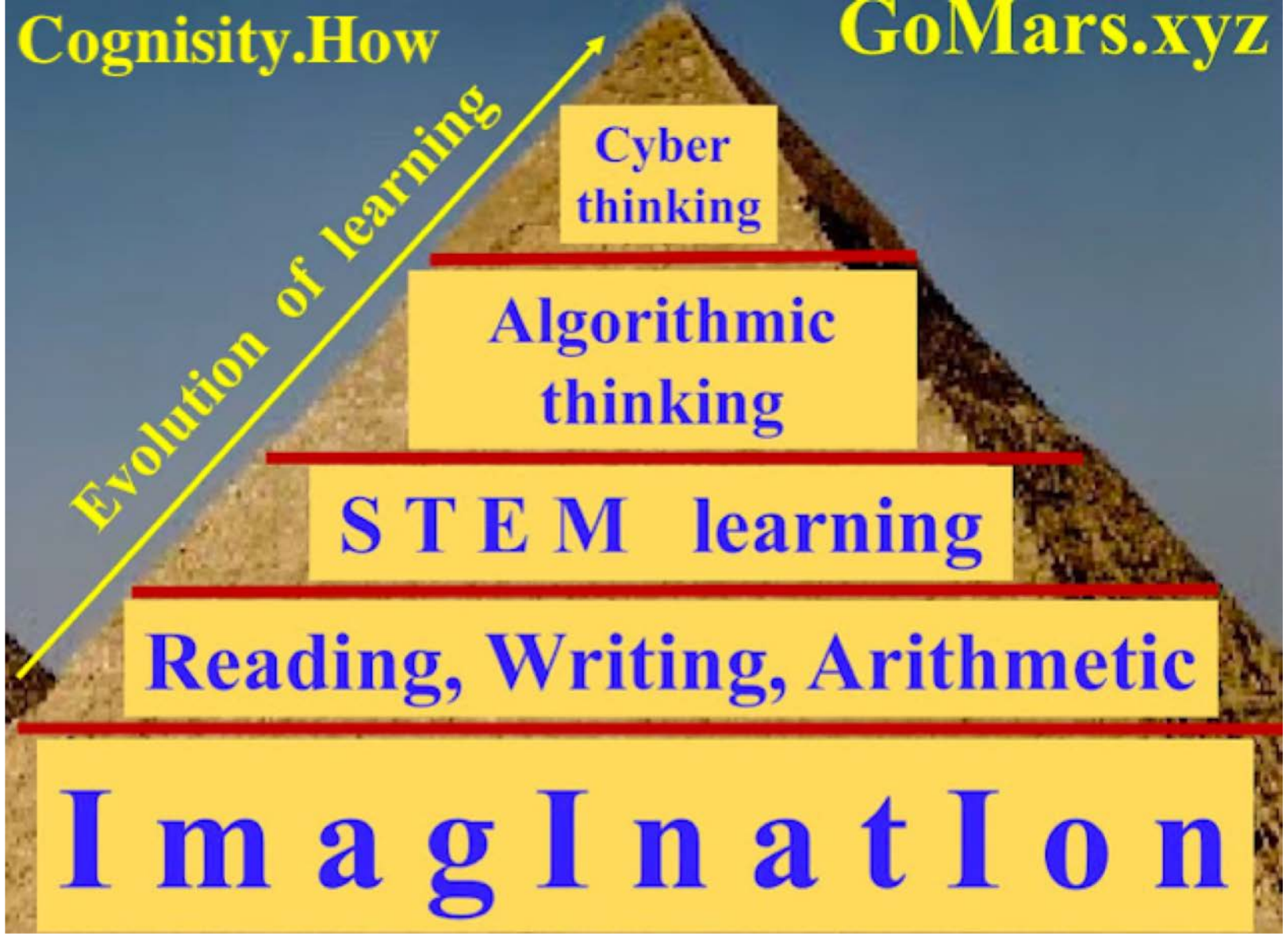
Not everyone can handle a dozen of balls, but *everyone* can handle one or two. Not everyone can become a Nobel laureate in physics, but everyone can learn how to solve *typical* physics problems (it's not genetic, it's a *skill*); there is a *strategy* for that.

Things you need to know about Physics:

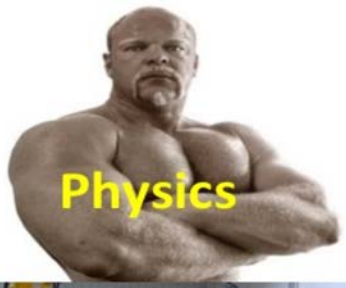
The *easiest* subject to learn

Learning Physics involves:

- Imagination ***(for every problem draw a picture)***
- Mathematics ***(Use the math test: IL1)***
- Constant use of the trial and error method ***(Use the steps listed in the algorithm)***
- Collaboration (study groups, piazza.com)


Cognisity.How
GoMars.xyz
Evolution of learning
Cyber thinking
Algorithmic thinking
S T E M learning
Reading, Writing, Arithmetic
I m a g I n a t I o n

Scientific investigation



Hands on activities

Robotics

2016 Massachusetts Science and Technology/Engineering Curriculum Framework

Table of Contents

Too intense, without proper background

Has no much of logical connections within or with

High School Intro-ductory Physics

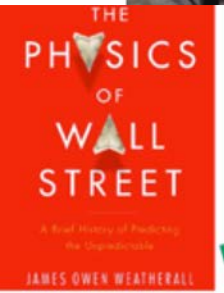
Tentative Schedule:

First Nine-Weeks
Scientific Method
Graphing
Math review (Scientific Nota
Motion

Second Nine-Weeks
Force
Work and Energy
Power
Momentum

Third Nine-Weeks
Rotational Motion
Gravity and Circular Motion
Temperature and Heat
Thermodynamics

Fourth Nine-Weeks
Density, Buoyancy
Waves, Electricity



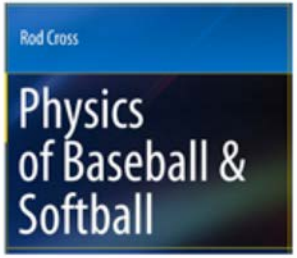
Biology

Medical physics (also called **biomedical physics**, **medical biophysics** or **applied physics in medicine**) is, generally speaking, the application of physics concepts, theories and methods to medicine or healthcare. Medical physics departments may be found in hospitals or universities.

Medicine

1 Mission statement of Medical Physicists
2 Medical biophysics and biomedical physics
3 Areas of speciality
- 3.1 Medical imaging physics
- 3.2 Radiation therapeutic physics
- 3.3 Nuclear medicine physics
- 3.4 Health physics
- 3.5 Clinical audiology physics
- 3.6 Laser medicine
- 3.7 Medical optics

Methods of physics

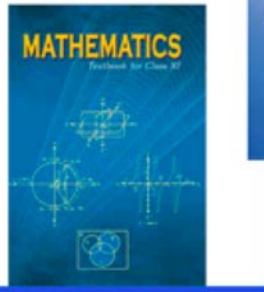


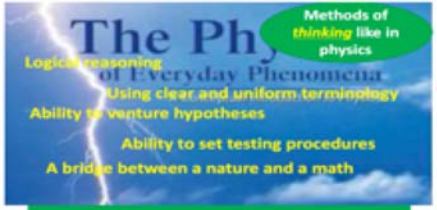
SPORT

Do not read this slide

Cognisity.Gow/2017/01/dorrSTEM.html

Everyone who learns physics can learn coding. The opposite ???





Physics = Reasoning

\+ Mathematics

1

FACT SHEET: President Obama Announces Computer Science For All Initiative

2 Coding = algorithmization (reasoning) + programming language (memorizing) 2

Physics is a **science**

Observations:

passive and active
(experiments)

Objects; properties of objects
Processes; properties of processes

Physics is a science

Observations:

passive and active (experiments)

Objects; properties of objects

Processes; properties of processes

Names;
Terms

language!

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

2

rotational kineti
rotational impu
rotational work
work-kinetic en

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

rolling
rolling without s
special cases of
Atwood's machi
law of conserva
law of conserva
last topic of tes

week 5

gravity (***the first***
force of gravity
Newton's law o
principle of sup
gravitational fie
gravitational po
bound system
energy of a bou
orbits
escape speed

stable equilibriu
unstable equilib
restoring force
oscillations
small oscillation
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

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

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

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

Do not even try to read this slide

What is the Missions of Education as a Human Practice?

http://www.cognisity.how/2018/01/mission.html

What is the Missions of Higher Education?

http://www.cognisity.how/2018/02/3Myths.html

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.

The last page of the syllabus

Physics is a science

The missions of a science is …

……

Search for ……

“……” ……

Physics is a science

The missions of a science is …

Predicting!

Search for patterns

“mining” data

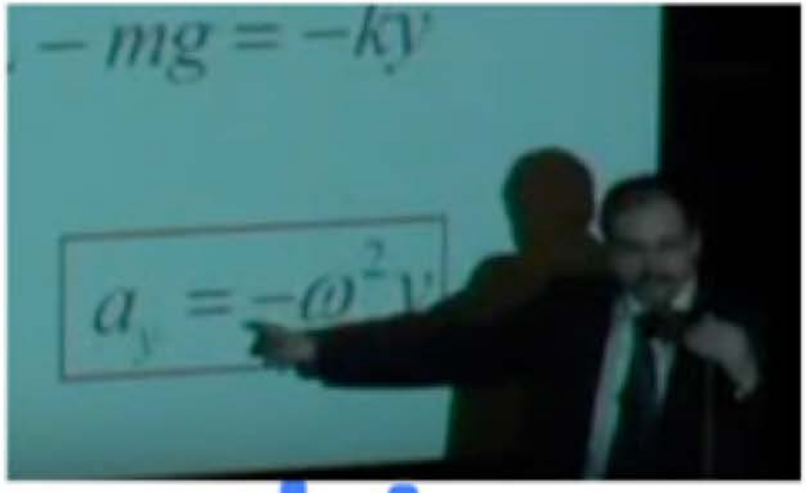
Physics = Science

1. Observations
   - differentiating
   - naming
   - classifying
2. Analysis
   - patterns
   - correlations
3. Predictions
4. Tests

is an internally consistent body of knowledge based on the scrupulous and logical analysis of a vast amount of ***data***."

Mathematics

Physics is a science.



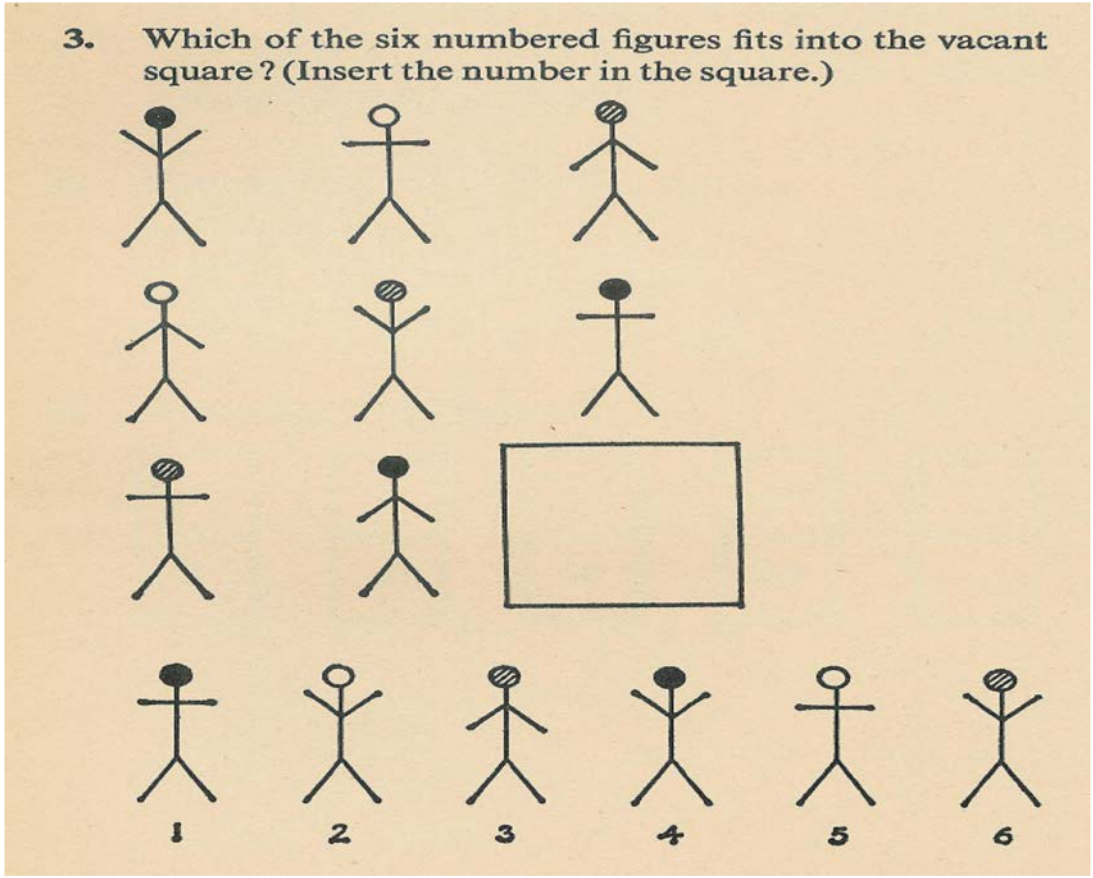
No patterns =>
No data =>
No science!

Teaching physics is *not*.

Physics Teacher Education Coalition Baltimore 2016

Patterns are everywhere!

1 1 2 3 5 8 13 21 ??



Physics (as EVERY science) is based on patterns!

In physics patterns are based on

1. **Primary Definitions**
   ↳ ???
2. **Primary/Fundamental Laws**
   ↳ ???
3. **Secondary connections (Equations; Algorithms)**

In physics patterns are based on

1. **Primary Definitions**

   A commonly accepted *agreement*

2. **Primary Laws**

   An *objective* connection

3. **Secondary connections (Equations; Algorithms)**

This week's topics

What is Physics?

Kinematics of 1 – D motion

Kinematics of 2 – D motion

Topics for the first two weeks (you do not need to read this slide!)

a scalar, 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/standard, measurement, 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, Force, N2L.

(develop your dictionary – memorize definitions)

Physics = science = applied Mathematics

We need a bridge between verbal and numerical description of the world.

Observations
- differentiating
- naming
- classifying

Physics is a science

Observations:

passive and active (experiments)

Objects; properties of objects

Processes; properties of processes

language!

Names;
Terms

Measurable parameters;
Variables; values

Connections;
Equations

Measurement

Measurement (metrology):
Set of operations having the object of determining a value of a quantity.
=> “**Assigning a number**”

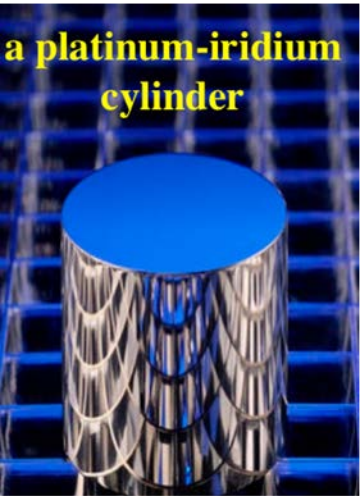
Wikipedia

Measurement, Standard (Etalon, Prototype), Unit

Measurement (in physics) is assigning a numerical value to a specific quantity by ***comparing with the standard*** (a.k.a. etalon, prototype), of the quantity.

A double-pan mechanical balance is used to compare different masses. When the bar that connects the two pans is horizontal, then the masses in both pans are equal. The "known masses" are typically metal cylinders of standard mass such as 1 gram, 10 grams, and 100 grams.

(credit: Serge Melki)

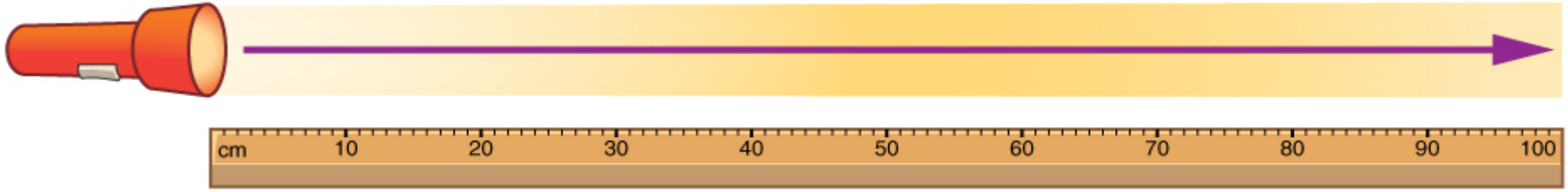


1 KG

(SI unit)

1 m = one ten-millionth of the length of the meridian through Paris from pole to the equator (1791).

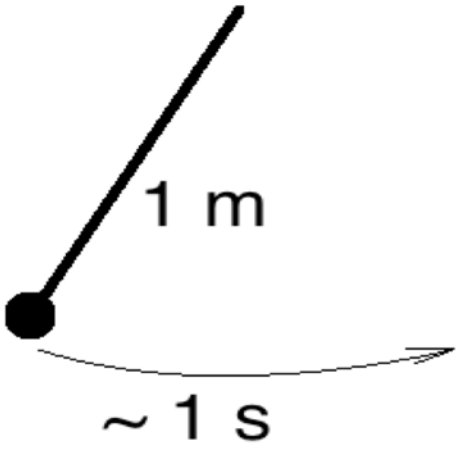
The standard platinum–iridium meter bar.



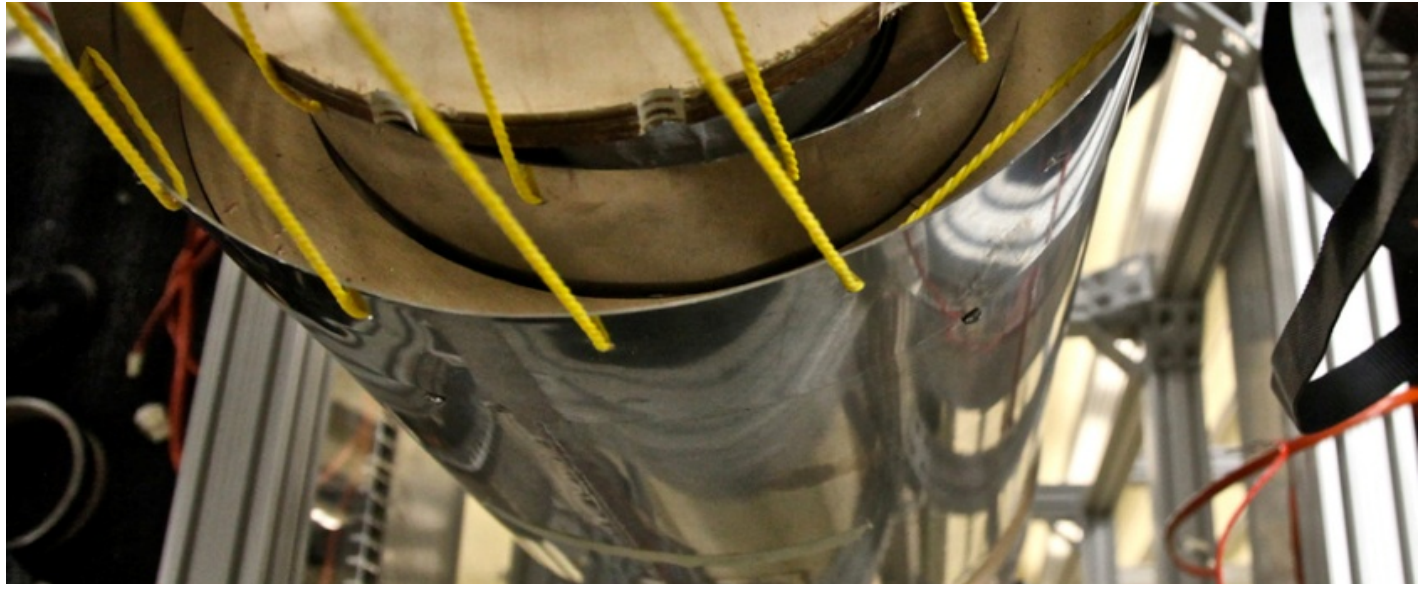
Light travels a distance of 1 meter
in 1/299,792,458 seconds

The meter is defined to be the distance light travels in 1/299,792,458 of a second in a vacuum.

1 m *(SI unit)*



1 s *(SI unit)*



An atomic clock such as this one uses the vibrations of cesium atoms to keep time to a precision of better than a microsecond per year. The fundamental unit of time, the second, is based on such clocks. This image is looking down from the top of an atomic fountain nearly 30 feet tall! (credit: Steve Jurvetson)

The units for *length, mass,* and *time* (as well as a few others), are regarded as ***base units*** (there is a standard for each base unit). These units are used in combination to define additional units for other important physical quantities such as force and energy.

L (length)	m
t (time)	s
m (mass)	kg
A (area)	m^2
W (width)	m
v (velocity)	m/s
F (force)	kg m /s^2
E (energy)	kg m^2 /s^2
V (volume)	m^3
p (momentum)	kg m /s
a (acceleration)	m /s^2
ρ (density)	kg / m^3

CONVERSION FACTORS

1 m = 100 cm; **1 mm = 0.001 m**

5280 feet = 1 mile; **1 mi = 1600 m**

3.281 feet = 1 meter; **1 year = 365 days;**

3600 seconds = 1 hour;

1 kg = 1000 g; **1 ton = 1000 kg.**

(do not know a conversion factor? Google it!)

1 m = 100 cm; 1 mm = 0.001 m

5280 feet = 1 mile; 1 mi = 1600 m

3.281 feet = 1 meter; 1 year = 365 days;

3600 seconds = 1 hour;

1 kg = 1000 g; 1 ton = 1000 kg.

54 mi/h = ?? m/s

54 mi/h =

1 m = 100 cm; 1 mm = 0.001 m

5280 feet = 1 mile; 1 mi = 1600 m

3.281 feet = 1 meter; 1 year = 365 days;

3600 seconds = 1 hour;

1 kg = 1000 g; 1 ton = 1000 kg.

54 mi/h = ?? m/s

54 mi/h = $54 \cdot \frac{1\,\text{mi}}{1\,\text{h}} = 54 \cdot \frac{1600\,\text{m}}{3600\,\text{s}} =$

$= 54 \cdot \frac{4.4\,\text{m}}{6.6\,\text{s}} = 24 \cdot \frac{\text{m}}{\text{s}}$

“This waterfall is 104851 deep”.

What is missing in the sentence above?

Victoria Falls is a 5,600-foot wide waterfall located on Zambezi River in Zimbabwe.

This waterfall is 104851 mm deep.

We need a UNIT!

Victoria Falls is a 5,600-foot wide waterfall located on Zambezi River in Zimbabwe.

convert 104851 mm in feet

All Shopping News Images Videos More Search tools

About 3,810 results (0.67 seconds)

Length

104851 Millimeter = 343.999344 Foot

More info *Feedback*

Millimeters to Feet conversion

www.metric-**conversions**.org/.../**millimeters**-to-**feet**.ht... Metric Conversions

Millimeters to **Feet** (**mm** to **ft**) **conversion** calculator for Length conversions with additional tables and formulas.

Millimeters to Feet (mm to ft) conversion calculator - RapidTa…

www.rapidtables.com › Conversion › Length conversion

Millimeters (**mm**) to **feet** (**ft**) **conversion** calculator and how to **convert**.

This waterfall is 104851 mm deep.

We need a UNIT!

Victoria Falls is a 5,600-foot wide waterfall located on Zambezi River in Zimbabwe.

Units used to measure THE SAME property form *a dimension.*

104851 mm = 344 feet = 105 m = 115 yard

= 0.1 km = 0.06 mi = 4128 inch

L = [length dimension]

T = [time dimension]

M = [mass dimension]

Dimensional Analysis

A correct equation always MUST have the same units on both sides of the equation. **(FYI: [a number] = 1)**

2*A = B/4 => [2*A] = [B/4] =>

[2]*[A] = [B]/[4] => ([2] = 1) 1*[A] = [B]/1

=> [A] = [B] Both sides MSUT have the same unit

We CANNOT *add* different units

[…] reads as "dimension/unit of …"

Find the unit of Kinetic Energy using SI units.

$$K = \frac{mv^2}{2}$$

m = mass; *v* - speed

Find the unit of Kinetic Energy using SI units.

$$K = \frac{mv^2}{2}$$

m = mass; v - speed

$[2] = 1$

$[K] = \frac{[m][v]^2}{[2]} =$

$[K] = \frac{kg \cdot \left(\frac{m}{s}\right)^2}{1} = \frac{kg \cdot m^2}{s^2}$

$= \frac{M \cdot \left[\frac{L}{T}\right]^2}{1} = M\frac{L^2}{T^2}$

SI

$kg \frac{m^2}{sec^2}$

DIMENSIONAL ANALYSIS

[L] = length [M] = mass [T] = time

Is the following equation *possible*?
Meaning – Is is dimensionally correct?

$$x = \frac{1}{2}vt^2$$

1. **Yes!**
2. **No!**
0. **I do not understand the question.**

LectureMCQ_L1 Q4

Dimensional analysis

$$x \stackrel{?}{=} \frac{1}{2} v t^2$$

$[x] =$ L general

m SI

m ? $1 \cdot \frac{m}{s} \cdot s^2$

$m \neq m \cdot s$

DIMENSIONAL ANALYSIS

[L] = length [M] = mass [T] = time

Is the following equation dimensionally correct?

$$x = \frac{1}{2}vt^2$$

$$[\mathrm{L}] = \left[\frac{\mathrm{L}}{\mathrm{T}}\right][\mathrm{T}]^2 = [\mathrm{L}][\mathrm{T}]$$

2. No!

LectureMCQ L1 Q5

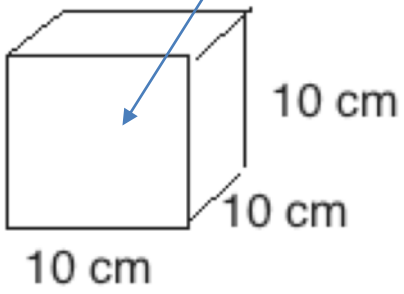
1 meter = 3.281 feet

1 ft = 0.3048 m

1 mi = 1.609 km

1 hp = 746 W

1 liter = ? (SI)



1. 1 cm
2. 10 cm
3. 100 cm
4. 1000 cm
5. 1 m
6. 10 m
7. 100 m
8. 1000 m
9. None of the above

- 1
  1.30% 1
- 2
  2.60% 2
- 3
  2.60% 2
- 4
  22.1% 17
- 5
  6.49% 5
- 6
  10.4% 8
- 7
  1.30% 1
- 8
  3.90% 3
- 9 none of the above
  49.4% 38