

# Lesson 1

Physics in general

- Physics (Greek:physics,meaning “nature”), natural science that involves the study of matter and motion thorough space-time, as well as applicable concepts such as energy and force.
- general analysis of nature
- synonymous with philosophy, chemistry, and certain branches of mathematics and biology
- during the Scientific Revolution in the 16th century it become a unique modern science

# Classical physics

- Includes traditional branches and topics recognized before the beginning of the 20th century-mechanics, sound, light, heat, electricity and magnetism
- mechanics: statics, kinematics, dynamics
- acoustics - a branch of mechanics
- optics- the study of light
- heat - a form of energy

# Modern physics

- Vocabulary

on the normal scale of observation - u normalnim razmjerima

ordinary- uobičajen, redovan

subatomic level- subatomska razina

motion-kretanje

valid-važeći

-modern physics deals with the behaviour of matter and energy under extreme condition or on the very large or very small scale

-the physics of elementary particles

-the quantum theory

-the theory of relativity

# EXERCISES:

I Answer the questions:

- How can we define physics?
- What does classical physics deal with?
- What are some branches of classical physics?
- How does classical physics differ from modern physics?
- What do you know about the quantum theory and theory of relativity?

II. Give synonyms for the following words:

- basic- \_\_\_\_\_, important - \_\_\_\_\_, to be concerned with- \_\_\_\_\_, affect- \_\_\_\_\_, to give rise to- \_\_\_\_\_
- III. Make sentences of your own using the words from the exercise II
- IV. Translate the part of the text dealing with modern physics

# Lesson 2

SCOPE AND AIMS

## Vocabulary:

scope-djelokrug

aim-cilj, namjera, svrha

amber-jantar

the validity of-vrijednost

supported by data-oslanjajući se na podatke

to generate- generiranje

- Physics- the “fundamental science”
- Ancient Chinese observed that certain rocks were attracted to one another by some invisible force
- electromagnetism as two different aspects of one force
- theory and experiment-theorists and experimentalists
- experiments and observation are to be collected
- theories supported by data –scientific laws
- theory and experiment are developed separately

## FUN WITH PHYSICS

- What is the difference between a physicist, an engineer, and a mathematician?

If an engineer walks into a room and sees a fire in the middle and a bucket of water in the corner, he takes the bucket of water and pours it on the fire and puts it out.

If a physicist walks into a room and sees a fire in the middle and a bucket of water in the corner, he takes the bucket of water and pours it eloquently around the fire and lets the fire put itself out.

If a mathematician walks into a room and sees a fire in the middle and a bucket of water in the corner, he convinces himself there is a solution and leaves.

# Quiz

- As early as 3500 B.C., a gnomon (a stick in the ground) was used to measure
  - Temperature
  - Time
  - Water levels
  - Wind velocity
  - Gravity
- 2. The distance an object travels in a given time frame (regardless of direction) is referred to as its:
  - Velocity
  - Inertia
  - Kinetic energy
  - Speed
  - Acceleration
- 3. What causes tides?
  - The tilt of the earth on its axis
  - Mostly the gravitational pull of the moon
  - Mostly the gravitational pull of the sun.
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- 4. To hit a target on land, at what point would you drop a bomb from an airplane?
  - Before the target
  - Directly over the target
  - After passing the target
- 5. If one cannonball is dropped from a given height and another is fired horizontally from the same height, which one will hit the ground first?
  - The one that is dropped
  - The one that is fired
  - They will both hit the ground at the same time
- 6. What is the sound barrier?
  - The speed that an object must travel to surpass the speed of sound
  - A unit for measuring the intensity of sound
  - The point at which a sound exceeds the human pain threshold
  - The distance between two people that cannot hear one another talking
- Answers: 1. Time, 2. Speed, 3. Mostly the gravitational pull of the moon, 4. Before the target, 5. They will both hit the ground at the same time, 6. The speed that an object must travel to surpass the speed of sound,

# Lesson 3

BRIEF HISTORY OF PHYSICS



## Vocabulary:

- ▶ calculus – račun
- ▶ contribution- doprinos
- ▶ approach - pristup
- ▶ to propose –predložiti, ponuditi
- ▶ celestial motion –nebesko gibanje
- ▶ terrestrial motion – zemaljsko gibanje
- ▶ to name after – imenovati po
- ▶ equal- jednak
- ▶ to propagate-raširiti
- ▶ to convert energy- pretvoriti energiju
- ▶ to anticipate- osujetiti,predvidjeti
- ▶ to prevail-prevladati, pobijediti

- ▶ corpuscle-čestica
- ▶ to propagate- množiti se, širiti se
- ▶ frequency-učestalost, frekvencija
- ▶ to verify-provjeriti, ovjeriti
- ▶ property-svojstvo, vlasništvo
- ▶ to foreshadow- nagovijestiti
- ▶ to revive- obnoviti, osvijestiti
- ▶ influence on the development –utjecaj na razvoj
- ▶ proposed theory-predložena teorija
- ▶ free falling bodies-slobodno padajuća tijela
- ▶ closely related theories-usko povezane teorije
- ▶ conversion of the energy-pretvaranje energije

- ▶ Thales
- ▶ Democritus
- ▶ Plato
- ▶ Aristotle
- ▶ Archimedes
- ▶ Aristarchus
- ▶ Ptolemy
- ▶ Galileo
- ▶ Copernicus
- ▶ Tycho Brahe
- ▶ Rene Descartes
- ▶ R.J.E.Clausius

## Youtube: Brief History on Physics , Part 1,2,3

Task: make notes while watching the films

<http://www.youtube.com/watch?v=y3tpN-Q6Pgk>

<http://www.youtube.com/watch?v=a6yN3p4f2S0&feature=relmfu>

<http://www.youtube.com/watch?v=G6mrGGttVRU&feature=relmfu>

- ▶ **Greek contribution:** Thales, Democritus (atomic theory of matter), Plato, Aristotle (critical influence on the development of science), Archimedes (anticipated the methods of the calculus).
- ▶ Questions:
- ▶ 1. What are the contributions to physics made in the period of Greek civilisation?
- ▶ 2. Who are the two most important philosophers of the Greek period?
- ▶ 3. What did Archimedes study?
- ▶ 4. What was Aristarchus famous for?

▶ **The scientific revolution:**

Mechanics and the study of planetary motions

Modern mechanics –Galileo and Simon Stevin, 16 th -17th century

Astronomy- Nicolaus Copernicus, Johannes Kepler, Galileo Galilei

Isaac Newton- Principia: 3 laws of motion

▶ Questions:

▶ 1.What was the first area of physics to receive attention?

▶ 2.What was Nicolaus Copernicus famous for?

▶ 3. What is Principia? What does it contain?

▶ 4.What are the other branches that received attention during this period?

▶ **Development of mechanics and thermodynamics**

Benjamin Thompson, 18 th century– relationship between heat and mechanical energy

▶ William Thomson and R.J.E.Clausius –two laws of thermodynamics

▶ Questions:

▶ 1. Who were the famous scientists important for the development of these two branches?

- ▶ **Advances in electricity, magnetism, and thermodynamics**
- ▶ Alessandro Volta 18th, 19th century– the electric battery
- ▶ in 1831-Michael Faraday discovered the reverse effect
- ▶ in 1886-Heinrich Hertz detected electric waves
- ▶ Questions:
- ▶ 1.Name the most important scientists and their inventions!

# EXERCISES:

- ▶ I. Translate the paragraph *The science revolution*
- ▶ II. Explain in English the meaning of the words:
- ▶ describable: \_\_\_\_\_

\_\_\_\_\_, court physician:

\_\_\_\_\_/revive: \_\_\_\_\_

\_\_\_\_\_/phenomenon: \_\_\_\_\_

\_\_\_\_\_.

# LESSON 4

GALILEO GALILEI

Watch the film about Galileo Galilei and make notes

- <http://www.youtube.com/watch?v=Rejbk1oJ2xg>

- Galileo- the “father of modern observational astronomy”, “the father of modern physics”, and “the father of modern science”.
- Galileo dropped 2 objects from the Leaning Tower in Pisa to disprove Aristotle theory that heavier object fall to the ground faster than lighter objects
- “The Law of Falling Bodies”

## Instructions:

1. Read the text on page 10 and answer the following questions:

- 1. What was Galileo Galilei famous for?
- 2. How was Galileo called?
- 3. What did his achievements include?
- 4. Explain the experiment done from the Leaning Tower of Pisa!

2. Write an essay about Galileo; use 150 words

# EXERCISES

I. Complete the following text with the words in the brackets:



## STATES OF MATTER

- The three common states of matter are solid, liquid, and gas. A solid maintains a \_\_\_\_\_ shape and a fixed size; even if a large force is \_\_\_\_\_ to a solid, it does not readily change in shape or \_\_\_\_\_.
- A liquid does not maintain a fixed shape, it takes on the shape of its container, but like a solid, it is not readily \_\_\_\_\_, and its volume can be changed significantly only by a very large \_\_\_\_\_.

- A gas has neither a fixed shape nor a fixed volume, it will expand to fill its container. For example, when air is pumped into an automobile tire, the air does not run to the \_\_\_\_\_ as a liquid would; it \_\_\_\_\_ out to fill the whole volume of the tire.
- Since liquids and gases do not \_\_\_\_\_ a fixed shape, they both have the ability to \_\_\_\_\_: they are thus often referred to collectively as fluids.
- The \_\_\_\_\_ of matter into three states is not always simple. How, for example, should butter be classified? Furthermore, a fourth state of matter can be distinguished, the \_\_\_\_\_ state, which occurs only at very high temperatures and consists of \_\_\_\_\_ atoms. Some scientists believe that the so-called colloids should also be considered a separate state of matter.
- (ionised, fixed, maintain, plasma, compressible, flow, force, spread, applied, volume, division, bottom)

# LESSON 5

ISAAC NEWTON

Task: Watch the film and make notes!

- <http://www.youtube.com/watch?v=wHgMGktPtqo&feature=related>

- Vocabulary:

plaque – kuga

to be knighted – učiniti koga vitezom

celestial body – nebesko tijelo

momentum – trenutak sile

prism – prizma

to decompose – rastvoriti, raščlaniti

to poll -glasanje

to deem – smatrati

conservation of momentum and angular momentum – održavanje količine gibanja i moment količine gibanja

- sent to Cambridge to become a preacher
- his calculus provided a new mathematical framework for the rapid solution of classes of physics problems
- *Philosophia Naturalis Principia Mathematica* was published in 1687
- Described universal gravitation and three laws of motion
- In mechanics he formulated the principles of conservation of momentum and angular momentum
- In optics he invented the reflecting telescope and developed a theory of colour
- In mathematics he shares credit with Gottfried Leibnitz for the development of the differential and integral calculus
- He was deemed much more influential than A.Einstein

# EXERCISES

- I. Answer the questions!
- Why did Newton's professor resign his position?
- What makes *Philosophia Naturalis Principia Mathematica* one of the most influential scientific works?
- How was Newton inspired to formulate his theory of universal gravitation?

- II. Translate the following text:

### **Newton's Laws of Motion**

- Newton's first law of motion is often stated as:
- An object at rest tends to stay at rest and an object in motion tends to stay in motion with the same speed and in the same direction unless acted upon by an unbalanced force.
- There are two parts to this statement - one which predicts the behaviour of stationary objects and the other which predicts the behaviour of moving objects.
- The behaviour of all objects can be described by saying that objects tend to "keep on doing what they're doing". All objects resist changes in their state of motion - they tend to "keep on doing what they're doing."
- Second Law of motion:
- Acceleration is produced when a force acts on a mass. The greater the mass (of the object being accelerated) the greater the amount of force needed (to accelerate the object)
- Everyone unconsciously knows the Second Law. Everyone knows that heavier objects require more force to move the same distance as lighter objects.
- Third Law of motion:
- For every action there is an equal and opposite reaction.
- This means that for every force there is a reaction force that is equal in size, but opposite in direction. That is to say that whenever an object pushes another object it gets pushed back in the opposite direction equally hard.
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# LESSON 6

THE BIRTH OF MODERN  
PHYSICS

## Vocabulary:

- crack – prasak, pukotina
- the nature of mater – priroda materije
- valid – važeći
- approximation – približnost
- indispensable – nužan
- antiparticle – antičestica
- large-scale conversation – pretvorba velikih razmjera
- solid- state physics – fizika čvrstog stanja
- plasma physics – fizika plazme
- cryogenics – kriogenika (fizika niskih temperatura)
- quantum theory- kvantna teorija
- photoelectric effect – fotoelektrični efekt ( pojava pri kojoj iz metala označenog elektromagnetskim zračenjem izlaze elektroni)

# EXERCISES

## I. Give the opposite of:

■ modern - \_\_\_\_\_, dense -  
\_\_\_\_\_

■ solid - \_\_\_\_\_, light -  
\_\_\_\_\_

## ■ II. Explain the meaning of the following:

■ fundamental discoveries,

■ indispensable tool,

■ indestructible atom

### III. Word formation:

#### NOUN

- revolution
- mass
- control
- development
- fundament

#### ADJECTIVE

## IV. Complete the line:

- to predict
- to explain
- to limit
- to complete
- to surround

V. Complete the extract from Einstein's essay text «The world as I see it» with the words in the brackets and then translate.

**«The world as I see it»**

"The most beautiful experience we can have is the mysterious. It is the fundamental emotion that stands at the \_\_\_\_\_ of true art and true science. Whoever does not know it and can no longer wonder, no longer marvel, is as good as dead, and his eyes are dimmed. It was the experience of mystery - even if mixed with \_\_\_\_\_ - that engendered religion. A knowledge of the existence of something we cannot \_\_\_\_\_, our perceptions of the profoundest reason and the most \_\_\_\_\_ beauty, which only in their most primitive forms are \_\_\_\_\_ to our minds: it is this knowledge and this emotion that \_\_\_\_\_ true religiosity. In this sense, and only this sense, I am a deeply religious man... I am satisfied with the mystery of life's eternity and with a knowledge, a sense, of the marvelous structure of existence -- as well as the humble attempt to understand even a tiny \_\_\_\_\_ of the Reason that manifests itself in nature."

(portion, cradle, fear, penetrate, radiant, accessible, constitute)

# LESSON 7

**NIKOLA TESLA - THE GENIUS  
WHO LIT THE WORLD**

## Vocabulary :

alternating current device- motor izmjenične struje

alternating current induction motor - indukcijski motor  
izmjenične struje

laser beam - laserska zraka

remote control - daljinski upravljač

vacuum tube amplifier – pojačalo

man-made lightning – umjetna munja

terrestrial stationary wave – zemaljski stojni val

# EXERCISES:

- Why did Tesla and Edison fall out?
- Make a list of some of his most important inventions!
- Which of (some of) his inventions are associated with other scientists?
- What do you think is the reason for this?
- Why was he considered eccentric? What, if anything, do you know about Tesla's private life?

## VOCABULARY PRACTICE:

- Find words in the text which mean:
  - mental rejection of something as untrue  
.....
  - having wide or considerable extent  
.....
  - relating to the earth or its inhabitants  
.....
  - an electric utility generating station  
.....
  - an electronic device for amplifying voltage, current, or power.....

Fill in the correct word derived from  
the word in brackets

Before the ..... (invent) of the telephone,  
communicating over great distances was slow and  
difficult.

- I see this as ..... (recognise) of my role  
in supporting learning and as
- ..... (acknowledge) of the teaching  
role that I have.
- ..... (subscribe) to magazines and  
periodicals rise.
- This leaves me with a number of difficult  
..... (decision) to make.

# TRANSLATE THE PARAGRAPH:

Tesla's generosity eventually left him without adequate funds to pursue and realize his inventions. His idealism and humanism left him with little stomach for the world of industrial and financial intrigue. His New York laboratory was destroyed by a mysterious fire. References to his work and accomplishments were systematically purged from the scientific literature and textbooks. Driven into a Hermetic exile in a New York hotel during the period between the two wars, 20 years of his potentially rich and productive contribution were taken from us. The only occasions of public appearance were the yearly press interviews on his birthday when he would describe amazing and far reaching inventions and technological possibilities. These were distorted and sensationalized in the popular press, particularly when he described advanced weapons systems on the eve of World war II. He died in obscurity in 1943. Only the FBI took note: they searched his papers (in vain) for the design of the "death-ray machine". It is interesting to note that the motivation for our "Star Wars" defense system was based upon fears that the Soviets had begun deployment of weapons based upon Tesla high energy principles. Public reports of mysterious "blindings" of U.S. surveillance satellites, anomalous high altitude flashes and fireballs, elf wave radio interference, and other cases lend credence to this interpretation.

# Put questions with the given question – words:

## DEATH

- (When) Tesla died at age 86 on 7 January 1943 from heart thrombus, alone in room 3327 of the New Yorker Hotel. (What) A few days after Tesla's death, the information center of the Yugoslav royal government-in-exile released a statement giving a short review of Tesla's achievements and the schedule for his memorial service and funeral. The speech, written by Louis Adamic, was read in a live broadcast on Radio New York by the mayor of New York City, Fiorello La Guardia, on 10 January 1943. The remains of Nikola Tesla were taken to Campbell cemetery. (What) The protocol anticipated the funeral service would be conducted on 12 January in the cathedral of Cathedral of Saint John the Divine in Manhattan. [(Who) Bishop William T. Manning delivered the introductory and the last prayer in English. The funeral service was conducted in the name of the Serbian Orthodox Church by priest Dusan Sukletovic, the superior of the Church of St. Sava of the New York parish.

- (Who)The bereaved family members present at the funeral were Sava Kosanovic and Nikola Trbojevic. A state funeral was attended by 2000 people. Tesla's casket was draped with U. S. and Yugoslav flags. (Who)The pallbearers were Nobel prize winners. Telegrams of condolence were received from many notables including the first lady, Mrs Eleanor Roosevelt and Vice-President Henry A. Wallace.
- Tesla's body was cremated and his ashes taken to Belgrade, Serbia, then-Yugoslavia in 1957. (Where)The urn containing his ashes was placed in the Nikola Tesla Museum in Belgrade. Despite having sold his AC electricity patents, Tesla died with significant debts. Later that year the US Supreme Court upheld Tesla's patent number 645576 in a ruling that served as the basis for patented radio technology in the United States.

- Soon after his death Tesla's safe was opened by his nephew Sava Kosanović. Shortly thereafter Tesla's papers and other property were impounded by the United States' Alien Property Custodian office in Tesla's compound at the Manhattan Warehouse, even though he was a naturalized citizen.
- At the time of his death, Tesla had been working on the Teleforce weapon, or 'death ray,' that he had unsuccessfully marketed to the US War Department. It appears that Teleforce was related to his research into ball lightning and plasma, and was conceived as a particle beam weapon. (What) The US government did not find a prototype of the device in the safe.
- (Who) Tesla's family and the Yugoslav embassy struggled with the American authorities to gain these items after his death because of the potential significance of some of his research. (What) Eventually Mr. Kosanović won possession of the materials, which are now housed in the Nikola Tesla Museum.