

ACE QUIZBOWL CAMP 2017 - SCIENTISTS (Instructor: Joe Czupryn)

Albert Einstein

- Element #99 is named after this man
- Formulated the particle theory of light to explain the photoelectric effect (which is what he won the Nobel for)
- Came up with the equation $E = mc^2$ (mass/energy equivalence)
- Names the fifth state of matter with Bose
- Founded special relativity which helped explain time dilation and the Twin Paradox
- His general relativity theory is described by "field equations" which show spacetime curvature due to matter and energy predicting gravitational lensing and frame dragging
- Developed a refrigerator with no moving parts with Szilard
- Studied the jiggling of pollen molecules (caused by osmotic pressure) to explain Brownian motion
- Won the 1921 Nobel Prize in Physics
- With Podolsky and Rosen, created a paradox attempting to disprove quantum mechanics (EPR paradox), which was solved by John Bell (Bell's theorem)

Isaac Newton

- Formulated three laws of motion
 - 1st Law – law of inertia
 - 2nd Law – Force = mass times acceleration (quantum analog of it named for Ehrenfest)
 - 3rd Law – every action has an equal but opposite reaction (led to conservation of momentum demonstrated by his namesake cradle)
- Namesake of the SI unit of force
- First proposed the Gravitational Constant in his *Principia Mathematica*
- Wrote *Optics* about color and light
- Discovered calculus independent of Leibniz
- His namesake rings for interference pattern are created by air between a lens and a glass
- Developed formulas with Robert Cotes
- Names a law of cooling

Antoine Lavoisier

- Formulated the Law of Conservation of Mass
- COINED THE TERMS oxygen and hydrogen
- Hypothesized all acids contain oxygen
- "Father of Modern Chemistry" who wrote the first chemistry textbook
- Discovered the existence of allotropes by showing graphite and diamond are both made of carbon
- Discredited the phlogiston theory by studying combustion (with Laplace) and showed how respiration is a form of combustion

Michael Faraday

- Names the SI unit for capacitance, which represents the number of Coulombs in a mole of electrons
- His namesake "law of induction" is one of Maxwell's four equations which states that the negative time rate of change of the magnetic flux through a closed loop equals the induced emf in the loop
- Discovered benzene (not to be confused with Kekule who discovered the STRUCTURE of benzene)
- Coined the term diamagnetism
- First to use "lines of force"
- His namesake cage consists of a room insulated with metal foil to block electric fields
- Names an effect which causes a rotation of polarized light by a magnetic field
- Invented the dynamo as well as a namesake rotator governed by the Verdet constant
- Created "Laws of Electrolysis"

Enrico Fermi

- Element #100 is named after this man
- Built the world's first nuclear reactor
- Names a particle with half integer spin (contrasts with bosons)
- With Dirac, names a distribution in statistics dealing with energies of single particles
- Named neutrinos
- His "Golden Rule" describes the transition from one eigenstate to another whose rate is dependent on the matrix squared as a part of perturbation theory
- Created a paradox asking why humans have not discovered more extraterrestrial life
- His namesake level/energy is the highest energy quantum state available and lies inside the bandgap of superconductors
- He was a member of Manhattan Project
- Charged particles reflected by a magnetic mirror give his acceleration

Archimedes

- Worked with simple machines, explained levers, and invented a namesake screw for moving water
- Work with math discovered his namesake spiral and calculated area enclosed by parabola
- Famous for his bathtub proclamation of "Eureka!" after discovering his namesake principle to explain buoyancy
- Wrote *The Sand Reckoner*
- Known for crazy war time inventions including his namesake claw for sinking ships, improbable heat ray, and odometer

Daniel Bernoulli

- His namesake fluid dynamics principle states an increase in velocity of a fluid causes a decrease in its pressure due to the conservation of energy,
- His principle explain lift (how airplanes fly)
- His principle is related to the Venturi effect
- His principle explains Pitot tubes
- His principle can be derived by integrating the Navier-Stokes or Euler equations along a streamline
- Names an equation with Euler for loading beams in physics

Ludwig Boltzmann

- Names a constant derived as the gas constant divided by Avogadro's number
- Developed an equation to describe entropy as his constant times the log of the number of microstates
- His law with Stefan describes energy released from a black body
- Names a distribution of gas particles with Maxwell
- Developed a radiative transport equation
- Names an equation where the BGK collision operator is used with lattice model to solve the Navier-Stokes equations

Robert Bunsen

- Namesake burner is used in chemistry labs
- Studied spectroscopic methods with Kirchhoff where they co-discovered cesium and rubidium
- Invented an antidote for arsenic poisoning and a carbon-zinc electric cell
- Did studies to explain the action of geysers

Gustav Kirchhoff

- Names Junction and Loop Rules for circuit analysis
- Coined the term "black body"
- Co-discovered cesium and rubidium with Bunsen
- Names three laws of spectroscopy from analyzing hot solids'/gases' spectral lines
- With Piola, he names two stress tensors

James Maxwell

- Names a set of four equations including two laws from Gauss, Faraday's law of Induction, and Ampere's Law, which he modified by adding the displacement current term
- Proposed a "demon" guarding a door between two boxes that violates the Second Law of Thermodynamics that Landaure investigated
- Names a distribution of gas particles with Boltzmann
- Wrote "On Physical Lines of Force"
- Gave a mathematical analysis of Saturn's rings (determined composition and C-Gap named for him)

Niels Bohr

- Modeled the atom where electrons travel in orbits around the nucleus,
- Namesake radius (approximately .53 angstroms) shows expected value for distance of an electron from the nucleus
- Pioneered the Copenhagen interpretation with Heisenberg (originally known as his complementarity) that stated light can be shown to be a particle or a wave in an experiment but not both at once
- The unit named for him is used for electron magnetic dipole moment

Svante Arrhenius

- Described acids as anything that increases H^+ ion concentration
- Gave an early theory of global warming by showing linear rise in Earth's temperature and CO_2 levels in air
- His namesake equation relates rate of reaction to activation energy that contains "pre-exponential factor" which is steric factor times collision rate (similar to Eyring-Polanyi equation)

Erwin Schrodinger

- His famous cat thought experiment is where a Geiger counter detects state of an alpha particle deciding whether or not poison gas is released thought to weaken the wavefunction collapse suggested by the Copenhagen interpretation
- His works include *What is Life?* and *Quantization as an Eigenvalue Problem*
- His namesake equation is central equation of quantum mechanics, relates the time derivative and the Hamiltonian of wavefunctions

Robert Boyle

- His namesake law states that ideal gases at constant temperature have an inverse relationship between pressure and volume ($PV = PV$)
- Wrote *The Skeptical Chemist* where he argues against "four element" theory
- Wrote *The Spring of the Air*
- Names a temperature where non ideal gases act like ideal gases (second virial coefficient is zero)

Charles Darwin

- Proposed the theory of evolution developed independently of Alfred Wallace
- Travelled aboard the HMS Beagle (Captained by Fitzroy) to the Galapagos Islands where he studied his namesake finches
- Wrote *On the Origin of the Species* and *The Descent of Man*
- Described the role of earthworms in the formation of vegetable mold

Linus Pauling

- Advocated high intake of vitamin C (megadoses)
- Won the Nobel Peace Prize and Nobel Prize in Chemistry
- Proposed hybrid orbitals in works like "The Nature of the Chemical Bond"
- Names a scale to measure electronegativity
- Determined a defect in hemoglobin causes sickle cell anemia and with Corey discovered alpha helices and beta sheets and wrote rules for structures of proteins
- He names a rule for determining the structure of complex ionic crystals

Henry Cavendish

- Discovered hydrogen and described it as "inflammable air"
- Gave a measurement of the gravitational constant using a torsion balance

Edward Jenner

- Invented the first vaccine (for smallpox) after realizing milkmaids who worked around cows rarely caught smallpox

Carl Linnaeus

- Father of modern taxonomy using binomial nomenclature

Werner Heisenberg

- Developed an uncertainty principle that states momentum and position of a particle cannot be simultaneously known

Edwin Hubble

- His namesake space telescope was replaced by the Webb Telescope
- Developed the tuning fork diagram
- His namesake constant relates distance and recession velocity of objects after he observed Cepheid variables; reciprocal of this is age of the universe
- Showed Andromeda was a separate galaxy

Jacobus Henricus van't Hoff

- Introduced the first equation for measuring osmotic pressure using his namesake factor (lowercase "i") that is a measure of how many particles are released into solution per unit solute
- Received the first ever Nobel Prize in Chemistry
- His namesake equation relates temperature and the equilibrium constant given the standard enthalpy change
- Showed tetrahedral geometry possible for carbon bonds to explain their polarization of light (optical activity)

Johannes Kepler

- Developed 3 laws of planetary motion after his work with Tycho Brahe
 - 1st Law – planets orbit the sun in the shape of an ellipse
 - 2nd Law – planets sweep out equal area over equal time during their orbits
 - 3rd Law – the square of an object's orbital period is directly proportional to the cube of the object's semi-major axis
- Composed Rudolphine Tables and *Cosmographic Mysteries*
- Names a conjecture on the best way to pack spheres
- With Poinsot, he names stellating polyhedra

Max Planck

- Described the emission of distinct units of energy with his namesake constant,
- His law of black body radiation improved upon Wien's approximation and overcame the UV catastrophe predicted by Rayleigh-Jeans
- His law with Fokker can be used to model Brownian Motion

Jonas Salk

- Invented the first polio vaccine (injected)

Albert Sabin

- Invented the first ORAL polio vaccine

Blaise Pascal

- Names a triangle in math used to expand polynomials
- His famous wager posed about God's existence is in his work *Pensees*
- His principle states that a change in pressure applied to a fluid is transmitted equally to every portion of the fluid

Louis Victor de Broglie

- Founded the wave-particle duality of light
- Explained why particles have a wave like nature with his namesake wavelength that equates Planck's constant over momentum to the wavelength of a matter wave tested by firing electrons at nickel and measuring diffraction
- Introduced pilot wave theory that was eventually refined by Bohm

Louis Pasteur

- Developed the rabies vaccine and also developed his namesake process for killing microorganisms in liquids

Robert Hooke

- His namesake law describes the elasticity of springs
- Described observations of cork, snowflakes, and insects in his book *Micrographia* and eventually coined the term "cell" from the resemblance to monk's living quarters
- Worked with Wren as chief Surveyor to London after Great Fire
- Helped Boyle design the first ever air pump

Ernest Rutherford

- Discovered atoms have a positively charged nucleus after shooting alpha particles at a sheet of zinc sulfide in his Gold Foil Experiment with Geiger and Marsden

Antonie van Leeuwenhoek

- Father of Microbiology who was the first to view sperm, bacteria, and RBCs through a microscope

Dmitri Mendeleev

- Developed the first formulation of the periodic table of the elements; Moseley however was the first to group the elements in order by atomic number

Marie Curie

- First woman to win the Nobel Prize and only woman to win in two fields; won prize along with her husband and Henri Becquerel for their work with radioactivity
- Discovered radium and polonium in pitchblende

Robert Millikan

- Conducted the oil drop experiment with Harvey Fletcher to first measure the charge of an electron that was highly disputed by rival Felix Ehrenhaft
- Proved Einstein's photoelectric effect theory

Sir Humphry Davy

- Developed a namesake safety lamp to prevent mines leaking methane from igniting torches
- Employed Faraday
- Studied properties of laughing gas
- Discovered many alkali/alkaline earth metals like Na/K/Mg/Ca

Lord Rayleigh

- His namesake scattering describes why the sky is blue
- His equation with Jeans concerns black body radiation which results in the ultraviolet catastrophe
- Described the inflection point criterion described by 1.22 times wavelength for resolution of two images
- His namesake dimensionless number determines whether conduction/convection occurs,
- Names an instability with Taylor in which a more dense fluid rests on top of a less dense fluid

Erwin Chargaff

- Created a rule when studying DNA based on his finding that levels of cytosine match levels of guanine and levels of thymine match levels of adenine

Rosalind Franklin

- Watson and Crick used X-ray pictures of DNA from her, she was deceased when they were awarded the Nobel Prize

Maurice Wilkins

- Won the Nobel Prize with Watson and Crick for their work on the structure of DNA

Paul Dirac

- Developed a namesake delta equation which brings about a construct with zero width and infinite height
- His namesake "sea" was used to predict existence of antimatter
- His namesake comb is where the function is equal to its own Fourier transform
- Formulated a "large numbers hypothesis"
- Names algebraic 4x4 matrices

Richard Feynman

- The namesake of a diagram which displays different particle interactions
- He has a namesake path integral formulation of quantum mechanics
- Caltec physicist who previously worked with John Wheeler on a time-inversion symmetry based interpretation of electrodynamics
- Awarded the Nobel Prize along with Schwinger and Tomonaga for his development of QED
- Proposed a parton model for particles
- Names a point at the 762nd digit of pi
- His namesake "ratchet" uses Brownian Motion

John Dalton

- Pioneered atomic theory of matter and noticed atoms of different elements have different weights
- Developed a law of partial pressures
- Wrote "A New System of Chemical Philosophy"
- Stated elements combine in ratios of small whole numbers in his Law of Multiple Proportions
- Discovered rainfall is due to changes in temperature

Joseph Thomson

- Developed the plum pudding model of the atom
- Discovered the electron

Joseph Priestley

- Discovered oxygen and described it as "dephlogisticated air"
- Found charcoal conducts electricity

James Chadwick

- Discovered the neutron

Alexander Fleming

- Discovered penicillin after accidentally contaminating his bacteria culture with a fungus and noticing the substance it released killed the bacteria around it

Lev Landau

- Developed the theory of superfluidity, as well as theory of second order phase transitions

Barbara McClintock

- Discovered transposons ("jumping genes") through her studies on maize kernels with her explanation of the Ac Ds system

Hendrik Lorentz

- His namesake factor is represented as $1 - \sqrt{1 - \frac{v^2}{c^2}}$
- His namesake transformation shows how to transform space-time to a moving reference frame
- Developed an equation relating refractive index to polarizability, which is a derivative of the Clausius-Monstott equation

Wilhelm Roentgen

- Discovered X-rays

Lord Kelvin

- Names an absolute temperature scale ($0^\circ \text{C} = 273 \text{K}$)
- Names an effect with Joule describing how gases grow cooler as they expand
- His namesake circulation theorem states change in circulation around a closed curve moving with the fluid is zero
- Helped lay transatlantic telegraph cable

Nicolaus Copernicus

- First to layout heliocentric theory (sun at the center of solar system) in his "Little Commentary"
- Wrote the controversial work "On the Revolutions of the Celestial Spheres"

Christiaan Huygens

- Studied the rings of Saturn and discovered its largest moon Titan
- Developed the pendulum clock
- His namesake principle states that spherical wavelets emanating from points on a wavefront conform to the next wavefront of a propagating wave

Tycho Brahe

- Astronomer whose study of the stars and planets led his partner Kepler to develop his planetary laws
- Replaced a missing piece of his nose with pieces of metal
- His tame moose died after getting drunk

Gregor Mendel

- Austrian monk who is known as the "Father of Genetics" for his work with pea plants and discovery of the law of independent assortment, as well as the law of segregation

Osborne Reynolds

- Defined his namesake number in fluid dynamics that determines whether fluid flow is laminar or turbulent

William Ramsay

- Won the Nobel Prize in Chemistry in 1904 for discovery of five noble gases (discovered argon with Lord Rayleigh)

Karl Landsteiner

- First to distinguish the major blood groups and Rh factor
- Identified the polio virus

Charles Lyell

- Scottish author of *Principles of Geology* and major influence on Darwin

Paul Ehrlich

- Developed the cure for syphilis using arsenic

Joseph Lister

- Pioneer of antiseptic surgery