Scientific Discoveries & Inventions			
Scientist / Theorist	**Date**	**Nation**	**Discovery / Invention & Its Significance / Impact**
Physics			
Isaac Newton	1687	England	Laws of gravity and motion were universally recognized and accepted until Einstein. Newton also developed calculus (at the same time as Gottfried Leibnitz independently did so.)
John Dalton	1803	England	Began research on atoms, & atomic "weight"
Dmitri Mendeleyev	1869	Russia	Periodic Table of Elements (that big chart in Chemistry)
Wilhelm Roentgen	1895	Germany	Discovered X-rays
J.J. Thomson	1897	England	Discovered electrons
Max Planck	1900	Germany	Quantum Theory. Energy can only be released in definite "packages" (*quanta*), formed basis for a completely new approach to the study of matter and energy.
Pierre & Marie Curie	Early 1900's	France	Discovered principle of radioactivity (breakdown of atoms) which in turn suggested that atoms themselves are not the smallest unit of matter.
Ernest Rutherford	Early 1900's	England	Confirmed Curies' theories on atomic structure. Furthered search for subatomic particles.
Albert Einstein	1905	Germany / Switzerland	<u>Theory of Relativity</u> 1) No particles of matter can move faster than speed of light (approx. 186,000 miles/second) 2) Motion can be measured only relative to some particular observer. It does not make sense to speak of absolute motion, space, or time. In addition to the three dimensions of length, width, and height, Einstein added *time* as the 4th dimension. (The *space-time continuum*) Time and space are linked together, and can vary depending on velocity & gravity. <u>$E=mc^2$</u> An *extremely small* amount of matter (*m*) can be converted into an *extremely large* amount of energy. (*E*) Thus, matter and energy are merely different forms of the same thing. (*c* is speed of light) Einstein's theories overturned all Newtonian laws of Physics, and were not widely accepted until they were confirmed at a total solar eclipse in 1913.

Biology			
Jean Baptiste Lamarck	Early 1800's	France	Theory that living things change their form in response to their environment. Thus, giraffes grow long necks so as to reach leaves on tall branches. Such changes are passed on to future generations.
Charles Darwin	1859 1871	England	Theory of Evolution *The Origin of Species* argued that plants and animals evolve from previous generations. Sparked a huge debate. *The Descent of Man* argued that evolution applied to humans. Darwin was burned in effigy across Christian Europe.

Medicine			
Edward Jenner	1796	England	Developed vaccine for smallpox. First vaccine in history.
Louis Pasteur	1860s	France	Developed process (Pasteurization) to kill bacteria, preventing the growth of germs and diseases. Pasteur also discovered the principle behind Jenner's smallpox inoculation. When exposed to a weakened version of a disease, the body produces "antibodies" that not only kill off the current disease, but remain in the body for life. With this knowledge, Pasteur develop vaccinations for anthrax and rabies.
Crawford W. Long	1842	U.S.	First administration of ether in surgery. Reduced pain and risk of shock during operations.
Joseph Lister	Late 1800's	England	Applied Pasteur's knowledge to surgery and hospitals. Dramatically improved surgical survival rates. Yes, *Listerine* is named after Joseph Lister.

Heavy Industry			
James Watt	Steam Engine	ca. 1765	Forms the basis for almost every engine today. Improved upon Thomas Newcomen's Steam Pump from early 1700's.
Antoine Lavoisier	Combustion	1789	The knowledge of how chemicals interact proved to be immensely powerful and practical to virtually all later industrial inventions.
Alessandro Volta	Electric Battery	1800	Allowed power to be stored for later use.
Joseph Aspdin	Cement	1824	Facilitated taller, stronger forms of architecture.
James Neilson	Blast Furnace	1828	Later perfected by Bessemer in the 1850's, the blast furnace was the means of producing high quality (pure) steel, which is far more versatile than iron.
Michael Faraday	Dynamo	1831	Converts mechanical energy to electricity.
William Stanley	Electric Transformer	1885	Developed the induction coil, a transformer that creates alternating current electricity.

"Soft Sciences" (Psychology, Economics, Sociology)			
Sociology			
Herbert Spencer	1877-1896	England	Social Darwinism Spencer used Darwin's theory of evolution as the basis for studying human communities. In *Principles of Sociology*, Spencer applied this theory of natural selection to society. Attempts at reform in society were useless and harmful. ("survival of the fittest," therefore let nature take its natural course, don't help the weak)
William Graham Sumner	1883	England	Sumner's *What the Social Classes Owe to Each Other* was a Social Darwinist argument that gov't action on behalf of the poor/weak interfered in evolution and sapped the human species. Reform tampered with the laws of nature. Sumner's answer to the book's title was, "Nothing!"
Louis Brandeis	1908	U.S.	The "Brandeis Brief" in *Muller v. Oregon*, persuaded an Oregon court that *environmental* (societal) factors were as important as legal ones in a case involving a 10-hour law limiting working hours for women.
Psychology			
Sigmund Freud	ca 1900	Austria	Developed 1st comprehensive theory of human personality, comprised of the *id*, *ego*, and *superego*. Theorized that much of human behavior is shaped by conflicts among these at a subconscious level. These conflicts can only be resolved through *psychoanalysis*, which reveal sexual, violent, and/or even self-destructive motivations. While most of Freud's theories are now discredited, he influenced a whole generation of later psychologists to prove or refute his theories.
Ivan Pavlov	Early 1900's	Russia	Developed theory of Classical Conditioning (Learning). Famous for his salivating dogs.
Economics			
Richard Ely	1885	U.S.	Ely led a small band of rebels in founding the American Economic Association, 1885, which linked economic to social problems and urged government intervention in economic affairs.
Thorstein Veblen	1899	U.S.	Veblen's book, *Theory of the Leisure Class*, analyzed the "predatory wealth" and "conspicuous consumption" of the business class. He attacked classical economic theory, rejecting simple laissez-faire theory. Veblen rejected Social Darwinism, claimed poverty was the root of all crime, thought laws of economics served as a mask for human greed.

Communication Inventions in 1800's/Early 1900's			
Inventor	**Invention / Discovery**	**Date**	**Significance / Impact**
Joseph Niépce & Joseph Daguerre	Photograph	1826	The first successful picture was produced in 1827 by **Niépce**, using material that hardened on exposure to light. This picture required an exposure of 8 hours. Louis Daguerre soon discovered a way of developing photographic plates, a process which greatly reduced the exposure time from eight hours down to 1/2 hour. He also discovered how an image could be made permanent. The French government bought the rights to Daguerre's invention in 1839. The finished product was named a Daguerreotype. The announcement that the Daguerreotype "requires no knowledge of drawing …" and that "anyone may succeed.... and perform as well as the author of the invention" was greeted with enormous interest, and "Daguerreomania" became a craze overnight.
Michael Faraday	Electricity	1831	Generated electric current in a wire by passing a magnet over the wire. Later, Faraday's work was used as the basis of the dynamo (electric generator)
Samuel F.B. Morse	Telegraph	1844	Enabled instant communication at the speed of light. Communication only through wires, and only by simple beeps ("dots" and "dashes") of Morse Code. The impact of the telegraph was immediately recognized. (Morse's 1st message, "What hath God wrought?")
Alexander Graham Bell	Telephone	1876	Allowed human speech (and any other sound) to be transmitted across wires.
Thomas Edison	Stock ticker Phonograph Electric (Incandescent) Light Motion Pictures	1869 1877 1879 1890's	Probably the single most famous inventor of all time. Edison had over 1,000 patents to his name. His personal favorite was the phonograph, but he's best known for his electric light. In addition to his individual inventions, Edison's biggest "invention" was the creation of inventing as an industry. Edison's prediction was that he could spit out a small invention every 2 weeks, as well as a "big" one twice/year.
Gugliermo Marconi & Nikola Tesla	Radio (Wireless Telegraph)	1890's	As the name implies, wires no longer needed. Used on ships in 1890's, increasingly used for more common purposes in early 1900's. Played a huge role in the Great War. (WWI)
George Eastman	Camera	1879	Eastman enabled middle-class America to document their world without the hours of preparation that previous cameras had required.

Transportation Inventions in 1800's/Early 1900's			
Inventor	**Invention / Discovery**	**Date**	**Significance / Impact**
James Watt	Steam Engine	ca. 1765	Forms the basis for almost every engine today. Improved upon Thomas Newcomen's Steam Pump from early 1700's.
Robert Fulton	Steamboat	1809	1st practical application of steam power to shipping.
Michael Faraday	Electricity	1831	Generated electric current in a wire by passing a magnet over the wire. Later, Faraday' work was used as the basis of the dynamo (electric generator)
George Stephenson	Railroad locomotive	1830's	Revolutionized transportation. People could now live in a separate city from where they worked.
Charles Goodyear	Vulcanized Rubber	1839	Discovered by accident, made possible the modern tire. Mad rubber much more useful by preventing it from sticking and melting in hot weather.
Elisha Otis	Passenger Elevator	1853	Improved movement in buildings, when later electrified, stimulated the development of skyscrapers.
Gottlieb Daimler & Karl Benz	Internal Combustion Engine	1890's	The basic unit of power in every automobile today.
Rudolf Diesel	Diesel Engine	1897	Simpler and easier to maintain than the standard internal combustion engine.
Wilbur & Orville Wright	Airplane	1903	One of the biggest transportation inventions ever. Flight has revolutionized international contacts and relations,

Textile Inventions in 1700-1800's			
Inventor	**Invention / Discovery**	**Date**	**Significance / Impact**
John Kay	Flying Shuttle	1733	doubled weaving production
James Hargreaves	Spinning Jenny	1764	Increased spinning rate 600-800%
Richard Arkwright	Water-Frame	1768	used waterpower to drive spinning wheels
Samuel Crompten	Spinning Mule	1779	Combined the Spinning Jenny & Water-Frame, the "water-powered spinning Jenny" was akin to a horse and donkey producing a mule, thus the name. The Spinning Mule was much too large & expensive to buy & use at home. It needed to be close to fast-flowing stream. The first factories started to appear in English hillsides.
Edmund Cartwright	Power Loom	1785	Created water-powered weaving, now cotton growers couldn't keep up
Eli Whitney	Cotton 'Gin'	1793	Dramatically increased the availability of cotton. Previously, one person could produce a pound of seedless cotton in 10 hours. After the cotton gin, a single person could produce more than 100 pounds in less than 1 hour. Later improvements to the cotton gin were even more productive.
	Interchangeable Parts	Early 1800's	Note: Whitney never made a dime from his cotton gin patent, (U.S. patents were rarely enforced in these days and the gin was easily copied from readily available parts.) Whitney did however, make his fortune with the concept of interchangeable parts. (using identical, standardized components in manufacturing)
Elias Howe	Sewing Machine	1836	First practical machine for automatic sewing.

Military Inventions			
Inventor	**Invention / Discovery**	**Date**	**Significance / Impact**
Samuel Colt	Revolver	1836	First successful repeating pistol. Later came to have major impact on U.S. settlement of Great Plains (Colt "Indian killer")
Richard Gatling	Rapid-fire ("Gatling") Gun	1862	The Gatling Gun consisted of six barrels mounted in a revolving frame. A later version with ten barrels, fired 320 rounds a minute. The U.S. Army purchased these guns in 1865 and over the next few years most major armies in Europe purchased the gun. By 1882 it could fire up to 1,200 rounds per minute. However, sales of the gun declined after Hiram Maxim began producing his automatic Maxim Machine Gun.
Alfred Nobel	Dynamite	1866	Revolutionized railroad tunnel building, became the world leader in explosives. Nobel was initially hopeful that his discovery would make future wars/aggression impossible, or at least impractical, because of the obviously high risk of life that dynamite brought. Later, Nobel used his patent royalties to found the Nobel Prizes in Physics, Chemistry, Biology, Medicine, Peace, Literature, etc.
Hiram Maxim	Machine Gun	1885	Maxim used the energy of each bullet's recoil force to eject the spent cartridge and insert the next bullet. The Maxim Machine-Gun would therefore fire until the entire belt of bullets was used up. Trials showed that the machine-gun could fire 500 rounds per minute and therefore had the firepower of about 100 rifles. The Maxim Machine-Gun was adopted by the British Army in 1889. The following year the Austrian, German, Italian, Swiss and Russian armies also purchased Maxim's gun. The gun was first used by Britain`s colonial forces in the Matabele war in 1893-94. In one engagement, 50 soldiers fought off 5,000 Matabele warriors w/ just 4 Maxim guns.
John Holland	Submarine	1898	While prototype submarines had existed since the American Revolution, Holland's sub was the first to combine potent offensive capability together with dependable navigation and depth control.
Ernest Swinton	Tank	1914	The tank was never properly utilized in WWI, but it showed great promise at breaking the trench-warfare stalemate that plagued both side in the Great War.

Miscellaneous Inventions			
Inventor	**Invention / Discovery**	**Date**	**Significance / Impact**
Blaise Pascal	Calculating Machine	1642	Pascal's device could only add and subtract, while multiplication and division operations were implemented by performing a series of additions or subtractions.
Fahrenheit & Celsius	Mercury thermometer	1714	Fahrenheit's thermometer used salt water as a standard, Celsius' free-water.
Benjamin Franklin	Lightning conductor (rod)	1752	Franklin's Lightning Rod saved thousands of buildings every year from burning by being struck by lightning.
Antoine Baumé	Hydrometer	1768	Measures the % of acid, lye, sugar etc. content in a liquid.
Richard B. Chenaworth	Cast-iron plow	1813	First iron plow to be made in three separate pieces, thus making possible replacement of parts.
Karl von Sauerbrun	Bicycle	1818	Sauerbrun's version had no pedals, brakes, or springs, but was built from pieces of horse-drawn carriages. Later models improved safety, maneuverability, and comfort.
Charles Babbage	Digital calculating machine	1823	Babbage is the originator of the concepts behind the present day computer. Charles Babbage believed in a definite order of the universe. He believed that once the world could be quantified then it could be predicted and controlled. (This was a fairly common philosophy of time with many scientists trying to discover the Natural Laws of the Universe.) In that pursuit he designed the analytical engine capable of performing any math problem. Even though he never completed his invention, it has earned him the title of the "Father of Computing."
Cyrus McCormick	Reaper	1831	Mechanized harvesting; early model could cut six acres of grain a day. Later models much more productive.
Richard M. Hoe	Rotary Printing Press	1847	Printed an entire sheet in one motion; vastly speeded up printing process.
Léon Foucault	Gyroscope	1852	Used as a navigational instrument in all sorts of planes, rockets, ships, etc.
Ferdinand Carré	Refrigerator	1858	At this time, restaurants and homes had "ice boxes," which had an insulated compartment for ice and another for food. The ice was replaced periodically by purchasing blocks from the "iceman," whose wagon was a common sight on the streets of towns and cities. Carré's version circulated ammonia around the container to be kept cold. It was unwieldy and cumbersome, and was improved upon in future years by dozens of competitors.
Washing Machine	Hamilton Smith	1858	Smith's version was the first to use a rotating drum. Later improved versions included electric power (1908) and galvanized (rust-proof) tub (1910).
Gustavus Swift	Processed Foods	1870's	Invented idea of "dissembly plants" for butchering meat.

Romantic Painters & Sculptors (*all* French!)			
Painters			**Sculptors**
Eugène Delacroix	Paul Cézanne	Edgar Degás	Auguste Rodin
Claude Monet	Paul Gauguin	Henri de Toulouse-Latrec	
Pierre-Auguste Renoir	Vincent van Gogh	Édouard Manet	

Romantic Musicians / Composers			
German	French	Russian	Italian
Ludwig van Beethoven	Hector Berlioz	Peter Tchaikovsky	Giuseppi Verdi
Franz Schubert	Frédéric Chopin	Modest Mussorgsky	
Robert Schumann	Franz Liszt	Nicolai Rimsky-Korsakov	
Gustav Mahler	Claude Debussy		
Johannes Brahms			
Richard Wagner			
Felix Mendelssohn			

Authors			
Nationality	**Romanticism**		**Realism**
England	William Wordsworth	John Keats	George Eliot (Mary Ann Evans)
	Percy Bysshe Shelley	Lord Byron	Charles Dickens
	Samuel Taylor Coleridge	Sir Walter Scott	
France	Victor Hugo	Alexandre Dumas	Gustave Flaubert Émile Zola
United States	James Fenimore Cooper	Washington Irving	Samuel Clemens (Mark Twain)
Russia			Leo Tolstoy
Norway			Henrik Ibsen