

Workshop on Science as a Site of Culture

30th October-4th November 2001

Organised by Majlis and Jindal Art Centre

30th October

- 9.30am Registration
10.30am Inaugural Lecture: Nature and Science **Dr. Vandana Shiva**
2.00pm Slide show and talk on powers of 10 **Prof. J.B. Mistry**
3.30pm Questions of Philosophy: Scientific Answers? **Dr. K. Subrmaniam**
5.00pm Visiting the site of Installation *A Leap into the Abyss*
Artist **Baiju Parthan** and Physicist **Dr. K. Sridhar**

31st October

- 10am Towards a Global History of Science: The relationship between Science, its History and Theory of History **Dr. Dhruv Raina**
12am Workshop on Mapping History and Science
3.30pm Tracing Evidence of Science and Technology in India (with film clippings) **Chhandita Mukherjee**
5pm Is there an Indian Scientist: Life of Ramanujan and Chandrasekhar
A Reading session

1st November

- 10.00am Science in the Coming Millennium: a Sociological Reading
Prof. J.P.S. Uberoi
12 noon Colonial Science: Case of Epidemiology **Dr. Mridula Ramanna**
2.30pm Science, Popular Beliefs and Cinema **Gayatri Chatterjee**
4.00pm Feature Film Screening *Structure of Crystal* by **Zanussi**

2nd November

- 10am Panel Discussion: "Across Boundaries: Talking of Methods"
Moderator: **Dr. Padma Prakash**
Discussants **Dr. M.C. Arunan**, Biology Lecturer; **Dr. Bhargavi Davar**,
Mental health researcher; **Dr. Urjit Yagnik**, Physicist, **Dr. Amrita
Shodhan**, Historian
1.30 pm Global Policies, Bodily Invasions: Technological Interventions in
Reproduction **Chayanika Shah**
3.30pm Modernism in Art, Scientific Patronage: an Analysis of Homi Bhabha's
Art Collection: a Slide Show **Vidya Kamat**
4.30pm Revisiting the Installation/Open Session

3rd November

- 10am Science and Technology: the Connections and the Disconnections
Satyajit Rath
- 11.30am Technology development, social context and ethics: the case of the
nuclear shadow **Vineeta Bal**
- 2pm Marxist Review of Science Practices **Dr. Vivek Monteiro**
- 3.45pm Documentary Film Screening: *Asking Different Questions*
Feminist Perspective on Science **Dr. Chayanika Shah**

4th November

- 10am Science, Astrology and National Identity **Dr. S. Balachandra Rao**
- 12noon Some Hoaxes, Some Wrong Theories: Stories from Science
Prof. A. A. Rangwala
- 2.30pm Interactive session
- 4pm Lecture-Demonstration on performance of *Lilavati* by
Jhelum Paranjape

→ Put significant dates on the board.

- Classify into pre-1900
- 1900 - 1927
- 1927 - 1945



1. Story of atom $\left\{ \begin{array}{l} \text{explicit connection} \\ \text{impact on others} \\ \text{influence of others} \end{array} \right.$

2. Actually looking at period from 1900 - 1927
1927 - 1945



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- 3 things to be said in the intro,
- short exercise in making connections.
 - order - representative but limited - time period.
 - events of diff. kinds - Eurocentric
1. Put science in its context.
 2. Linkages across disciplines.
- look at cards read info. and abstract from it.
examples of this

“Origin of species”

British naturalist Charles Darwin explains the theory of evolution by natural selection in the “Origin of Species”. He shows that species are modified and new species emerge as individuals better adapted to their environment outreproduce those less well adapted.

1859

Mendel’s Experiments with peas

After experimenting with crossbreeding of sweet peas and making a statistical analysis, Austrian monk Gregor Mendel concludes that each of an organism’s inherited traits is determined by two heredity units called genes, one from each parent organism.

1866

Discovery and naming of chromosomes

Scientists began examining the cell nucleus and found that clusters of rods appeared before cell division. These rods, or chromosomes, as they were named, split in two lengthwise and the two sets went separately into the two halves of the dividing cell.

1887

Rediscovery of Mendel’s work

German biologist Cal Correns, Dutch botanist Hugo de Vries, and Austrian botanist Erich Tachermark independently rediscover the significance of Mendel’s work with peas. They also found that Mendel provides a mechanism through which Darwin’s theory of natural selection operates.

1900

Mechanism of Mendelian heredity

American geneticists Thomas Morgan, Calvin Bridges, Alfred Sturtevant, and Herman Muller publish “The Mechanism of Mendelian Heredity”, claiming that invisible genes within the chromosomes of the cell nucleus determine an offspring’s hereditary traits.

1915

Prohibition on teaching evolution theory

The Tennessee legislature passes the first state law prohibiting the teaching of Darwin’s theory of evolution in any Tennessee school. A teacher actually put on trial for teaching in spite of the ban.

1925

Discovery of cathode rays

German physicist Eugen Goldstein discovers cathode rays, which are seen as streaks of fluorescence, flowing from the cathode, or negatively charged electrode, in an evacuated tube.

1876

Discovery of the phenomenon of radioactivity

French physicist Antoine-Henri Becquerel discovers radiations from an Uranium compound. Soon after Marie Curie demonstrates that these radiations emanate from the Uranium atom, thus disproving the long held notion that the atom was indivisible.

1896

Discovery of the electron

British physicist J. J. Thomson discovers the first subatomic particle that is the electron as the fundamental particle that carries the electric charge and calculates its mass. Later its charge is calculated and cathode rays and some radioactive rays identified as electrons.

1897

Introduction of the quanta

German physicist Max Planck while stating some radiation law, uses the concept that energy is radiated in discrete packets called quanta. This becomes the foundation of quantum theory and is a concept used by Einstein to explain results of experiments in photoelectric effect.

1900

Thomson's model of the atom

British physicist J. J. Thomson proposes a model for the atomic structure in which the electrons are seen as embedded in a positively charged atom like raisins in a pudding.

1904

Bohr Rutherford model of the atom

British physicist Ernest Rutherford, suggests a model of the atom with a massive nucleus with positive charge and electrons surrounding it, leaving the atom neutral and with a lot of empty space. Danish physicist Neils Bohr applies notion of quanta to the atom suggesting that electrons can orbit around the nucleus in only fixed orbits.

1911 – 1913

First artificial nuclear reaction

British physicist Ernest Rutherford studies the first artificial nuclear reactions when on bombarding nitrogen nuclei with alpha particles (part of the radioactive radiations) he finds it splits to eject hydrogen nuclei. These hydrogen nuclei which are the lightest, he then terms the positive charged particle in the nucleus, the proton.

1919

Wave aspect of particles

French physicist Louis-Victor-Pierre-Raymond de Broglie proposes that every particle should have an associated matter wave. The nature of the wave would depend on the characteristic of the particle.

1923

The Uncertainty Principle

German physicist Werner Heisenberg states the uncertainty principle that it is impossible to know both the position and momentum of a subatomic particle with exact precision simultaneously. This contradicts the classical view in science that accurate measurements are possible within the limits of the accuracy of the instrument.

1927

Discovery of the neutron

British physicist James Chadwick discovers the neutron which is a neutral particle with the same mass as the proton and is also a component of the atomic nucleus.

1932

First nuclear fission reaction

German chemist Otto Hahn achieves the splitting of the atomic nucleus when he bombards uranium nuclei with high energy neutrons. It is his colleague Austrian physicist Lise Meitner and her nephew Otto Frisch who recognise the reaction as a nuclear fission reaction and for the first time show that it is possible to split the nucleus and release large amounts of energy.

1938

The Manhattan Project Dec 6 1941

President Franklin Roosevelt signs a secret directive ordering the development of a nuclear fission bomb. Many top scientists were invited to join the project called the Manhattan Project at a desert site called Los Alamos. The director of the project was J. Robert Oppenheimer.

Patenting of the elevator

American mechanic Elisha Graves Otis patents the safety elevator, also known as the safety holster. This cagelike apparatus operates by a combination of rope, grips, and ratchets.

1852

Invention of the telephone

The telephone is invented by the Scottish-American teacher Alexander Graham Bell. He develops it as a result of trying to develop a system of electronic speech for the deaf students whom he was teaching.

1875

Light bulb

American inventor Thomas Alva Edison demonstrates an incandescent vacuum light bulb that burns for nearly fifty hours and is still not extinguished.

1879

First working motor car

German engineer Carl Friedrich Benz develops the first working motor car powered by gasoline. The safety bicycle with two equal sized wheels is also developed by an English inventor J. K. Stanley in the same year.

1885

The first skyscraper

The first skyscraper, built for the Home Insurance company, goes up in Chicago. Designed by American architect William LeBaron Jenney, it is a ten storey steel-framed marble building.

1885

Low cost camera 1888

American inventor George Eastman markets the first low-cost, easy-to-use camera, the Kodak. This twenty five dollar device holds a roll of stripping paper for up to one hundred photographs.

First air flight

Orville Wright flies 120 feet in 12 seconds, in a twelve horsepower biplane built by him and his brother Wilbur. It is the first successful flight of a heavier than air machine.

1903

The assembly line

In Detroit, the Ford Motor Co., uses the assembly line system to build cars, which reduces assembly time from 12.5 to 1.5 hours. Earlier the car stopped at each point in the process of assembly, now it is continually moving.

1913

Automated cotton picker

American inventors John and Mack Rust develop the all mechanical cotton picker, which when popularised two decades later leads to a lot of job losses for African Americans on Southern farms.

1927

Manufacture of jeeps

The four cylinder general purpose field vehicle called the jeep is developed by US engineer Karl Pabst for the Bantam car co. The first US superhighway with tunnels, the US turnpike, also opens.

1940

The first computer

American theoretical physicist John V. Atanasoff and his assistant Clifford Berry build the first computer that successfully uses vacuum tubes to perform calculations.

1942

US national system of highways 1944

The U.S. National System of Interstate highways is set up by a Congressional federal highways act designating the construction of forty thousand miles of highways across the country.

1870s

Discovery of Africa

First random discoveries of diamonds in South Africa. At the time European countries controlled less than ten percent of the African continent. This was followed by a conference of European countries in Berlin to lay down rules for the new competition for lands in Africa.

1890-1900s

Imperialism and Colonial Wars

Almost 90% of Africa is divided amongst the European powers. There is a Boxer Rebellion in China. Russians fought and lost a war with Japan. The British fought the Boers in South Africa.

1911

Labour Management

Frederick Taylor, from a well-to-do Philadelphia family, was a foreman in a Pittsburgh steel mill. He wrote the *Principles of Scientific Management* that would change the workplace forever. He devised a means of detailing a division of labour in time-and-motion studies and a wage system based on performance.

Mar 8, 1857

Women's Activism

Women workers first marched on the streets of New York City. Majority of the demonstrators were workers from the garments industry who protested against low wages, generally inhuman conditions and for a twelve hour working day.

1870s

Adoption of Gold Standard and Welfare Statism

The adoption of gold as standard for monetary value and the maintenance of gold reserves against which the currency was issued. This restricted money supply and created a depression. It created also international stability and confidence in money. It marked the beginning of the institutionalist school of economic theory which argued for the involvement of governments to aid the distribution of wealth against laissez-faire attitudes.

Institutional Anthropology 1883

German American Franz Boas begins his work on Eskimos and inspires and trains many influential anthropologists like Ruth Benedict, Alfred Kroeber, Margaret Mead and Edward Sapir who study societies in Africa and the Far East. They stress the importance of culture and language in shaping Human Behaviour.

1886

Union Labour and Anarchism

The Federation of Organised Trades and Labour Unions in the USA passed a resolution stating that eight hours would constitute a legal day's work from May 1 a year later. The resolution called for a general strike to achieve the goal. The movement grew rapidly involving 250,000 workers a year later. The demonstrations on May 1 in Chicago and the subsequent Haymarket square meeting which was controlled by prominent anarchists in the labour movement laid the foundations for the May 1st to be recognised as labour day around the world.

1930s

Keynesian Economics

In a period of unemployment and the depression John Maynard Keynes' influential *A Treatise on Money* and later *The General Theory of Employment, Interest and Money* suggested an alternative explanation about the origins of unemployment and depression. This centred upon aggregate demand created by the total spending of consumers, business investors, and public agencies. When aggregate demand was low, sales and jobs suffered. When it was high, all was well.

1948

The New Laissez Faire

Milton Friedman at the University of Chicago laid the foundations for a new school of Economics, which while it is no longer popular inaugurated an era of market capitalism. In his own words, "The basic long-run objectives, ... are political freedom, economic efficiency and substantial equality of economic power.... All three objectives can best be realized by relying, as far as possible, on a market mechanism within a "competitive order" to organise the utilisation of economic resources".

1848, 1867

"Workers of the World Unite"

The *Communist Manifesto*, *1st Volume of Das Kapital*. These works by Karl Marx spoke of dialectical materialism – that civilisation is determined by the material means of production and the relations of production. He suggested that the owners of the means of production and the labourers form different classes and these differences should be erased to create an egalitarian communist society.

1852	Patenting of the elevator
1859	“Origin of species”
March 8, 1857	Women’s Activism
1866	Mendel’s Experiments with peas
1867	“Workers of the World Unite”
1870s	Discovery of Africa
1870s	Adoption of Gold Standard and Welfare Statism
1875	Invention of the telephone
1876	Discovery of cathode rays
1879	Light bulb
1883	Institutional Anthropology
1885	First working motor car
1885	The first skyscraper
1886	Union Labour and Anarchism
1887	Discovery and naming of chromosomes
1888	Low cost camera
1896	Discovery of the phenomenon of radioactivity
1897	Discovery of the electron
1890-1900s	Imperialism and Colonial Wars
1900	<i>The Interpretation of Dreams</i>
1900	Rediscovery of Mendel’s work
1900	Introduction of the quanta

1904	Thomson's model of the atom
1907	Cubism
1911	Labour Management
1911-1913	Bohr Rutherford model of the atom
1913	<i>The Psychology of the Unconscious</i>
1913	Behaviourism
1913	The assembly line
1914	<i>Tender Buttons</i>
1915	Mechanism of Mendelian heredity
1919	First artificial nuclear reaction
1920	<i>The Cabinet of Dr. Caligari</i>
1920s	Jazz
1922	<i>Ulysses</i>
1922	<i>The Waste Land</i>
1923	Wave aspect of particles
1924	Surrealism
1924	<i>The Trial</i>
1924	<i>Rhapsody in Blue</i>
1925	Prohibition on teaching evolution theory
1927	The Uncertainty Principle
1927	Automated cotton picker
1929	<i>All Quiet on the Western Front</i>
1930	Keynesian Economics
1932	Discovery of the neutron
1938	<i>The Second Coming</i>

1938	<i>The Second Coming</i>
1938	First nuclear fission reaction
1940	Manufacture of jeeps
Dec 6, 1941	The Manhattan Project
1942	The first computer
1944	US national system of highways
1945	Atomic bombs dropped.
1948	The New Laissez Faire

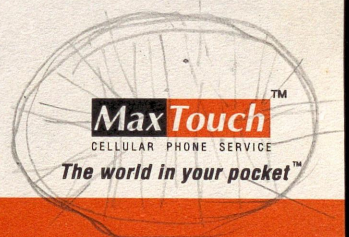
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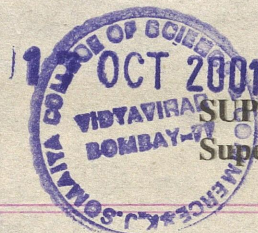
1. Atom story - how science is done^{or}
2. Connections - direct betn events & political history.
3. Multiple points of view 1900 - 1930s.
4. Technology & social implications
5. Macro. → Micro.
6. European story & imperial story.



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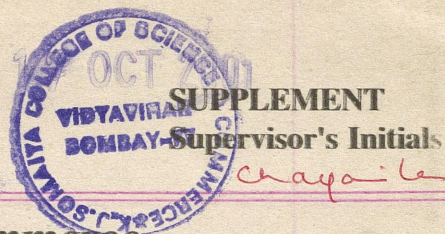
Roll No. _____

Date & Time 17.10 E

Class _____

- (1) 1852 Elevator (162) American Otis.
1853 Patenting of safety match (163) Swedish.
1863 London underground (176)
1875 (2) Telephone (190) Scottish American
Milk chocolate (190) - Swiss.
1877 (1) Phonograph (195) Edison - US.
1879 (3) Bulb (196) U.S. 1881 - Savoy theatre lit (199) England
1884. Patenting of Linotype typesetting machine (203) German American
1885 (4) First working motorcar (204) German Benz.
1885 (5) First skyscraper (204) - 10 storeys. - America.
Safety bicycle (204) - English
(7) 1888 Camera - low cost, easy to use 25\$ (207) American
1891 First motion picture viewing system (212) (American.)
1894 Diesel engine - German
Pneumatic tyres - French - mfd. in America (216).
1900 Tractor (American) (224).
(6) 1903 First air flight - Wright Brothers. American (228)
(7) 1913 Assembly line - Detroit. 12.5 → 1.5 hrs. (244).
~~1914 Proton to +ve nucleus of H. Rutherford (245)~~
1917 SONAR - French
AM for radio - US army corps } (249).
1918 Pop. up toaster patented - US (250).
1919 Dial telephones . US (251).
1923 Zipper - B.F. Woodruff co. (257).
1926 Demo. of motion picture & synchronised sound (261).
1927 Demo. of T.V (263)
(8) 1927 Automated cotton picker. loss of jobs. (263)
1929 16mm movie camera, projector & film - KODAK (265)
1935 RADAR - Scottish physicist. } (276)
- Germans in 1934
B. 17 Bomber (US)
Polyethylene - UK.
1st technicolour feature film.
(9) → Chrysler
Empire State Bldg. } 1931.

- 1936 720 foot high Boulder dam "Hoover dam" U.S. } (277)
tampou - US.
- 1937 Nylon patented - Du Pont } (279)
Dry copy process Xerography
Grocery shopping cart designed
- 1938 Hungarian brothers patent ball point pen. (281)
- 1939 Fluorescent lighting } (283)
Commercial passenger air service
FM radios sold
- (10) 1940 Germans fly turboprop } (285)
MIG - I - Russian fighter plane
- (11) Jeep - Bantam Car Co. 600,000 jeeps for WWII } (286)
U.S. superhighway - nylon stockings
- (12) 1942 First computer to perform calculations (289)
- 1944 Americium, Curium,
First nuclear reactors U → Plutonium for bombs (291)
Rockets - German (292)
- 1950 First xerox machine - Haloid Co. of N.Y. (307)
- 1952 Japanese made hand held radios sold in US by Sony (309)
- 1955 US & USSR satellite programme (314)
- 1958 Boeing 707 } (320)
Soviet & Am. spacecrafts
- 1959 I.C. (322)
- 1960 LASER US } (325)
Al cans as containers for soft drinks food cans
- 1969 Landing on moon.
- 1970 Intel invents the μ P chip.
- 1973 Universal product code in US supermarkets (347)
- 1975 First P.C. (349) - Microsoft formed.
- 1976 Fax m/c.
- 1980 CNN } (357)
First P.C. c MS-DOS
- 1983 Cellphones tested (362)



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Roll No. _____

Date & Time 17.10 E

Class _____

- ✓ 1867-1894 : Das Kapital (182)
1893 : Emile Durkheim publishes "Division of labour"
1895-96 : Freud. (214)
1906 - Earthquake - San Francisco.
1912 - British Dawson Pittdown man (242).
~~1913 - Bohr's model of atom (243) (Denmark)~~
~~1914 - Rutherford the nucleus of H: proton (245)~~
~~1915 - Sommerfeld model (German) (247).~~
1915 - 1918 - Malinowski - British - Trobrianders (248)
1916 - Sanger - first birth control clinic NY (248)
1928 - Margaret Mead "Samoa" (264)
1935 - Alcoholic Anonymous - Stock broker &
surgeon (275)
- George Gallup - American Instt. of public opinion (276)
⑩ Segregated blood story (287)
⑬ 1944 : 40,000 miles of highways commissioned. (292)
1945 : 120 German scientists surrender to U.S. } (293)
- Rocket research in New Mexico.
1946 - Spock (295)
1950s : psychology - treatment - new methods (305)
1952 - DSM - I (309)
1953 - 79. Use women's names for typhoons, hurricanes (311)
1957 : Richter scale (318)
1958 - Russian scientist Ilya - all female vertebrate (319)
1960s : creationist movement - law struck down in 1987.
1970 : Earth day celebrated (342)

America : Anthropology
Astronomy
Geology
Archaeology



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Supervisor's Initials

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Roll No. _____

Date & Time _____

Class _____

(180)

✓ (1) 1857 Mendel's study on peas begins 1866 : concludes

1859 - Origin of species ✓ 1862 - Post. cur (175)

(179) 1882 : Mitosis → chromosomes

1871 - Descent of man

(185) (3) 1887 : No. of chromosomes constant in a cell.

(2) 1900 : Mendel's work discovered - German, Dutch, Austrian

1902 chromosomes & Mendel's heredity - corresp.

~~(18)~~ ← 1903 : Chromosomal theory of heredity - American (227)

1907 : Begin work on fruit flies - Morgan

1911 : - American (240)

1909 : Word "gene" coined - carrier of heredity - Dutch (236)

(5) 1915 : "Mechanism of Mendelian Heredity" - Morgan (246)

1925 : Tennessee teacher - put on trial for teaching

Tennessee state passes legislature prohibiting evolution teaching (258)

(6) 1928 : Penicillin - 1939 actual prodn (264)

(4) 1935/1932 : Sulpha drugs - German pathologist (275)

1926 : American - distinguish betn. bacteria & virus (260)

1929 : American & German isolate estrogen (265)

1934 - German chemist isolates progesterone (275)

1940s : American geneticists give clues of how chromosomes & their genes copy exactly from cell to cell (283)

1944 : Canadian - DNA determines heredity (280)

1947 : Broad spectrum antibiotic - US (297)

1953 : Structure of DNA (US, Brit)

1955 : Birth control pill (314)

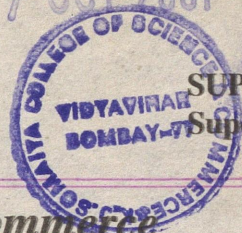
1960s : Masters & Johnson (334)

1967 : Heart transplant first (336)

1970s : cloning of plants
superovulation in cattle

- 1973: Genetic engg. begins (346).
- 1976 Chinese gynaeas develop C.V.R (357)
- 1978 IVF - England (354).
- Laparoscope
- 1981 Chinese geneticists first to clone a fish (358)
- 1982 AIDS. (360)
- 1983 Monsanto Life Sciences Research Centre (363)
- Sheep cloned.
- 1984: Bhopal gas leak } (363)
- HIV virus
- 1987 Prozac (371)

17 OCT 2001



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Roll No. _____

Date & Time 17.10 E

Class _____

- ① 1876 Cathode rays (191) - Goldstein German.
- ② 1895 X-rays - Rontgen - German (217)
- ③ 1896 Radio activity - Becquerel - French (218)
- ④ 1897 J. J. Thomson - (e⁻) - British (220)
- 1900 Planck - energy packets called quanta - German (223)
- 1903 Poincaré - sensitivity to initial condns. (228).
↳ French.
- ⑤ 1904 Thomson British plum model of atom (230)
- ⑥ 1905 General sp. theory of relativity Einstein - German (231)
- ⑥ 1911 Rutherford model of atom British (240)
- 1912 Austrian - American physicist - cosmic rays (241)
- 1913 Bohr's model of atom Denmark (243)
- ⑦ 1914 Rutherford +ve nucleus of H: proton - English (245)
- 1915 Sommerfeld model - German (247)
- 1916 General theory of relativity - Einstein (248)
- 1918 Emily Noether (German) symmetry - consn laws (250)
- ⑧ 1919 Artificial nuclear rxn - Rutherford (251)
- 1923 Compton effect - U.S. (256)
- ⑨ 1923 De Broglie - matter waves (256)
- 1924 Bell laboratories established for Phy. research (257)
↳ American telephone & Telegraph and E. G. E.
- 1925 Austrian born American Pauli - exclusion principle } (258)
- Dutch Uhlenbeck & Goudsmit - define spin }
German - Heisenberg - matrix mechanics }
1926 Austrian Schroedinger - wave mechanics } (261)
- Born - wave packet, German }
Fermi (Italian) - Dirac (British) statistics }
1927 Bohr - complementarity principle } (262)
- ⑩ Heisenberg - uncertainty principle }
Electron diffraction expt. }
↳ American Davisson & British Thomson
- 1929 Hubble's law - U.S. (265)
- 1930 American discovers Pluto (267)
- 1930 Dirac - ^{matrix} mechanics + wave mech. (268)
- ⑪ 1932 British Chadwick - discovers neutrons } (271)
- Heisenberg - composition of nucleus. }

1934. Artificial radioactivity Curie - Joliot French (275)

1935 Yukawa - strong interaction (275)

1937 Muon - Anderson U.S (278)

This period also development of better microscopes & telescopes.

(12) 1938 Nuclear fission - Hahn - German (280)

(13) 1939 Story on bomb (283), (288)

1940 Neptunium, ~~Plutonium~~, C-14 (U.S.), enriching U, betatron (accⁿ) (285)

1941. One day before Pearl Harbor - Manhattan project started (288)

~~1944~~ 1946 1st automatic electronic digital computer ENIAC (296)

1948 Shell model of nucleus German-American, German (300)
BED (301)

~~1944~~ 1950s Transistor - Bell labs. (302)

Plate tectonics } (305)
Two kinds of particles hadrons, leptons

1954. CERN - Yang & Mills (313)

1961 First human being in outer space (320)

(60s is period of satellites, humans in outer space)

1964. Gellmann suggests quarks - Finnegans Wake Joyce (331)

~~1933~~

Atom	-	13
Psychology	-	5
Art	-	10
Imperialism	-	4
Bio	-	6
Labour / Eco.	-	5
Technology		13



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Roll No. _____

Date & Time 20.10.01

Class _____

Railways → roadways
↳ cars ↗

- ①
1857 Mendel (from the book) 180 pg.
- ②
1887 Discovery and naming of chromosomes
Scientists began examining the cell nucleus and found that clusters of rods appeared before cell division. These rods or chromosomes, as they were named, split in two lengthwise and the two sets went separately into the two halves of the dividing cell.
- ③
1900 Rediscovery of Mendel's work (223)
German bio. ... 223 ... in pea pods. They also found that Mendel provides a mechanism through which Darwin's theory of natural selection operates.
- ④
1915 Mechanism of Mendelian Heredity (246)
- ⑤
1859 "Origin of Species"
British naturalist Charles Darwin publishes " "

Institutional Anthropology

German American Franz Boas begins his work on Eskimos and inspires and trains many influential anthropologists like Ruth Benedict, Alfred Kroeber, Margaret Mead and Edward Sapir who study societies in Africa and the Far East. They stress the importance of culture and language in shaping Human Behaviour.

Cubism

Picasso built upon the experimentation of Cézanne and began to paint objects from more than one viewpoint at a time. The resulting Cubism reduces the traditional structure of the painting to a series of multi faceted planes and cubes, perspective and modelling are completely abandoned. Cubism breaks the rule established since the Renaissance regarding the representation of successive views simultaneously. His painting *Les Femmes d'Alger* causes a stir in Paris.

Discovery of Africa

First random discoveries of diamonds in South Africa. At the time European countries controlled less than ten percent of the African continent. This was followed by a conference of European countries in Berlin to lay down rules for the new competition for lands in Africa.

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American inventors John and Mack Rust develop the all mechanical cotton picker, which when popularised two decades later leads to a lot of job losses for African Americans on Southern farms.

First air flight

Orville Wright flies 120 feet in 12 seconds, in a twelve horsepower biplane built by him and his brother Wilbur. It is the first successful flight of a heavier than air machine.

Discovery of cathode rays

German physicist Eugen Goldstein discovers cathode rays, which are seen as streaks of fluorescence, flowing from the cathode, or negatively charged electrode, in an evacuated tube.

First working motor car

German engineer Carl Friedrich Benz develops the first working motor car powered by gasoline. The safety bicycle with two equal sized wheels is also developed by an English inventor J. K. Stanley in the same year.

First nuclear fission reaction

German chemist Otto Hahn achieves the splitting of the atomic nucleus when he bombards uranium nuclei with high energy neutrons. It is his colleague Austrian physicist Lise Meitner and her nephew Otto Frisch who recognise the reaction as a nuclear fission reaction and for the first time show that it is possible to split the nucleus and release large amounts of energy.

Patenting of the elevator

American mechanic Elisha Graves Otis patents the safety elevator, also known as the safety holster. This cagelike apparatus operates by a combination of rope, grips, and ratchets.

Manufacture of jeeps

The four cylinder general purpose field vehicle called the jeep is developed by US engineer Karl Pabst for the Bantam car co. The first US superhighway with tunnels, the US turnpike, also opens.

Discovery of the electron

British physicist J. J. Thomson discovers the first subatomic particle that is the electron as the fundamental particle that carries the electric charge and calculates its mass. Later its charge is calculated and cathode rays and some radioactive rays identified as electrons.

Discovery of the neutron

British physicist James Chadwick discovers the neutron which is a neutral particle with the same mass as the proton and is also a component of the atomic nucleus.

Thomson's model of the atom

British physicist J. J. Thomson proposes a model for the atomic structure in which the electrons are seen as embedded in a positively charged atom like raisins in a pudding.

US national system of highways

The U.S. National System of Interstate highways is set up by a Congressional federal highways act designating the construction of forty thousand miles of highways across the country.

"Workers of the World Unite"

The *Communist Manifesto*, 1st Volume of *Das Kapital*.
These works by Karl Marx spoke of dialectical materialism - that civilisation is determined by the material means of production and the relations of production. He suggested that the owners of the means of production and the labourers form different classes and these differences should be erased to create an egalitarian communist society.

Atomic bombs dropped

'Little Boy' atomic bomb dropped on Hiroshima.

'Fat Man' atomic bomb dropped on Nagasaki.

The Manhattan Project

President Franklin Roosevelt signs a secret directive ordering the development of a nuclear fission bomb. Many top scientists were invited to join the project called the Manhattan Project at a desert site called Los Alamos. The director of the project was J. Robert Oppenheimer.

Invention of the telephone

The telephone is invented by the Scottish-American teacher Alexander Graham Bell. He develops it as a result of trying to develop a system of electronic speech for the deaf students whom he was teaching.

The Uncertainty Principle

German physicist Werner Heisenberg states the uncertainty principle that it is impossible to know both the position and momentum of a subatomic particle with exact precision simultaneously. This contradicts the classical view in science that accurate measurements are possible within the limits of the accuracy of the instrument.

Union Labour and Anarchism

The Federation of Organised Trades and Labour Unions in the USA passed a resolution stating that eight hours would constitute a legal day's work from May 1 a year later. The resolution called for a general strike to achieve the goal. The movement grew rapidly involving 250,000 workers a year later. The demonstrations on May 1 in Chicago and the subsequent Haymarket square meeting which was controlled by prominent anarchists in the labour movement laid the foundations for the May 1st to be recognised as labour day around the world.

Light bulb

American inventor Thomas Alva Edison demonstrates an incandescent vacuum light bulb that burns for nearly fifty hours and is still not extinguished.

The first skyscraper

The first skyscraper, built for the Home Insurance company, goes up in Chicago. Designed by American architect William LeBaron Jenney, it is a ten storey steel-framed marble building.

Women's Activism

Women workers first marched on the streets of New York City. Majority of the demonstrators were workers from the garments industry who protested against low wages, generally inhuman conditions and for a twelve hour working day.

Labour Management

Frederick Taylor, from a well-to-do Philadelphia family, was a foreman in a Pittsburgh steel mill. He wrote the *Principles of Scientific Management* that would change the workplace forever. He devised a means of detailing a division of labour in time-and-motion studies and a wage system based on performance.

Adoption of Gold Standard and Welfare Statism

The adoption of gold as standard for monetary value and the maintenance of gold reserves against which the currency was issued. This restricted money supply and created a depression. It created also international stability and confidence in money. It marked the beginning of the institutionalist school of economic theory which argued for the involvement of governments to aid the distribution of wealth against laissez-faire attitudes.

The New Laissez Faire

Milton Friedman at the University of Chicago laid the foundations for a new school of Economics, which while it is no longer popular inaugurated an era of market capitalism. In his own words, "The basic long-run objectives,... are political freedom, economic efficiency and substantial equality of economic power.... All three objectives can best be realized by relying, as far as possible, on a market mechanism within a "competitive order" to organise the utilisation of economic resources".

Keynesian Economics

In a period of unemployment and the depression John Maynard Keynes' influential *A Treatise on Money* and later *The General Theory of Employment, Interest and Money* suggested an alternative explanation about the origins of unemployment and depression. This centred upon aggregate demand created by the total spending of consumers, business investors, and public agencies. When aggregate demand was low, sales and jobs suffered. When it was high, all was well.

The first computer

American theoretical physicist John V. Atanasoff and his assistant Clifford Berry build the first computer that successfully uses vacuum tubes to perform calculations.

The Cabinet of Dr. Caligari

The Cabinet of Dr. Caligari, a disturbing film opens in Berlin. It is based on Expressionism, an artistic style in which the artist seeks to depict not objective reality but rather the subjective emotions and responses that objects and events arouse in her. This is done through distortion, exaggeration, primitivism, and fantasy and through the vivid, jarring, violent, or dynamic application of formal elements.

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First artificial nuclear reaction

British physicist Ernest Rutherford studies the first artificial nuclear reactions when on bombarding nitrogen nuclei with alpha particles (part of the radioactive radiations) he finds it splits to eject hydrogen nuclei. These hydrogen nuclei which are the lightest, he then terms the positive charged particle in the nucleus, the proton.

Surrealism

Surrealism grew principally out of the earlier nihilistic Dada movement, but Surrealism's emphasis was not on negation but on positive expression. The movement represented a reaction against what its members saw as the destruction wrought by the "rationalism" that had guided European culture and politics in the past and that had culminated in the horrors of World War I. (Andre Breton, Salvador Dali, etc.)

Bohr Rutherford model of the atom

British physicist Ernest Rutherford, suggests a model of the atom with a massive nucleus with positive charge and electrons surrounding it, leaving the atom neutral and with a lot of empty space. Danish physicist Neils Bohr applies notion of quanta to the atom suggesting that electrons can orbit around the nucleus in only fixed orbits.

The Second Coming

Things fall apart; the centre cannot hold;
Mere anarchy is loosed upon the world,
The blood-dimmed tide is loosed, and everywhere
The ceremony of innocence is drowned;
The best lack all conviction, while the worst
Are full of passionate intensity.

-- W. B. Yeats

The Waste Land

T.S. Eliot's new poem *The Waste Land* is published. It breaks new ground in poetry. It seems to express people's feelings of despair and pointlessness after WWI. Its disjointed style contains fragments of different languages, everyday speech, references to myths and religions, echoes of other books. It reflects a feeling of hopelessness towards the future.

Jazz

Jazz, a style of American dance music originated in the South by black Americans; characterized by strong, prominent meter and improvisation, becomes popular not just in New Orleans but all over the US. Famous artists like Duke Ellington and his band perform at the well know New York Cotton Club at Harlem.

Ulysses

Stream of consciousness is a narrative technique that attempts to reproduce the thought patterns of characters. James Joyce's novel *Ulysses* is published and in the same year is banned as indecent in Britain and the U.S. It follows the life of Leopold Bloom through one day in Dublin and uses mythology, symbolism, and other devices through the text.

All Quiet on the Western Front

A hard hitting novel on the horrors of trench fighting in the Great war was a best seller in Germany this year. *All Quiet on the Western Front*, written by Erich Maria Remarque, tells the story of German schoolboys who enlist to fight for their country but have to cope with dirt, disease and death. Hemingway's *A Farewell to Arms* is also published the same year.

The Trial

Franz Kafka, Czech novelist and author of *The Trial* and *The Castle*, died before any of his work was published. His writings display a sense of human detachment and bewilderment in the face of a dispassionate and uncaring society. *The Trial*, a surrealist novel, deals with a man persecuted and put to death by the inscrutable agencies of an unfathomable court of law.

The Interpretation of Dreams

Sigmund Freud publishes *The Interpretation of Dreams* where he claims that the central processes of our thinking are unconscious. As most of our actions follow this unconscious, reason cannot be relied upon. He also states that being born male or female has a central effect on the development of a person and thus men and women are very different. Here he lays the foundation for Psychoanalysis.

The Psychology of the Unconscious

Swiss psychiatrist Carl Gustav Jung, initially a Freudian, publishes *The Psychology of the Unconscious*. He developed his own theories on the division of personalities into extroverts and introverts. He theorizes that there exist certain ideas, which he calls 'archetypes' which are inherited from the distant past and are part of a "collective unconscious" that exists in all people.

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Behaviourism

American psychologist J.B. Watson explains his theory of behaviourism where he claims that psychology is a "science of behaviour." His aim is to predict and control behaviour rather than describe or explain it. He also wishes to eliminate the traditional distinction between animal and human behaviour.

Tender Buttons

Gertrude Stein parallels the theories of Cubism in prose, specifically in her concentration on the illumination of the present moment and her use of slightly varied repetitions and extreme simplification and fragmentation. Among her work that was most thoroughly cubist is *Tender Buttons*, which carries fragmentation and abstraction beyond the borders of intelligibility (for many readers).

The assembly line

In Detroit, the Ford Motor Co., uses the assembly line system to build cars, which reduces assembly time from 12.5 to 1.5 hours. Earlier the car stopped at each point in the process of assembly, now it is continually moving.

Introduction of the quanta

German physicist Max Planck while stating some radiation law, uses the concept that energy is radiated in discrete packets called quanta. This becomes the foundation of quantum theory and is a concept used by Einstein to explain results of experiments in photoelectric effect.

Wave aspect of particles

French physicist Louis-Victor-Pierre-Raymond de Broglie proposes that every particle should have an associated matter wave. The nature of the wave would depend on the characteristic of the particle. This idea further develops later into the concept of wave-particle duality (the observation of wave or particle behaviour depends on the nature of the experiment).

Discovery of the phenomenon of radioactivity

French physicist Antoine-Henri Becquerel discovers radiations from an Uranium compound. Soon after Marie Curie demonstrates that these radiations emanate from the Uranium atom, thus disproving the long held notion that the atom was indivisible.

Mendel's Experiments with peas

After experimenting with crossbreeding of sweet peas and making a statistical analysis, Austrian monk Gregor Mendel concludes that each of an organism's inherited traits is determined by two heredity units called genes, one from each parent organism.

Mechanism of Mendelian heredity

American geneticists Thomas Morgan, Calvin Bridges, Alfred Sturtevant, and Herman Muller publish "The Mechanism of Mendelian Heredity", claiming that invisible genes within the chromosomes of the cell nucleus determine an offspring's hereditary traits.

"Origin of species"

British naturalist Charles Darwin explains the theory of evolution by natural selection in the "Origin of Species". He shows that species are modified and new species emerge as individuals better adapted to their environment outreproduce those less well adapted.

Prohibition on teaching evolution theory

The Tennessee legislature passes the first state law prohibiting the teaching of Darwin's theory of evolution in any Tennessee school. A teacher actually put on trial for teaching in spite of the ban.

Rediscovery of Mendel's work

German biologist Carl Correns, Dutch botanist Hugo de Vries, and Austrian botanist Erich Tschermak independently rediscover the significance of Mendel's work with peas. They also found that Mendel provides a mechanism through which Darwin's theory of natural selection operates.

Discovery and naming of chromosomes

Scientists began examining the cell nucleus and found that clusters of rods appeared before cell division. These rods, or chromosomes, as they were named, split in two lengthwise and the two sets went separately into the two halves of the dividing cell.