THE HISTORY OF CHEMISTRY IN JAPAN AND AROUND THE WORLD

- Focusing on Invention, Discovery, Commercialization, and the Founding of Major Companies -

Year	Big Trend of Era	Chemistry-related Developments of Japan	Chemistry-related Developments of the World	Society in General
1774			・(France) Antoine Lavoisier, "the father of modern chemistry," discovered the law of conservation of mass. **Movement from alchemy to "chemistry" as an industry.**  Antoine Lavoisier	・*Kaitai Shinsho* ("New Book of Anatomy") was published by Genpaku Sugita and others.
1791		 Yoan Udagawa  Seimi Kaiso	・(France) Nicholas Leblanc developed an industrial process for producing sodium carbonate (i.e. Leblanc process).	・US Declaration of Independence (1776) 
1802			・(USA) DuPont was founded to manufacture gunpowder.	
1828			・(Germany) Friedrich Woehler succeeded in synthesizing urea. **The world's first synthesis of an organic substance.**	
1837	Oversea exchange of chemical information	・Publishing of *Seimi Kaiso*, authored by Yoan Udagawa, begins (completed in 1847). Japan's first book on chemistry.		・The Rebellion of Heihachiro Oshio.
1856			・(UK) William Perkin synthesized Mauve, an aniline synthetic dye, for the first time in the world. **Industrialization of coal chemistry.**  William Perkin	・The first EXPO in London (1851)
1859		・*Ponpe Seimisho*, edited by Ryojun Matsumoto, was published. It was the first text of chemistry based on taking notes from lectures given by Pompe van Meerdervoort, a Dutch naval surgeon.		・Yokohama Port was opened.
1860		・*Kagaku Shinsho* ("New Book on Chemistry"), a translated book by Komin Kawamoto, was published. **First book with "chemistry" in title.**	・(UK) C. Williams separated the main ingredient of natural rubber and named it "Isoprene."	・American Civil War (1861 - 1865)
1861		・Seirenkata (a "refining laboratory") was started in Banshoshirabesho. (Place of origin: the Chemistry Department of the University of Tokyo) In 1865, Seirenkata was renamed "Kagakusho" (a "chemical laboratory").		
1863			・(Germany) Bayer and Hoechst were established to manufacture dyestuffs. In 1865, BASF was established to manufacture dyestuffs and other chemicals.	
1866			・(Belgium) E. Solvay industrialized the ammonia-soda process (i.e. Solvay process).  E. Solvay	
			・(Sweden) Alfred Nobel invented dynamite.	
1868			・(USA) Hyatt Brothers invented celluloid.	・The Meiji Restoration.
1869		・Koenraad Woulter Gratama, a Dutchman, gave an opening speech as vice principal of Osaka Seimikyoku, a chemistry school.		・Suez Canal was opened. 
1870		・Education on chemistry began at Tokyo Kaisei School (now the University of Tokyo). **Start of chemistry education :** Chemistry education began with the lectures given by Gratama at Osaka Seimikyoku. Such famous scientists as Jokichi Takamine and Kikunae Ikeda graduated from the school, but it was closed in 1872, and was assimilated into Tokyo Kaisei School.	・(USA) Standard Oil was founded.	
1871			・(Germany) BASF commercially produced synthetic alizarin dyes.	
1872	Production of inorganic chemical products unde	・Osaka Zoheiryo (the Mint Bureau) started to manufacture sulfuric acid using a lead chamber process for mint production. **Introduction of inorganic chemical industry.**		・Railway was opened between Shimbashi and Yokohama.
1877			・(France/USA) Charles Friedel of France and James Crafts of the USA discovered the synthesis process of the benzene derivatives (i.e. Friedel-Crafts reaction).	・The University of Tokyo was established.
1878		・The Chemical Society of Japan was established. (First chairman: Mitsuru Kuhara.)	・(Germany) Bayer succeeded in synthesizing indigo.	
1881		・Osaka Mint Bureau (now Japan Mint) started to manufacture Leblanc-process sodium carbonate and other chemicals.		・Bank of Japan was established.

		Introduction of soda industry.		
		· Komeisha (now Nippon Paint) developed paste paint from zinc oxide. Introduction of paint industry.		
1884			· (France) Count H. Bernigaud de Chardonnet acquired a patent to manufacture artificial silk from nitrocellulose and, in 1891, he produced it commercially.	· Japanese transfer from a Grand Council to a Cabinet system.
1886		· Tsuchiya Rubber Co. succeeded in rubber heat vulcanizing. Introduction of rubber processing industry.		
1887	Chemical fertilizer industry started	· Tokyo Jinzo Hiryo (now Nissan Chemical Industries) was founded. The following year, it started to produce chemical fertilizers (superphosphate of lime) domestically. Chemical fertilizer industry started.		
		· Nagase Shoten (now Kao) was founded.		
1889		· Nippon Seimitsu Seizo (now Nissan Chemical Industries) was established and, in 1891, it started to manufacture Leblanc-process sodium carbonate in Onoda.		· Eiffel Tower was built at Paris Expo.
1890		· Nagase Shoten (now Kao) launched Kao Sekken (Kao Soap).	· (Netherlands) Predecessor to Royal Dutch Shell was established.	· First Imperial Diet.
1891		· Tomijiro Kobayashi established T. Kobayashi & Co. (now Lion).		
1892		· Jokichi Takamine discovered digestive enzyme Taka-Diastase.		
		 Jokichi Takamine		
1895			· (Germany) Emil Fischer discovered Fischer esterification.	· Sino-Japanese War (1894 - 1895)
1897		· Okinoyama Coal Mine (now Ube Industries) was established.	· (Germany) Bayer discovered aspirin, a raw material for medicines.	· Government-managed Yawata Steel Works was completed.
			· (USA) Dow Chemical was established to manufacture bleach.	
1898		· Kotaro Shimomura succeeded in producing ammonium sulfate for fertilizers with ammonia from a by-product recovery coke oven.	· (France) Mr. and Mrs. Curie discovered polonium and radium.	
1900		· Jokichi Takamine succeeded in extracting adrenalin.		
1901		· Tokyo Gas started to distill coal tar.	· (Germany) Adolf Frank and others produced lime nitrogen from nitrogen in the air and carbide.	· First Nobel Prize Award Ceremony.
		 Tsuneichi Fujiyama  Manufacture of carbide		
1902	Start of carbide/lime nitrogen manufacturing	· Tsuneichi Fujiyama succeeded in manufacturing carbide by the hydraulic power generation of Sankyozawa. (He later established Denki Kagaku Kogyo.) A path to electric chemistry/carbide (acetylene) chemistry.	· (France) Air Liquide was established to manufacture commercial gas.	· Industrial Bank of Japan was founded for the purpose of introducing overseas capital.
1905		· Takanobu Tanaka built a factory to manufacture celluloid. Introduction of plastic industry.	· (UK) Courtaulds started a full-scale manufacture of viscose-process artificial silk thread.	· Russo-Japanese War (1904 - 1905)
1907		· Asahi Glass was founded.	· (Netherlands/UK) Royal Dutch of the Netherlands and Shell Transport of the UK merged to form Royal Dutch Shell.	
1908		· Tomonori Nakano developed the Nakano-method mercury process electrolysis (i.e. electrolytic soda process).	· (Germany) Fritz Haber and Karl Bosch succeeded in an experiment to directly synthesize nitrogen in the air to fixed ammonia.	· In the US, the Ford Model T, a noted automobile, was produced.
		· Sakai Celluloid and Japan Celluloid Artificial (now both Daicel) were established and started to manufacture celluloid in 1911.	· (USA) Leo Baekeland synthesized phenolic resins (commercial name: Bakelite). The world's first synthetic resins.	
		 Manufacture of celluloid		
		· Kikunae Ikeda discovered monosodium glutamate. In 1909, he commercialized it as the seasoning "Ajinomoto".	 Fritz Haber  Karl Bosch  Leo Baekeland	
		· Shitagau Noguchi established Nippon Chisso Hiryo K.K. (now Chisso) by merging Sogi Electric and Nippon Carbide Shokai.		
		 Shitagau Noguchi		
		· Kawamura Ink Manufactory (now DIC) was founded.		
1909	Start of fertilizer/ dyestuff production coal chemistry	· Asahi Glass succeeded in the commercial production of sheet glass using a "hand blown cylinder process" at its Kansai Plant.	· (Germany) Flitz Hoffmann of Bayer obtained a patent on butylrubber with the addition of polymerization of metylisoprene. The world's first commercial production of synthetic rubber.	
1911		· Sankyo started to produce phenol resins (succeeded by what is now Sumitomo Bakelite). Introduction of synthetic resin industry.	**(France) Madame Curie was awarded the Nobel Prize in Chemistry.**	
		 Hand blown cylinder process		
		· Mitsui Mining started to manufacture ammonium sulfate in Omuta by tar distillation. Mitsui Chemicals was founded.		

1912

Start of coal chemistry : Synthetic dyestuffs and ammonia were produced with ammonia and benzene using the gas of coak oven.

- Rikou Majima determined the chemical structure of urushiol, a substance of lacquer.
- (USA) William M. Burton developed a thermal cracking process for petroleum, a path to increased production of gasoline.

1913

- Sumitomo Fertilizer Manufacturing (now Sumitomo Chemical) was established, manufacturing fertilizers from sulfer dioxide gas emitted by copper smelters. Origin of Sumitomo Chemical.
- (Germany) BASF started operation of a processing factory for synthetic ammonium based on Haber-Bosch method.

1914

- The government decided the soda industry, tar distillation industry, and electric chemistry industry were integral industries.
- First World War (through 1918)

- Yuraseiko (now Honshu Chemical Industry) had built benzene distillation equipment and started to manufacture aniline for dyestuffs.

Benzene distillation equipment

1915

- Denki Kagaku Kogyo was established.
- Hodogaya Soda Works (now Hodogaya Chemical) was established.
- Japan's first electrolysis of soda manufacturing started.
- Albert Einstein of Germany advocated for the general theory of relativity.

1916

- Itsuzo Hata and Seita Kumura succeeded in spinning viscose-process rayon. Azuma Industries commercialized the process.
  Chemical fiber industry started.
- Factory Law was enforced. (Minimum age 12, 12-hour labor)

- Nippon Kayaku Seizo (now Nippon Kayaku) was established, manufacturing explosives for industrial use.

1917

- Yokohama Cable Manufacturing (now Furukawa Electric) and BF Goodrich established a joint-venture company Yokohama Rubber Manufacturing (now The Yokohama Rubber).
- (Germany) Franz Guenter of BASF discovered potassium diisopropylnaphthalenesulphonate in detergents.
  World's first synthetic detergent.

- RIKEN was established.

1918

- Chika Kuroda determined the chemical structure of shikonine, a substance of natural violet pigment.
  Japan's first female chemist.

Chika Kuroda

- Teikoku Rayon (now Teijin) was established.
- Edogawa Barium Industry (now Mitsubishi Gas Chemical) was established.
- Kansai Paint was established.
- Nihon Soda Kogyo (now Tokuyama) was established.

1919

- Eight companies including Sakai Celluloid merged and established Dainippon Celluloid (now Daicel).

1920

- Nippon Soda was established.
- (USA) Standard Oil produced IPA by using propylene from refinery plant gas.
  World's first petrochemical product.
- League of Nations was established.

1922

- Asahi Kenshoku (now Asahi Kasei) was established.

Manufacture of ammonia using the Casale sythesis process

1923

- Nippon Chisso Hiryo (now Chisso) started manufacturing ammonia using the Casale sythesis process in Nobeoka.

Synthetic ammonium industry : Synthetic ammonium is a symbolic product for modern chemistry. Big-scale, high-pressure technology had become a start to the development of the process industry, requiring the integration of power.

- (USA) Ivan Ostrominsky and others manufactured synthetic rubber from butadiene using the emulsion polyerization process.
- Great Kanto earthquake of 1923.

1925

- (Germany) IG Farben Industries was founded.

1926

- Nobuteru Mori established Nippon Iodine (now Showa Denko).

Nobuteru Mori

- (UK) ICI was established by merging four companies in alkali, fertilizer, and dyestuff industries including Nobel, a gunpowder manufacturer, to compete against IG of Germany.
- Taisho Emperor passed away and Showa Emperor took over the throne.

- Shin-Etsu Nitrogen Fertilizer (now Shin-Etsu Chemical) was established.
- Toyo Rayon (now Toray) was established.
- Kurashiki Kenshoku (now Kuraray) was established.

1927

- (USA) Goodrich manufactured polychlorovinyl and commercialized polychlorovinyl sheet and wall papers.
  World's first general-purpose plastics.
- Charles Lindberg succeeded in a non-stop flight across the Atlantic Ocean.

1928

- Nippon Gohsei succeeded in commercializing organic synthesized acetic acid.
- (Germany) Wacker Chemie started to produce acetic acid vinyl and polyvinyl alcohol.

1929

- Konishiroku (now Konica Minolta Holdings) was established and it launched the first photo films
- The Great Depression started

Chemical imports were halted due to the war. Toward domestic production

Production of artificial fiber started

Synthetic ammonia industry appeared as a big-scale equipment industry

Shift to wartime regime: Production of synthetic rubber, fiber and resins was promoted

With the priority production system, fertilizer production was revived

Rapid increase in the import of synthetic resins/Arrival of energy revolution

1930		(Germany) IG commercialized polystyrene.	
1931	Showa Fertilizers (now Showa Denko) shifted technology to produce ammonia for Japan's first domestic technology (by Tokyo Kogyo Shikenjo).	(UK) ICI discovered the synthesis process of polyethylene with the ultra-high 2,400 atmospheric pressure.	Manchurian Incident occurred.
1933	 Production of domestic metal ammonium	(Germany) IG developed "Buna S" of hot SBR. **World's first general-purpose synthetic rubber for tires.**	New Deal was started in the US.
1934	Nippon Iodine (now Showa Denko) succeeded in producing domestic metal aluminum with alunite for the first time in Japan. **Start of aluminam refining.**	 Wallace H. Carothers	
	Nippon Tar (now Mitsubishi Chemical Industries) was established jointly by Mitsubishi Mining and Asahi Glass. This was the foundation for Mitsubishi Chemical.		
	Fuji Photo Film (now Fujifilm Holdings) was established.		
1935	Toyo Soda Manufacturing (now Tosoh) was established.	(USA) Wallace H. Carothers of DuPont succeeded in synthesizing polyamide synthetic fiber (nylon 66) for the first time. **World's first general-purpose synthetic fiber.**	
1936	The Society of Chemical Machinery (now The Society of Chemical Engineering) was established with Kyuhei Kobayashi as the first president.		
1937	Nippon Oil & Fats (now NOF Corp.) was established.	(USA) Theodore Lefort of Union Carbide developed a process for direct oxidation of ethylene oxide and commercialized it.	Marco Polo Bridge Incident occurred and Second Sino-Japanese war started.
1938	Nitto Boseki succeeded in commercilizaing glassfiber.	(USA) Roy Plunkett of DuPont invented polytetrafluoroethylene (later named "Teflon").	National Mobilization Law was promulgated.
1939	Ichiro Sakurada laboratory of Kyoto Imperial University succeeded in synthesizing synthetic fiber vinylon (Synthesis No. 1).  Commercialization of polychlorovinyl	(Germany) IG (Bayer) commercialized polyurethane resins.	Second World War (through 1945)
		(UK) ICI commercialized high-pressure process polyethylene.	
1940	Nippon Chisso Hiryo (now Chisso) commercialized polychlorovinyl in the scale of 1.5 tons per day.	(USA) Dow Chemical commercialized polychlorovinylidene.	
1941	Osame Gosei Kagaku Kogyo (now Nippon Shokubai) was established and it succeeded in commercializing phthalic anhydride for the first time in Japan.  Instrument panel room for phthalic anhydride	(UK) John R. Whinfield and James T. Dickson of Calico Printers succeeded in synthesizing and spinning polyethylene phthalate.	Asia-Pacific War (through 1945)
1942	Ube Industries was established by merging Okinoyama Coal Mine, Ube Shinkawa Iron Works, Ube Cement Production, and Ube Nitrogen Industry.	(USA) DuPont started production of polytetrafluoroethylene "Teflon."	Battle of Midway.
	Yahagi Kogyo (now Toagosei) was founded.		
1943	Nippon Chemical Industries (now Mitsubishi Rayon) started production of MMA in Ohtake.	(USA) Standard Oil New Jersey began production of butyl rubber.	
1947	Sekisui Sangyo was established. In the following year, it had acquired Nara Plant of Nippon Chisso Hiryo (now Chisso) and renamed itself Sekisui Chemical.	(USA) GE produced full-scale silicone using direct synthesis process.	
1948	Chemical Society (now Chemical Society of Japan) and Society of Chemical Industry merged and started as the new Chemical Society of Japan, with Ichiro Ishikawa as the first president.	(USA) Dow Chemical started to manufacture high-impact polystyrene (HIPS) and extruded polystyrene foam sheet.	The Republic of Korea was formed.
	Japan Chemical Industry Association was established with Yasuzaburo Hara as the first chairman.	(USA) DuPont commercialized polyacrylonitrile fiber "Orlon" by DMF solvent, a dry spinning process.	USSR closed down Berlin.
1949	Nippon Chisso Hiryo (now Chisso) started mass production of carbide-process vinyl chloride in Minamata.  The world first integrated production vinylon	(W. Germany) Karl Ziegler created alkylaluminium from AlH3 and ethylene.	People's Republic of China was formed.
	Kyowa Hakko Kogyo (now Kyowa Hakko Kirin) was established.	(USA) Monsanto developed grafted-type ABS resins.	GHQ permitted the resumption of petroleum refineries and the importation of crude oil.
	Kanegafuchi Kagaku-Kogyo (now Kaneka) was established.		
1950	Toyo Rayon (now Toray) started to manufacture one-ton of nylon fiber per day in Shiga. **An era of synthetic fiber opened.**		The Korean War outbroke.
	Kurashiki Rayon (now Kuraray) began an integrated production of vinylon for the first time in the world.		
	Production of synthetic fiber : Unlike natural and recycled fibers, synthetic fibers enabled mass production, thereby supporting the mass consumption era.		
1951	Japan Gas Chemical (now Mitsubishi Gas Chemical) was established.		
1952	Kenichi Fukui, Teijiro Yonezawa, and Haruo Shingu of Kyoto University released the Frontier Orbital Theory. **Exploration of a new aspect to organic chemistry reaction theory.**  Kenichi Fukui	(W. Germany) IG dissolved and divided into BASF, Hoechst, Bayer, and others.	Agency of Industrial Science and Technology was established.

Year	Big Trend of Era	Chemistry-related Developments of Japan	Chemistry-related Developments of the World	Society in General
1953	Introduction of policy to promote international competitiveness, rationalize ammonia and foster organic chemistry	· Tokyo Shibaura Electric (now Toshiba) and Shin-Etsu Chemical started full-scale production of silicone by direct process.	· (W. Germany) Karl Ziegler succeeded in synthesizing polyethylene in low pressure, under 10 atmospheric pressures.  Karl Ziegler	
		· Daikin Industries succeeded in domestic production of fluoro (Polytrifluoromonochloroethylene) resins. It developed tetrafluoroethylene in 1955.		
1954		· Government determined "Outline of Fostering Petrochemical Industry".	· (Italy) Giulio Natta succeeded in propylene polymerization with titanium trichloride as the catalyst. This led to the production of polypropylene.	
			· (USA) Standard Oil Ohio developed production process for acrylonitrile (i.e. Sohio process).  Giulio Natta	
			· Formosa Plastics was established.	
1956		· Japan Exlan started to produce polyacrylonitrile fibers. Kanegafuchi Kagaku-Kogyo (now Kaneka) and others also started to produce the fibers.		· Second Arab-Israeli conflict (Suez Crisis)
1957		· Toyo Rayon (now Toray) and Teikoku Rayon (now Teijin) introduced technology from IC of UK to manufacture polyethylene fibers and film.  Production of SBA and MEK	· (USA) Harcules Powder, (Italy) Montecaccini, and (W. Germany) Hoechst started to produce isotactic polypropylene independently.	
		· Maruzen Oil (now Cosmo Oil) produced SBA and MEK from exhausted gas of oil refinery. **Japan's first petrochemical product.**	· (Italy) ANIC produced emulsion polymerization SBR.	
		· Japan Synthetic Rubber (now JSR) was established.		
1958	Introduction of full-scale petrochemical industry	· Mitsui Petrochemical Industries (now Mitsui Chemicals) Iwakuni and Sumitomo Chemical Niihama started operation. Petrochemical products including polyethylene were produced domestically. **Petrochemical era opened.**  Petrochemical complex	· (W. Germany) Bayer commercialized polycarbonate.	· Tokyo Tower was completed. 
		· Japan Petrochemical Industry Association was established with Kamesaburo Ikeda as first chairman.  Kamesaburo Ikeda		· Economic boom (1958-61)
		Start of petrochemical industry : Although starting behind Europe and the US, it grew rapidly. With domestic production and the strengthening of international competitiveness as a goal, many industrial capitalists entered to compete.		
1959		· Nippon Oil (now JX Nippon Oil & Energy) Kawasaki and Mitsubishi Petrochemical (now Mitsuibishi Chemical) Yokkaichi petrochemical complexes started operation. (Completed the first stage of domestic petrochemical production.)	· (USA) DuPont started to produce polyacetal "Delrin".	
		· Nippon Shokubai Kagaku Kogyo (now Nippon Shokubai) commercialized ethylene oxide with its own technology for the first time in Japan.		
		· Zeon domestically produced NBR, HSR, and SBR latex special synthetic rubber with the technology of Goodrich.		
		· Teijin produced polycarbonate domestically.  Production start of SBR		
1960		· Japan Synthetic Rubber (now JSR) started to produce general-purpose synthetic rubber SBR with the technology of Goodyear.	· (Netherlands) Shell manufactured SBR by solution polymerization with litium catalist.	· Campaign against the Japan-US Security Treaty.
		· Shin-Etsu Chemical started to produce high-purity silicon.  Production of chloroprene rubber	· (USA) DuPont launched aromatic polyamide "Aramid".	· Organization of Petroleum Export Countries (OPEC) was established.
		· Asahi-Dow (now Asahi Kasei) launched food wrapping film made of polyvinylidene chloride (PVDC).		· Liberal Democratic Party announced its policy for rapid economic growth/income doubling.
1961		· Toyo Koatsu Industries (now Mitsui Chemicals) and Dainippon Celluloid (now Daicel) started to produce styrene acrylonitrile copolymer (SAN) independently in Japan with their technology.		· USSR succeeded in launching a manned spaceship for the first time.
1962		· Denki Kagaku Kogyo started to produce chloroprene rubber with its own technology, using the carbide acetylene process.	· (USA) *Silent Spring*, authored by Rachel L. Carson, was published. It pointed out the dangers of such chemicals as DDT agrochemical for ecosystem. **It led to environmental activity.**	· Successful first flight of domestic airplane "YS-11." 
		· Mitsui Chemical Industry (now Mitsui Chemicals) domestically produced polypropyrene.		· Cuban Missile Crisis.

1963	・Toagosei Chemical Industry (now Toagosei) launched instant glue "Aron Alpha."		・Successful TV broadcast between Japan and the US by communications satellite.
	・Hamano Resin (now JSR) and Nitto Chemical Industry (now Mitsubishi Rayon) and others started to produce ABS resins.		
1964	・Kurashiki Rayon (now Kuraray) started to produce artificial leather "Clarino."		・Tokyo Olympic Games were held.
1965	・Zeon commercialized butadiene extrusion process with DMF as solvent (GPB process).	・(USA) GE developed polyphenyleneoxide (PPO) and commercialized it in 1967 as modified PPE.	・Vietnam War (through 1975)
			・Economic boom (through 1970)
1966	・Toyo Soda Manufacturing (now Tosoh) started to produce vinyl chloride monomers by oxychlorination process for the first time in Japan.  Production of vinyl chloride monomers by oxychlorination process	・(India) Reliance was established to develop into textile industry.	・Cultural Revolution in China (through 1977)
1967	・Petrochemical Cooperation Round-Table Conference determined standards for newly-established facilties for ethylene producing over 300,000 tons per year.		・Environmental Pollution Prevention Law was promulgated. **Pollution issue :** Environmental pollution such as air and water pollution became a social issue around 1965.
1968	・Toyo Koatsu Industries and Mitsui Chemical Industry merged and Mitsui Toatsu Chemicals was formed.	・(USA) George H. Heilmeier and others of RCA produced a display device using nematic liquid crystal. **Movement to desk-top caluculators, word processors and other technologies.**	・Ministry of Health and Welfare acknowledged mercury pollution incidents in Minamata and Agano River as pollution diseases.
	・Toyo Ohka Kogyo started to manufacture photo resists for semiconductors.		
1970	・Oji-Yuka Synthetic Paper (now Yupo Corp.) developed polyolefin synthetic paper.	・(W. Germany) Hoechst developed polyehtylene terephthalate (PBT) resins.	・Osaka Expo was held. 
	・Nippon Shokubai Kagaku Kogyo (now Nippon Shokubai) commercialized acrylic acid with its own propyrene oxidation technology for the first time in Japan.		・14 pollution-related bills were enacted into law at an extraordinary Diet session.
1971	・Sakuji Ikeda and Hideki Shirakawa succeeded in synthesizing a polyacetylene film membrane by acetylene polymerization. **Applied for the development of lithium-ion rechargeable battery and others.**		・Environment Agency was formed.
	・Zeon started to produce polyisoprene by extraction process.		・Nixon Shock : Yen moved to provisional floating exchange rate system.
	・Toray started to produce polyacrylonitrile carbon fiber "Torayca."		
	・Japan Gas Chemical and Mitsubishi Edogawa Chemical merged to form Mitsubishi Gas Chemical.		
1972	・Sanyo Ethylene started operation in the Mizushima Petrochemical Complex. **15 petrochemical complexes were all present.**	・Club of Rome announced a "limitation of growth" with the drying up of natural resources, including petroleum.	・Restoration of diplomatic ties between Japan and China.
1973	・Kuraray started to produce vinylalcohol ethylene copolymer resins "Eval".		・Fourth Arab-Israeli conflict outbroke. First Oil Crisis occurred with resulting confusion of shortage of commodities such as detergents.
	・Law Concerning the Examination and Reguation of Manufacturing of Chemical Substances was proposed. **The world's first law regulating chemical substances.**		・Issue of mercury-polluted fish and nationwide protest by fishermen.
	・Ministry of International Trade and Industry (now Ministry of Economy, Trade and Industry) was directed to make overall inspections of the 3,253 plants nationwide due to many occurrences of accidents at chemical factories.		
	・Government determined the conversion of the production process of caustic soda using mercury. **Conversion of soda manufacturing process.**		
1974	・Asahi Chemical Industry (now Asahi Kasei) started to manufacture hollow-fiber artificial kidneys.  Ion-exchange membrane electrolysis	・(USA) Stanley N. Cohen and Herbert W. Boyer developed recombinant DNA technologies. **Introduction of biotechnology.**  Stanley N. Cohen	・Bombing incident of Mitsubishi Heavy Industry Bldg. occurred.
1975	・Asahi Chemical Industry (now Asahi Kasei) started commercial production of caustic soda by ion-exchange membrane process electrolysis.		・The first Summit Conference of the Leading Industrialized Nations was held. (Rambouillet Summit)
1976		・Saudi Basic Industries Corporation (SABIC) was established.	
1977	・Petrochemical Corporation of Singapore (PCS) was established. 		

Pollution issue occurred

First Oil Crisis

Second Oil Crisis

Expansion of petochemical structure by Special Law for the Structural Improvement of Specified Industries

Bubble economy

1978
- Sanyo Chemical Industries commercialized superabsorbent resins (SAP) for the first time in the world.


PCS was established

- New Tokyo International Airport (Narita) was opened.

1979
- The first East Asia Petrochemical Industry Conference was held.
- Second Oil Crisis occurred.

1980
- The Saudi Methanol (AR-RAZI) was established.
- Kyodo Sakusan started to produce methanol-process acetic acid for the first time in Japan.


Production of methanol-process acetic acid

Oil Crisis : The price of crude oil soared during the first crisis due to the fourth Arab-Israeli conflict. The second crisis was due to the Iranian Revolution

1981
- Prof. Kenichi Fukui of Kyoto University was awarded the Nobel Prize in Chemistry.
  Japan's first awarding of the Nobel Prize in Chemistry.

1982
- Joint sales company (by four companies) was established in vinyl chloride resins industry.
- Honda America started to manufacture passenger cars.
- Ministry of International Trade and Industry (now Ministry of Economy, Trade and Industry) decided to virtually liberalize importation of naphtha for petrochemical industry.
- Industrial Structure Council submitted a report on how the petrochemical industry should operate.

1983
- Nippon Unicar started to produce the US UCC-process straight-chain low density polyethylene.
- Mitsubishi Rayon commercialized isobutylene direct oxidation process MMA monomers for the first time in the world.
- Joint sales companies (four companies) were established in polyolefin industry.


Production of straight-chain low density polyethylene

- China Petroleum and Chemical Corp. (SINOPEC) was established.
- Special Law for the Structural Improvement of Specified Industries was proposed and enforced.

1984
- Ube Ammonia Industry completed a coal gasification process large-scale ammonia facility.
- Kanegafuchi Kagaku-Kogyo (now Kaneka) developed and commercialized amorphous silicon solar cells.


Direct oxidation process MMA monomers were commercialized

- (India) A subsidiary company of the US UCC had an accident regarding the leaking of poisonous gas in Bhopal, India.
  Issue of risk communications was raised.

1985
- (Canada) Canadian Chemical Producers' Association advocated Responsible Care.
- Conferece of Ministers and Governors of the Group of Five Countries agreed to depreciate high dollars (i.e. Plaza Agreement)

1986
- The completion of the conversion of production process of caustic soda and of the non-mercury process.
- Dainippon Ink and Chemicals (now DIC) acquired the graphic arts materials division of the US Sun Chemical.
  Global development of the Japanese chemical companies occurs in full scale.
- Bubble economy started (through 1991)

1988
- Bridgestone acquired Firestone of the US.

1989
- Conference of Environment Ministers on Global Warming Countermeasures was held and it was agreed to maintain the emission level of carbon dioxide at a certain level until 2000.
- Wall in Berlin was destroyed and the Cold War ended.

1990
- Zeon and Japan Synthetic Rubber (now JSR) expanded the use of cyclic olefins transparent resins to materials for electronic information devices.
- International Council of Chemical Industry Associations (ICCA) was founded.
- East and West Germanies were united.
- Meeting of the Parties to the Montreal Protocol resolved the total abolishment of ozone-destroying substances (special freon and others).

1991
- Asahi Chemical Industry (now Asahi Kasei) developed practical lithium-ion rechargeable battery.
- Club of Rome organized "Business Council for Sustainable Development (BCSD)".
  Developed to an international stadardization of environmental management.
- United Soviet Socialist Republic ceased to exist and the Commonwealth of Independent States was formed.

1992
- The United Nations Conference on Environment and Development "Earth Summit" was held.

1993
- Four chemical organizations held the first events of the "Dream Chemistry 21."
- Nichia Corp. succeeded in developing blue-light emitting diode for the first time in the world.


Press conference on merger to form Mitsubishi Chemical

Earth Summit : Since the United Nations Conference on Environment and Development in 1972, the conference has been held every 10 years by the UN.

- Basic Environment Act was proposed and enforced.

1994
- Mitsubishi Kasei and Mitsubishi Petrochemical merged to form
- (Netherlands) Akzo and (Sweden) Nobel merged to form
- Product Liability Act (PL Act) was

	Reorganization of the chemical industry accelerated	Mitsubishi Chemical.	AkzoNobel.	proposed.
		Industry reorganization : De-industrialization due to high yen and globalization, caused by the closing of cold-war structure, prompted the chemical industry to consolidate. Business consolidation and M&A progressed.		
1995		· Japan Responsible Care Council was established.  Japan Responsible Care Council	· The First Conference of the Parties to the UN Framework Conference on Climate Change (COP) was held.	· The World Trade Organization (WTO) was established.
1997		· Mitsui Petrochemical Industries and Mitsui Toatsu Chemicals merged to form Mitsui Chemicals.	· *Our Stolen Future*, authered by Theo Colborn and others, was published. She mentioned about the dangers of chemicals as endocrine disrupters.	· The Asian Financial Crisis occurred.
1999		· Pollutant Release and Transfer Register Law (PRTR Law) was proposed.	· (Germany) Hoeckst and (France) Rhone-Poulenc merged and Aventis was formed. The chemical section of Hoechst was acquired by Celanese.	
		· All of the production processes of caustic soda were converted to the ion-exchange membrane process.	· (USA) Exxon and Mobil merged to form ExxonMobil.	
2000		· Japan Chemical Industry Association (JCIA) started its Long-range Research Initiative (LRI) regarding the effects of chemicals on human heath and the environment. JCIA coordinates with the chemical industry associations of Europe and the US (CEFIC, ACC) and ICCA.	· (Netherlands) Shell and and polyolefin companies (Elenac, Montell, and Targor) of Basell were merged and Basell was formed.	
		· Hideki Shirakawa was awarded Nobel Prize in Chemistry for conductive polymer.	· (France) Total Fina acquired Elf Aquitaine and Total Fina Elf was formed. (Complete in 2003.)	
2001	Progress in international activity of chemical management	· Ryoji Noyori was awarded the Nobel Prize in Chemistry for asymmetric synthesis of organic compound. **It is widely applied in the pharmaceutical and food industries.**		· China joined in the WTO.
2002		· Koichi Tanaka was awarded Nobel Prize in Chemistry for biopolymers. **He developed a device to measure the mass of protein.**	· (USA) Cargill Dow Polymers started to operate its big-scale facility of polylactide-based biodegradable plastics "Nature Works."	
		· Roche of Switzerland acquired Chugai Pharmaceutical.  Ground-breaking ceremony of Petro Rabigh	· (Saudi Arabia) SABIC acquired the petrochemical business of DSM of The Netherlands and advanced into the European market.	
			· World Summit on Sustainable Development was held. It was agreed to develop the Strategic Approach for International Chemical Management (SAICM).	
2005		· Sumitomo Chemical jointly established Petro Rabigh with Saudi Aramco.	**SAICM :** "It aims at minimizing the adverse effects on health and the environment by the manufacturing and use of chemicals by 2020." In Japan, through GPS/JIPS, the chemical industry with adequate management is handling risk assessment and information disclosure of many chemicals in the supply chain in general.	· Kyoto Protocol, concerning prevention of global warming, became effective.
		· Mitsubishi Chemical Holdings was formed with Mitsubishi Chemical and Mitsubishi Pharma (now Tanabe Mitsubishi Pharma) under its umbrella. In 2007, Mitsubishi Plastics and, in 2010, Mitsubishi Rayon were integrated under its umbrella.		
		· Yamanouchi Pharmaceutical and Fujisawa Pharmaceutical merged and Astellas Pharma was established.		
		· Daiichi-Sankyo, a joint holding company of Sankyo and Daiichi Pharmaceutical, was established and the two companies merged in 2007.		
2006			· The First International Conference on Chemical Management (ICCM-1) was held.	
2007			· (Saudi Arabia) SABIC acquired the engineering plastics business of GE of the US.	
2008	Simultaneous recession around the globe	· Osamu Shimomura was awarded Nobel Prize in Chemistry for green fluorescent protein. **The discovery was made from Aequorea victoria and the protein is used as a tool for medical research.**	· (Netherlands) AkzoNobel merged ICI of the UK.	· The price of crude oil exceeded the 100 dollar mark of West Texas Intermediate (WTI) for the first time at New York Mercantile Exchange.
2010		· Eiichi Negishi and Akira Suzuki were awarded Nobel Prize in Chemistry for palladium-catalyzed cross coupling reaction in organic synthesis. **An epoch-making process for efficiently synthesizing carbon to carbon.**		
2011		· Mitsubishi Chemical and Asahi Kasei Chemicals jointly established Nishi Nippon Ethylene for unified operation of Mizushima Ethylene Center.		· The Great East Japan Earthquake.