

This list of Indian inventions and discoveries details the inventions, scientific discoveries and contributions of India, including the ancient, classical and post-classical nations in the subcontinent historically referred to as India and the modern Indian state. It draws from the whole cultural and technological history of India, during which architecture, astronomy, cartography, metallurgy, logic, mathematics, metrology and mineralogy were among the branches of study pursued by its scholars.[1] During recent times science and technology in the Republic of India has also focused on automobile engineering, information technology, communications as well as research into space and polar technology.

For the purpose of this list, the inventions are regarded as technological firsts developed in India, and as such does not include foreign technologies which India acquired through contact. It also does not include technologies or discoveries developed elsewhere and later invented separately in India, nor inventions by Indian emigres in other places. Changes in minor concepts of design or style and artistic innovations do not appear in the lists.

Inventions [ edit ]

Administration [ edit ]

Janapada (democratic republic system) (1100-500 BCE) [2]

Local government: presence of municipality in Indus Valley Civilization is characterised by rubbish bins and drainage system throughout urban areas. Megasthenes also mentions presence of a local government in the Mauryan city of Pataliputra. [3] [4]

Passport: Arthashastra ( c. 3rd century BCE ) make mentions of passes issued at the rate of one masha per pass to enter and exit the country. Chapter 34 of the Second Book of Arthashastra concerns with the duties of the Mudrã•dhyaká¹fa ( lit. 'Superintendent of Seals') who must issue sealed passes before a person could enter or leave the countryside. This constitutes first passports and passbooks in world history[5]

Communication [ edit ]

Computers and programming languages [ edit ]

Construction, civil engineering and architecture [ edit ]

The Great Stupa at Sanchi (4thâ€"1st century BCE). The dome shaped stupa was used in India as a commemorative monument associated with storing sacred relics.

BharatNet(National Optical Fibre Network) is establishment, management, and operation of the National Optical Fibre Network as an Infrastructure to provide

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a minimum of 100 Mbit/s broadband connectivity to all rural and remote areas. BBNL was established in 2012 to lay the optical fiber.

English Bond: The English bond is a form of brickwork with alternating stretching and heading courses, with the headers centred over the midpoint of the stretchers, and perpend in each alternate course aligned. Harappan architecture in South Asia was the first to use the so-called English bond in building with bricks.

Finance and banking [ edit ]

Cheque: There is early evidence of using cheques. In India, during the Maurya Empire (from 321 to 185 BC), a commercial instrument called the adesha was in use, which was an order on a banker desiring him to pay the money of the note to a third person. [30]

Direct Benefit Transfer, This program aims to transfer subsidies directly to the people through their bank accounts. It is hoped that crediting subsidies into bank accounts will reduce leakages, delays, etc.

Digital Banking Unit(DBU) is a specialised fixed point business unit/hub housing certain minimum digital infrastructure for delivering digital banking products and services as well as servicing existing financial products & services digitally, in both self-service and assisted mode. [31]

Payments bank is an Indian new model of banks conceptualised by the Reserve Bank of India (RBI) without issuing credit.

Small Finance Bank are a type of niche banks in India. Banks with a small finance bank (SFB) license can provide basic banking service of acceptance of deposits and lending. The aim behind these is to provide financial inclusion to sections of the economy not being served by other banks,

Micro Finance Institutions(MFI) is an organization that offers financial services to low income populations.

Games [ edit ]

Genetics [ edit ]

Metallurgy and manufacturing [ edit ]

Close-up of Wootz steel , pioneering steel alloy matrix developed in India

Music [ edit ]

Musical Notation: Samaveda text (1200 BC – 1000 BC) contains notated melodies, and these are probably the world's oldest surviving ones.[113]

Metrology [ edit ]

Crescograph, Bose Institute, Kolkata

Crescograph: The crescograph, a device for measuring growth in plants, was invented in the early 20th century by the Bengali scientist Sir Jagadish Chandra Bose. [114] [115]

Incense clock: The incense clock is a timekeeping device used to measure minutes, hours, or days, incense clocks were commonly used at homes and temples in dynastic times. Although popularly associated with China the incense clock is believed to have originated in India, at least in its fundamental form if not function. [116] [117] Early incense clocks found in China between the 6th and 8th centuries CE—the period it appeared in China all seem to have Devanāgarī carvings on them instead of Chinese seal characters. [116] [117] Incense itself was introduced to China from India in the early centuries CE, along with the spread of Buddhism by travelling monks. [118] [119] [120] Edward Schafer asserts that incense clocks were probably an Indian invention, transmitted to China, which explains the Devanāgarī inscriptions on early incense clocks found in China. [116] Silvio Bedini on the other hand asserts that incense clocks were derived in part from incense seals mentioned in Tantric Buddhist scriptures, which first came to light in China after those scriptures from India were translated into Chinese, but holds that the time-telling function of the seal was incorporated by the Chinese. [117]

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Science and technology [ edit ]

Textile and material production [ edit ]

Button: Ornamental buttonsâ€”made from seashellâ€”were used in the Indus Valley civilisation for ornamental purposes by 2000 BCE.[140] Some buttons were carved into geometric shapes and had holes pierced into them so that they could be attached to clothing by using a thread.[140] Ian McNeil (1990) holds that: "The button, in fact, was originally used more as an ornament than as a fastening, the earliest known being found at Mohenjo-daro in the Indus Valley. It is made of a curved shell and about 5000 years old." [141]

Palampore: à¸²à¸¼à¸²à¸@à¸³à¸¼à¸°à¸• (Hindi language) of Indian origin [158] was imported to the western worldâ€”notable England and Colonial Americaâ€”from India. [159] [160] In 17th-century England these hand painted cotton fabrics influenced native crewel work design. [159] Shipping vessels from India also took palampore to colonial America, where it was used in quilting. [160]

was imported to the western worldâ€”notable England and Colonial Americaâ€”from India. In 17th-century England these hand painted cotton fabrics influenced native crewel work design. Shipping vessels from India also took palampore to colonial America, where it was used in quilting. Prayer flags: The Buddhist sĀtras, written on cloth in India, were transmitted to other regions of the world. [161] These sutras, written on banners, were the origin of prayer flags. [161] Legend ascribes the origin of the prayer flag to the Shakyamuni Buddha, whose prayers were written on battle flags used by the devas against their adversaries, the asuras . [162] The legend may have given the Indian bhikku a reason for carrying the 'heavenly' banner as a way of signyfying his commitment to ahimsa . [163] This knowledge was

carried into Tibet by 800 CE, and the actual flags were introduced no later than 1040 CE, where they were further modified. [163] The Indian monk Atisha (980â€”1054 CE) introduced the Indian practice of printing on cloth prayer flags to Tibet. [162]

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Wellbeing [ edit ]

Weapons [ edit ]

Indigenisation and improvements [ edit ]

Discoveries [ edit ]

Mathematics [ edit ]

Number System Numbers 0 1 2 3 4 5 6 7 8 9 Tamil à³| à¯¸ à¯¸" à¯¸© à¯¸ª à¯¸« à¯¸¬ à¯¸- à¯¸® à¯¸¯ Gurmukhi o à©¸ à©" à©© à©ª à©« à©¬ à©- à©® à©¯ Odia à-| à-¸ à-" à-© à-ª à-« à-¬ à-- à-® à-¯ Bengali à¸| à¸¸ à¸" à¸© à¸ª à¸« à¸¬ à¸- à¸® à¸¯ Assamese à¸| à¸¸ à¸" à¸© à¸ª à¸« à¸¬ à¸- à¸® à¸¯ Devanagari à¥| à¥¸ à¥" à¥© à¥ª à¥« à¥¬ à¥- à¥® à¥¯ Gujarati à«| à«¸ à«" à«© à«ª à«« à«¬ à«- à«® à«¯ Tibetan à¼| à¼; à¼ç à¼¸ à¼© à¼ª à¼« à¼¬ à¼- à¼® à¼¯ Brahmi Telugu à±| à±¸ à±" à±© à±ª à±« à±¬ à±- à±® à±¯ Kannada à³| à³¸ à³" à³© à³ª à³« à³¬ à³- à³® à³¯ Malayalam àµ| àµ¸ àµ" àµ© àµª àµ« àµ¬ àµ- àµ® àµ¯ Burmese á•€ á•• á•, á•f á•„ á•... á•† á•‡ á•^ á•% Khmer áŸ áŸ; áŸç áŸ¸ áŸ© áŸª áŸ« áŸ¬ áŸ- áŸ® áŸ¯ Thai à¹• à¹' à¹" à¹" à¹• à¹- à¹~ à¹™ Lao à»• à»' à»' à»" à»" à»• à»- à»- à»~ à»™ Balinese á-• á-' á-' á-" á-" á-• á-- á-- á~ á™ Santali á±• á±' á±' á±" á±" á±• á±- á±- á±~ á±™ Javanese ê¸• ê¸' ê¸' ê¸" ê¸" ê¸• ê¸- ê¸- ê¸~ ê¸™

The half-chord version of the sine function was developed by the Indian mathematician Aryabhata

AF = FD. Brahmagupta's theorem (598â€"668) states that

"It is India that gave us the ingenuous method of expressing all numbers by the means of ten symbols, each symbol receiving a value of position, as well as an absolute value; a profound and important idea which appears so simple to us now that we ignore its true merit, but its very simplicity, the great ease which it has lent to all computations, puts our arithmetic in the first rank of useful inventions, and we shall appreciate the grandeur of this achievement when we remember that it escaped the genius of Archimedes and Apollonius, two of the greatest minds produced by antiquity."

Trigonometric functions : The trigonometric functions sine and versine originated in Indian astronomy, adapted from the full-chord Greek versions (to the modern half-chord versions). They were described in detail by Aryabhata in the late 5th century, but were likely developed earlier in the Siddhantas, astronomical treatises of the 3rd or 4th century. [249] [250] Later, the 6th-century astronomer Varahamihira discovered a few basic trigonometric formulas and identities, such as  $\sin^2(x) + \cos^2(x) = 1$ . [242]

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Philosophy [ edit ]

Catuskoti (Tetralemma): The four-cornered system of logical argumentation with a suite of four distinct functions that refers to a logical proposition P, with four possibilities that can arise. The tetralemma has many logico-epistemological applications and has been made ample use of by the Indian philosopher NÄgarjuna in the Madhyamaka school. The tetralemma also features prominently in the Greek skepticist school of Pyrrhonism, the teachings of which are based on Buddhism. The founder of the Pyrrhonist school lived in India for 18 months and likely learned the language, which allowed him to carry these teachings to Greece.[251]

Medicine [ edit ]

Cataract in the Human Eye –magnified view seen on examination with a slit lamp . Indian surgeon Susruta performed cataract surgery by the 6th century BCE.

Mining [ edit ]

Diamond mining and diamond tools: Diamonds were first recognised and mined in central India, [268] [269] [270] where significant alluvial deposits of the stone could then be found along the rivers Penner, Krishna and Godavari. It is unclear when diamonds were first mined in India, although estimated to be at least 5,000 years ago. [271] India remained the world's only source of diamonds until the discovery of diamonds in Brazil in the 18th century. [272] [273] [274] Golconda served as an important centre for diamonds in central India. [275] Diamonds then were exported to other parts of the world, including Europe. [275] Early references to diamonds in India come from Sanskrit texts. [276] The Arthashastra of Kautilya mentions diamond trade in India. [274] Buddhist works dating from the 4th century BCE mention it as a well-known and precious stone but don't mention the details of diamond cutting. [268] Another Indian description written at the beginning of the 3rd century describes strength, regularity, brilliance, ability to scratch metals, and good refractive properties as the desirable qualities of a diamond. [268] A Chinese work from the 3rd century BCE mentions: "Foreigners wear it [diamond] in the belief that it can ward off evil influences". [268] The Chinese, who did not find diamonds in their country, initially used diamonds as a "jade cutting knife" instead of as a jewel. [268]

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"jade cutting knife" instead of as a jewel. Zinc mining and medicinal zinc: Zinc was first smelted from zinc ore in India.[277] Zinc mines of Zawar, near Udaipur, Rajasthan, were active during early Christian era.[278][279] There are references of medicinal uses of zinc in the Charaka Samhita (300 BCE).[280] The Rasaratna Samuccaya which dates back to the Tantric period ( c. 5th – 13th century CE ) explains the existence of two types of ores for zinc metal, one of which is ideal for metal extraction while the other is used for medicinal purpose.[280][281] India was to melt the first derived from a long experience of the old alchemy zinc by the distillation process, an advanced technique. The ancient Persians had also tried to reduce zinc oxide in an open stove, but had failed. Zawar in Tiri valley of Rajasthan is the first known old zinc smelting site in the world. The distillation technique of zinc production dates back to the 12th century CE and is an important contribution of India in the world of science.

Sciences [ edit ]

4 NO 2 in its pure form. Bengali Chemist Prafulla Chandra Roy synthesised  $\text{NH}_3$  in its pure form.

Early concept of Gravity: Brahmagupta described gravity as an attractive force and used the term  $\text{gurutva}$  for gravity. (He derived the same concept that the ancient Greeks did it 1000 years before but later debunked by Galileo)[282][283][284] Aryabhata advocated a heliocentric model of solar system, where the planets spin on their axes and follow orbits around the Sun, while the moon revolving around the earth in epicycles.

(it was already told by Greek philosopher Aristarchus of Samos )

Space [ edit ]

Innovations [ edit ]

Computer science and programming [ edit ]

Linguistics [ edit ]

Metrology [ edit ]



Standardisation: The oldest applications and evidence of standardisation come from the Indus Valley Civilisation in the 5th millennium BCE characterised by the existence of weights in various standards and categories as[327] well as the Indus merchants usage of a centralised weight and measure system. Small weights were used to measure luxury goods, and larger weights were used for buying bulkier items, such as food grains etc.[327] The weights and measures of the Indus civilisation also reached Persia and Central Asia, where they were further modified.[328]

A total of 558 weights were excavated from Mohenjodaro, Harappa, and Chanhu-daro, not including defective weights. They did not find statistically significant differences between weights that were excavated from five different layers, each about 1.5 m in thickness. This was evidence that strong control existed for at least a 500-year period. The 13.7-g weight seems to be one of the units used in the Indus valley. The notation was based on the binary and decimal systems. 83% of the weights which were excavated from the above three cities were cubic, and 68% were made of chert.[329]

Miscellaneous [ edit ]

Punch (drink) a mixed drink containing fruits or fruit juice that can be both alcoholic and non-alcoholic originated in the Indian subcontinent before making its way into England by passage through the East India Company.[331] This beverage is very popular among the world with many varietal flavors and brands throughout the beverage industry.

See also [ edit ]

References [ edit ]

## Reference

[Transforming Nursing Education Through Problem-Based Learning](#)

[Research Methods in Psychology: Investigating Human Behavior](#)