Nuclear Weapons

1. India's nuclear triad

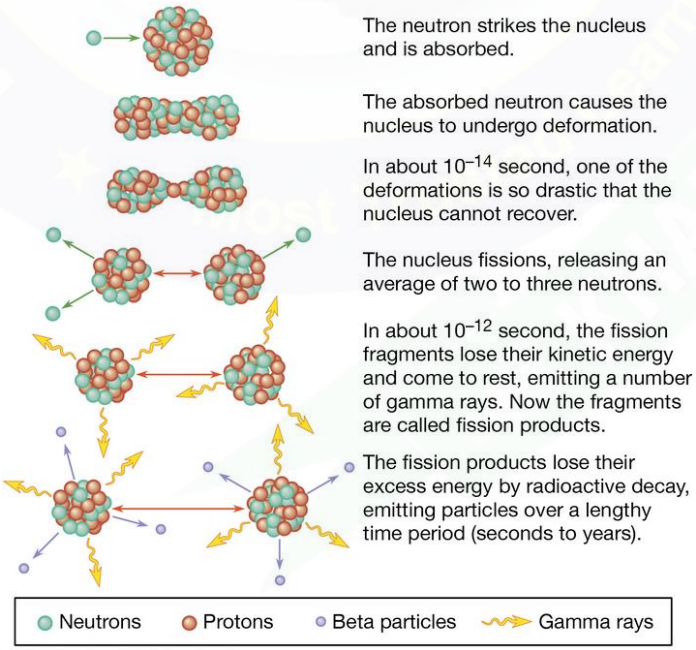
India is a **nuclear weapon state since 1974** and one of the few countries in the world to have a **nuclear triad** with nuclear-armed strike aircraft, land-based inter-continental ballistic missiles (ICBMs) and sea-based submarine-launched ballistic missiles (SLBMs)

1. Air: India has multiple strike aircraft, such as the nuclear-capable Anglo-French Jaguar, French Dassault Mirage 2000 and the Russian Sukhoi 30 MKI aircraft (being upgraded to carry the nuclear-tipped supersonic Brahmos missile).
2. Land: India's land-based nuclear capable ballistic missiles include the Agni family of missiles with a range of 5,000 km for Agni-V, which means it can reach all of China. The Agni V can be launched from a mobile transporter or a special railway wagon, so it can be kept hidden and moved at will.
3. Water: The third component of the triad is nuclear-powered Arihant class submarines that can launch the 700-km range K-15 Sagarika also called BO5 ballistic missile and the 3,000-km range K-4 ballistic missile (under development).

2. Nuclear bombs

The Atomic Bomb

Atomic bomb, also called atom bomb, weapon with great explosive power that results from the sudden release of energy upon the splitting, or **fission** (shown in the figure below), of the nuclei of a heavy element such as **plutonium** or **uranium**.



Many isotopes of uranium can undergo fission, but Uranium-235 undergoes fission more readily and emits more neutrons per fission than other such isotopes. Plutonium-239 has these same qualities. These are the primary fissionable materials used in atomic bombs.

When a neutron strikes the nucleus of an atom of the isotopes uranium-235 or plutonium-239, it causes that nucleus to split into two fragments, each of which is a nucleus with about half the protons and neutrons of the original nucleus. In the process of splitting, a great amount of thermal energy, as well as gamma rays and two or more neutrons, is released. Under certain conditions, the escaping neutrons strike and thus fission more of the surrounding uranium nuclei, which then emit more neutrons that split still more nuclei. This series of rapidly multiplying fissions culminates in a chain reaction in which nearly all the fissionable material is consumed, in the process generating the explosion.

A nuclear weapon's explosive power is measured in yield, which is expressed in tons of TNT. Fission, or atomic bombs, can be as small as one kiloton (KT) of explosive power or as large as several hundred kilotons.

The detonation of an atomic bomb releases enormous amounts of thermal energy, or heat, achieving temperatures of several million degrees in the exploding bomb itself. This thermal energy creates a large fireball, the heat of which can ignite ground fires that can incinerate an entire small city. Convection currents created by the explosion suck dust and other ground materials up into the fireball, creating the characteristic mushroom-shaped cloud of an atomic explosion. The detonation also immediately produces a strong shock wave that propagates outward from the blast to distances of several miles, gradually losing its force along the way. Such a blast wave can destroy buildings for several miles from the location of the burst.

Large quantities of neutrons and gamma rays are also emitted; this lethal radiation decreases rapidly over 1.5 to 3 km (1 to 2 miles) from the burst. Materials vaporized in the fireball condense to fine particles, and this radioactive debris, referred to as fallout, is carried by the winds in the troposphere or stratosphere. The radioactive contaminants include such long-lived radioisotopes as strontium-90 and plutonium-239; even limited exposure to the fallout in the first few weeks after the explosion may be lethal, and any exposure increases the risk of developing cancer.

The first atomic bomb was built in Los Alamos, New Mexico, during World War II under a program called the Manhattan Project.

The U.S. is the only country to have used an atomic bomb in war — the first, nicknamed Little Boy, was dropped on Hiroshima, Japan on Aug. 6, 1945 with a yield of 15 KT and the second, Fat Man, was dropped on Nagasaki, Japan on Aug. 9, 1945 with a yield of 20 KT.

Over time, atomic weapons have become more efficient. Compact atomic bombs directed to hit a city directly could still cause casualties in the hundreds of thousands, if not millions.

Thermonuclear Weapons

Thermonuclear weapons, often referred to as **Hydrogen bombs** or H-bombs, are nuclear weapons in which their extreme explosive powers are obtained through the process of **nuclear fusion** – the process of forming a heavier nucleus from two lighter ones. (Nuclei of the hydrogen isotopes tritium or deuterium are fused.) This fusion requires incredibly high temperatures. They are nearly all achieved through the initial detonation of an atomic bomb.

Like atomic bombs, the explosion of an H-bomb produces a blast that can destroy structures within a radius of several miles, extreme heat that can spark firestorms and intense white light that can induce blindness. Radioactive fallout, or the release into the environment of highly unstable fragments or byproducts of fission such as cesium-137 and strontium-90, can poison living creatures and contaminate air, water and soil for hundreds of years.

These weapons can be thousands of times more powerful than atomic bombs and are measured in yield equal to megatons of TNT and yet they can be made small enough to fit in a ballistic missile warhead or an artillery shell that can be carried. In 1952, the U.S. was the first nation to successfully test a 10 MT fusion bomb. Although they can be much more destructive than atomic bombs, hydrogen bombs are also much more difficult to create.

Dirty Bombs

Dirty bombs, also known as **radiological weapons**, are usually **non-nuclear bombs** - based on conventional explosives - but when detonated, they spread radioactive material. This radioactive material contaminates the area in which the bomb exploded. It can be difficult to clean up and such nuclear waste can render an area uninhabitable for decades.

3. India’s nuclear doctrine

India’s nuclear doctrine was first enunciated following a Cabinet Committee on Security (CCS) meeting in January 2003 – over four and a half years after the May 1998 tests.

Main Features of India’s Nuclear Doctrine:

The main features of India’s nuclear doctrine were summarized as follows in the CCS press release of January 4th 2003:

1. Building and maintaining a credible minimum deterrence;
2. A “No First Use” posture; nuclear weapons to be used only “in retaliation against a nuclear attack on Indian territory or on Indian forces anywhere”;
3. Nuclear retaliation to a first strike will be “massive” and designed to inflict “unacceptable damage”.
4. Nuclear retaliatory attacks to be authorized only by civilian political leadership through the Nuclear Command Authority.
5. Non use of nuclear weapons against non nuclear weapon states.
6. India to retain option of retaliating with nuclear weapons in the event of a major attack against it with biological or chemical weapons;

7. Continuance of strict controls on export of nuclear and missile related materials and technologies, participation in FMCT negotiations, continued moratorium on testing;
8. Continued commitment to the goal of a nuclear weapon free world, through global, verifiable and non discriminatory disarmament.

4. NPT and CTBT

Treaty on the Non-Proliferation of Nuclear Weapons or NPT

The Treaty on the Non-Proliferation of Nuclear Weapons (known as the Non-Proliferation Treaty or NPT) is a cornerstone of global security. The NPT aims to prevent the spread of nuclear weapons to additional states while ensuring fair access to peaceful nuclear technology under international safeguards (audits and inspections).

There are two categories of parties to the treaty—

1. Nuclear weapon states (NWS)

2. Non-nuclear weapon states (NNWS)

Under the treaty, NWS are defined as the five states that exploded a nuclear device before January 1, 1967 (United States, Soviet Union [now Russia], United Kingdom, France, and China).

The Non-Proliferation Treaty was signed in 1968 and came into force in 1970.

The NPT:

- Forbids the five member states with nuclear weapons from transferring them to any other state
- Forbids member states without nuclear weapons from developing or acquiring them
- Provides assurance through the application of international safeguards that peaceful nuclear energy in NNWS will not be diverted to nuclear weapons or other nuclear explosive devices
- Facilitates access to peaceful uses of nuclear energy for all NNWS under international safeguards
- Commits all member states to pursue good faith negotiations toward ending the nuclear arms race and achieving nuclear disarmament.

The NPT regime also includes a number of treaties restricting nuclear testing.

1. The Partial Test Ban Treaty (1963) outlawed atmospheric, space, and underwater nuclear testing.
2. The Threshold Test Ban Treaty (1974) outlawed underground tests of more than 150 kilotons yield.
3. The Comprehensive Nuclear-Test-Ban Treaty (CTBT), which is a multilateral treaty by which states agree to ban all nuclear explosions in all environments, for military or

civilian purposes. It was adopted by the United Nations General Assembly on 10 September 1996 but it has not entered into force due to the non-ratification of eight specific states.

The NPT embodies the international community's efforts to prevent the further spread of nuclear weapons and its aspirations for global disarmament. It also facilitates cooperation in the peaceful uses of nuclear energy under International Atomic Energy Agency (IAEA) safeguards. For these reasons, the NPT is generally recognized as the foundation of the international nuclear nonproliferation regime.

As of April 2004, only three states have not signed the treaty: India, Israel, and Pakistan. Democratic People's Republic of Korea (DPRK, also known as North Korea) announced its withdrawal from the NPT on January 10, 2003, and its withdrawal came into effect on April 10, 2003.

Israel, India, and Pakistan are known or believed to possess nuclear weapons today. Because they did not detonate a nuclear explosive device before January 1, 1967, however, they are not considered Nuclear Weapon States under the NPT. This means that if they were to join the treaty, they would have to do so as Non-Nuclear Weapon States, eliminate their nuclear arsenals, and accept comprehensive IAEA inspections on all of their nuclear activities. This was the path followed by South Africa, which possessed nuclear weapons from 1979 until 1991, when it joined the NPT.

North Korea joined the treaty as a NNWS in 1985, but did not comply with the NPT's requirement to place all of its nuclear material under comprehensive safeguards. North Korea withdrew from the treaty in 2003.

The Comprehensive Test Ban Treaty (CTBT)

Introduction to the Comprehensive Nuclear-Test-Ban Treaty (CTBT)

The **Comprehensive Nuclear-Test-Ban Treaty (CTBT)** aims to eliminate all forms of nuclear explosions worldwide. This includes both military and civilian uses. The United Nations General Assembly adopted the treaty on 10 September 1996. However, it has not yet come into force, mainly due to non-ratification by eight key nations.

Negotiation and Status of the CTBT

The CTBT was negotiated at the Geneva Conference on Disarmament in 1994 and opened for signature in 1996. To date, 184 nations have signed it. The treaty's enforcement depends on ratification by 44 specific countries, as listed in Annex 2. These countries had nuclear capabilities in 1996. The treaty will become effective 180 days after these countries ratify it.

Goal and Background of the CTBT

The primary aim of the CTBT is to promote global nuclear disarmament and prevent nuclear weapon proliferation. Its roots lie in the Cold War era, characterised by extensive nuclear testing by the United States and the Soviet Union.

Nations Not Ratifying the CTBT

Eight nations critical to the treaty's enforcement have not ratified it:

1. **China**
2. **Egypt**
3. **Iran**
4. **Israel**
5. **United States**
6. **India**
7. **Pakistan**
8. **North Korea**

These countries are part of the Annex 2 states essential for the treaty's activation.

Reasons for Non-Ratification

The reasons for non-ratification vary:

- **China** awaits the U.S. Senate's decision.
- **Egypt** may ratify following Iran and Israel.
- **Iran** could ratify after key regional players, like Israel.
- **Israel** has concerns about the treaty's inspection processes.
- **United States** did not ratify due to concerns over maintaining a nuclear arsenal and verifying compliance.
- **India** sees the CTBT as discriminatory, favouring nuclear states.
- **Pakistan**'s reluctance relates to security concerns, particularly regarding India's capabilities.
- **North Korea** generally avoids treaties with strict verification measures.

Other Treaties on Nuclear Testing

Besides the CTBT, there are treaties that limit or ban nuclear testing:

1. **Partial Test Ban Treaty (PTBT)** – Bans nuclear tests in the atmosphere, space, and underwater.

2. **Threshold Test Ban Treaty (TTBT)** – Prohibits underground nuclear tests with yields over 150 kilotons.

3. **Peaceful Nuclear Explosions Treaty (PNET)** – Imposes yield limits on underground nuclear explosions outside test sites.

Together with the CTBT, these treaties form a global framework for reducing nuclear testing and promoting disarmament.

India's Stance on the CTBT

India's position on the CTBT is shaped by its security and strategic needs:

1. **Non-Signatory Status**: India has not signed the CTBT, criticising it for favouring nuclear weapon states.

2. **Nuclear Deterrent**: India views nuclear weapons as essential for its security.

3. **Voluntary Testing Moratorium**: India has stopped nuclear testing, aligning with the CTBT's goals.

4. **Future Ratification Prospects**: India's ratification is unlikely soon, but it keeps open the option of testing for national security.

Thus, India aligns with the CTBT's goals but has not signed it due to concerns over discrimination and security.