

Defence (3)

• **Agni-4 test-fired: ballistic missiles & the nuclear triad**

Detail: Agni-4 — MRBM, ~4,000 km, two-stage solid-fuelled, road-mobile, ~1,000 kg payload; test-fired 6 Aug 2026 from ITR Chandipur, Odisha, under the Strategic Forces Command
Detail: Agni ranges — 1 (~700 km), 2 (~2,000), 3 (~3,000), 4 (~4,000), 5 (5,000+), plus Agni-P
Detail: Ballistic = rocket-powered, unpowered arc, exits the atmosphere; cruise = jet-powered, low-flying, manoeuvrable (BrahMos, Nirbhay)
Exam hook: The triad — Agni (land), Su-30MKI/Rafale/Mirage-2000 (air), Arihant-class SSBN with K-15/K-4 (sea, most survivable). NCA (2003) — Political Council chaired by the PM authorises use, Executive Council by the NSA. IGMDP (1983) under A.P.J. Abdul Kalam

• **The Andaman & Nicobar Command**

Detail: Created 2001, HQ Port Blair — India's first and only tri-service theatre command, led by CINCAN (three-star, customarily Navy)
Detail: Tasks — island defence, EEZ patrol, anti-piracy and anti-smuggling, HADR, CORPAT with Indonesia and Thailand, exercises with Singapore
Detail: Indira Point on Great Nicobar is India's southernmost point; the Ten Degree Channel separates Andaman from Nicobar; the Six Degree Channel separates Great Nicobar from Sumatra; Barren Island is India's only active volcano
Exam hook: The islands command the western approaches to the Malacca Strait. Renamings — Ross = Netaji Subhas Chandra Bose Dweep, Neil = Shaheed Dweep, Havelock = Swaraj Dweep. Cellular Jail at Port Blair

• **Operation Sindoor & the logic of deterrence**

Detail: Deterrence = persuading an adversary not to act — by punishment (threatened retaliatory cost) or by denial (making success impossible); it requires capability + credibility + communication
Detail: Compellence forces an adversary to undo an action, and is harder than deterrence — the distinction most worth carrying into an interview
Detail: The escalation ladder runs sub-conventional → conventional → nuclear, and escalation control is the central skill; grey-zone operations use cyber, information, economic and drone means below the war threshold
Exam hook: CCS chaired by the PM is the apex security body, supported by the NSC and NSA; the CDS since 2020 heads the Department of Military Affairs. Intelligence — IB internal, R&AW external, DIA military, NTRO technical, NIA investigation

Environment (2)

• **The Green Credit Programme & Mission LiFE**

Law: Green Credit Rules notified 12 Oct 2023 under the Environment (Protection) Act, 1986; tree-plantation/eco-restoration modality 22 Feb 2024, revised 29 Aug 2025
Body: Administrator is ICFRE, Dehradun
Detail: Green credit rewards environment-positive ACTIONS; a carbon credit = 1 tonne of CO₂-equivalent under the Carbon Credit Trading Scheme (BEE, successor to PAT) — the distinction that gets tested
Exam hook: Mission LiFE announced at COP26 Glasgow (2021), launched 2022 at Kevadia. Panchamrit — 500 GW non-fossil, 50% renewables, net-zero 2070

• **The Clouded Leopard Conservation Action Plan**

Detail: *Neofelis nebulosa*; IUCN Vulnerable; WPA 1972 Schedule I; CITES Appendix I; State Animal of Meghalaya; Clouded Leopard National Park in Sepahijala WLS, Tripura
Detail: Arboreal and nocturnal; longest canines relative to skull size; rotating ankles allow head-first descent; cannot roar — it is not a *Panthera*
Detail: Action Plan released on International Clouded Leopard Day (4 Aug 2026) under GoI-GEF-UNDP, at the 91st SCNBWL meeting at Coimbatore, with 14 priority landscapes in the North-East
Exam hook: NBWL is chaired by the PM, its Standing Committee by the Environment Minister. Protected areas — National Park, Sanctuary, Conservation Reserve and Community Reserve (the last two from the 2002 amendment)

Sci/Tech (9)

• **Magnetorheological fluids & the hybrid rheometer**

Detail: MR fluid = micron-sized carbonyl-iron particles in carrier oil; a magnetic field aligns them into chains, so apparent viscosity rises within milliseconds into a viscoelastic solid — reversible and electrically controllable

Detail: Non-Newtonian, behaving as a Bingham plastic (has a yield stress). ER fluid responds to an electric field; a ferrofluid uses nanoparticles and stays liquid

Detail: Shear-thinning = ketchup, blood; shear-thickening = cornflour suspension (liquid armour)

Exam hook: Heating lowers liquid viscosity but raises gas viscosity. Uses — dampers, brakes, clutches, prosthetics, seismic dampers, recoil control

• **India's indigenous African Swine Fever vaccine**

Detail: ASF virus is a large DNA virus affecting domestic and wild pigs only — NOT zoonotic; high fever, haemorrhages, mortality up to ~100%; first detected in India in 2020, worst in the North-East

Detail: Spreads by contact, contaminated pork/swill, fomites and soft ticks; survives in frozen and processed pork. Distinct from Classical Swine Fever (an RNA virus, for which a vaccine exists)

Body: Developed by ICAR, dedicated on ICAR Foundation Day, 4 Aug 2026; ICAR established 16 July 1929; IVRI Izatnagar, NIHSAD Bhopal; WOAHS sets standards

Exam hook: Vaccine types — live-attenuated, inactivated, subunit/toxoid, vector, mRNA. DIVA distinguishes infected from vaccinated animals

• **The Deep Ocean Mission & Matsya-6000**

Body: Deep Ocean Mission launched 2021, Ministry of Earth Sciences, six verticals

Detail: Matsya-6000 is a human submersible for 3 crew to 6,000 m under the Samudrayaan mission, built by NIOT Chennai, with a titanium spherical crew module; wet harbour trials at 8 m at Kattupalli in early 2025

Detail: Pressure rises ~1 atmosphere per 10 m, so ~600 atm at 6,000 m. Ocean zones — epipelagic, mesopelagic, bathypelagic, abyssopelagic, hadalpelagic; chemosynthesis at hydrothermal vents

Exam hook: Resources — polymetallic nodules (manganese, nickel, copper, cobalt) in the Central Indian Ocean Basin, polymetallic sulphides, gas hydrates, OTEC. India was the first Pioneer Investor (1987) under the International Seabed Authority (Kingston)

• **Space debris & ISRO's collision avoidance manoeuvres**

Detail: LEO is below ~2,000 km — densest and riskiest; 20 of India's 22 active LEO satellites are at higher risk. ISRO performed 20 CAMs in 2025 and 9 in 2026

Detail: Orbital speed ~7-8 km/s, so even a 1 cm fragment is destructive; Kessler syndrome = a collision cascade

Detail: MEO for navigation; GEO at 35,786 km for communication; polar/sun-synchronous ~600-800 km for imaging. Graveyard orbit for GEO, deorbit for LEO; debris-free missions targeted for 2030

Exam hook: Outer Space Treaty 1967 (no appropriation, no WMD), Liability Convention 1972 (absolute on Earth, fault-based in space), Registration Convention 1975. Project NETRA and IS4OM (Bengaluru) track objects

• **Non-animal methods — organ-on-chip & the 3Rs**

Detail: in-vivo = in a living organism; in-vitro = cells outside the body; in-silico = computer simulation; ex-vivo = tissue studied briefly outside

Detail: New Approach Methodologies (NAMs) — organ-on-chip (a microfluidic device lined with human cells), organoids (3D mini-organs from stem cells), 3D tissue models, in-silico toxicology. ICMR supported 109 projects across 71 institutes; 8 CSIR labs have capability

Detail: NAMs complement rather than fully replace animal models — the honest qualifier

Exam hook: 3Rs = Replacement, Reduction, Refinement (Russell and Burch, 1959). CPCSEA regulates under the Prevention of Cruelty to Animals Act, 1960. ICMR 1911, CSIR 1942, DBT 1986

• India's beam catcher for FAIR

Detail: FAIR = Facility for Antiproton and Ion Research, Darmstadt, Germany, beside GSI; India is a **founding member and major shareholder**, coordinated by **Bose Institute, Kolkata**

Detail: India delivered the **first of three beam catchers**, designed by **CSIR-CMERI Durgapur**, for the **super-FRS** that produces radioactive beams; absorbs heavy-ion beams of **0.4-1.5 GeV/nucleon**, ~29 kJ deposited in **50-100 ns**, causing **thermal shock** in graphite

Detail: An **antiproton** is the proton's antiparticle — same mass, negative charge, **annihilates** with matter ($E=mc^2$); antimatter was predicted by **Dirac**, and the **positron** was found first

Exam hook: Accelerators use **electric fields to accelerate** and **magnetic fields to steer and focus** — **dipole bends, quadrupole focuses**. Types: **linac, cyclotron, synchrotron**

• The 'Boss Scam' & India's cyber-crime machinery

Detail: Malware disguised as Statement of Account / MCA / RBI files on WhatsApp, SMS and email; hijacks a senior executive's WhatsApp, then instructs staff to pay **mule accounts**

Detail: **58,000+ alerted in 30 days** via SMS header **I4CMHA-G**; **10,000+ protected by geo-blocking C2 servers** through the **Sahyog Portal**

Body: **I4C** (MHA) handles **crime** — runs **NCRP** and helpline **1930**;

CERT-In (MeitY) is the **incident-response** agency under the IT Act 2000; **NCIIPC** (under NTRO) protects **critical information infrastructure**;

Defence Cyber Agency is tri-service

Exam hook: **Trojan** = disguised malware; **worm** = self-propagating; **ransomware** = encrypts for payment; **C2** = command-and-control. Social engineering exploits **authority, trust and urgency**

• AI in MedTech & India's medical device sector

Detail: "AI in MedTech" knowledge paper released **8 Aug 2026** at **India Medical Device 2026** (9th edition) by the **Department of Pharmaceuticals** with FICCI, setting out **five priorities** for responsible AI adoption

Law: Medical devices are regulated as "**drugs**" under the **Drugs and Cosmetics Act, 1940**, via the **Medical Devices Rules, 2017**; regulator **CDSCO** under MoHFW, headed by the **DCGI**

Detail: Risk classes **A (low)**, **B**, **C**, **D (high)** — **pacemakers, stents, heart valves**; **NPPA** caps prices of **stents and knee implants**

Exam hook: Risks — data bias, **black-box opacity**, liability, privacy under the **DPDP Act 2023**, and validation of **software as a medical device**. India leads in pharma but is **import-dependent in high-end devices** — hence the **PLI** for medical devices

• MSS+ road technology: the science of pavements

Detail: **MSS+** = Modified Mix Seal Surfacing Plus, an indigenous **low-emission** surfacing and maintenance technology from **CSIR-CRRI New Delhi**, demonstrated at Jaipur for Rajasthan

Detail: **Flexible pavement** = bituminous, spreads load **layer by layer**, depends on the **subgrade**, cheaper but needs frequent maintenance. **Rigid pavement** = cement concrete slab, carries load by **beam action**, costlier but longer-lived

Detail: Layers — **subgrade, sub-base, base, binder, wearing course**.

Bitumen is the **heaviest residue of fractional distillation of crude** and is **thermoplastic** — it is **NOT tar**, which is coal-derived

Exam hook: **Hot mix** needs ~150-160°C; **cold mix/emulsion works at ambient temperature** — the low-emission route. **PMB** and **CRMB** (crumb rubber from waste tyres) extend life