VAJIRAM & RAVI

SURE SHOT MAINS TEST SERIES SENIORS 2025

General Studies GS3 - SECTIONAL TEST - 8 SCIENCE & TECH + ENVIRONMENT + DM Test Code - VR1223308	Evaluator Code: Date of Assignment: CQ:

NAME: SAUMYA MEHRA		Time allowed: 3 Hours
STUDENT. ID.:		Email:
UPSC ROLL NO:.:		Submission Date: 23rd July 2025
MOBILE NO.:		

QUESTION PAPER SPECIFIC INSTRUCTIONS

Please read each of the following instructions carefully before attempting questions:

There are **TWENTY** questions printed in **ENGLISH**.
All the questions are compulsory.
The number of marks carried by a question/ part is indicated against it. Word limit in questions, wherever specified, should be adhered to. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.

Q No.	Marks	Q No.	Marks	Q No.	Marks
Q1	/10	Q8	/10	Q15	/15
Q2	/10	Q9	/10	Q16	/15
Q3	/10	Q10	/10	Q17	/15
Q4	/10	Q11	/15	Q18	/15
Q5	/10	Q12	/15	Q19	/15
Q6	/10	Q13	/15	Q20	/15
Q7	/10	Q14	/15	Total	/250

Instructions:–

1. **Legible Scanning:** Exercise due diligence in scanning your scripts for clear legibility
2. **Submissions** marred by poor scanning, notably those with illegible sections or blackened pages due to improper scanning, risk being excluded from the evaluation process.
3. **Non-Adherence Consequences:** Failure to comply with the aforementioned instructions may lead to the disqualification of your submission.

For Student Only		
Start Time - 4:05 PM.	End Time - 6:58 PM.	
Mode of Examination	Online ✓	Offline ☐

Receiving date -	Dispatch date -

Parameters		Good	Average	Needs Improvement
Conceptual Understanding				
Understanding Demand of Question				
Structure	Introduction			
	Body			
	Conclusion			
Presentation-Illustrations, flowcharts, diagrams, etc.				
Language and Handwriting				
No. of Questions Attempted				
Adherence to Word Limit: Yes/No				

Mentor's Feedback

Evaluator/Reviewer Suggestions

👆 ☺ All the Best ☺ 👆

Evaluator/Reviewer Suggestions

👍 😊 All the Best 😊 👍

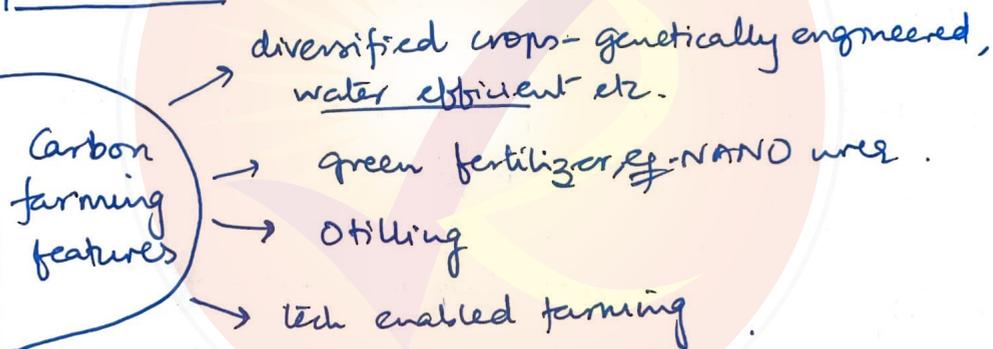# VAJIRAM & RAVI

(Answer questions in NOT MORE than the word limit specified for each in the parenthesis. Content of the answer is more important than its length.)

1. What is carbon farming? Explain its role in sustainable agriculture and climate change mitigation. Discuss the key practices involved.   **(10 marks, 150 words)**

Carbon farming is a sustainable farming practice involving carbon neutral activities throughout the supply chain of farming from planting to post harvest.

Carbon farming features
→ diversified crops- genetically engineered, water efficient etc.
→ green fertilizer eg-NANO urea.
→ Otilling
→ tech enabled farming

ROLE IN SUSTAINABLE AGRI & CLIMATE CHANGE MITIGATION

① . Carbon farming promotes least GHG emissions Eg. dry seeded rice farming → controls CH_4 emissions.

2. Sustainable farming as it promotes <u>less</u> <u>wastage</u> → using perishables as <u>manure</u>, <u>preserve soil</u>

3.   Odisturbance of soil by promoting no tillage — to not <u>led carbon emission escape</u>

4. <u>Agro forestry</u>: binds carbon & maintains SOC (soil organic carbon) & reduces GHG emissions.

[KEY PRACTICES] —

① Regenerative farming: involves <u>regenerating</u> preserving soil nutrients.

② Dry Alternate Wet & Dry Rice Seeding — ↓ CH₄ emissions.

③ ZBNF — Zero Budget Natural farming

④. ✗ organic farming.

Thus; carbon farming not only addresses hey climate change concerns but also promotes sustainable <u>farming & food</u> <u>security</u>

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2. Discuss several ways in which biotechnology can help in ensuring food security in India.

(10 marks, 150 words)

Biotechnology has made several inroads in India, with India being the 3rd largest Active Pharmaceutical Ingredient (API) producer by volume in the world.

Apart from that it also helps in food security

① Fortification of food.
   ↳ adding Zinc, folic acid, vitamins to food like rice, wheat etc.
   ↳ used by Anganwadi workers in MDMS scheme for improving children's food security needs –

② Genetically engineered crops – recently approved PUSA DST 1 Rice crop → drought resistance, disease resistance, nutrient

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rich crop. It Can be used in NFSA's PDS system - meets nutritional needs.

③. Biotech in farming -

4.using Nano Urea: helps in efficient use of inputs → farmers saving costs → Lih aurno culture practices → ↑diversification of crops → meets nutritional needs.

④. Using biotech like CRISPR-CAS 9 to enhance nutrition of crops → food security.

⑤. Use of Transgenic crops → might help with "hidden hunger" or micronutrient needs.

→ R&D centres of excellence in industry.

Way Forward → improve patent process for biotech Cos-for commercialisation

→ Fortified foods on NeM platforms & other ecommerce platform.

SDG 2.0 O Zhunger encapsulates not just no hunger but also addresses nutritional needs which the biotech sector helps achieve

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3. Examine the role of community-led conservation efforts in protecting endangered species in India. Mention the features of two such efforts taken in recent years.

(10 marks, 150 words)

Community led conservation efforts are those where NGOs, govt, philanthropists, local population comes together and devises various ways to conserve endangered species.

For eg → opening up zoos for hurt, injured animals.

→ asorging populace to "adopt" an endangered species.

→ brand ambassadors spreading the word for conservation efforts → communities responding back by efforts..

Role of community led conservation efforts → protecting endangered species

① Volunteering as NGOs etc at local shelter & zoos.

② . Crowd funding for local zoos to improve infra & other facilities.

③. Spreading awareness; special day outing of school students at local zoos.

④. Urging funding efforts by marketing + advertising to encourage philanthropists to donate.

⑤ CSR activities — where consumers donate nominal amount for saving species ⟨of⟩ "Save Tiger"

> [2 efforts in the recent years.] —

① The ~~Vantara~~ Vantara Zoo & Rehab centre led by the Ambanis.
↳ provides rehab facilities.   ↳ monitors any sick animals that may need help.

② World wildlife funds → adopt a ~~dig~~ tiger initiative → can donate to do so.

Thus, community led efforts are key to the LIFE mission where ordinary citizens are made aware of our endangered species.

4. Discuss the significance of the Fast Breeder Reactor (FBR) in achieving the goals of India's Nuclear Energy Program. **(10 marks, 150 words)**

The Fast Breeder Reactor uses Thorium as fuel, which is the 3rd and final stage of our 3 step Nuclear program as devised by Homi J Bhaba.

Significance of FBR → goals of nuclear energy program.

① Thorium → will make Indiaa self reliant
   ↳ vast thorium deposits in India: monazite sands.

② wo bio works with higher efficiency, less fuel wastage
   ↳ energy efficiency & security goals –

③ generates higher amount of nuclear power due to efficiency.

— helps achieve 100GW of nuclear energy by 2047.

④. Might help India make inroads with Nuclear Suppliers Group

   ↳ helps us get hands on latest tech for our nuclear energy needs.

⑤. ↳ self sufficiency can lead to energy surplus → can export energy as well
→ helps with ↓ import bill + maintain resilient Global value chains.

Way Forward
→ Invest in R&D towards nuclear.
→ Invite tech transfer esp. with allies — Russia, Germany, US.
→ Industry academia linkages in nuclear tech.

Thus; in order to achieve our over & above our Panchamrit goals, to truly be energy resilient, we must work with Fast Breeder Reactors.

5. As India advances towards net-zero by 2070, discuss the significance of Green hydrogen towards India's climate goals and energy transition.

(10 marks, 150 words)

India, in its Panchamrit goals at COP 27 of UNFCCC has made a non binding target of net-0 by 2070. For this, Green H_2 is the way to go.

What is Green H_2 —

① Energy utilised by electrolysis process of splitting H_2O into H_2 & O_2.

② This process generates a lot of energy by reneneable means → can be used in various sectors — transport, power, etc and is emission free.

Significance of Green H_2 —

① Reneneable & emission free. especially

green H_2 (from renewable sources), blue H_2 (from carbon capture & storage).

②. Can help with energy <u>diversification</u>; moves away from <u>fossil fuels</u> and <u>space taking</u> <u>solar & wind</u>.

③. <u>Increase our pace</u> to achieve net-0 by 2070.

④. Promotes ~~for~~ H_2 <u>generation</u> from carbon capture & storage too → this also helps <u>reduce emissions</u>.

(Way Forward)
→ R&D emp → in green H_2 → Centres of Excellence to be opened up.
→ operationalize industry clusters for green H_2
→ National H_2 mission implementation.

Recently, India has opened H_2 hubs in <u>Deendayal</u>, <u>Tuticorin</u>, <u>Paradeep</u> which is a step in right direction towards net 0 by 2070.

6. What are the environmental and health impacts of metal mining pollution? Suggest measures to mitigate the same. **(10 marks, 150 words)**

Metal mining pollution is caused due to metal processing extraction from deep mines. metalization in heavy industries which involves huge amounts of carbon emissions & toxic gases.

Environmental impacts → metal mining & health impacts. pollution.

① Those employed in digging mines → marginalized tribal sections → heavy exposure are compromised &are susceptible to pollution causing diseases. (Asthma, cancer etc).

② Digging mines → land desertification which leads to GHG emissions.

③ loss of biodiversity & flora & fauna.

Ex. tribal forests razed for iron mining in Jharkhand.

④. Long term health impacts → spillover to next generation & exacerbated due to lack of health facilities in tribal areas.

⑤. Digging up earth → release of methane & other g toxic gases.

⑥. Soil runoff due to lack of trees.

⑦. ✗ | Measures to mitigate | —

① Curbs & checks on Rathole mining — follow supreme court order.

② safety equipment & gear to workers.

③ Mandated reafforestation activities under CAMPA.

④ Due diligence under EIA.

⑤. rehab facilities for displaced tribals.

Thus, metal mining must balance development needs with health & environmental needs.

7. Define deep-sea mining and briefly explain how it can result in long-lasting changes to the seabed ecosystem. **(10 marks, 150 words)**

Deep sea mining refers to mining all the way into the seabed for various resources such as <u>petroleum</u>, methane hydrates, <u>polymetallic nodules etc</u>.

<u>Deep Sea mining</u> currently has guidelines related to it under <u>UNCLOS</u>.

While, deep sea mining can be <u>understandable</u> for <u>developmental needs</u>, it can result in long lasting changes to sea bed systems →.

① . It can disturb <u>biodiversity</u> of seabed (unique)
  → might disturb deep sea creatures → even leading to death.

② . Might lead to unprecendented release of GHGs trapped inside <u>the seabed such</u> as methane, CO_2 etc.

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③ Might reduce ocean's ability to fix carbon → might lead to ocean acidification

④ Might tinker with photosynthesis capabilities of plants → water decrease CO_2 fixation.

⑤ Lead to chain reactions which might affect whole of the ocean.
   E→ ocean acidification → coral bleaching → dying out of fish reliant on corals.

⑥ Way Forward. —

① Develop new tech which does minimal harm & disturbance to Ocean bed.

② Use deep sea mining as a last resort.

③ Conservation efforts for marine hots pots : like corals, estuaries etc.

   Thus deepsea mining must follow a rules based global order which is in line with sustainability principles.

8. Deepfakes blur the line between reality and illusion, transforming pixels into convincing lies that challenge our perception of truth. Comment.

(10 marks, 150 words)

Deepfakes are AI augmented and distorted images that create a false perception of reality. These have a realistic look & feel to them which blurs lines between reality & illusion.

The recent Human development Report of 2024 mentions challenges associated with AI especially deepfakes.

How deepfakes can impact our perception of truth.

① Can be used as a tool of cyberbullying especially against women.

② Can be harmful for national security
Eg recent deepfakes on the Internet following Operation Sindoor undermine national security.

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③ Harm the dignity of an individual.
Eg. might make unsavoury edits of
real human beings → lack of agency over
such activities.

④. Can lead to misinformation & misuse of
Article 19 — free speech & expression

⑤ "Reverse deepfake" where people believe
actual, non deepfake images /videos to be
deepfake due to lack of trust.

Way Forward

① Active compliance officers of social media
websites who take action per IT Act.

② IT Act to have a clause on AI
misuse & deepfakes.

③. Real time data monitoring during war
times to dispell false deepfakes.

④ Awareness + digital literacy campaign

    Deepfakes have become a nuisance &
can even impinge on our fundamental rights —
Article 21(personal liberty) thus they need to
be swiftly dealth with.

9. Tropical rainforests of the ocean are under serious threat of existence. Discuss. Also, suggest measures to rejuvenate these critical ecosystems. **(10 marks, 150 words)**

Tropical rainforests of the oceans are another term for coral reefs & are rightly called so. They occupy less than 2% of ocean area yet sustain 25% of marine life

CORAL REEFS IN THE WORLD..
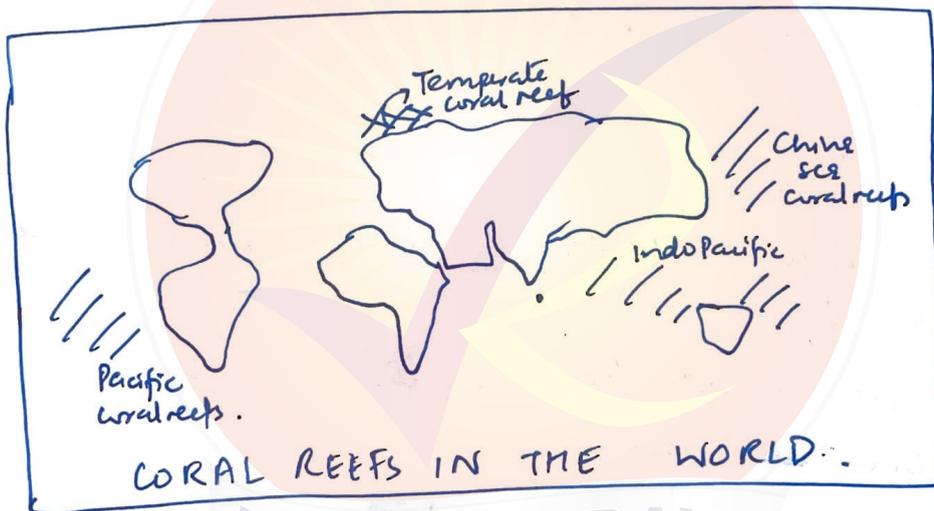
How coral reefs are under threat of existence

① Threat from increasing GHG emissions → global warming → ocean warming → corals can't live beyond 25/26°C which while oceans are warming beyond 30°C

② Improper waste disposal → waste like plastic choked chokes up coral reef ecosystem → leads to death.

③ Oil spills & other anthropogenic activities like trawling → uproots coral reefs & causes coral bleaching

④ Ship pollution → another reason for coral reef crisis

Measures –

① Follow MARPOL guidelines for ↓ ship pollution from di green lanes.

② Prevent screening in marine conservation areas.

③ Geoengineering techniques to improve O_2 balance in oceans.

④ Strict enforcement of pollution management guidelines. & Waste management under EPA, Coastal Regulation zones etc.

Thus, it is important to protect coral reefs as it is an important SDG goal 14 – life undersea.

10. Damage to critical infrastructures amplifies the impact of natural disasters. Discuss the significance of building disaster resilient infrastructure in India.
(10 marks, 150 words)

12% of India's landmass is suspe susceptible to landslides. Other disasters include: earthquakes, droughts, heatwaves etc which ~~cause such~~ Is exacerbated by harm to critical infra.

⎡ How damage to critical infra occurs ⎤

①. Damage to tunnels, roads in hilly areas → exacerbates harmful effect of landslides → accumulates harmful debris aswell.

②. Damage to critical transport infra → difficulty in fast disaster response to arrive at location. / Difficult to leave as well.

③. Non earthquake proof infra → leads to accumullation of rubble & debris which ~~of which~~

further increases _fatality_ chances in earthquakes.

⑤. Damage to _power sector_ → no electricity → no _communication_ during disasters like floods, cloudbursts. without which rescue missions can be difficult.

Significance — disaster resilient infra.

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①. _Earthquake proof_ critical infra → very _little_ damage to both _infra_ & people.

②. Robust materials to be used in tunnels & roads _eg_ _geotextiles_, etc. → helps against landslides.

③. _Urban forestry_ → preventative measure for disasters like heat waves & droughts.

④. Raised floors, houses on stilts → protects from _urban flooding_

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11. What is cloud computing? How is it used in smart homes for automation and device control? Discuss the benefits and challenges of using cloud computing in such systems. **(15 marks, 250 words)**

Cloud computing is the next big thing in Web4.0. Cloud computing refers to ways in which large amounts of data can be stored, processed & used especially in field of AI & Big Data Analytics.

How its used in smart-homes —

① Cloud Computing → gathers data such as facial recognition → can be used in automated home security devices.

② Can be Retrofitted Internet of Things and to cloud computing → utilised in appliances like fridges, voice proactivated modules (Alexa of Amazon) → can be

③. Cloud Computing → processes data such as ambient room temperatures: automates thermostat temperatures as per time & weather conditions.

Benefits

①. Reduces manual labour involved in repetitive tasks. Especially for busy office going folks.

② Helpful for security & safety of houses. Can also help protect valuable goods & items.

③. Benefits women in that, it reduces triple burden → delegates housework to cloud computing.

④. Useful for elderly population who may need special assistance. E

setting up reminders for medicines etc.

Challenges :-

①. Concern of <u>data privacy</u> → due to lack of robust laws on Big Data → always an issue.

②. Long term effect -- <u>atrophying</u> of physical capabilities if we delegate too many functions to <u>machines</u>.

③. Lead to <u>isolation</u> : ~~lack of~~ ~~cause~~ no need for community as cloud computing can perform majority tasks by itself.

④. In case of <u>glitches & errors</u> : no other recourse
<u>For</u> eg if security (home) systems stop working → would create an issue.

Thus; it's important to balance <u>need of</u> <u>cloud computing</u> with necessary manual <u>labour</u>. Cloud computing tech in India should also take into <u>consideration</u> input on <u>house</u> <u>help sector</u> as well.

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12. "India's research and development ecosystem lacks the scale, coordination, and investment needed to drive innovation-led growth." In this context, examine the major challenges facing R&D in India and suggest key reforms to make it globally competitive.

(15 marks, 250 words)

India's R&D ecosystem utilises <2.5% of GDP which makes it an underfunded sector. This is bound to create scale issues, lack of coordination and investment.

scale → very less funding <2.5%
↳ poor private funding

R&D → coordination → PPPs still in nascent stage
↳ lack of industry academia linkage.

investment → poor private participation
↳ lack of incentives by Govt.
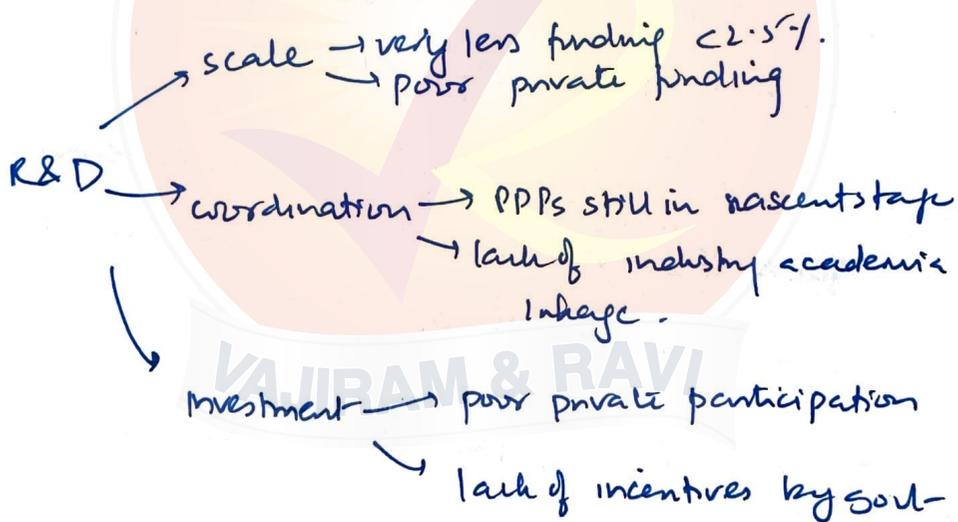
Major challenges. –

①. lack of R&D funding at nascent stage

②. lack of <u>research incubation centres</u> that undertake innovation in key sector.

③ lack of <u>investments</u> due to bureaucratic delays & hurdles.

④. lack of incentives to <u>private sector</u> to <u>innovate</u>.

⑤. ~~lack~~ ~~For~~ India has substantial ~~patents~~ patent research papers but lacks <u>commercialisation</u> of patents.

⑥. lack of <u>coordination</u> with govt, industry-academia & <u>private sector</u>.

Key Reforms -

①. Increase R&D expenditure along lines of New <u>education policy 2020</u>.

②. Improve academia - industry linkages.

③. Identify emerging tech & offer fin. & tech incentives to industries to research

④ Streamline patent discovery of new innovations.

⑤. From "brain drain" to "brain circulation" incentivise students / researchers to come back to India & contribute to research. & offer goodpay, resources .

⑥. Tech transfer with other countries.

⑦ Establish centres of Excellences with IITs, IIMs etc .

Thus; R&D in India needs a serious rehaul & changes across in value chain must be done to make India innovative .

13. Discuss the primary objectives of India's Gaganyaan mission. Analyse its potential impacts on India's space exploration and scientific capabilities. What are the key challenges associated with this mission?   **(15 marks, 250 words)**

Gaganyaan mission

would be India's 1st ever ~~w~~ space mission that will carry man to space.

India is set to carry 3 people in space that will orbit earth in LEO.

Primary objectives
→ To carry men into space.
→ Further getaway into building our own space station.
↘ Perform microgravity experiments in space.

Potential impacts → space exploration + scientific capabilities

①. Might open up gates to to building our very own space station.

Ⓐ. Help in performing micro gravity experiments.

Ⓑ Bring India to the forefront of the <u>space sector</u> in the <u>globe</u> alongside space powers like US, Russia & China.

Ⓒ Help India utilise <u>tech transfer</u> from other countries.

Ⓓ help to form space alliances for <u>military</u> free + defense <u>free</u> space.

<u>Key challenges.</u> -

① . Funding capabilities may be a challenge as it is a mission of large scale.

② - 1st mission in space so : take to do extensive research on <u>health</u> <u>impact</u> in & after space journey.

③. R&D on space suits, space food, make for a sustainable journey.

④. No scope for error: as this is a high stakes mission.

Way Forward —

① Continue training at Roscosmos in Russia to equip astronauts.

② Work on tech transfer with US, Russia for building robust space suits.

③ ~~Establish Do~~ Do extensive research on health impacts of ~~astrona~~ astronauts.

Thus, the recent Axiom 4 mission which had Shubanshu Shukhla as the 2nd man in space is the step in right direction for Gaganyaan.

14. Marine plastic pollution poses a significant threat to biodiversity and coastal ecosystems. Discuss the various mitigation measures to deal with this problem, and also international initiatives in this regard.

(15 marks, 250 words)

Marine plastic pollution occurs due to overconsumption, lack of safe disposal areas, lack of processing waste etc. This inturn, harms marine ecosystem which harms the whole biosphere.

Threat to biodiversity & coastal ecosystems

① . It might endanger coastal ecosystems
ↄ choking up of marine animals on plastic waste
ↄ dying out of coral reefs that sustain 25% of marine population.

② . Marine pollution → difficulty

in sustainable fishing as pollution might lead to more fish dying → harms economy of coastal communities.

③. Reduces aesthetic appeal of coasts & beaches → harms tourism sector.

④. Micro plastics are bioaccumulative → cause diseases in marine life → as well as the entire food chain all the way to humans → neurological conditions in humans.

Mitigation measures

①. Strict regulation of coastal regulation zones by EPA.

②. Mandated Plastic waste management guidelines to be strictly enforced.

③ Promote waste segregation @ source.

④ Mandate waste processing & recycling near sensitive hotspots like waste → to process plastic waste.

⑤. Enforce EPR certification for plastic industries.

⑥ Encourage community led efforts of cleaning beaches.

[International initiatives] —

① MARPOL — green & pollution free shipping

②. UNCLOS — prevent microplastic pollution + best practices for curbing marine pollution.

Thus, marine pollution is needs ~~harmful to~~ to be controlled for not just achieving SDG 14 (~~Loose~~ life under sea) but also SDG 15 (~~Land~~ life over land).

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15. Urban air pollution in India is increasingly becoming a critical environmental and public health concern. Examine the causes and consequences of urban air pollution and suggest suitable measures to mitigate its adverse impacts.

(15 marks, 250 words)

Urban air pollution is led by transport emissions & industry emissions that false worsens air quality and creates an unsustainable urban place for people to live in.

Urban → environment → AQI16
air pollution   concern → Global warming.

→ public → respiratory diseases.
   health
   concern. → lack of green spaces.

Causes of urban air pollution →

① . Transport emissions: ~40% of urban air pollution especially due to cars, & private vehicles.

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②. <u>Industry</u> emissions in & around. cities.

∴ NCR → industry hub - heavy industries, chemicals etc → lead to air pollution.

③. <u>Agri emissions</u> → especially stubble burning during Nov → Jan in nearby <u>Punjab</u> & <u>Haryana</u>. → ↑ in AQI in <u>Delhi - NCR</u>

④. Personal uses → air conditioners, freezent other electrical appliances → GHG emissions.

Consequences of urban air pollution

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① Increase in Air Quality Index.

② Increase in PM 2.5 → respiratory & serious <u>cardiac</u> diseases.

③ Increases patients in hospitals — compromises with <u>Infra</u> capabilities

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④. Lack of green spaces → decrease of biodiversities, can even change migration patterns of animals & birds.

⑤ Lack of community spaces like gardens, parks etc due to uncomfortable environment due to high levels of pollution.

Suitable measures. —

①. Enforce 'GRAP' all around the seasons not just for winters in metropolitan cities.

②. Enforce strict emission control guidelines as mandated by EPA, NGT etc.

③. Make use of Green Credit Rules, ESCERTs & etc. to curb emissions.

④. Build more green spaces, revitalise wetlands, lakes etc.

⑤. ↓ concretisation by using sustainable materials.

Thus. SDG-11 → for robust infrastructure & cities also requires an urban pollution free scenario.

16. "India's disaster risk management strategies need to be reoriented in the wake of increasing urbanisation and climate-induced hazards." Discuss how India's Smart Cities Mission can be leveraged to mainstream climate resilience and disaster risk reduction. **(15 marks, 250 words)**

India's rapid urbanization soon to reach 50% by 2050 & climate induce hazards which only seem to be getting more irregular need a rehauling of disaster risk management strategy.

Now. Disaster risk management strategies (DRMS) need to change in the wake of urbanisation & climate induced disasters.

① . Need for robust infra → infra that is resilient from earthquakes, floods etc.

② . Need for early warning systems in cities to protect hedge against irregular climate induced hazards.

③ Mock Drills in schools, offices etc to protect against disasters.

④ Rising urbanisation → increase in no. of high rise buildings → need to make them earthquake proof to prevent aftermath.

⑤ Urbanisation → strain on sewage networks. in case of disaster like floods, sewage networks will be further stressed.

Smart cities Mission → leverage to mainstream climate resilience & DRR.

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① Control centres in cities can make use of AI & Big Data. Its uses':

→ analyse vast weather data → help with Early warning systems

↳ analyse traffic → streamline traffic in case of disaster.

②. AMRUT 2.0 → manage wastewater & sewage network to hedge against aftermath in floods.

③. Public transport → & that makesure if sustainable fuel may help reduce negative effects of urbanisation

④. Smart Rainwater harvesting systems can help prevent flooding & keeping temperatures cool.

Thus, there is a need to reimagine Smart Cities mission to be able to react to DRR & increasing urbanisation & the nexus between the 2.

17. Heatwaves have emerged as "silent disasters" in India. In this context, discuss the significance of Heat Action Plans (HAPs) in India. Also, suggest other actionable interventions to mitigate heatwave-related fatalities. **(15 marks, 250 words)**

According to ~~ffffb~~ reports, 55% of district in India suffer from heatwaves. This makes up 35% of the population. They are a reason for heat related fatalities in India.

high heat risk zones - Gujarat, Rajasthan, Tamil Nadu, MP etc.

How heatwaves are silent disasters →

①. They have a skewed effect on heat related fatalities mostly affecting marginalised sections → tribal population & daily wage workers etc.

②. Not noticeable symptoms → might raise temperatures very quickly which might lead to heat strokes, dehydration & even death.

Significance of HAPs. — .

Heat Action Plans are heat zones that are areas that record high temperatures based on past & real time data

①. Can be incorporated in EWS systems of cities. → warnings can be issued for HAPs

②. gig workers & daily wages workers can demand protective measures on basis of HAPs location.

③. help in policy implementation → can be incorporated in Graded Response Action Plans

Other interventions → mitigate heatwave related fatalities

①. Improve infra capabilities of hospitals to handle heat stress related issues.

②. Skill enhancement + capacity building of hospital staff.

③. heat stress free infrastructure esp for middle income groups not having ACs.
‡ white roofing in Ahemdabad by Mahila Housing Trust.

④. Provision of relief by the roadsides → shaded regions, sarayus (drinking water) etc.

Tamil Nadu, in Chennai has recently taken efforts to build airconditioned pods for gig workers rest. This shows how heat waves also have an economic but also moral aspect to them.

18. Evaluate India's institutional mechanisms for responding to nuclear emergencies. Propose a strategic framework for disaster risk reduction, incorporating global best practices and IAEA guidelines.   **(15 marks, 250 words)**

India's institutional mechanisms have been in place since the times nuclear energy was incorporated into our energy mix.

Institutional mechanisms :-

① . The Civil Nuclear Liability Guidelines put onus on the Producer in case of nuclear emergencies. → This is in line with the absolute liability principle & as per NGT.

② . Evacuation measures are in place basis the types & scope of nuclear emergencies.

③. Placing of ~~nuclear~~ nuclear infra. in the outskirts of populated areas to minimize damage.

Strategic framework → DRR. | —

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①. Need for seperate, region specific guidelines.

②. Having multiple ~~con~~ control mechanisms / safety mechanisms in place.

③. Need to handle nuclear emergencies differently on basis of different disaster risks nuclear sites might face.
    Et different set of actions for those response to flooding, earthquake etc.

④. Strict Environmental Impact Assessment without any exceptions.

⑤ check for <u>seismic activity</u> ~~before~~ during impact assessment.

It is also important to follow best practices & IAEA guidelines →.

① . Follow best practices of ~~safe~~ countries like Japan
→ incorporate learnings from <u>Fukushima</u> Disaster 2011.

② . IAEA guidelines that incorporate emergency response during different types of <u>disasters</u> .

Thus; it becomes important to balance need for nuclear capabilities to become energy sufficient ~~but~~ and also a foolproof emergency plan for disaster risk reduction.

Introduction	
Body	
Conclusion	
Presentation	
Marks:	

19. Discuss how wearable technology is reshaping the future of personalised medicine. What are the challenges in integrating such technologies in India's public health infrastructure?

(15 marks, 250 words)

Wearable tech refers to incorporating technology in our every day wear such as <u>watches</u>, <u>glasses</u>, as well as medical gear → <u>Insulin monitors</u> etc.

| Wearable tech. | — | Advantages. |

① . Watches. ⟶ displays health indicators – helps in diagnosing, monitoring health.
→ helps in tracking deep sleep, heart beat, calories burnt etc.

② . Insulin monitors ⟶ Monitors glucose levels → ideal for insulin resistance, diabetic patients.

③ wearable heart monitors.

→ monitors heartbeats

→ detects anomalies

→ early detection + diagnosis of cardiac issues.

Challenges → Integrating in public health infra.

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①. Difficulty in seamless transition to wearable tech due to lack of digital literacy.

②. Also Significant use of wearable tech by elderly population → might also face issues getting around the technology.

③. Concerns regarding data privacy → wearable tech, still a new upcoming sector - doesn't have

robust data privacy safeguards in place.

(4). Might Public health infra → health might be having obsolete infra → makes it difficult for seamless integration of high tech wearables.

Way Forward.

① . DPDP Act to incorporate wearable tech industries as data fiduciaries.

② . digital literacy to be enhanced: programs in easy to understand language for elderly. & marginalized sections.

③ . Updating public health infra by investments.

④ Run pilot project to note best practices

wearable tech might fasten the pace of a health industry value chain from identification, diagnosis to consulation & remedies.

20. The BioE3 Policy aims to make India a global hub for sustainable biomanufacturing. Examine its key features and how it aligns with the goals of 3 trillion economy and sustainability. Highlight the major implementation challenges.

(15 marks, 250 words)

The BioE3 Policy is a wholehearted initiative to drive innovation in the biotech sector by leveraging fast developing economy & skilled workforce.

Bio Economy.

BioE3 Policy.

Environment.   Employment.
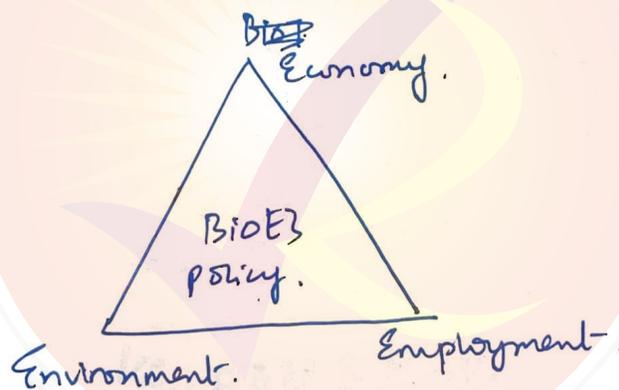
The goal of BioE3 is to create a realise the goals of 3 trillion economy & viksit Bharat by 2047.

Key features –

①. Creating a <u>skilled workforce</u> – leverage rich & growing demographic dividend.

②. Make use of <u>AI hubs</u>, to <u>accelerate</u> <u>R&D</u>.

③. Aligning with <u>LiFE</u> principles & <u>Net 0</u> carbon economy.

④ Promote <u>circular economy</u>. 3 trillion economy which is also sustainable.

Major implementation challenges –

① Lack of <u>industry academia linkages</u>.

② Poor <u>skilling</u> of workforce. └ only 46% graduates employable.

③. Balancing <u>development needs</u> with environment sustainability.

Can often seem like a 0 sum game

④. Manage negative environmental externalities of biotech sector : antimicrobial resistance, microbiological warfare etc.

⑤. Strain on financial resources to also support emerging tech in Biomanufacturing apart from skilling workforce.

Way Forward —

①. Establish Centres Of Excellence in biotech.

②. R&D in Active Pharma Ingredients to reduce reliance on china. & become self reliant.

③. Use Skill India Mission & Startup mission to skill & match empl. workforce to employers.

④. Conduct thourough env. impact Assessments (EIA) of biomanufacturing projects.

⑤. Tech Transfer & handholding from developed countries. Eg— iCET with USA &India..

　　Bio E3 aligns with not only development (Viksit Bharat goals). but also Panchamrit goals.