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: PRINCE SETHI	**Time allowed: 3 Hours**

STUDENT. ID.: 2 1 V R 3 8 5 3 7

UPSC ROLL NO::: 0 8 4 5 1 2 0

MOBILE NO.:

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Submission Date: 4 August 2025

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 - 5:00 PM		End Time - 8:07 PM	
Mode of Examination ONLINE		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** 😊 👍

Q/1 Carbon farming refers to net-neutral farming or 'Carbon-negative' farming practices to ensure Sustainable & Climate-resilient agriculture.

| Role in Sustainable Agriculture |

1) Carbon-neutral farming — preventing green house gas emissions.

eg) Agriculture is responsible for 20-25% carbon emissions and, Methane, nitrous emissions

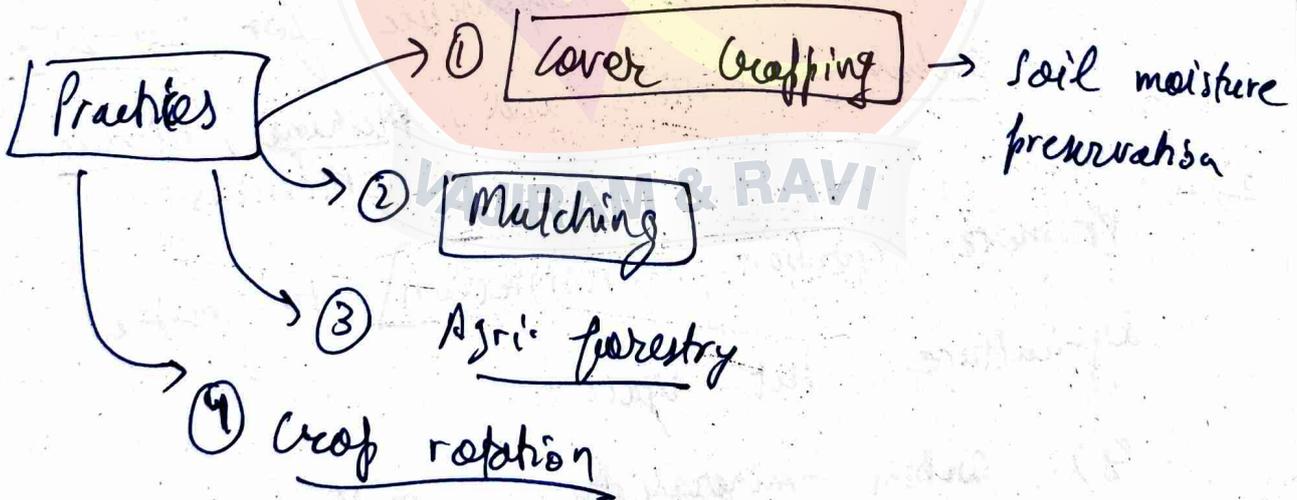2) Promote |carbon-sequestration| to make agriculture net-negative.

eg) Carbon-mineralization method by spreading carbonate & phosphate on field.

| Role In ~~Sustai~~ Climate mitigation |

1) Carbon storage and sequestration

2) Agri-forestry to promote soil conservation

3) Sustainable water use and preservation of soil moisture

4) Climate [resilient yields] & productivity

&) Rice yields expected to decline ~20% by 2050 (WFP & FAO)

[Practices]

→ ① [Cover Cropping] → soil moisture preservation

→ ② [Mulching]

→ ③ Agri forestry

→ ④ Crop rotation

Thus, carbon farming must adopted under Paramparagat Krishi Vikas Yojana to promote [SDG-2] - zero hunger.
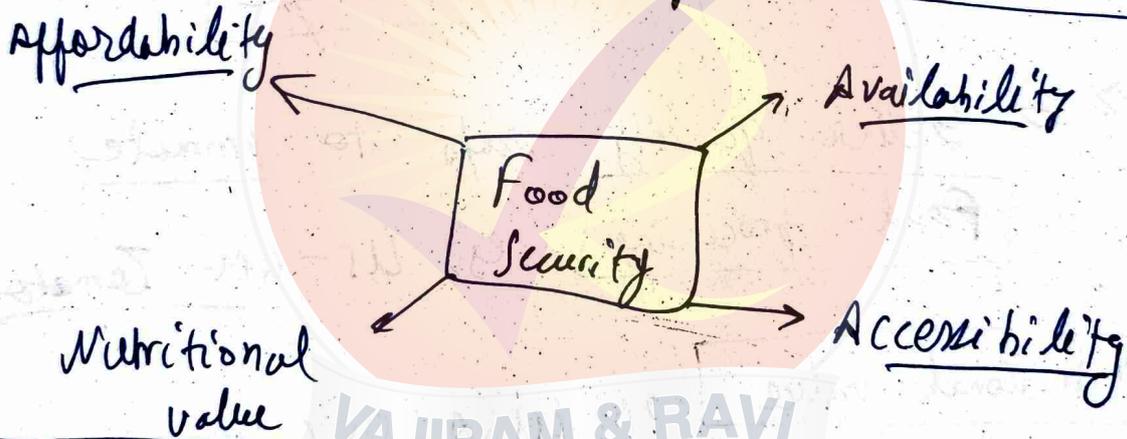
Q2

The branch of Biotechnology responsible for ensuring food security is "Yellow" Biotechnology, — to genetically enhance nutritional content of crops.

| Several ways to Help Promote food security |

Affordability

Availability

Food Security

Nutritional value

Accessibility

A) **Affordability** → (1) Genetically enhanced crops to **reduce cost of production**

(2) Pest-resistant crops e) Bt Brinjal

⇒ Reduce **Pesticide costs**.

B) [Availaibility] → ① Improving crop yields

eg) HYV Pulses (~~Atma~~ Atma nirbharta in Pulses)
Budget 2025.

② Shorter life cycle crops

eg) Kamala Rice Variety of ICAR.

C) [Accessibility] → ① Improving shelf-life
of crops ⟹ [reduce wastage]

→ ② Better quality crops to promote
[Food processing] eg) US-GM-Tomato

D) [Nutritional value] → ① PUSA DST 111 Rice
with enhanced vitamin A content.

[Way Forward] → ① Promoting [HYV millets]
→ ② Fast track clearance through [GEAC]

are some measure which can promote
"technology for people" approach.

Q3

Community level conservation refers to active public participation in protection, rehabilitation and improvement of population of endangered species.

Role of Community - led Conservation

Ⓐ **Awareness** Generation eg⟩ Diclofenac ban awareness to protect vultures in UP.

Ⓑ **Protection of Species**

↳ safeguarding ~~ecosystem~~ ecosystem

↳ safeguarding ~~eggs~~ of vulnerable species

eg⟩ Olive -ridley turtles egg collection & protection from Gahirmatha beach.

Ⓒ Joint management of forests

under ~~the~~ forest conservation Act — JFM

Ⓓ Ecosystem improvement and 'safe-space'

development eg> 'Garuda' Protection

in Assam ~~etc~~ by women SHG.

Ⓔ Prevention of Illegal wildlife trade

eg> Rhino protection in Pobitora WLS

through Community Policing

Thus, by community participation, capacity

building and joint forest management
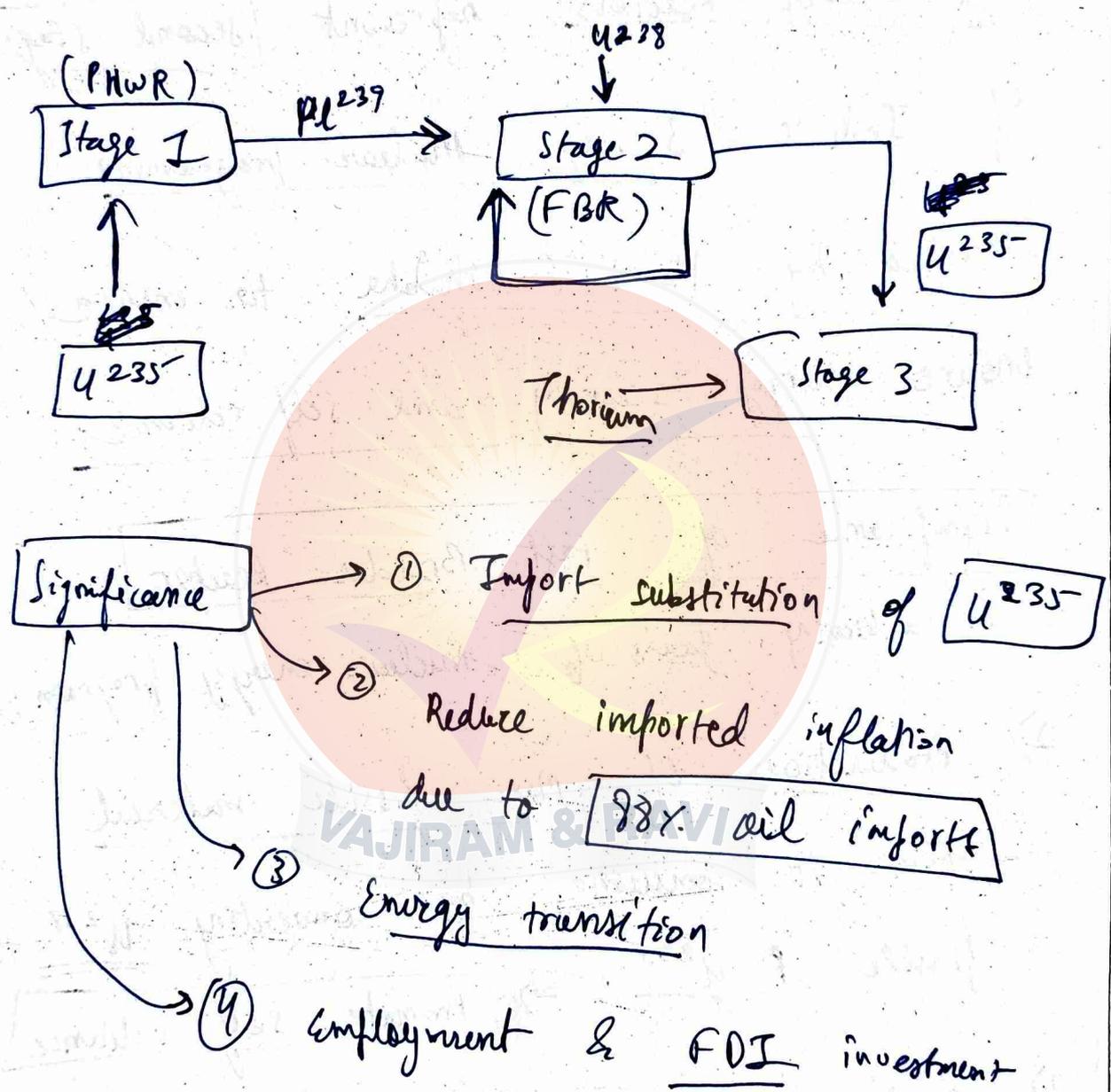
we can safeguard our pristine

Biodiversity hot-spots.

Q4

Fast - Breeder Reactors represent second stage of India's 3-Stage Nuclear programme developed by Homi J. Bhabha to ensure. Insure energy security and self reliance.

Significance of Fast Breeder Reactor

in achieving goals of Nuclear energy program :-

1) Production of more fissile material than it consume by converting U^{238} to fissile U^{235}. ⇒ Promote self reliance

2) Utilization of waste plutonium ^{239} from first stage of Pressurised heavy water reactor ⇒ Promote waste reduction

3> Promote energy security through off-grid deployment in remote areas.

(PHWR)
Stage 1 → Pu^{239} → U^{238} ↓ Stage 2 (FBR) → U^{235}

↑ U^{235}

Thorium → Stage 3

Significance →

① Import substitution of U^{235}

② Reduce imported inflation due to 83% oil imports

③ Energy transition

④ Employment & FDI investment

Thus, by amending Indian civil nuclear liability Act, we can foster more private sector participation

QS

India Green hydrogen Mission aims to produce 5 MMT of Green H_2 by 2030 to promote net-zero economy by 2070 & achieving Panchpran goals.
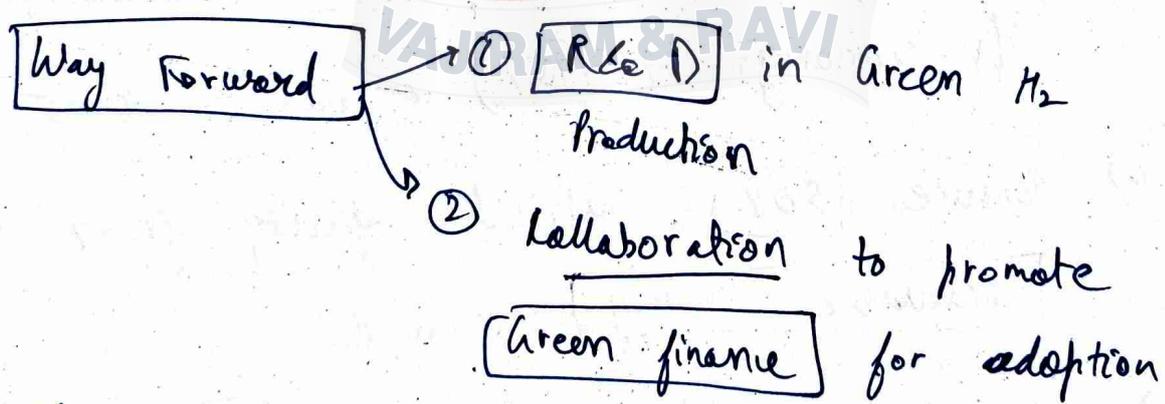
Significance towards Climate Goals.

1) Promote clean energy production free of CO_2e. ⇒ Reduce carbon intensity of economy by 45% compared to 2005

2) Ensure 50% installed capacity from Renewable energy (Green H_2)

3) Promote EVs based on fuel cells as suggested by Tarun Kapoor Committee

(4) Reduction in Pollution and Black/Brown Carbon emissions (tail pipe VOCs)

Significance towards Energy Transition

1) Align with 'phase down' as promised in COP28.

2) Promote energy security & self reliance in clean energy

3) Energy Transition in hard to abate sectors — long-haul trucks & aviation

Way Forward → ① R&D in Green H_2 Production

② Collaboration to promote Green finance for adoption

Thus, by R&D & infrastructure development in pipeline & EV, we can promote energy transition.

Q6

Mining sector in India is growing by average CAGR of 4%. however, environmental & human costs make current mining practices unsustainable in long run.

| Environmental Impacts of mining |

1) Pollution of [Rivers] 8) Acid mine drainage

2) [Heavy metal contamination] of ground water

3) [Deforestation] & land-use change

4) loss of fertile soil   5) loss of Biodiversity

| Health Impacts |

1) Black lungs disease ⇒ [Coal] mining

2) [Silicosis] ⇒ lung cancer in [Asbestos] mines.

3) Development defects in foetus due to heavy metal Pollution

4) | Cancer | in uranium mining areas g) | Jaduguda |

| Measures to promote Sustainable mining |

A) Environmental   Health & Social

1) Environmental impact assessment   1) Health impact Assessment

2) | Green technologies | to reduce emissions   2) Regular Medical Check-ups.

3) | Water circularity | to prevent scarcity   3) Zero-Waste discharge

4) | CAMPA | donations → reforestation   4) | Pollutant sensors | through RFID & IoT

Thus, by above measures we can ensure | SDG-3 | Good health for all & | SDG-15 | protection of life on land.

Q.7

With the discovery of Poly metallic Modules, Polymetallic Sulphides & Cobalt rich crusts in Indian ocean & south china sea, world is witnessing new 'Mineral Reash' for deep-sea minerals.

⇒ Deep Sea Mining refers to mining in the Abyssal Plains area of ocean
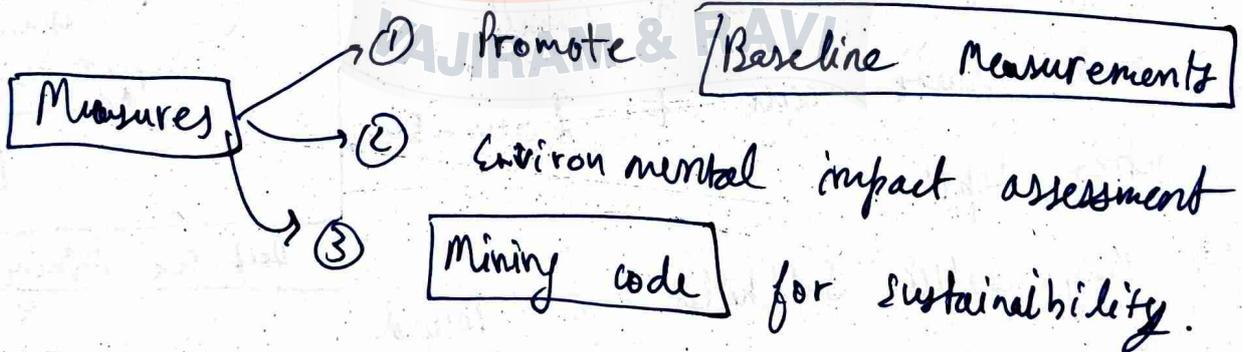

Deep Sea Mining

⇒ Poly metallic modules & Cobalt rich crusts occur at 2000-5000 metres depth.
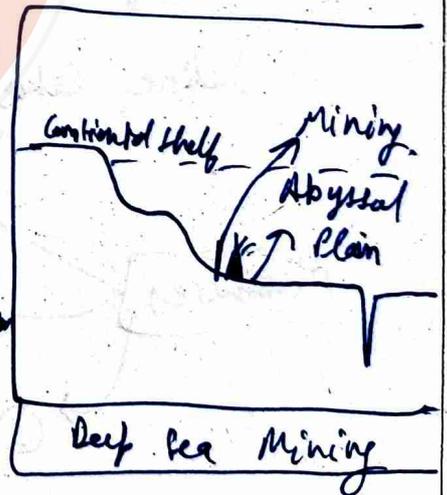
⇒ Poly metallic Sulphides are found near hydro thermal vents in deep seas.

Long-Term Changes to sea-bed ecosystem

1) Disruption of `Dark-oxygen` production near metal nodules due to electric voltage.

2) Displacement of `Benthic species` y) eels & Annelida worms y) ~~flat f~~ ribbon worm.

3) Changes in salinity of deep sea → making it unfit for sensitive species.

4) Disrupt Breeding & Migration cycles of species.

5) Disruption of unique - under-sea - Saline lakes.

Measures
① Promote `Baseline Measurements`
② Environmental impact assessment
③ `Mining code` for sustainibility.

Thus, India collaborate with ISA to promote sustainable deep sea mining through ~~Matysa~~ Matsya 6000 project.

Q8

Deep fakes are <u>AI generated Images</u> through complex [Convolutional Neural Network] processing of images & <u>super-imposcition</u> of computer generated Imagery, posing significant challenges to our perception of truth.

[Challenges posed by Deep fakes.]

1) <u>Close to real imagery</u> → illusion of truth

2) Utilization in <u>cyber crimes</u> eg> <u>Voice overs</u> <u>Phishing</u>

3) [Rumours] provocation ⟶ [riots]
   eg> <u>Pune Riots, 2025</u> - August

4) Increase in [trust-issues] disrupting <u>social capital</u>.

5) <u>Blackmailing</u> & <u>Extortion</u> eg) <u>AI generated</u>
<u>pornography</u> of <u>Archita Phukan</u>.

6) | Haves' & Have nots | — leading to
rise in <u>inequalities</u> among small & large
Corporates. eg) <u>Kollywood Movies</u> ChI

| However, there are ~~too~~ some positive
impacts |

① <u>Special education</u>
for differently ables

② <u>Artistic</u>
development
eg) <u>Ghibli</u>.

③ Virtual
Reality
development

④ <u>Awareness generation</u> Campaigns

Thus, by regulating the use of deepfakes
and ChI by '<u>Sand-box</u>' approach , we
can ensure positive <u>utilization</u> of this tech.

Q9

Tropical Rainforests are alias for Coral reefs which although covering [1%] of ocean floors host [25%] of marine species, much like high species richness of tropical rain forests.

Serious threats to Tropical Rain forest of Ocean	
Anthropogenic	**Natural**
1) Ocean Pollution e.g) Plastic	1) Marine Heatwaves
2) Eutrophication → "Coral Smothering"	e.g) Great Barrier Reef
	2) Coral Disease Outbreak
3) Ocean warming due to anthropogenic CO_2 emissions	e.g) white Band disease in Carridean Corals.
	3) Sea-level Changes
4) Bottom Trawling & explosive fishing	4) El-Nino & La Nino → ocean warming

Measures to Rejuvenated Corals

1) [Bio-rock] Technology ⟹ <u>Artificial Ref generation</u>

2) [Sound-wave] promoted [Coral breeding]

g) [Coral reef Acoustics] promoting breeding in lab.

3) [Calcification] of <u>Corals</u>. through <u>geo-engineering</u>

4) [Marine Conservation Parks.] under Kunming ~~Montreal~~ Biodiversity framework - <u>30x30</u>

5) International <u>Collaboration</u> on [R&D] & protection   g) Coral Triangle

Thus, by adopting holistic approach we can achieve [SDh 14] - <u>life below water</u>.

Q10

As per UNISDR, disaster resilience refers to enhancement in "capacity to cope", reduction of vulnerabilities and exposure to disaster.

$$Disaster\ Risk = Hazard \times Exposure \times Vulnerability$$

= Sendai Framework

Consequences of damage to Critical Infrastructure

1) Disruption of critical services → Power, connectivity

2) Food insecurity => damage to storage infrastructure

3) Health → epidemics due to vector Borne disease

4) Disruption of hospitals, & schools.
   ↳ retard sustainable development goals
   SDG - 3 & 4.

Significance of Building Disaster Resilient Infrastructure

Ⓐ [Hazard Risk] Reduction :— 1) Resilience to natural disasters eg) Smart cities → Flood management

2) [BIS] & GRIHA codes ⟹ Resilience to Earthquake

Ⓑ [Exposure] :— 1) Highways reinforcement in mountainous regions ⟹ landslide Prevention.

2) Monitoring & Early warning Infrastructure
↳ eg) INCOIS , ISRO Atlases

Ⓒ [Vulnerability]

1) Storm shelters → Protection to Tsunami & cyclone.

2) [Hondsbossche Dunes] → Netherlands - wave Breaks -

Thus, we should focus on NDMA guidelines, & nature based solution to promote disaster risk resilience

Q1|

Cloud Computing refers to storage of data, processing and transmission through centralized Cloud based network.

Use of Cloud computing in Homes for automation and device control :-

Cloud Network.
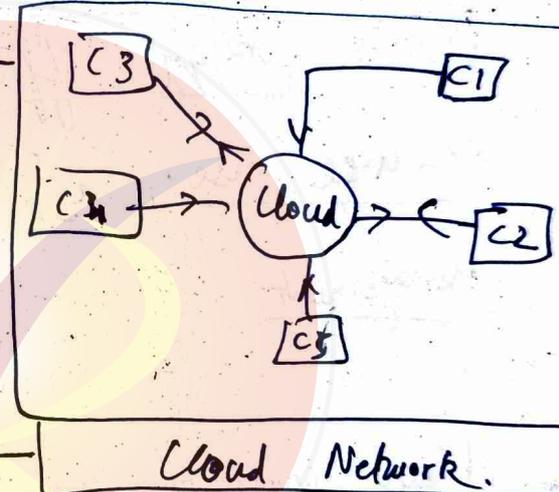
1) Centralized Connection of digital devices.

2) Interconnected Control eg) Controlling AC, TV with mobile.

3) Seamless & hassle free - experience

eg) [Locking of Home] → Start Car & AC in Car

4) Promote efficiency and enhance * technology

exposure.

Benefits of Cloud computing & Automation

1) Promote **Internet of Things** (IoT) to enhance user - experience

2) Promote **energy efficiency** & minimize resource use.

y) Automatic home power management

3) Cloud computing ensure easy accessibility of large processing power for rent reducing inequalities.

4) Save storage expenditure & hardware related to computing

5) Promote B **Robotics integration** at homes.

6) Boost further research.

7) Promote <u>upstream & downstream industries</u> & service providers.

| Challenges of Cloud Computing at Home |

1) Risk of | Privacy Breach | → Snooping

2) Intentional <u>Sabotages</u> eg) <u>Automatic & home</u> <u>locking, Car Sabotage</u>

3) <u>Surveillance</u> <u>Risk</u> & <u>Stalking</u>

4) Breach of <u>Cloud database</u> → data a theft.

Thus, we need to promote cyber-security through <u>Gulshan Rai</u> Committee recommendation on <u>cyber forensics</u> & indiginous Capacity development.

Q12

India spend only 0.7% of GDP on research & development against 2.6% of China leading 'fund starved' research and uncoordinated research.

| Major Challenges Facing India's R&D |

(A) | Scale Issues | :— 1) siloed research in universities

2) ~~only~~ Majorly large firms participate
   ↳ leave behind MSMEs,

3) Lack of National level research labs

(B) | Coordination Issues |

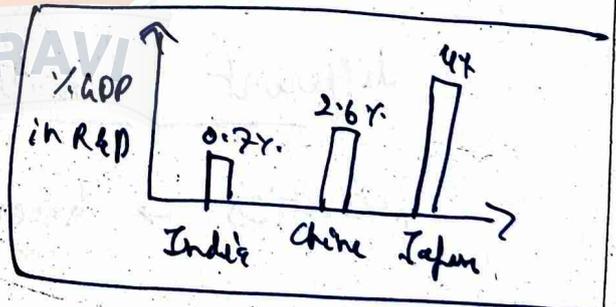1) lack of Industry – Academia – Government

Participation.

2) lack of Coordination among different IITs & between IITs & State Universities.

3) lack of <u>Government led</u> research promotion aligned with national priorities (unlike China)

| Investment Issues |
---

1) only 0.7% investment on Research

2) <u>Fund Starved</u> State Universities.

3) lack of <u>Private Investment</u> ⇒ only 11% expenditure of Private in R&D (Economic Survey 2025)

Reforms to Make Indian R&D Competitive

1) Private Participation through [NSF]

2) Involve [Schools] in R&D through Atal Tinkering Labs.

3) Promote Tax-breaks and lower regulatory burden for [FDI] in R&D

4) Targetting [0.1%] increase per year in R&D through budgeting.

5) National Science Commission to align different universities towards National priorities → Green tech, Biotech & Space Tech.

At last, promoting entrepreneurship in [STEM] through Stand up India can promote scale & competition in R&D.

Q13

Gaganyaan Mission is set to be India's first Creued space-flight mission which will enhance India's capabilities towards future Missions like Bharatiya ~~Antarix~~ Antariksha Station (BAS)

Primary Objectives of Gaganyaan Mission

1) First Creued flight by 2027.

2) Development Of Human-rated Spacecraft GSLV-3-HR

3) Development of indigenous cryogenic engine

4) Development of reusable launch vehicle

5) Training of Crew for space missions.

6) Development indigenous private sector through INSPACE to reduce ISRO's burden

Impacts on India's space exploration

1) Boost India's goal of manned flight to moon.

2) ~~Develop~~ Promote Microgravity research and its impact on Humans.

3) Promote indigenous space sub-systems & launch vehicles.

Impact on space & scientific capabilities

1) Boost further development of Bharatiya Antariksha Station

2) Development of reusable rockets reducing costs

3) Enhance Private sector & startups with

Space technologies

4) Promote India as |launch service to ISS|

5) Promote upstream & downstream services

y) subsystems & tourism respectively

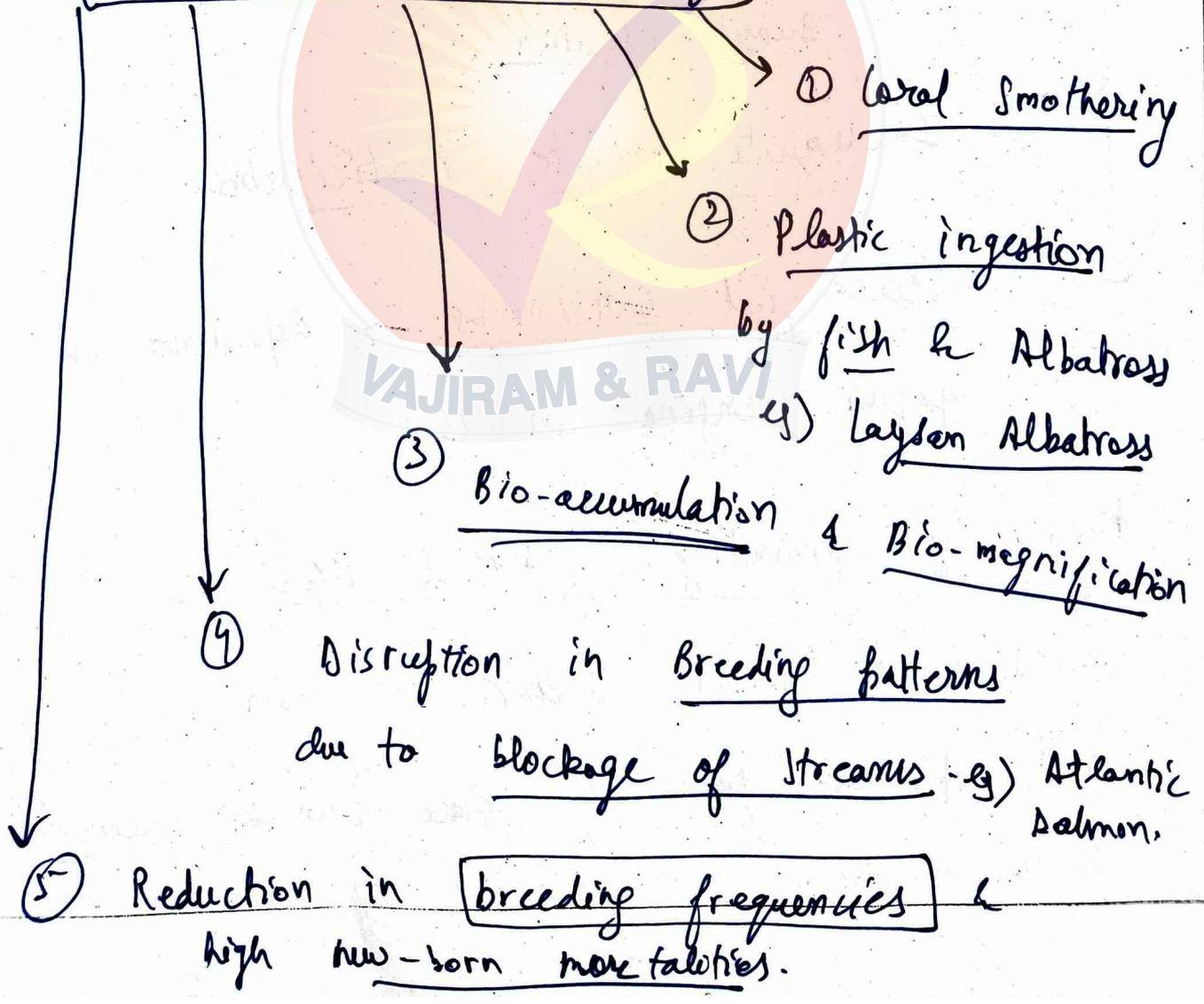|Challenges| → ① |High Initial Cost|

        ↳② lack of adequate Funding, low Budget allocation.

        ③ Inadequate Private Participation

        ④ Technological Bottlenecks → dependence on cryogenic engine on US.

Thus, by promoting targetted R&D & incentivizing private sector we can speed up our goal of ~~Space~~ - human crewed space mission.

(14)

Recently scientists in Japan found Micro-plastics in Placenta & human brain raising concerns over marine plastic pollution threats on biodiversity & coastal ecosystems.

Threat to Biodiversity

① Coral Smothering

② Plastic ingestion by fish & Albatross
4) Layson Albatross

③ Bio-accumulation & Bio-magnification

④ Disruption in Breeding patterns due to blockage of streams -eg) Atlantic Salmon.

⑤ Reduction in breeding frequencies & high new-born mortalities.

Impact on | Coastal Communities |

1) Loss of beach aesthetics & tourism economy erosion eg) Juhu Beach.

2) Loss of livelihoods & rise in poverty risk
⇒ Reverse | SDG-1 | - zero poverty.

3) Threat to | food security | → Collapse of fish stocks ⇒ Reverse | SDG-2 | - Zero Hunger

4) Human health vulnerability due to micro plastics accumulation → | Renal failure |

Mitigation Measures to reduce Micro plastic pollution

1) Trap plastics from sewage life through nets (Australia)

2) | Bio-plastics | development → | IIT Roorkie |

3) Ban on Single Use Plastics under Indian Plastic waste management Rules.

4) Extended Producer Responsibility

Internacional Measures

1) Direct → Global Plastic Treaty Negotiations

⇒ India's demand on Comprehensive ban.

2) Basel Norms on transboundary waste transportation (indirect)

Thus, by global collaboration & SDG-17 'Partnerships', we can collective address marine plastic pollution through behaviour change & technology.

Q15

Lancet Report 2020 reported 8.8 million premature deaths due to Air pollution in ~~2024~~ 2018-2020 highlighting grave concern of air pollution for health & environment.
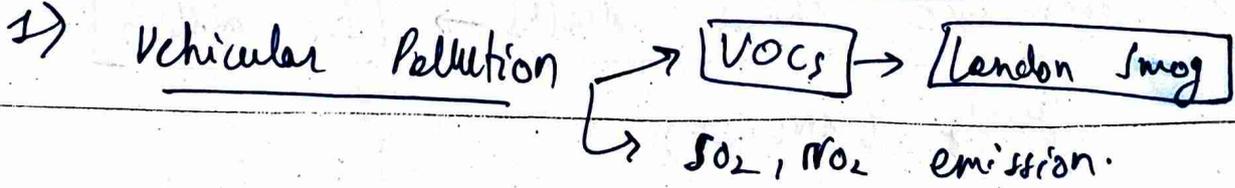
```
┌─────────────────────┐      ① Asthma cases
│ Critical Problem    │──→
│ For Public Health   │──→  ② Loss of lung capacity
└─────────────────────┘          & Cancer
```

```
┌──────────────────────────┐   ① Premature loss of
│ Problem for environment  │──→        leaves of plants
└──────────────────────────┘
       │              ② Reduction in Pollinators (UK study)
       │
       └──→ ③ River Acidification (Acid Rains)
```

┌────────────────────────────────────┐
│ Causes of of Urban Air Pollution   │
└────────────────────────────────────┘

1) Vehicular Pollution ──→ │VOCs│ ──→ │London Smog│
        └──→ SO_2, NO_2 emission.

2) <u>Indoor Air Pollution</u> → Paint, <u>Varnish</u> & <u>wooden upholstery</u>

3) Open <u>Waste incineration</u> & <u>Waste to Energy plants</u>

4) | Landfill pollution emissions | → | CO | , NO_2 etc

5) | Nearby stubble burning |

| Natural Causes | → "Bowl effect" of Delhi

└→ Temperature Inversion

winds converge

| Consequences of Air Pollution |:-

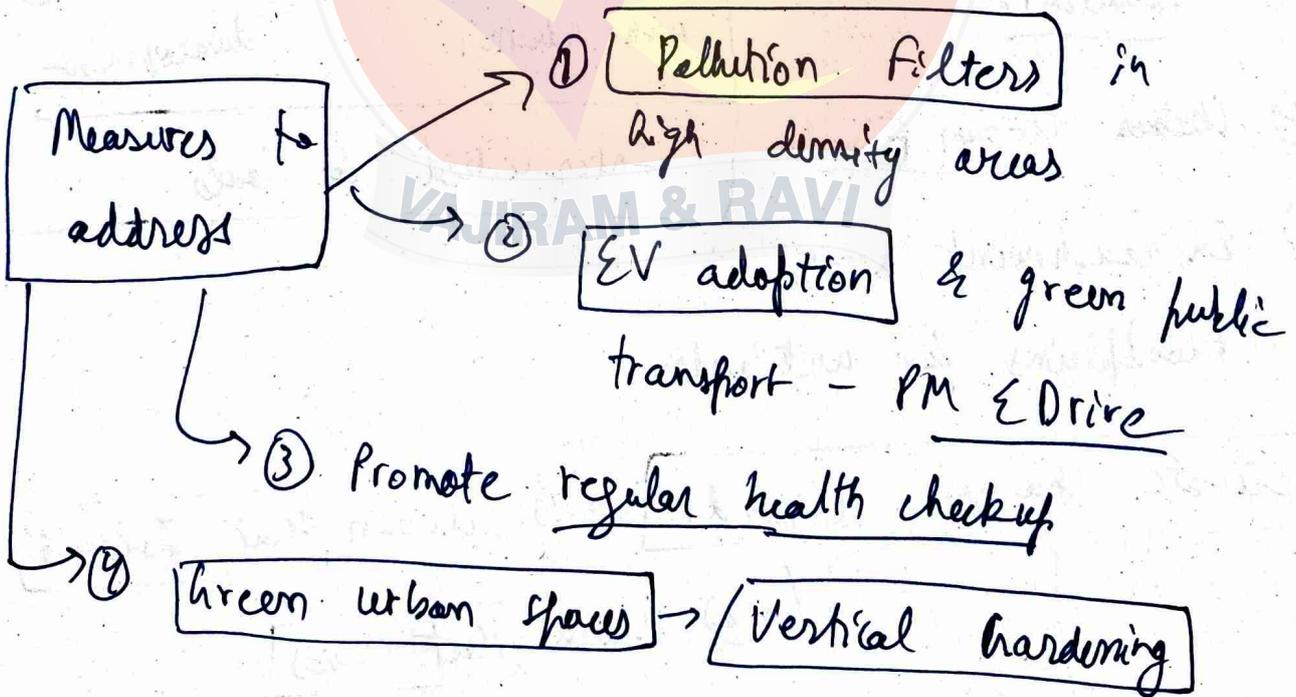1) ↑ loss of | DALYs | in urban areas.
(10 years loss in Delhi)

2) Premature child deaths → | 1.7 million | yearly (UNICEF)

3) [Environmental Impact] → loss of pollinators & primary productivity in plants

4) [Social Impact] → Rise in [inequalities]

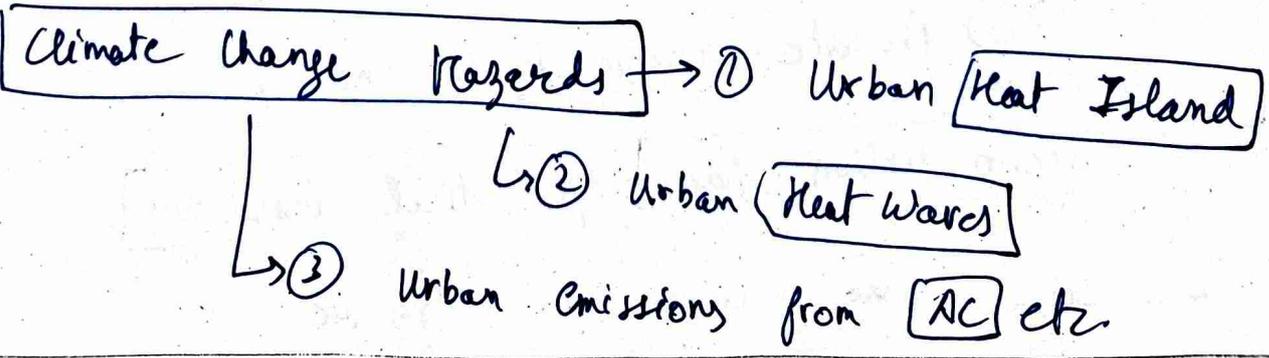g> [Open slum houses] → more vulnerable

5) Impact on [Women & children]

Solid cooking fuel   outdoor play

① [Pollution filters] in high density areas

Measures to address

② [EV adoption] & green public transport – PM EDrive

③ Promote regular health checkup
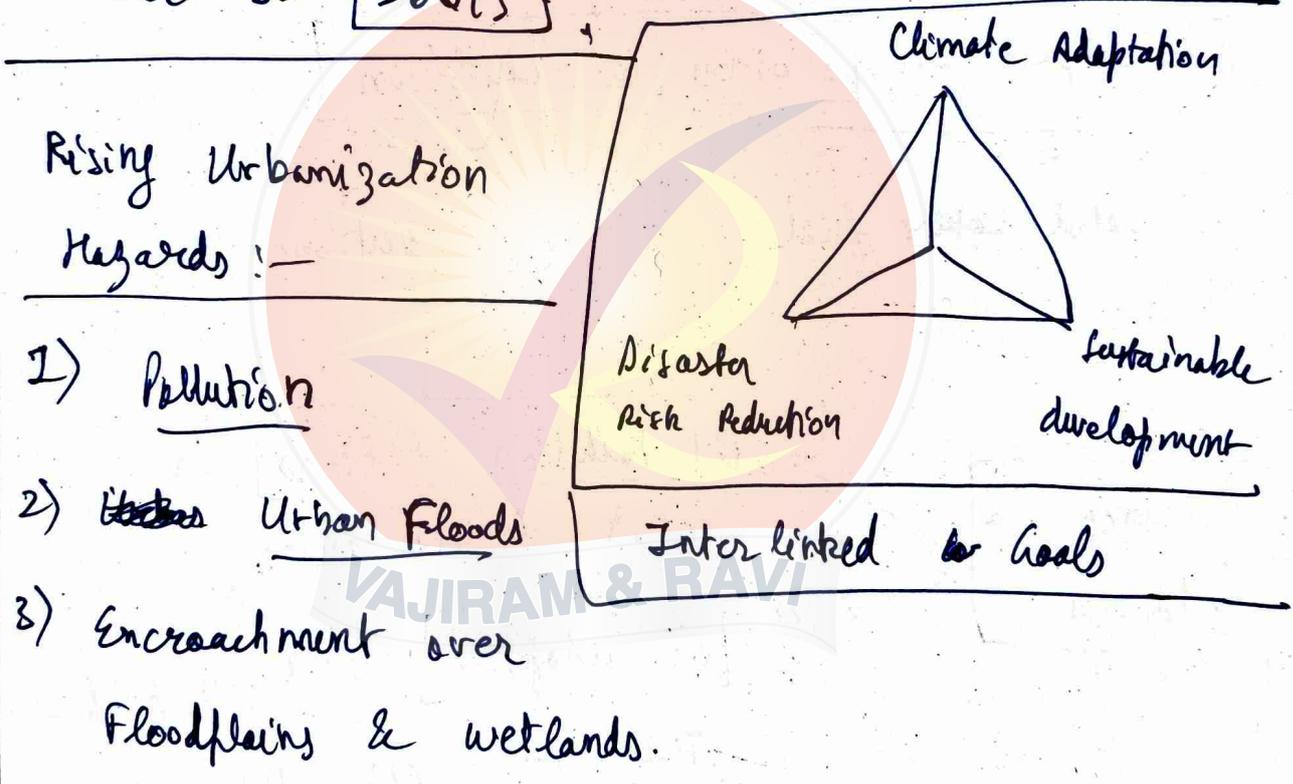
④ [Green urban spaces] → [Vertical Gardening]

are some new measures to promote [Smart cities] & pollution free cities.

Q 16
(b)

As per Sendai Framework, Climate Change
and disaster management are interlinked
must be incorporated into development goals
under ~~the~~ SDGs ,

Rising Urbanization
Hazards :—

1) Pollution

2) ~~Urban~~ Urban Floods

3) Encroachment over
   Floodplains & wetlands.

Climate Adaptation

Disaster
Risk Reduction

Sustainable
development

Interlinked to Goals

Climate Change Hazards → ① Urban Heat Island

↳② Urban Heat Waves

↳③ Urban Emissions from AC etc.

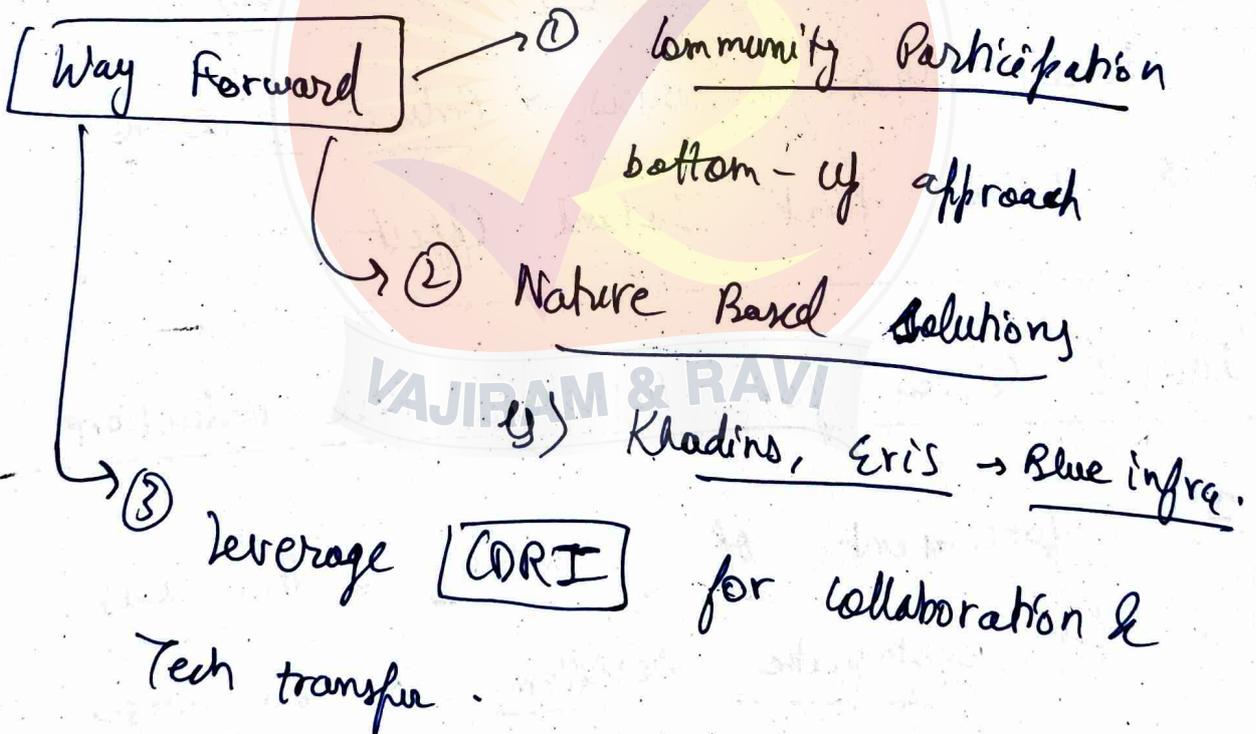Leveraging Smart Cities mission for
Mainstream Climate Resilience

1) Development of Passive Cooling Buildings

2) Promote Green-Blue-Infrastructure

   4) vertical Garden, green corridors

3) Urban Green Mobility 4) EV cars &
Green Hydrogen Buses → Reduce emissions
& Urban Heat Island Effect

SMART Cities for Disaster Risk Reduction

1) Enforcement of GRIHA & BIS codes
for Earthquake resilience & low energy
Consumption

2) Maintainence & upgrade Storm drains
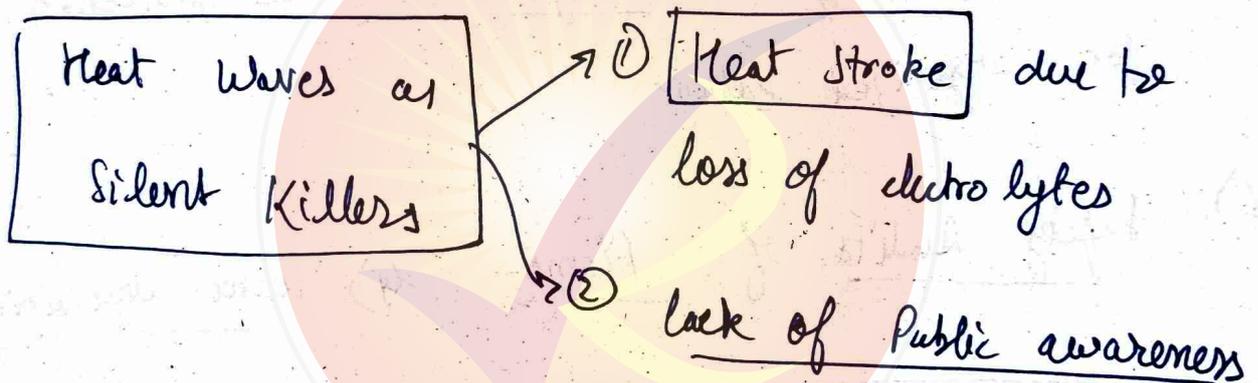& sewage system (Isher Judge Committee)

3) [Sponge cities] development to prevent urban flooding (Singapore model)

4) [Integrated Governance] like [Gati shakti] between different departments y) Health, Fire, Police, Administration.

[Way Forward] → ① Community Participation
bottom - up approach

→ ② Nature Based Solutions
y) Khadins, Eris → Blue infra.

→ ③ leverage [CDRI] for collaboration & Tech transfer.

Thus, by collaboration, governance & technology development we can promote resilient smart cities.

(9)7

Heatwaves refers to 4-6.5°C higher temperature than long-term average when current temperature reaches above 40°C on plains & 30°C on mountains.

Heat waves as Silent Killers
→ ① Heat stroke due to loss of electrolytes
→ ② lack of Public awareness

Heat Action Plans Significance

1) Development of Early Warning systems.

2) Public awareness campaigns & social media awareness drives.

3) Development of Governance strategies.

3) Incident response plans

4) [Structural Measures] → doctors training
   ↳ enhancing hospital capacity & beds
   ↳ water-points & shadow-zones.

5) Regulation of working hours & protection for organized labour

6) Safety Audits of Firms- 4) Water availability

[Deficiencies] → ① 'Not notified' disaster under NDMA
   ↳ ② State expenditure limited to 10% under [SDRF] allocation

Others Measures to Promote Resilience

1) Amend NDMA to make heat waves notified disaster.

2) Understanding Disaster Better through national centre for research

3) Integrated ~~reserven~~ Governance & interagency coordination. y) Police - DDMA & NDRF

4) Non-Structural Measures → Heat safety Bye laws

5) Structural Measures → Development of water - points & community centres.

6) Climate - change Adaption → Machine learning Model to predict heat wave & last mile dissemination.

~~have~~ ~~the~~ These measures can promote effective Heat Wave management as for PM 10 point programme.

Q18

India's <u>NDMA</u> <u>guidelines</u> deal with <u>Chemical,</u>
<u>Biological</u>, <u>Radiological</u> & <u>Nuclear</u> (CBRN)
<u>disasters</u> to ensure hazard risk vulnerability
reduction & efficient disaster management

Effectiveness of India's Institutional Mechanisms

1) $\boxed{AERB}$ → Provide <u>safety</u> regulations.

     ↳ <u>safety audits</u> of nuclear plants

     ↳ <u>Independent</u> analysis of safety performance

2)) $\boxed{Legal}$ — $\boxed{Civil\ Nuclear\ liability\ framework}$

    → Technology <u>developers</u> accountable for
disasters.

    ⇒ <u>compensation mechanisms</u> for victims.

⇒ Producers responsibility for management of disaster and prevention

Deficiencies in Institutional Framework

1) Allegation of lack of independence of AERB as regulator.

2) Surface - level checks and audits by AERB.

3) Conflict of Interest as AERB & nuclear power plants are government entities.

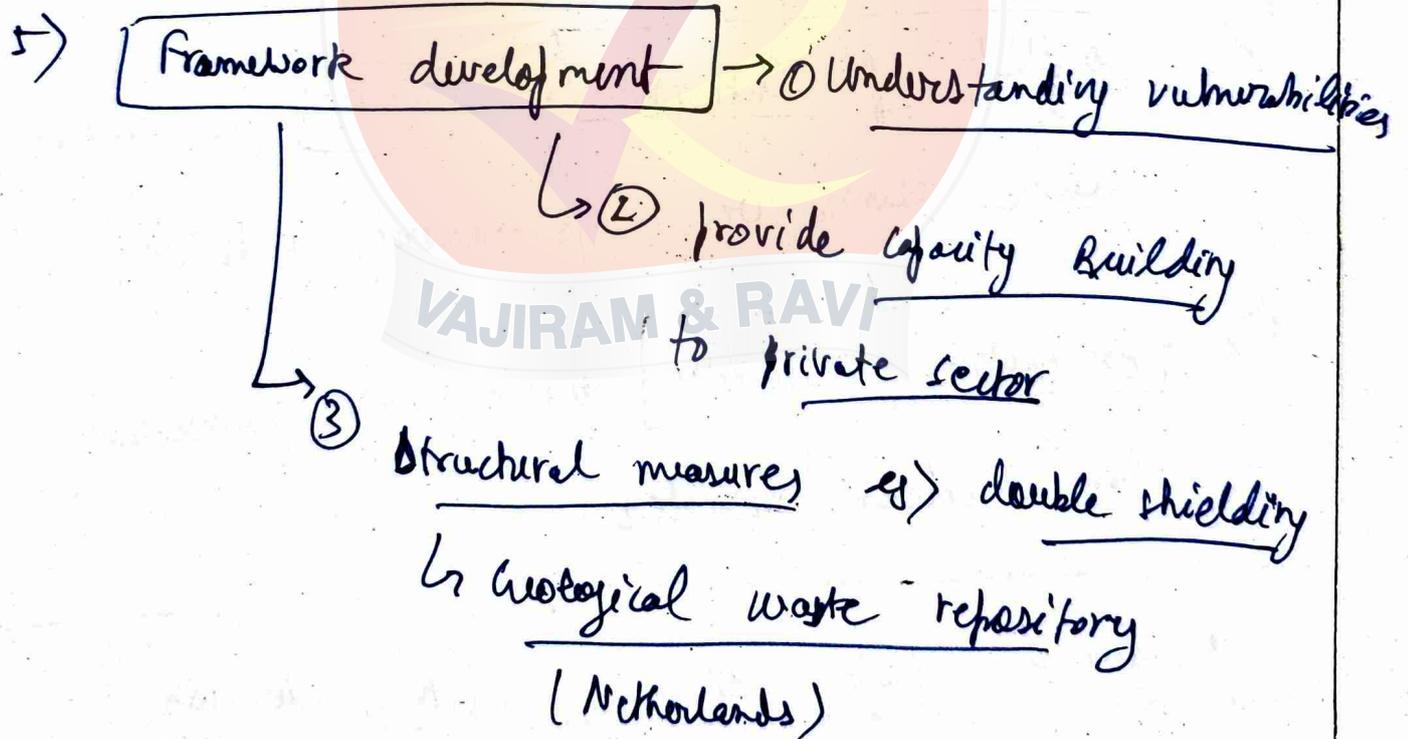4) Excessive liability burden on producers for nuclear disaster.

Measures for disaster Risk Reduction

1) Expert & Independent Regulator for Nuclear sector safety

2) Third-party safety audits by independent firms appointed by <u>AERB</u> along with <u>CAG</u>.

3) [Liability Sharing] between Government & private entity (Ukraine).

4) Regular safety checks by Intra-Company vigilence.

5) [Framework development] → ① Understanding vulnerabilities

↳ ② Provide capacity Building to private sector

③ Structural measures eg) double shielding
↳ Geological waste repository
(Netherlands)

Thus by above measures, we can address 'Not in my backyard phenomenon' & Attract [FDI]

Q
19

Wearable Technology refers to smart watches, portable health monitors etc, which provide medical information about personal health. for example Apple, samsung smart watch.

| Wearable Technology Reshaping Personalized Medicines |

1) Targeted Intervention as per personal health statistics.

2) Enhance information into patient lifestyle and medical history

3) Precision Medicine & effective monitoring

4) Promote Personal lifestyle intervention

over drug dosages. ⟹ promoting sustainability

5) opportunities for data analysis &
early warnings through AI models. &

Challenges Posed by such technology to
public health infrastructure

1) Cyber Vulnerability — 1) Personal data
Breaches

2) Targeted Advertisement through personal
data misuse & sale.

3) Create new digital divide between poor
& rich - 'Haves & Have nots'

4) Inadequate doctor & nurse training on
digital technologies.

5) Fiscal Burden on government on database

management & security infrastructure.

> Measures to sustainably Integrate wearable Technology to public infrastructure

1) Convergence between schemes. eg) Ayushman - Bharat and Digital Public Infrastructure.

2) One = Health approach → Community - level disease surveillance

3) Training & capacity Building of doctors.

4) Integrate with e- Sanjeevani

5) Encrypted storage Storage (National Quantum Mission)

These measures ensure sustainable & smart Healthcare infrastructure

Q20

Recently government of India launched Bio E3 policy to promote Biotechnology integration into several sectors to promote 3 Trillion economy development in Biotech sector & replicate success of IT boom.

Key Features of Bio E3 Policy

1) Promotion of Employment

→ Training & skill development

→ R&D & high skill jobs.

2) Economy → Promotion of Exports and biotechnological products

3) Environmental conservation grow through

'Grey Biotechnology'

Alignment with 3-Trillion Economy

1) Promotion of [Health] and medicines.
   → 'Red' Biotechnology ⟹ CAR T-cell therapy

2) Encourage [Agricultural development] through [Green Biotechnology] → HYV seeds, Pest resistant crops.

3) [Climate Resilient Economy] → Promotion of dry land & arid agriculture (Drought resilient varieties) under Brown Biotechnology.

4) Promotion of [exports] eg> [Aquaculture] development & disease resilience (Blue — Biotech)

5) [Environment conservation] → Grey Biotech

eg> Oil Zapper Bacteria genetic engineering

Major Challenges in Implementation

1) [Low R&D investment] eg> 0.7% of GDP

2) Lack of University level research
   ↳ Concentration in private sector

3) Inadequate ~~Regulatory~~ ease of doing
   business → eg> Multiplicity of licences.

4) Lack of Trade treaties allowing GMOs

5) Public apprehension and threat of
   loss of gene diversity.

By promoting Industry - academia
linkage, we can promote 3 trillion economy
in Biotech Sector.