

GS SCORE

BATCH - II
TEST - 7

GEOGRAPHY, DISASTER MANAGEMENT, SCIENCE AND ENVIRONMENT

Time Allowed: 3 hrs.

Max. Marks: 250

Q:	Marks	Instructions to Candidate
1.	2.5	<ul style="list-style-type: none">• There are 20 questions.• All questions are compulsory• The number of marks carried by a question is indicated against it.• Answer the questions in NOT MORE THAN 200 words each. Contents of the answer is more important than its length.• Answers must be written within the space provided.• Any page or portion of the page left blank in the Question-answer Booklet must be clearly struck off. <p style="text-align: right;">25/9/2017</p>
2.	3	
3.	5.5	
4.	5	
5.	4.5	
6.	4.5	
7.	3.5	
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9.	3	
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17.	5.5	
18.	5	
19.	5.5	
20.	4.5	

1. Invigilator Signature

2. Invigilator Signature

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Date 24 Sept 2017

Signature Abhisri

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ES SCORE

GS MAINS TEST SERIES 2017

Q1. What do you understand by biological disaster? While listing the workplace and occupations prone to biological hazards, discuss the preventive and control measures that are required to be taken at these places. (12.5 Marks)

Biological Disasters

→ These are disasters that involve biological agents like lethal viruses, bacteria & others to cause large scale harm & destruction to human life.

Workplace prone

① Hospitals - due to contaminated use of medical tools, spread of epidemics & infection.

② Research labs - where medical research is ongoing like genetically modified organisms, developing new medicines etc.

→ Leakage of harmful chemicals or agents
→ contamination

③ Outer space - may be a source of future biological disasters due to alien species.

④ Biological terrorism is another rising threat.

Preventive & control measures

① Prevent such disasters by taking steps like sanitising hospitals, medical labs, R&D workplaces, space stations etc.

② Set up a standard operating procedure in cases of threat, emergencies & even disasters.

③ Develop technology to deal & prepare for such disasters.

Remarks

2.5

Very General

Very
Generic
points.

- ④ Ensure capacity building for trained response.
- ⑤ Hold drills, inspections.
- ⑥ Spread awareness, ~~ban~~ ~~broken~~ enforce safety protocols.

Remarks

Q2. Water resource augmentation, conservation, efficient utilization will be very important determiner of India's future development. What is the status of water resource in India and discuss needs for its conservation and efficient utilization. (12.5 Marks)

Despite having 2.4% of world's area, 16% of its population, India only has 4% of world's water resources. Hence conservation & efficient & optimal use of water is critical due to its limited availability.

STATUS of water resources

① Very limited water is available as freshwater - most is either frozen as ice caps or glaciers or flowing as salty water in oceans.

② Due to unpredictable & variable monsoon, water availability is uneven spatially & temporally.
 → Highest rainfall in Mawsynram
 → Drought in part of Rajasthan

Also discuss groundwater

③ Due to large population, per capita water resource is very low. How much 11500 BCM

④ Inefficient use of water - high water wastage - in domestic, agricultural & industrial use.
 Eg: Depleting ground water levels

⑤ Pollution of water - from agriculture, industry & domestic use.
 → Ganga pollution etc.

NEED for conservation & efficient use

① Water is a critical resource necessary for all aspects.
 → Drinking water → Sanitation → Agriculture & Food security

Remarks

- Industrial application like leather etc
- ② Due to its limited availability, due care given to conservation & efficient use
 - ③ Also important to sustain biodiversity - flora & fauna.
 - ④ Due to competitive use of water - increasing urbanisation & changing lifestyles, critical to ensure optimal water use in all sectors.

Steps like monitoring ground water levels, efficient agriculture, watershed development, rain water harvesting, probing of water to curb wastage etc ~~will~~ help.

- Need for conservation
- ↳ ↑ popⁿ demands judicious use
 - ↳ ↑ agri. productivity & prodⁿ requires water
 - ↳ ↑ industrialisation requires water
 - ↳ to reduce inter state conflict
 - ↳ To maintain the environmental sanctity i.e. flora & fauna

Remarks

Q3. Renewable energy is emerging as anchor of Indian economic development. What is the spatial distribution of renewable energy resources in India? What efforts have been made to augment these resources? (12.5 Marks)

India has massive Renewable energy potential. For example in wind energy alone, it has a potential of nearly 300 GW.

SPATIAL DISTRIBUTION

① Solar Energy

→ Rich in states like Gujarat, Rajasthan, Maharashtra etc which have high intensity of sunlight for a longer period.

→ Northern & Central India (Tropical belt)

② Wind Energy

→ Coastal states & mountain valleys which have winds ~ 15 km/hr are rich.

Eg: Tamil Nadu, Uttarakhand, Gujarat etc.

③ Hydro electricity

→ Coastal states - due to tides

→ Areas with waterfalls, quick flowing rivers like Brahmaputra in North East (Arunachal Pradesh, Meghalaya etc).

④ Geothermal Energy

→ Hot springs like Puga valley in Ladakh & Manikaran stream in Himachal Pradesh etc.

⑤ Waste to energy - all rural & urban waste treatment plants

EFFORTS to augment

① A target of 175 GW of Renewable energy by 2022 has been set

100 GW - solar, 50 - wind, 10 - Hydro, 5 - waste to energy

Intro should fairly match with the demand of the question

good

Remarks

- ② Target of 40% total energy output by non-fossil fuel sources in Paris Climate Deal by India (INDC)
- ③ Financial incentives like tax breaks & exemptions, subsidies, cheap loans (IREDA), accelerated depreciation, priority sector lending in credit etc
- ④ Mapping of potential by schemes like Wind ^{atlas} solar mapping etc
 → Exploration is encouraged (HELP)
- ⑤ Awareness is spread about potential benefits
- ⑥ Private sector, International collaboration for finance, technology & capacity building (Solar mission scheme)
- ⑦ R&D, technology encourage to further reduce tariff
- ⑧ Policy steps like amending Tariff policy for fixing Renewable energy generation & purchase obligations by industries, BS VI fuels etc
- ⑨ Developing Carbon market like PAT, CDM in Kyoto protocol etc

55

Good

Work on introduction & conclusion

Remarks

Q4. What do you understand by energy security? How India should develop its energy mix to assure sustainable energy access to its people? Also discuss the steps taken by government in this direction. (12.5 Marks)

Energy Security

→ It means having sufficient availability of energy } quantity
per capita to ensure a basic standard of living

→ It means having power ~~24x7~~, reduced } quality
outages

→ It means power is affordable & accessible to all } inclusive
regardless of social, economic or geographical factors

→ It also includes environmental sustainability.

→ For all ~~at~~ below steps must be made efficient.

Fuel → Generation → Transmission → Distribution → Consumption

Sustainable access to people

① To ensure energy to each & every citizen, flexibility required - off grid solutions for remote villages like solar, wind or ^{small} hydro ~~water~~ energy solutions.

② Along with increased domestic energy production, in the grid, international options must be tapped for energy import.

→ Oil import from Middle East → ^{Natural} Gas from Iran
→ Hydroelectricity from Bangladesh etc.

③ Transmission must be strengthened - lay more ~~land~~ lines, reduce AT & C losses etc.

→ Green corridor for Renewable energy transfer

④ Renewable energy potential of each region developed by infrastructure, investment, capacity building, awareness,

Remarks:

- Also add the usage of thermal energy.

Very good

private participation, R&D. etc.

STEPS TAKEN

- ① Ease of doing business increased by policy steps like NELP, transparent coal auctions, off shore wind energy policy, National solar mission etc.
- ② Financial incentives to encourage Renewable energy like tax exemptions, cheap loans, PSL etc, subsidies etc.
- ③ Making fossil fuels like thermal energy more efficient.
- ④ R&D, technology development in this sector.
- ⑤ Building carbon market like PA T etc.
- ⑥ International solutions like natural gas from Iran, TAPI etc.

Good

Remarks

Q5. India is the largest user of groundwater resources, which is unsustainable with visible signs emerging. Elaborate. How should India manage its groundwater resources with sustainable use? (12.5 Marks)

India used its ground water resources in an exploitative manner

① Largest user

- Highest use by domestic houses then industries then agriculture.
- Water levels in aquifers have depleted at an accelerating rate.

② Unsustainable with visible signs

- Due to excess drawing of ground water, salt water intrusion in coastal areas.
- Lack of water increases concentration of harmful minerals like fluoride (causing skeletal Fluorosis), Arsenic (Black foot disease), Mercury (Minamata disease) etc.
- These diseases have become common & deadly.
- In areas of excessive irrigation from ground water, soil becomes saline due to capillary action & water logging.

These signs prove that over-use is unsustainable.

HOW TO MANAGE

- ① Limit over drawing of water by ensuring efficient use of water by households, agriculture & industry.
- ② Current law & sub-optimal pricing allows wastage & misuse. - curb this by putting in place reformed law to limit no. of tube wells in private lands & optimal pricing of water with subsidies for the poor.

Remarks

- A.S.
- ③ Recharge groundwater by watershed management, rain water harvesting etc.
 - MGNREGA labour may be used to built necessary tanks/trenches & other infrastructure.
 - ④ Spread awareness & educate public about judicious water use.
 - ⑤ Use NGOs, private sector to strengthen campaign.

good

Remarks

Q6. Ports are not just the facilitator of trade, but could be inclusive centers of economic development. In this light discuss the significance of Sagarmala project and its objectives. (12.5 Marks)

Ports are considered the gateway of a country to the world beyond. They have been of significance since ancient times.

Introduction is not in sync with demand of the

OBJECTIVES of Sagarmala project

- ① Port Modernisation
 - using latest infrastructure & technology to revamp 12 major ports & 100s of other minor ports.
 - Streamline process of customs, permissions etc for ease of doing business.
 - Ensure security of life & property.
- ② Connect these ports of hinterland to ensure access of facilities for all regional & social development which is inclusive.
- ③ Build industrial clusters to exploit trade & economic divers potential of ports due to their access to international countries - creates jobs for locals.
- ④ Ensure community development of locals - to rec benefits of port development. Inclusive growth.
- ⑤ Build inland waterways connecting to these ports wherever possible.

SIGNIFICANCE

- ① India has ~ 7500 km of coastline & 14000 km of potential inland waterways - this can be tapped by ports.
- ② India's location is such that it lies on many major international trade routes.

Remarks:

③ Transport by water is cheap, energy efficient & apt for bulky cargo.

[90% of India's international trade by volume by shipping]

④ Coastal & river side communities can vastly develop with ports - by jobs, economic & infrastructural facilities, private sector development, inclusive growth.

Hence sagarmala project is a step in the right direction. Other measures like construction of 106 National water ways etc will also help.

4.5

good

Remarks

Q7. Sustainability of India's forest cover lies in adoption of social forestry, examine. Also discuss what factors are hampering the growth of social forestry in India? (12.5 Marks)

Despite the National forest policy mandating 33% of forest cover in plains in India, we have only 23% of area under forests.

Social forestry can greatly help in increasing forest cover & ensuring sustainability.

- ① Social forestry means using social resources like common property resources, road side paths, public parks & even private lands to build plant trees.
- ② Such free planted areas can be used by local people for minor forest resources (fallen tree branches for firewood etc).
- ③ Used by landless agriculturists for cattle grazing etc.
- ④ Used to strengthen biodiversity of area - flora & fauna.
- ⑤ Participation of locals in forest managements increases sustainability as
 - they feel ownership, hence are driven
 - they use traditional knowledge & practices ∴ sustainable
 - invested economically in the social forest.

FACTORS hampering of social forestry

- ① Poor implementation of social forestry policy by Central, state & mainly local govt.
 - PRIs must rigorously encourage Common Property Resources instead of letting them waste in disuse.
 - Urban bodies must aggressively plant trees on road sides, public parks etc.

Remarks

21.34%

- ② Resistance to participation of locals in planning & implementation.
 → Requires sensitising & mindset change of officials.
- ③ Lack of awareness amongst locals
- ④ Poor maintenance of grounds where saplings have been planted. neglected, they don't survive.

By correcting the above factors, sustainable forests by using social forestry can be ensured.

3.5

Problems → SSFs are many
 ↳ lack of involvement of women the
 ↳ no women empowerment which was one
 of the goal of SF

↳ Overplantation of Eucalyptus trees

↳ Alienation of tribals

↳ Marginal farmers were not benefited

Remarks

Q8. Discuss the problems of agro-based industries in India. Do you think agro-based industry could be a better option to absorb, shift of labour force from agriculture. What steps has government taken to promote agro-based industries in India? (12.5 Marks)

Problems of agro based industries -

- ① Accessing agricultural raw materials from markets due to poor regulation of APMC markets - barriers & non transparent pricing.
- ② Inadequate infrastructure, capital tools, latest machines, irregular power etc.
- ③ Lack of use of genetically modified crops by farmers to give desired crops with easy processibility, seasonal nature of agriculture, crop failure etc.
- ④ Poor access to credit
- ⑤ Lack of organised cooperatives, trained labour
- ⑥ Poor transport channels to connect to markets - domestic & international barriers.
- ⑦ Lack of use of quality checks (like AGMARK, FSSAI etc) to ensure good price for quality.

Upstream challenges

Downstream challenges

Good

Never work this -
 (Yes) agro industries are a better option to absorb excess labour from agriculture

- ① Underemployment in agriculture on large scale
- ② Vertical upliftment of labourers as income will be good enhanced in socio-economic development
- ③ Agro industries are labour intensive & less require less capital
- ④ Demand for their products has increased in India & globally due to changing lifestyles
 → Demand for processed foods etc.
- ⑤ Abuse Wastage of food can be stopped

Remarks

STEPS taken

- ① Building requisite infrastructure, ^{power,} technology, capital tools under schemes like Mega Food parks.
- ② Financial incentives like subsidies, tax breaks, priority sector lending from Banks, Priority sector in Make in India policy etc.
- ③ Modernising & reforming APMC markets with steps like electronic - NAM (National Agricultural Market) for transparent price discovery etc.
- ④ Modernising transport roads, storage like warehouses cold storage etc.
- ⑤ Increasing quality regulation by FSSAI etc.

Very good

Remarks

Q9. Indian efforts in conserving tiger population are appreciable. In this reference, discuss achievements and steps taken by government to protect this magnificent animal. Also highlight some challenges which remains and need to be addressed. (12.5 Marks)

Being a tiger-rich country, India has taken many steps to protect them -

- ① Declared tiger as the national animal - emphasising its importance
- ② Enacted the National Tiger Conservation Authority act to give statutory protection to tiger reserves
→ Ensures habitat protection & tiger conservation in a focussed manner.
- ③ Signed many international treaties like SAHAN (South Asia Wildlife Enforcement Network) & Global Tiger Forum to work with other nations to protect tigers.
- ④ Strictly banned illegal trading & poaching of tigers & hunting under Wildlife Protection Act, 1972.
- ⑤ The achievement is that Tiger population in India has consistently improved & India now has one of the highest tiger populations in the world today.

CHALLENGES

- ① Habitat destruction of tigers due to increasing population, urbanisation & industrialisation
→ Eg. Panna tiger reserve to be affected by Ken-Betwa river linking.
→ Hence in such cases of conflict, alternate arrangements for land can be made.

Remarks:

→ illegal encroachments must be curbed.

② Man & animal conflict result in man-eater tigers & a nuisance for locals.

→ Proper boundary of reserves for safety of both tigers & humans.

③ Illegal poaching, hunting etc for tiger skins etc still persists.

→ Strict enforcement of laws

→ Use local intelligence

→ Use international frameworks to crack down on smugglers.

④ Availability of food & water to tigers during drought

Achievements are not discussed

Remarks

Q10. With fires raging across Central Indian forests and the Himalayan Pine forests, the frequency of such blazes has risen by a drastic 55 per cent in the past year. In this reference, discuss whether forest fire is always non-desirable? What are various reasons of forest fire and How to prevent Major Fires? (12.5 Marks)

No, forest fires are not always non desirable. They have many benefits -

- ① Due to burning of trees, the soil is enriched with new minerals hence becoming fertile for future growth.
- ② Wild & undesirable plant species like weeds, exploitative grasses etc are wiped out to give a healthier ecosystem.

REASONS for forest fire & steps to prevent them

- ① The ^{natural} oak plantations in Mountain temperate forests have been widely replaced by pine trees. These pine trees are vulnerable to fires hence leading to increased forest fires.

→ Natural vegetation of a region must not be completely replaced.

→ Oak & maple trees must be replanted.

- ② Careless tourists or locals may unintentionally leave a matchstick behind or start a camp fire & start a forest fire.

→ Regular policing of local forests by community policing will help in prevention.

→ Spreading awareness amongst tourists & locals.

- ③ Intentional starting of fire by mischief makers

Remarks

Never
Form
Opinion
before
proving it

→ strict enforcement of updated laws
 → proper investigation, use of forensics etc in each case
 to punish culprits & act as deterrent

④ Slow response to forest fires, lack of coordination
 between local, state police & National Disaster Relief
 force - leads to massive fires.

→ Proper standard operating procedure for coordinated
 action must be put in place.

→ Flexibility, as per local needs

⑤ Droughts, heated weather also increase risk of
forest fire

→ Steps to curb climate change, induce rain (cloud
seeding as being done in Maharashtra) are also
innovative steps

Good

Remarks

Q11. What does the court verdict terming Ganga and Yamuna as living entity mean? What are the consequences of such directives? (12.5 Marks)

The High court has termed Ganga & Yamuna as living entities.

It means -

① They will have the same rights of redressal as a normal citizen does in case any of their legal rights are violated.

② They will have a caretaker responsible for their well being & overlooking their rights - this court appointed the state secretary & the project head of Namanganga as caretakers.

Who are Guardians?

CONSEQUENCES

① Due to Effective enforcement of legal rights of the river if it is polluted, it can action will be taken against pollutions.

→ Remedy for loss

→ Punishment to culprit will act as deterrent.

Hence cleaner & healthier rivers will be ensured.

② Idea of rights of the river will be expanded.

→ since it will be open judicial interpretation.

→ Example: Action against municipal bodies for releasing untreated sewage into river.

③ Innovative solutions to problems of rivers can be found.

Remarks:

2.5

⑤ Awareness amongst people & locals about their duty towards river conservation, about right of rivers
→ Hence public participation increased (by P.L.S etc)

Remarks

Q12: Elephant-human conflict is one of the most challenging issues in conservation of Heritage animal of India. What are various reasons of Elephant-human conflict? What needs to be done in resolving these conflicts? (12.5 Marks)

Elephants are intrinsic to the Indian culture & all steps to conserve them must be taken.

REASONS for Conflict

- ① Diminishing habitat for elephants - hence they wander into human territory & cause havoc.
- ② Increasing population, changing lifestyles with urbanisation etc have resulted in humans invading the forests & homes of elephants.
 - Lack of corridors for elephants to commute
 - Due to roads being constructed within sanctuaries, accidents b/w humans & elephants (especially at night) cause harm to both.
- ③ Increasing encroachment of locals deeper into reserve territories can lead to further conflicts due to limited availability of resources.
 - During drought, conflict over water.
- ④ Inhuman treatment of domesticated elephants for tourism, temples etc further makes them aggressive.

What needs to be done -

- ① Ensuring wide & sufficient habitat for elephants for themselves to prevent conflicts.
- ② Reduce disturbance by barriers like deforestation, encroachments etc.

Remarks

- ③ Prevent construction of civilian roads for every day use within elephant reserves.
Especially during night time.
- ④ Ensure proper connectors for commute for elephants between reserves.
- ⑤ Proper availability of water during drought.
- ⑥ Construct border walls - tall & strong to prevent elephants or biome from wandering into each others territory.
- ⑦ Enforce code of conduct for humane treatment of elephants in circus, temples, tourism etc to prevent cruelty.

~~Absrupt ending~~

~~Conclusion~~

Remarks

Q13. The effects of urbanization and climate change are converging in dangerous ways. In this reference, discuss how cities are contributing to climate change and in turn how they are impacted by it? Discuss what should be done to make cities more suitable with special mention of concept of green buildings to reduce impact of climate change.

Contribution of cities to climate change -

(12.5 Marks)

- ① Air pollution due to vehicular emissions of green house gases leads to global warming.
- ② Release of gases like CFCs, HCFCs etc, N₂O etc from excessive refrigerant use like air conditioning depletes ozone layer.
- ③ Use of cemented footpaths, dark coloured buildings lead to Urban Heat Island effect & further heating.
- ④ Poor drainage Excessive deforestation leads to lack of greenery.
- ⑤ Over exploitation of limited resources like water.
- ⑥ Poor design, over population lead to unsustainable growth like Urban floods etc.

How cities are impacted -

- ① Increased frequency of extreme weather events like floods (Smoggers - Thailand), drought (Marathwada), cyclones etc.
- ② Overall heating leading to water shortage, crop failures etc, impact on health etc.
 → 2016 was hottest year on record.

What should be done

① Green Buildings

- Sustainable design to reduce pollution & exploitation
- Water & waste recycling mechanism, rain water harvesting, efficient use of renewable energy like solar rooftops etc.

Remarks

→ Use of greener construction design, materials & techniques like mass timber buildings.

→ Use of smart technology like vertical gardens.

① Ensure green cities with planting of trees wherever possible. forestation

② Water waste recycling to prevent over exploitation

③ Use energy efficient cars & fuels, mass transport to curb vehicular emissions.

④ Locate polluting industries on outskirts of cities & enforce anti-pollution measures.

Very good

Remarks

Q14. Environmental governance introduced by international bodies aims at improving the quality of human living within the carrying capacity of supporting ecosystems. Elaborate with respect to role played by UN in sustainable development. (12.5 Marks)

Environmental governance is critical in ensuring sustainable development of India & the world.

- ① Ensures that environmental aspect of each policy is thoroughly analysed before its implementation to ensure a green country.
- ② Priority given to protect ecosystems that are threatened by over exploitation.
Eg: Kashmiranagar Report on Western Ghats to declare Ecosensitive zones.
- ③ Balance between development & ecosystem.
→ If Paria Tiger reserve will be affected by Ken Betwa river linking, alternate land must be allotted to it.
- ④ Inclusion of local knowledge & participation in environmental governance.
→ Eg: REDD+ mission of UN.
- ⑤ Ensure adaptation & mitigation to curb impact of climate change - RED, awareness etc.

Role played by UN

- ① UNFCCC - a multilateral platform to plan, discuss & implement mutually agreed steps universally to fight climate change.
→ Paris Climate Deal was enforced with each country taking its INDCs.
- ② CBD (Convention on Biodiversity) to conserve flora & fauna.

Remarks

- ③ UNESCO's Man & Biosphere Programme to preserve habitats.
- ④ UNEP (UN Environment Program) to help sustainable development.
- ⑤ Financial support for developing countries like GEF, Green Climate Fund etc.
- ⑥ Encourage CBDR (Common But Differentiated Responsibilities) principle.
- ⑦ Increase awareness through IPCC - Assessment Reports.
- ⑧ Capacity building, supporting R&D etc to ensure environmental governance.

3 /

- Rather than just enumerating the names, also try to relate them with Sustainable ~~ecosystem~~ ecosystem.

Remarks:

Q15. The advances in science and technology lend themselves to greater possibilities for more efficient disaster management worldwide. Elaborate. (12.5 Marks)

Advancement in science & technology (S&T) is critical for efficient disaster management.

① Before the disaster

- Preparing for the possibility of disasters by conducting research into it, making people aware.
- Building material, styles required to scientifically make them resilient to earthquakes, ^{proper} drainage system to prevent urban floods.
- Mapping of vulnerable zones by through S&T to prepare them adequately.
- Use of scientific steps like planting trees in tsunami, cyclone prone areas, cloud seeding to induce rain & prevent droughts.
- Using S&T to build effective communication channels, monitoring of weather through satellites for advance warning & disseminating information.

② During the disaster

- Use drones, satellites, radios, social media to quickly disseminate information, search & rescue, spot people stuck on remote islands (during floods) etc.
- Use of such technology to disperse food & medical kits.

③ After the disaster

- Use of S&T for recovery, rehabilitation & reconstruction.

Remarks

Write some names of technologies

→ Communities can be built back better by using disaster preparedness techniques determined by S&T.
Eg: Houses on higher land with flood resilient technology for flood prone areas.

Hence S&T is critical in all aspects of disaster management.

Remarks

Q16. With rising vulnerability to cyber threats and electronic voting machines being proved to be vulnerable there is a demand for defaulting back to offline, paper based systems, but Blockchain technology is gaining importance that it would fight electoral fraud. Critically discuss. (12.5 Marks)

Remarks



Remarks

Q17. What are gravitational waves? What does the discovery of it hold for the world? How is LIGO detecting and what is the contribution of India towards this project?

(12.5 Marks)

Gravitational waves

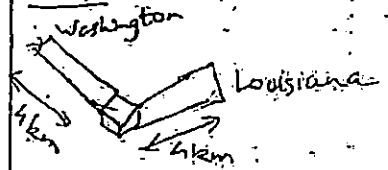
Good

- Gravitational attraction is caused due to bending of space-time fabric due to a very heavy object.
- Consider analogy of a heavy ball placed on a rubber sheet - causing a curve where a small ball to rotate about it.
- But other space bodies like Earth, sun, moon etc themselves move in these space-time curvatures also - causing ripples in space-time. These ripples form gravitational waves.
- Postulated by Einstein in General Theory of Relativity.
- Travel with speed of light, need no medium of propagation.

Significance of Discovery

- ① Study of black holes - can't be seen but emit gravitational waves.
- ② Study of big bang theory - study of origin of universe.
- ③ Study of anti matter & dark matter.
- ④ Proof of wave nature of all 4 fundamental forces.

LIGO [Laser Interferometer Gravitational wave observatory]



- ① Comprises of 2 L shaped laser interferometers placed perpendicular to each other.
- ② Disturbance: Normally laser beam is reflected at opposite ends to give destructive interference - no signal.
- ③ When gravitational waves enter it, laser beam is compressed at one end & expanded at another - signal not cancelled i.e. a signal is detected.

Remarks

Contributions of India

- S.S.
- ① In ~~center~~ manufacturing of certain components of LIC.
 - ② In sending Indian scientists to help in the discovery & study of its significance.

India will be the ~~3rd~~ country in the world to have its own LIC.

good

Remarks

Q18. Why is there is lack of communication between the scientific community and the public when it comes to acceptance of science projects like INO? Give your opinion. By writing a short note on India based neutrino observatory, mention its significance and why is it not gaining public support? (125 Marks)

There is lack of acceptance of projects like INO & lack of communication b/w concerned parties is one of the reasons.

① Regarding the INO project, there is protest regarding the forest area it may clear. Hence protests by environmentalists.

② Fear of public regarding nature of work to be conducted in INO & how it may adversely affect them.

→ Both these obstacles can be overcome by dialogues, conciliation & communication.

INO

→ To be originally based in Travis, Tamil Nadu.
 → The objective was to do research on the particle behaviour & characteristics of an elementary particle - in the Standard Model - Neutrinos.

→ Such research can yield vast benefits for innumerable fields from use of technology in everyday life to understanding the basis of matter & even study of outer space.

→ Since neutrinos are highly unreactive, such an observatory will have to be placed many km below the ground for effective study of neutrinos & their isolation.

Remarks

7. Not gaining public support because -

- ① People don't understand the significance of study of neutrinos.
- ② They see no utility for themselves in this research.
- ③ They also fear whether such experiments can cause harm to nearby locals - lack of trust.
- ④ Rehabilitation of displaced personnel
- ⑤ Lack of communication from govt. officials & scientists.

hence educating them, making them aware of benefits; ensuring use of safety protocol & rehabilitating displaced locals will help.

good

Remarks

Q19: To what extent is India a Knowledge based economy? What are the measures taken to make it so? What alternate suggestions are needed to make it a knowledge based economy? (12.5 Marks)

Knowledge sector comprises the quaternary & quinary sector.

→ India is still a developing knowledge based economy.
→ Though it has come a long way, with a rising IT sector, R & D, etc, there is still a lot of potential to be tapped.

① Medical drug making still relies on generic drug development of established drugs, though necessary, → Indian Pharma needs to focus on innovation & research into new medicines

② IT sector sees many talent migrating to other countries.
→ Enough jobs in own country must be target of knowledge based economy.

③ R & D in scientific sectors is promising like IND, gravitational waves, space etc. yet much more can be done eg: Renewable energy etc.

So Measures taken -

- ① India has a National IIT policy in place to encourage R & D.
- ① National Biotechnology Strategy has been set up & BIRAC instituted to overlook biotechnology R & D.
- ③ Other areas like nanotechnology etc also have a policy in place.

Remarks

① Knowledge based jobs are being created in various sectors like medicine, science, political science, law etc.

→ Higher education in these areas

→ Skill training

② The govt is also trying to encourage service sector export to other countries through trade deals.

Alternate suggestions

① Sufficient awareness, education, skilling in knowledge based sectors

② Incentives to enter such careers like scholarships etc.

③ Spurring job creation through Entrepreneurship

④ Ensuring necessary infrastructure & schemes for encouraging innovation like Atal Innovation Mission etc.

Remarks

S.S.

Very good

Q20. What is reusable launch vehicle? Why is it considered an important milestone for Indian space program?

(12.5 Marks)

Reusable launch vehicle (RLV) - Technology demonstration was recently successfully tried by ISRO.

What RLV is -

- ① It is a space launch satellite that can be used multiple times to launch rockets into outer space.
- ② After being launched from Earth, RLV will take the concerned satellite into outer space, eject it & place it into pre-decided orbit. After this it will re-enter Earth's atmosphere and land back on Earth.

→ Hence proving its re-usability.

Important Milestone

- ① Successful trial of RLV - TD proves that ISRO is on track to soon have its very own RLV.
- India will be the 1st country to do so.

② The significance of RLV is that they can massively reduce cost in launching satellites due to re-usability.

→ Currently a PSLV after launching a rocket is destroyed hence requiring new construction & investment each time.

Remarks

③ Environmentally beneficial as use of resources like minerals, power etc in repeated construction of Launch vehicle is prevented.

Hence RLV is indeed a critical milestone for the Indian space programme — will establish India as the master & international leader in outer space.

AS

— Could have added more points

Overall good attempt

Remarks