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93 1/2

UPSC

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Science & Technology Test 25

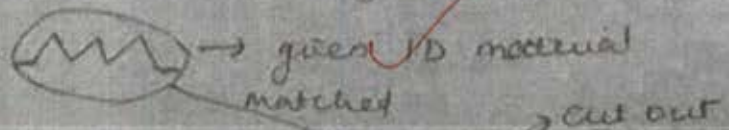
Q1.

clustered regularly interspaced ^{short} Palindromic Repeats (CRISPR) ^{is} a gene editing technology representing "molecular scissors" that have become the face of life sciences ^{good intro} in the past few years.

CRISPR Gene Editing Technology

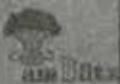
- Based on interaction between bacteria and bacteriophage (virus that kills bacteria).
- Bacteria's defense mechanism has been copied.
- Involves CAS-9 protein that acts as a molecular scissor that can be given an "identification material" which is then cut out from the DNA strand.

relevant but brief



DNA →

↳ good



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Benefits

You can diversify it by adding
↳ useful in de-
↳ healthier food etc

- ① Defective material is erased } genes } treat genetic disorders
- ② Birth defects / genetic defects can be removed. eg: AIDS removal
- ③ Changes can be made in babies in embryo - ensure healthy birth
- ④ Medical application can enhance health indicators } generation of antibiotics

Challenges / Concerns

Valid Points

- ① Ethical concerns
 - Humans "playing God"
 - BioRights
 - "Designer Babies"
- ② Biological Concerns
 - changes in DNA } Link } could with destructive features } can change ecological balance
 - Unknown realm → disastrous consequences

Q-5

③ Economic inequality in access to benefits derived.

CRISPR - CAS 9 is a life changing technology but its use must be controlled and ethical for it to be truly beneficial.

Nice
Need to balance using of technology

UPSC

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केवल प्रश्न संख्या ही
लिखें।

improve it
by giving brief
account of features
of this mission

Gaganyaan is set to be India's
manned mission to space. Currently,
very few countries have achieved this
threshold.

Although people of Indian origin have
been to space (eg. Kalpana Chawala),
no Indian has been to space via Indian
missions.

Gaganyaan and Technological Development

- ① capability of launching humans into orbit will be displayed by the country.
- ② Involves completely different methods of rocket development as it must be made habitable by humans
 - pressure maintenance
 - temperature condition control.
- ③ Can involve space station development like US, Russia (GLASSBORO), China (Tianwen).

link these points with fast technology development
↳ astrobiology
↳ material etc

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Gaganyaan + Economic Development

① Boost to ISRO's viability & credibility

② India as a space-power will

contribute to its reputation and attract

collaboration.

③ Plan to private sector, FDI, space

tourism probability, enhanced space

collaboration.

④ Tech transfers can add to potential of India's space program.

Gaganyaan & Educational Development

① Humans in space can do research

② In-space (zero gravity) experiments

can yield knowledge.

③ Space station can help India enhance

space analysis and knowledge of the

unknown - gravity waves, blackhole,

wormholes etc.

Gaganyaan is the next threshold

for the Indian Space Program and can

boost India's probability of becoming an

accepted & respected global leader.

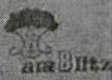
here you can add
Point like
employment generation
hub for space programmes
industry growth

inter national
collaboration

Try to give specific
points as per
demand

R&D
collaboration b/w
industry &
Academia
astronomy or
career etc

Nice
Conclusion



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Q3.

In India, data suggests that the number of women in scientific fields has been very low. This has various socio-cultural & historical causes.

Use
intro

Women in Science

- Around 40% of those studying STEM subjects are women.
- This number falls further in higher studies and jobs.

Reasons for low no. of women in Science

- socio-cultural framework & stereotypes
 - ↳ women are incapable of doing math-based/scientific subjects
 - ↳ much commitment required but women are expected to marry & do childcare.

link it with
Patriarchal
Mindset

relevant
points

- Economic restraints ~ people prefer to educate male child when money is limited.



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• Inadequate acceptance / infrastructure to welcome women into these fields → especially in higher education

lacking institutional support

Steps Taken by Government

• various schemes to enhance participation of women in STEM

eg: Vigyan Jyoti Scheme & WEST

• Infrastructure enhancement scheme
eg: CURIE

• KIRAN scheme for encouraging women in these fields.

do elaborate in brief about these step & target

Final Conclusion

to improve it's outlook if it is to accept women into these fields. we must be capable enough to nurture our own Kalpna Chawlas in the country instead of encumbering to brain drain.

India needs a change in mindset and outlook if it is to accept women into these fields. we must be capable enough to nurture our own Kalpna Chawlas in the country instead of encumbering to brain drain.

5

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write anything extra
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पर प्रश्न संख्या के
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84.

Nanotechnology refers to the technological use of nanomaterials which are substances with sizes in the nanometer scale. This technology comes with many uses as well as challenges.

fair
you can mention some specific properties like conductivity, reactivity, etc.

Nanotechnology & Pollution Control

• Soil Pollution ~ use of bioremediation techniques through nanomaterial to remove impurities / hard metals like lead (Pb), etc.

add here you can add some emerging areas like nanotechnology has good potential

• Water Pollution ~ use of filtering systems to remove minuscule impurities in water, use as precipitate, etc.

Nano-filtration
Ag NPs

• Air Pollution ~ Nano-filters in cities to suck in and clean polluted city air.

absorbent
carbon nano tubes
etc.

Thus, nanotechnology's benefits are many in the field of pollution control.



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तिरिक्त कुछ
लिखें।

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However, it can become a challenge too.

Nanotechnology - threat to pollution

• Nanotechnology particles are very small and hard to locate.

• If lost, they can accumulate in water bodies / air / soil.

• Since most are made of non-biodegradable material, they are a source of pollution.

• Bioaccumulation & Bioamplification in living beings in these ecosystems are threatened by nanoparticles.

Thus, nanotechnology use must be controlled & sustainable to be of net benefit to the environment.

Nevertheless, it is a potential tool for achieving Panch Anmit goals.

U.S

all valid
points
covered

leak it with mobility & bioavailability & toxicity

Good
conclusion
as per demand

Please do not write anything except the question number in this space. कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

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85.

Plant Genetic Resources refers to the natural reservoir of genetic and species diversity in flora.

Why conserve PGRs?

① Floral diversity is of utmost importance.

↳ Environmentally

- biodiversity
- habitat provider
- niche development
- dependence of various species eg: bees.
- carbon sink

↳ Economically

eg: Neelakurinji on western Ghats attracts tourists in large numbers when it blooms every 12 years. Trip Gardens, Kashmir source of income/beekeeping, etc.

↳ Aesthetic → flowers are beautiful and should be conserved for their inherent life.

Vague intro
variety of seed & plant both modern & traditional

relevant points
help you can add to diversify your answers
↳ food security
↳ sustainable agriculture
↳ biotechnology

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कृपया इस स्थान
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- ② Scientific Reasoning for Preservation of PGRs
 - ↳ provide insights into biodiversity, hotspots, ecosystems frameworks.
 - ↳ can provide historical insight in evolutionary biology
 - ↳ climate change impact can be understood by gauging biome shifts, etc.
 - ↳ can help identify beneficial genes for plant productivity / weed immunity etc. → use in agriculture

Nice

Initiatives of Govt. to conserve PGR :-

- ① Wildlife Protection Act 1972 & Environmental Protection Act 1986 provide for National Parks, Wildlife Sanctuaries, Biosphere Reserves, Community Reserves, etc.
eg. Nilgiri Biosphere Reserve - protects flora and fauna & in-situ conservation.

- ② Conservation of biodiversity hotspots ensures safety of threatened species. Schedule 6 of WPA '72 protects plants.

more needs to be done to preserve rich fauna of the nation & protect species from climate impact.

Give equal weightage to 2nd part of Question

Add National Gene Bank
↳ PVP & FR Act 2002 etc

Conclusion missing

Page 235

Please do not write anything except the question number in this space.

कृपया इस स्थान में प्रश्न संख्या को अतिरिक्त कुछ न लिखें।

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86.

Self driving Cars are those that do not require a driver & work by automation, artificial intelligence and machine learning to drive safely.

Purpose of Self-Driving Cars

- ① Reduce accidents due to not following traffic guidelines.
- ② Reduce time taken to deliver traveller.
- ③ Enhance road safety.

Good points as per demand

Obstacles for Autonomous Vehicles

① Technical obstacles

↳ technology is yet to develop to create reliable cars.

↳ inadequate traffic rules except in metropolitan city centres.

↳ inadequate infrastructure (unsafe roads) make investment futile.

all relevant points covered

link with legal & regulatory standards

② Economic Obstacles

↳ immense research & development required.

↳ lots of finances could create pressure on government (public sector)

↳ need to align Electric Vehicles (FAME II) aims with need for automation.

↳ Automobile industry must have enough demand to invest sustainably.

③ Social Obstacles

↳ Resistance from conventional auto drivers / Ola / Uber.

↳ Issue of automation replacing jobs - create higher unemployment from current 7%.

↳ unequal access to cars (rich-poor divide)

Self driving cars could spell a revolution in India's technological path & road safety sphere. However, it's important to understand priorities and the greater need for employment and road infrastructure development than the need for introducing such cars.

5

diversify your
answers by factors
like

↳ IPR

↳ Privacy concern

↳ Auto insurance
etc

link with
employment

fair

Need of proper
assessment \$
RFD

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कृपया इस स्थान
में प्रश्न संख्या को
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इस इतिहास
को पढ़ना
चाहिए
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87.

Non fungible Tokens (NFTs)

are a new commodity introduced after the widespread use of crypto-currency and blockchain.

Good intro

Functioning of NFTs

① unique non-interchangeable commodities in the cryptomarket.

their uniqueness is what resulted in the name a digital certificate as it gives a unique identity to the good.

Valid but brief it

② It can be sold/bought in the cryptomarket.

③ Uses blockchain technology to secure its value and transaction.

④ Examples include :- music / artwork (usually artists' creations).

⑤ Acts like an intellectual property protector.

Explain mechanism of NFT as per demand

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Advantages of NFTs

- ① Store of value and IP right protection
- ② Trustworthy and secure method of safekeeping ~ blockchains are based on end-to-end encryption and fairproof transaction.
- ③ No fear of duplication
- ④ No government-sourced arbitrary action (because blockchain is decentralized).

exclusive ownership rights

link with more rising opportunities

relevant

Challenges of NFTs

- ① Cybersecurity challenge ~ cybercrime is developing just as fast as cybertech.
- ② Inadequate safety measure (because it doesn't come under any government)
- ③ Instability can lead to severe losses.
- ④ Fraud, organized crime, money laundering is still possible.

Hacking NFT Frauds etc

Nice Points

4

Thus, NFTs are a technological space for value storage but also have come with some risks.

Conclusion Missing

Write the question number
in this space.
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प्रश्न संख्या को
अभिलिखित करें।

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88.

Biotechnology is a field that involves the overlap of biology & technology. In a developing nation like India, biotech has great scope in various sectors.

Biotechnology ~ Survise sector

* Agriculture [Economy]

↳ gene editing technology can help create genetically modified organisms (GMOs) for greater productivity.
eg: Gm mustard (recently approved by the GEAC)

↳ create pest-resistant, drought resistant crops through alteration of crops, with support from ICAR.

↳ enhanced fertilizers to meet soil nutrition and soil health and sustainability requirements.

eg: PUSA encourages to replace stubble burning

To improve
it you can
mention sectors
like Agriculture
Health, Environ-
mental etc
where this technology
can revolutionize

Good

UPSC

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* Nutrition & Health [Human Capital]

bioaugmentation of foods through
bio-fertilization.

eg: adding iron to rice/wheat
to fight anaemia (around $\frac{1}{3}$
of women aged 15-35 in India are
anemic).

medical implements

① somatic cell development for synthetic
organ creation

② in vitro fertilization & healthy
surrogacy

③ use of biotech to enhance measurement/
survey of body/diseases
eg: cancer treatment through
CAR-T cell formula.

④ Treatment of diseases eg COVID 19 with
monoclonal
antibodies

with enhanced use of biotech, India
can gain in terms of economic capital

as well as human capital, thereby
boosting its progress on the path
to a \$ 5 trillion economy.

relevant points
covered

Link these points
with intellectual
wealth, on treatment
opportunities, employment
innovation etc
as per demand

fait
conclusion
as per demand

3.5

Please do not
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प्रश्न संख्या के
तिरिक्त कुछ
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चाहिए
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03.

Thorium is one of the new materials used in nuclear reactors for production of nuclear generated energy.

fair intro

do mention in brief how convenient it is to use as fuel

Advantages of Thorium

① less reactive (more controllable reaction) than uranium.

② more naturally available.

eg: thorium sands of monazite in Kerala are a reserve.

devising

add ↓
it did not irradiate U-238

③ naturally extractable as opposed to difficult extraction of other reactive elements like uranium.

↳ less waste production etc

④ Technology for use of thorium is well developed.

India has a few nuclear reactors

eg: Rawatbhatta, Kudankulam,

Tarapur

Please do not write anything except the question number in this space.
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Hurdles in large scale Deployment

- ① Immense intrinsic costs of setting-up
- ② High maintenance costs.
- ③ Safety/security concerns. (terrorism, etc).
- ④ Inadequate facilities for management of radioactive waste.
- ⑤ Requires clearing of large areas (deforestation).
- ⑥ Need to import thorium because inadequate resources in India.
- ⑦ Replaces coal → may displace employed individuals in PSUs

do mention some specific points
↳ shootage of fissile material to sustain reaction
↳ delay in commissioning

Need for :-

- ① Kelkar Committee is public private investment in non-conventional sources of energy
- ② Small-scale nuclear reactors - local energy needs.

3:5

Nuclear energy is the future of energy that is clean & sustainable. Adequate support is required in this aspect to achieve 2070 Carbon Neutral goal.

Nice conclusion

Need of R & D as it is cost effective

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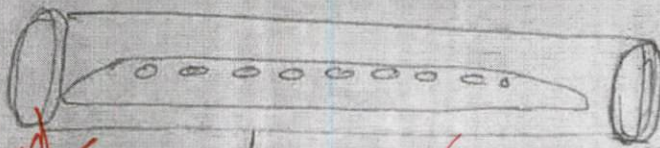
उम्मीदवारों को इस भाग में नहीं लिखना चाहिए।
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Q10.

Hyper loop technology is the future of travel by rail. It is the futuristic stage after Bullet train.

Good Intro

What is hyperloop technology?



Good

↳ magnetic waves used to keep the train in suspension in a 'loop' & cylindrical framework

Partial Vacuum tube

Benefits of Hyperloop Over Bullet Train

① no rails, no touch. Use of superconductor reduces friction to near zero. therefore speed is even higher than bullet train.

hope you can mention about flexibility of road, etc

② works completely on magnetic waves & electricity - uninterrupted movement. Thus, this is more timely & likely to be accurate.

link with energy efficiency

③ modern means of travel

Please do not write anything except the question number in this space.
कृपया इस स्थान में प्रश्न संख्या को अतिरिक्त कुछ न लिखें।

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Candidates must not write on this margin

Does India Need Such Investment?

Yes

No

① Hyperloop technology has economic benefits ✓

→ greater speed ensures faster transport of workers ✓

→ reduced logistic costs ✓

→ technological growth creates employment ✓

→ GDP growth ✓

② Environmental benefits ✓

→ greater use of public transport ✓

→ reduced (zero) emissions ✓

③ Modernization of Indian economy ✓

~~is not~~ The development of Hyperloop Technology could be a substantial part of ~~that~~ National Monetization Pipeline and modernization of India ✓

① India has other priorities ✓

- poverty elimination ✓
- human capital investment ✓

② Very high costs in infrastructure development.

③ may lead to inequality / unequal access → rural-urban divide.

④ Metro systems and rail already exist - why build an overcrowded city?

All relevant points ✓

5

fair conclusion
Need to focus on local capacity building, technology etc. ✓

Please do not write anything except the question number in this space.
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
Content of the Question is more important than length.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को इस खण्ड में नहीं लिखना चाहिए।
Candidates must not write on this margin

Q11.

Neutrinos are the 2nd most abundant particle in the universe after light particles or photons. Their discovery has opened up a field of new research & applications.

fact
You can mention some basic properties

Neutrinos in life

* countless number of neutrinos pass through and within the human body at any given time.

* neutrinos are ever present and neutral.
Unlike light, they do not interact with the environment in any measurable direct way.

Micro points

* It is assumed that neutrinos play a role in maintaining balance in the world.

Significance & Potential of Neutrinos

* Help find what makes up dark matter/ dark energy of the universe.

* Help explore the origins of the universe.

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UPSC

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* look into blackholes / wormholes.

* further research into the laws of physics } do mention structure of nucleons, supernova etc

* Research into the "God" Particle / smaller particles that build neutrons, etc.

Possible Application
part?
Missing

India's Initiatives in Neutrino Research

Although research in physics has very little scope in India, there have been some developments.

① Dark Sky Reserve, Hauke, Ladakh

② Collaboration with scientists of NASA, etc.

③ work at CERN laboratory, Geneva.

elaborate in brief mention about India's such laboratories in Karnataka (1960's)

Good conclusion as per demands

neutrino research can provide insights into the science of existence and may also give rise to new technology that can enhance the experience of humanity in the world.

4

(Please do not write anything except the question number in this space)
कृपया इस स्थान में प्रश्न संख्या को अतिरिक्त कुछ न लिखें।

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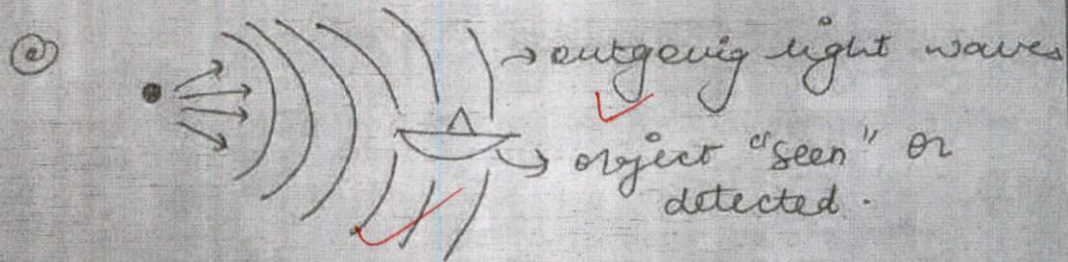
Q12.

Light Detection & Ranging (LIDAR) technology uses light waves to gauge the distance, density, speed, etc. of various objects.

fair intro

in pulsed laser form

LIDAR features



- ② High accuracy in data collection
- ③ Upgradation over radio waves, etc.
- ④ Since speed of light is highest, speed of data collection is also high.
- ⑤ Trustworthy technology due to high precision.

Valid Points & Good use of diagrams

Significance of LIDAR

- ① Industrial Significance
 - application in various industrial products eg. ships/drones.

Please do not write anything above the question number in this space.
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

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Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
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- application in Industrial Safety
eg: nuclear power plants - infrastructure security features can employ LIDAR.

structure & civil engineering

- use by CRPF paramilitary forces to enhance detection of criminals near critical infrastructure regions like DISCOM, etc.

real time sea surveillance

relevant points

Commercial Significance

- application in naval ships
eg: INS Vikrant, etc can have LIDAR tech for defence purposes.
- application in house guard systems
- Drones / aircrafts etc can use LIDAR for enhanced navigation.

here you can add

↳ Entertainment & Agricultural industries

Satellite Applications

- Meteorological applications
 - weather forecasting
 - cyclone, etc warnings
 - weather phenomena research.

do elaborate in brief

↳ Mapping
↳ Seafloor & riverbed

UPSC

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उम्मीदवारों
इस इतिहास
नहीं लिखना
बाहिर
Candidate
must not
write on the
margin

• Medical applications
→ use of light waves for detection & treatment of disease.

Use of
robotic
arms

• Technical application
→ modernization of detection, prediction and data collection via LIDAR.

Explain limitation
part as well
to fetch good
marks

LIDAR's advantages allow for many practical uses and must be encouraged for societal benefits, along with scientific endeavour.

Good
conclusion
as per
demand

55

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कृपया इस स्थान में प्रश्न संख्या के अनिश्चित कुछ न लिखें।

UPSC

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Q13.

India is entering the age of digitization, speeded up by the covid induced lockdown that forced many people online. Digital technology has major application, especially for agriculture.

do not link this with aim of doubling farmer's income

Agricultural Transformation through digital Technology

① modernization

↳ Data collection & survey of land - this can be carried out using drones and e-filing of measurements

eg: SWAMITVA scheme by ministry of Panchayati Raj

relevant points

↳ weather forecast via various apps

to avoid crop loss

↳ labour demand and supply through digital application eg: ASFFM portal

↳ soil health detection for 'aware' agriculture eg: soil health card scheme

monitor demand of irrigation fertilizers, harvest etc

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कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

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Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
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↳ sharing of best practices / experiences via net. } to improve product quality

↳ sharecropping / tenant money transfers through digital payment.

do explain your points in brief

↳ DBT ~ greater fiscal & digital inclusion of the poor.

↳ online land dispute resolution.

crop monitoring link with optimum use of resources

↳ using digital world for greater agri-based knowledge & enhancing skill.

⊙ Organization of Agriculture

↳ using digital media like Over-the-Top (OTT) platforms for connecting with neighboring farmers.

Relevant Points covered

↳ collectivization of fields for cooperative farming and using online communication to build trust & stay connected.

↳ sharing / logging of proceeds from farms digitally, to enhance transparency and accountability.



PLEASE DO NOT
WRITE ANYTHING IN THIS
MARGIN
कृपया इस स्थान पर
कोई भी बात न लिखें।

UPSC

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इस हार्जिए में
नहीं लिखना
चाहिए।
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write on this
margin

with digital technology various agricultural goals can be achieved:-

- ① Sustainable agriculture
- ② Community agriculture
- ③ Reduced land disputes
- ④ Enhanced productivity
- ⑤ Reduced uncertainty (and farmer suicides)

Valid
Add some steps taken
by government
→ PMKSY
→ HRS sensor
to monitor
soil health
etc.

Pair
to improve
link with
with
sociality
levelhood

Modernization & Organization of Agriculture
through digital technology is the
route to a sustainable & beneficial
Evergreen Revolution in agriculture.

5

(Please do not write anything except the question number in this space)
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

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सोदकारों को इस हारिए में नहीं लिखना चाहिए
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Q14.

Geospatial technology refers to systems that use topography, space, geography to calculate and collate objective data. It involves satellite technology, drones, etc.

Vague intro
Link this with
Use of GPS, Remote Sensing, Global Information System

Geospatial Technology - Role in Growth

① Economic impact

↳ using geospatial technology to plot and combine infrastructural projects, etc.

eg: GATI shakti

↳ use of geospatial technology for

internet dissemination, satellite-web

and enhancing inclusion in the digital space.

All relevant points covered

② Agricultural impact

↳ SWAMITVA scheme uses drone

imagery to digitalize land records -

reduce litigation.

Land Use Management



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write anything except
the question number
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कृपया इस स्थान
में प्रश्न संख्या को
अतिरिक्त कुछ
न लिखें।

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इस दायरे में
नहीं लिखना
चाहिए
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write on this
margin

- ↳ obtaining quality of soil / water / weathers and cropping accordingly
- ↳ using geospatial tech to connect agri with industry
 - transport
 - logistics
 - cold storage
 - movement of goods

(real time information)

through
monitoring
via
satellite

② wildlife conservation

- ↳ assessing forest cover / rate of deforestation
- ↳ measuring impact of conservation on various ecosystems
eg: Himalayas

Link these points
with disaster
management
Biodiversity
conservation
etc

Roadblocks in harnessing GS Tech.

- ① Requires high level technology development
- ② skilled manpower + capital intensive
- ③ Involves security concerns
eg: use for organized crime / terrorism.

Link with lack
of super computers
& quantum
computers.

Please do not
use any part of
question number
in this space
कृपया इस स्थान
में प्रश्न-संख्या को
प्रतिरिक्त कुछ
न लिखें।

UPSC

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उम्मीदवारी को
इस इलाक़े में
नहीं लिखना
चाहिए।
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⊙ Inadequate market

Elaborate!
No demand for geo spatial services

However, the government has recently released a notice on Drone Rules

Try to give more specific effect by government
Like ↳ National Geo Spatial Policy
↳ Indian Satellite Navigation Policy etc

delegatises the market for drones
encourages private investment
- pushes indigenous production

The new legislation creates space for the growth of geospatial technology but more incentives are required for the benefits to translate into growth of all sectors of Indian economy

improve it by mentioning
↳ de-skilling
↳ data security
↳ privacy enhancement
etc

Give equal weightage to all parts of Question

4.5

Please do not write anything except the question number in this space.
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

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उम्मीदवारों को इस हाशिये में नहीं लिखना चाहिए।
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Q15.

Robotics is the field of technological development that deals with the use of 'robots' - mechanical devices that carry out machine learning to interact with the human world.

Good Intro

Potential of Robotics

① enhanced precision & accuracy which can save lives in the medical field (medical operation, etc).

② no emotional interference ensures peak performance at all times.

③ Inability to lie / manipulate makes robots trustworthy, transparent.

④ mechanical/repetitive operations can be given to robots → save effort.

⑤ more labour is left to be skilled and spend effort on entrepreneurship and further creation - thereby enhancing efficiency.

To diversify your answer add Areas like
↳ Automobile
↳ military
↳ environment

Nice Points

UPSC

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India has progressed immensely in the field of robotics :-

① Application in industry - to carry out basic operations. *ex?*

② Creation of "human" robot that can communicate at basic level with humans.

③ Robotics in the field of medicine and senior citizen care.

Some challenges faced in Robotics

① Lack of emotional intelligence creates a communication void between robot & human and may result in social errors.

eg: In bollywood movie, Reynikant robot saves life of lady in burning building but erodes her dignity because she is unclothed.

② Fear of excessive machine learning leading to supreme intelligence and dominance of robots.

Provide some work done by institutions & universities in this direction
↳ DRDO IIT

give some examples

avoid giving ex from movies



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write anything extra
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in this space.
कृपया इस स्थान
प्रश्न संख्या के
तिरिक्त कुछ
लिखें।

UPSC

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इस हद्दिय में
कोई लिखना
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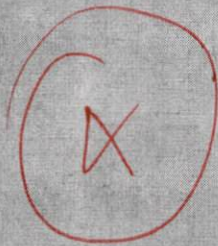
① Ethical concern - should humans
be devising such creations which
should be brought about by God?
*help you can
add → Procurement
of hardware & software
nature, knowledge gap*

② Accessibility to all - inequality
in distribution of benefits makes
this field more divisive than
beneficial.

Despite the challenges, robotics

is a field of great potential.

If done ethically, the progress of
robotics can enhance growth
through efficient & sustainable
use.



write anything except
the question number
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कृपया इस स्थान
में प्रश्न संख्या को
अतिरिक्त कुछ
न लिखें।

UPSC

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इस भाग में
कोई लिखना
चाहिए
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Q16.

Unmanned Aerial Vehicles (UAVs)

are another name for "drones".
these are used mostly in the military
for the purpose of surveillance and
tracking of enemy movement. But
they can also be used in other fields.

fair
intro

Other Uses of UAVs:-

① Agriculture ~ surveying land,
soil quality, weather, humidity,
etc.

crop survey
spray pesticide
fertilizers
etc

② wildlife Conservation ~ drones are
a good way to track wildlife from
a distance and collect data.

flora &
fauna

③ Aerial seeding ~ use of clay-covered
seeds and spraying these in unreachable
terrain for afforestation.

eg: rugged mountains/hilly area

④ Rural dispute resolution ~ eg. SWAMIVA
is using drones to digitize land records.

All valid
Points

here you can
mention areas
like Health,
Disaster management
etc

Please do not
write anything else
in this space
कृपया इस स्थान
पर प्रश्न संख्या के
अतिरिक्त कुछ
न लिखें।

UPSC

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① Surveillance near Critical Infrastructure
units like industrial regions,
nuclear power plants, etc.

② Illegal uses :- used for organized
crime, terrorism, stalking, etc.

measures by Indian Government

③ legislation, deregulation of drone
usage :-

① Drone Rules 2021

expands market for drones

invites private participation

encourage indigenous production,
reduction of imports.

reduces red tapeism (need for
paperwork, etc)

④ Encouraged usage of drones
in varied sectors like agriculture,
industry.

No mention about
Drone regulation
& focus areas
like Digital Sky
Platform
& digital policies

elaborate your
points in
brief

UPSC

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उम्मीदवारों को
उपरोक्त लिखित
परीक्षा में
उत्तर लिखने
का समय
दिया जा रहा है।
Candidates
must not
write on the
margin

① Call for make in India and
push for industrialization of
production.

However, more is required for
beneficial use of UAVs :-

② Design linked Incentive (DLI)
for drone production and indigenization.

③ Incentivize use of drones in
agriculture, industry, etc.

④ curtail illegal/harmful use.

UAVs are a technical solution to
various issues faced by sectors in
economy, and must be harnessed
to improve it mentioning
new & exciting
applications which
can propel
Indian economy.

5

UPSC

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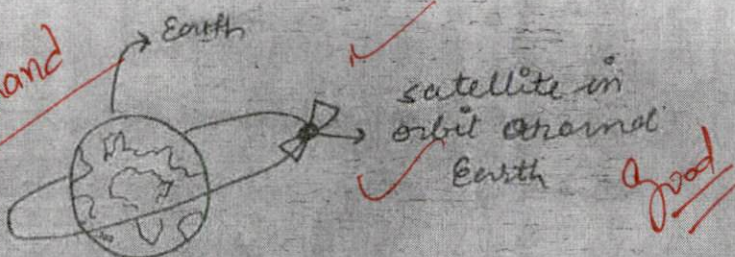
917

Remote sensing satellites are satellites sent into orbit for diversified purposes like imaging, defence, etc.

Mention basic working principle of Remote sensing Satellite

Advantage & Applications of Remote Sensing Satellites

How it works :-



do mention some Advantage of remote sensing as per demand

Types of satellites

- (a) geosynchronous → seem to be above a single point on Earth.
- (b) geostationary → a geosynchronous satellite at 0° latitude
- (c) Polar orbit
 - ↳ near poles

(d) low earth / lagrange point orbits ~ distance from Earth.

Please do not write anything except the question number in this space.

कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

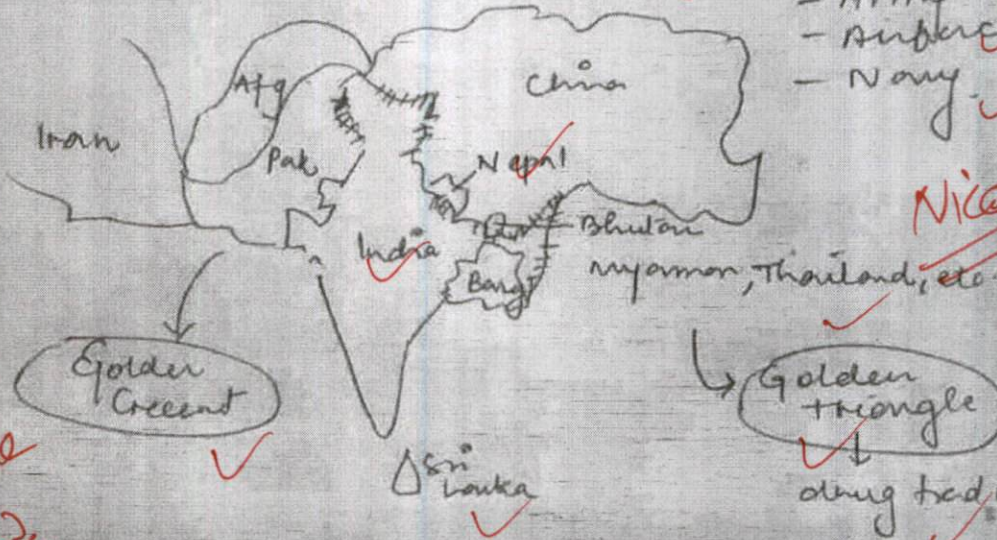
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उम्मीदवारों को इस कॉपी में नहीं लिखना चाहिए।
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① Use in defence

↳ A geosynchronous satellite can monitor the neighborhood of India

- Army ✓
- Airforce ✓
- Navy ✓



all valid points are covered

↳ porous borders can be monitored to control illegal movement - means of policing and support to various forces eg: BRO, ITBP, etc.

here you can add coastal, ocean application (sea ice, waves etc) Agriculture sectors etc

② Use in weather forecasting, etc. to enhance agricultural development, support Disaster management forces and wildlife conservation.

③ Use in navigation (eg: USA's Global Positioning System) for civilian purposes.

Please do not write anything except the question number in this space.
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

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Candidates must not write on this margin.

India's Remote Sensing Satellites

Missing part
India's remote sensing satellite
↳ IRSAT
↳ CARTOSAT
↳ SARAL

NAVIC ~ Navigator with Indian constellation ~ group of 7 satellites for GPS-like services in the Indian subcontinental region.

NISAR ~ NASA-ISRO satellite with purpose as geospatial logging to analyze climate change effects. [Earth Observation]

India continues to aim for more launches to enhance geospatial technology through remote sensing, not just for defence requirements but also for civilian benefit. } Social, Political, Environmental development

Nice conclusion

4

Write anything except
the question number
in this space.
कृपया इस स्थान
में प्रश्न संख्या को
अतिरिक्त कुछ
न लिखें।

UPSC

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इस हाशिये में
कोई लिखना
नाहिए।
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margin

Q18.

India is ranked 40th worldwide on the Global Innovation Index by WIPO, as per 2022 report. It has improved consistently for around a decade.

Good intro

Why do we need innovation?

① Economic Benefits

a) innovation leads to indigenization and domestic production.

b) reduction in import dependence

c) lowers foreign exchange

d) supply chain independence

e) increased industrial efficiency, productivity

all relevant points are covered

② Social Benefits

a) Reduced unemployment due to greater availability of jobs.

b) Job growth parallel to GDP growth will ensure best user of demography dividend of India.

You can link these points with how it help during COVID. growth in investment & GDP in recent past

UPSC

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नहीं लिखना
चाहिए
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write on this
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c) Innovation leads to better policies
for people, better societal results
due to spillover effects of growth.

d) greater prestige from brand name
expansion as India exports its goods

② Other Sectors

a) Agricultural innovation
eg: sprinklers, Happy Seeders,
PUSA decomposers

b) Science & Tech - space
research, satellite development,
environment protection

c) Medicine - biotechnology,
innovation in vaccines, treatment
of NCDs and Neglected Tropical
Diseases.

d) Education, msme, rural/
RURBAN growth, transport, etc.

All these developments enhance
India's self-reliance or Atmanirbharta.

India has taken various steps to
enhance - create a conducive
environment for innovation.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
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(Specimen Answer Booklet - For Practice Purpose Only)

- ① Make in India initiative
- ② Incentive to indigenous products
eg: one district one product (ODOP)
- ③ Start Up India - boost to new ideas
- ④ Initiatives like Shark Tank to give encouragement to innovative ideas
- ⑤ Focus on STEM subjects and incentivizing female participation through schemes like WEST, Vigyan Jyoti, CURIE, etc.
- ⑥ Push to public-private partnership (PPP) as per Kelkar Committee Report.

Innovation is the future of development and the panacea for Atmanirbhar Bharat.

7

here you can add
Atal innovation mission / Labs
MIDHAT program
Smart India Hackathons
etc

you can add effect of it like growth of start up & unicorns

Please do not write anything other than the question number in this space.
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

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Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
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Q19.

Good intro

Genetically modified organisms (Gmos) are synthetically altered genes meant to enhance various features of crops like drought resistance, weed resistance, etc. This has both solutions & challenges to Indian agrarian system and condition of nutrition.

Existing Systemic Issues

① agrarian situation

↳ small land size :-

↳ 80% of farmers hold small to marginal sized landholdings of < 0.5 ha.

relate these points with question how?

↳ low productivity of land
↳ high dependence on monsoons
↳ monocropping, dependence on MSP / FFP.

SM crop can solve these problem & bring this part as well

malnutrition

↳ Anaemia : $\frac{1}{2}$ of Indian women in target group 15-35 are anaemic.

Page

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↳ India ranked 132 on Human Development Index (HDI) and 116 on Global Hunger Index (GHI).

↳ high prevalence of stunting, wasting amongst children.

↳ 28% of world's multi-dimensional poor are in India.

Gm Agriculture ~ Benefits

① Increased productivity of agriculture
(so small landholdings can be economized)

↳ enhance returns to small farmers.

② Reduced need for fertilizer/pesticides

↳ reduced costs to farmers.

↳ reduced subsidy burden on govt.

③ Reduced dependence on erratic rainfall & monsoon (El Niño).

④ Proportification can resolve issue of malnutrition. eg. iron to reduce anaemia.

⑤ Introduce multi-cropping - increased nutritive diversity amongst the poor.

relevant points
diversify it by
adding

↳ high income to farmer
↳ long shelf life
↳ improve taste & preservation issue

Food security

pest resistance

Challenges with GM crops

① Ethical Concerns :- playing 'God'
by manufacturing plants. } Health issue

② Fears of development of invasive species, harsh side effects, etc. [One Health concept, WHO] } Biodiversity loss

③ unequal access to benefits may } monopoly of companies
make efforts futile.

④ legislative issues ~ India's IP rights,
GEAC approval, etc take time.

GM crops come with some challenges.
India needs much more than just
Bt-cotton and GM-mustard to
achieve agrarian goals and solve SDG
1 (Poverty) and SDG 2 (Hunger)
and SDG 3 (Health).

here you can
add
environmental
threat to CRP

fair conclusion
Need of develop
regulatory protocol
& participatory
approach

55

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कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

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Q20.

Artificial Intelligence is the use of machines, machine learning, etc for various tasks like in fields like medicine, defence, education, industry etc.

Good in 120

Application of AI

① used to carry out basic tasks in industry, eg:- repetitive operation.

Autonomous etc

② used in recruitment of individuals for jobs.

③ interaction with humans in fields like senior citizen care, etc.

Health

④ defence applications, security based on voice, actions, behaviors etc.

⑤ mapping human behavior for industrial ends like market expansion and price discrimination.

⑥ medicinal applications → disease treatment, etc.

Valid Points
here you can add
↳ cyber security
↳ Agriculture
↳ research etc

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यहाँ इस स्थान
प्रश्न संख्या के
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इस कालिका में
नहीं लिखना
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write on this
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Ethical issues with AI

① fear of exponential intelligence
growth - what if robots become
smarter than humans? Ullmann
consequences.

② Racial Discrimination - AI tends to
work on human patterns - so if
a company has been discriminatory?
in the past AI will follow the same
bias.
↳ Transparency etc

③ Emotional intelligence and the
rights of AI - should they be
treated as humans? Should they
get some rights as citizens?
} digital
behaviours

Challenges of AI adoption in India :-

- ① Inadequate spending on Research & development (around 1% of GDP only) } qualified workforce
- ② hacking demand in Indian market & industry.
- ③ Absence of legislation in AI.

Try to give more specific points like - Privacy issue creation of new integrity

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② No means of fair distribution of benefits from AI.

mention awareness data quality management etc

fair conclusion

NITI Aayog has provided a framework called "AI for All" that encourages fair development of AI and equitable distribution of its gains. These AI can spell out the future of a Smart India and a Digital India.

6

