

Artificial limbs often require - principle
of neuroplasticity and nanodevices

eg. bionic
eye.

- ④ Performance of complex surgery -
which is not possible with
traditional medical equipments -
can be conducted at the cellular
level

(Eg) Nano carriers for eye surgery.

Nano
Sponges
↓
toxicity
absorb

- ⑤ Further research - nanobots can
be used to identify curious information
about body organs - that can be
instrumental in contributing to
disease prevention and better pharmaceuticals
and surgical advancements in the
future.

(Yet) we must be aware of the toxicity,
issues of bioaccumulation and threat
of diseases like silicosis while using
nanotech on a large scale.

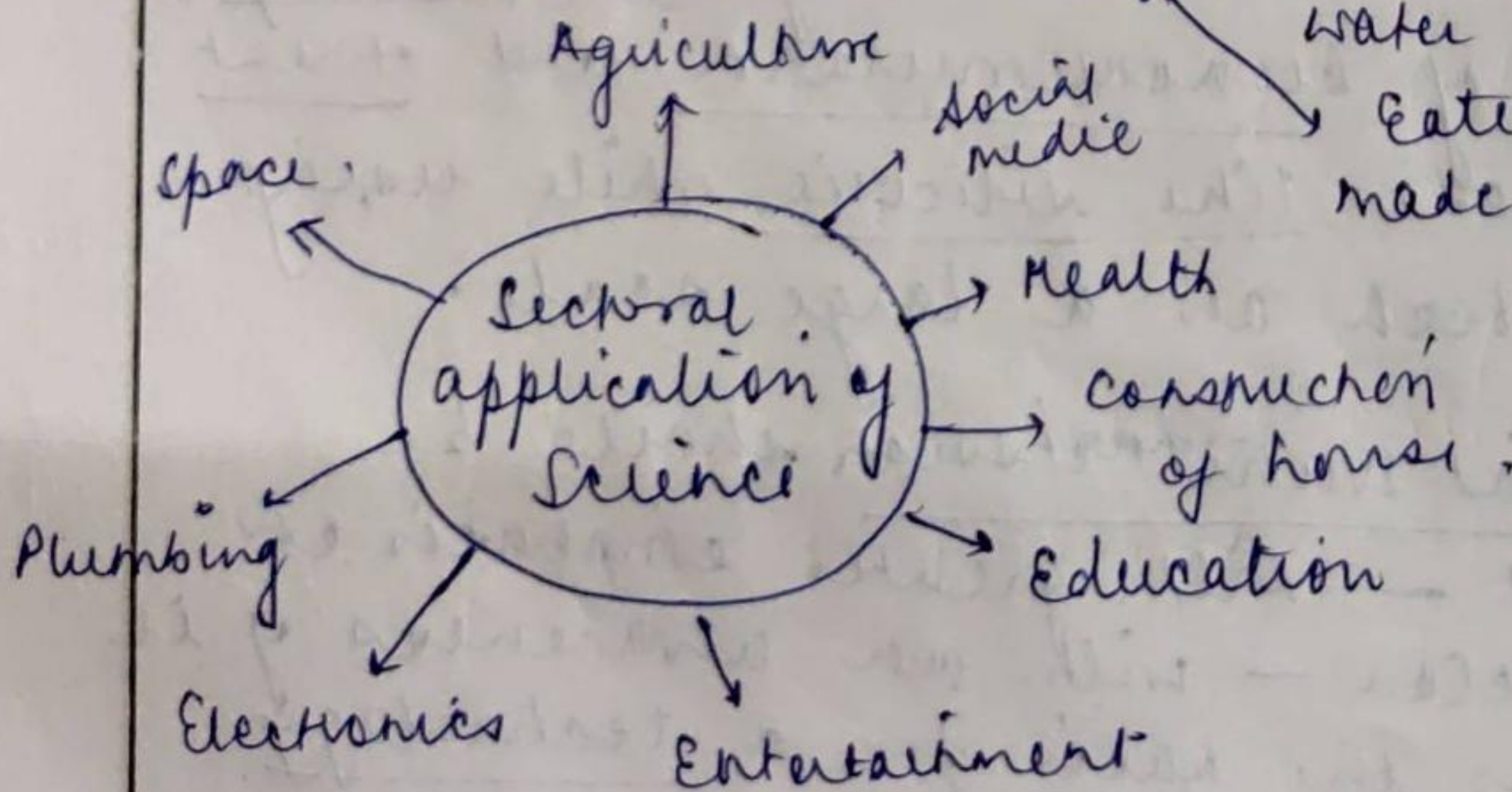
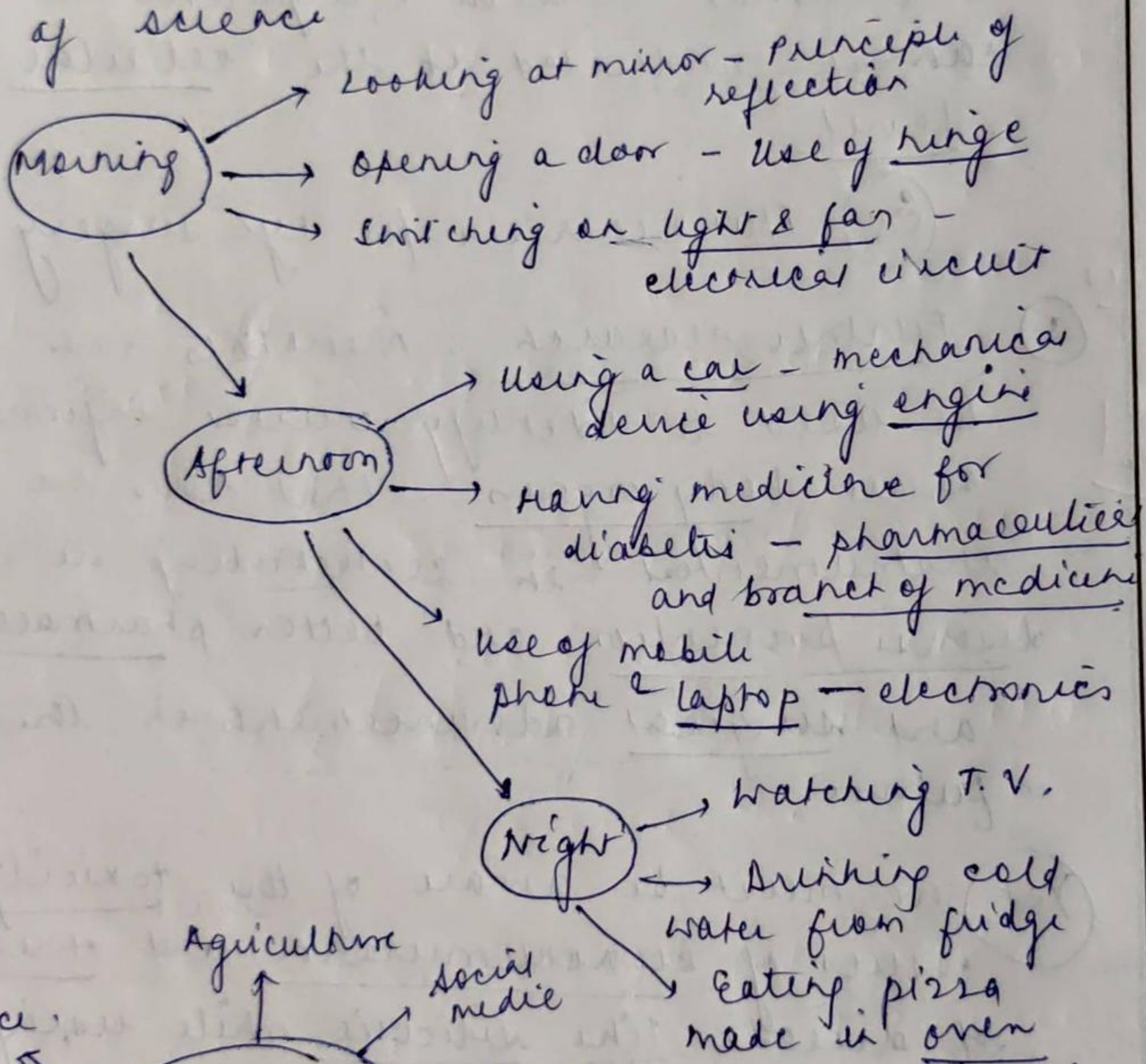
funding
↓
IIT Sc
- 11 TM

The National Nano mission should be
encouraged - with greater emphasis on
health sector - with an awareness of its
threats - as the basis for a technology
revolution in the healthcare sector

U.P.S.C.

2. How is science intervener deeply in our life?
What are the striking changes in agri triggered
off by science based tech?

Every step we take right from when
we wake up to when we sleep —
is inextricably linked with the application
of science



U.P.S.C.

① stones - spraying pesticides

② vertical farming

इस भाग में कुछ
न लिखें
(Don't write anything
in this part)

over the years many striking changes
have emerged in field of agriculture

① Pre sowing analysis - (Eg) use of
soil health card - to analyse quantity
of micronutrients in soil - predict
appropriate crop according to climatic
and soil conditions - for best productivity.

② Machines - such as mechanical
thrusters, plough, winnowing machines
to decrease human labour.

③ Irrigation - newer techniques like
micro and drip irrigation to conserve water

④ newer techniques of agriculture

(Eg) Aquaculture, agraponics and
hydroponics - plants grown in
artificially controlled conditions without
soil.

⑤ Use of nano technology - Use of
nanofertilizers, nanobots to study
presence of microbes and nutrient
analysis.

⑥ Use of data analysis to help farmers in
selling and analysing best markets.

Thus the application of science has
truly transformed all aspects of life
focusing

* HYV seeds

* GM crops

Robo plants

Agri marketing

U.P.S.C.

3. COVID 19 pandemic has caused unprecedented devastation worldwide. However technological advancements are being availed readily to win over the crisis. Give an apt of how technology was sought to aid management of the pandemic.

The COVID 19 pandemic, according to UN Sustainable Dev. Solutions Network has left as many decades before when it found us — affecting all sectors of life.

Technology has come to our rescue in mitigating its negative impact in many ways.

(7) diagnostics, medicines and vaccines

✓ - Ranging from the RT-PCR test to Rapid Antibody Test or the ELISA test, quick diagnosis of the virus was possible.

- This was accompanied with development of vaccines, and medicines limiting worldwide mortality.

- All this was ~~helped~~ achieved with help of cutting edge technology in biomedical field.

serum
home
based
testing

Cipla
+
Roche
casirivimab

U.P.S.C.

Chemical
Codes
— low, med.
high risk

④ Screening — AI,
Thermal cameras
Clusters

इस भाग में कुछ
न लिखें
(Don't write anything
in this part)

II Administration

Tracing COVID 19 patients and isolating them - possible through GPS and other signfencing technology - along with develop. of apps like Aarogya Setu

data dashboards
migration map
real time data - smart phones

III Sanitation and Cleanliness

through new technology - like ARSO developed mass sanitizers ~~for pub~~ and disinfectants for public places like airports.

★ Work from home

IV Communication and Information

dissemination along with tackling issues of mental health and loneliness - Skype possible through regular Zoom meets and Google meets for international conventions as well as seeing family members

V Tele Education and Tele Health Consultations

through mobile phones also limited the problems caused by social distancing.

The pandemic ~~was~~ ^{is} thus an unprecedented disaster in front of us — but technology has helped us manage it ~~at least in~~ to some extent — which must be supported by economic, social & political steps.

④ Robots
Nurses.
(Kerala)
Little Peanut
(China)

④ Drones
↓
delivering
medicine

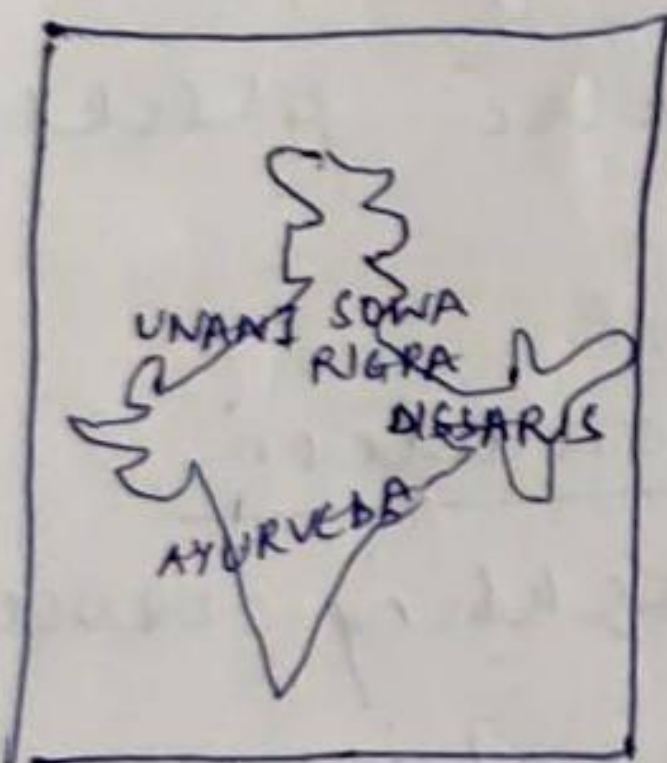
contactless
functioning

U.P.S.C.

①

How is the Govt protecting traditional knowledge of medicine from patenting by pharma companies? C10

India has historically been a land of ancient knowledge — from the birthplace of Yoga to composition of texts like Charaka and Sushruta Samhitā and a rich repository of tribal knowledge about medicinal plants.



MEDICINE SYSTEMS

~ 2000 patents → issued
The Government seeks to protect ~~the~~ this knowledge through

① effective IPR regime —
and legal system — which

struck down the patenting of indigenous sources of knowledge like tulsi and 'kaldi' by American pharma companies.

② Establishment of AYUSH ministry —
for encouraging the use of alternative medicine for treating lifestyle disorders and as a supplement to modern medicine

biopiracy
Nagoya
Protocol
(signing)

U.P.S.C.

Translated m. knowledge
from Sans, Hindi,
Arabic, Urdu,
Tamil.
इस भाग में कुछ
न लिखें
(Don't write anything
in this part)

~~National~~ Trad. Knowledge Dig. Library

(2001) Establishing a digital library and
repository of Indian indigenous
resources and medicinal plants along
with their uses.

5 intl
languages

(4) Use of lawmaking - Laws like the Biodiversity Act

(*) Has
licensed

(*) PPVFR Act establish a balance
between the rights of farmers or
indigenous producers and pharma
companies.

2,00,000
local

treatments
as public
property

free for
anyone to
use / not
to brand

(*) Forest Rights Act of 2006 establishes
rights of forest dwellers over minor
forest produce, sacred groves or any
other medicinal plants that they
grow.

(*) Revive
WTO
talks

(5) The Indian judiciary has also
supported the protection of traditional
knowledge from being poached upon
by ~~the~~ MNCs from abroad.

- Nagoya

- UNESCO
Intangible
Cultural
Heritage
Status
recognition

W
WHO
WHO
Global
Centre for
Traditional
Medicine

Thus a cooperative effort by government,
civil society can only enable a protective
and enabling regime for traditional
medicine to act as a supplement in
the modern Indian healthcare sector in
the future.

U.P.S.C.

How can biotechnology help to improve the living standards of farmers? (10)

Biotechnology refers to harnessing cellular and molecular processes to develop technology in the interest of making life easier for us.

It has greatly enhanced living standards for farmers.

① Greater productivity $\Rightarrow$ Greater income

Introduction of genetically modified crops like BT cotton - increased productivity manifold - making India a major cotton exporter - increasing monetary income.

② Less use of fertilizers & pesticides - less cost.

(Eg) Use of BT cotton against pink bollworm.

③ Additional sources of income - genetics in livestock.

Genetics modification can be made in cattle to increase milk productivity and also nutrients within the milk.

(Eg) CHARIMA of Haryana.

Dhanashakti - 1st iron rich pearl millet in India
 (4) Additional source of nutrients. →
Biofertilisation of ~~rice~~ ^{crops} of Golden Rice (vit A fortification)

(5) Reduced dependence on weather conditions

Climate resilient crops.

(Eg) Development of flood resistant rice (Swarna Sub 1 by ICAR) can increase stability of income.

• short maturing period

*↑
FOOD SECURITY*

HOWEVER it can have negative effects on farmers in the long run as well.

Effects → Health : No detailed study on long term effects of edible GM crops

→ Long term increased resistance to pests (Eg) pink bollworm attack in Punjab, 60 farmers died in Varanasi (excess pesticide spraying)

Land productivity

→ Development of monoculture → Reduced diversity of food intake

→ risk of crop failure

→ Increased dependence on MNCs (Eg) Monsanto (cotton) Bayer (mustard)

WAY FORWARD

Schemes - BioTech - Kisan, BIRAC

According to Supreme Court judgement and Committee by PC Kesavan and MS Swaminathan -

GM crops should be restricted to non edible crops until further study — and care must be taken to protect farmers from excessive dependence on MNCs.

Input intensive

*↓
Knowledge intensive*

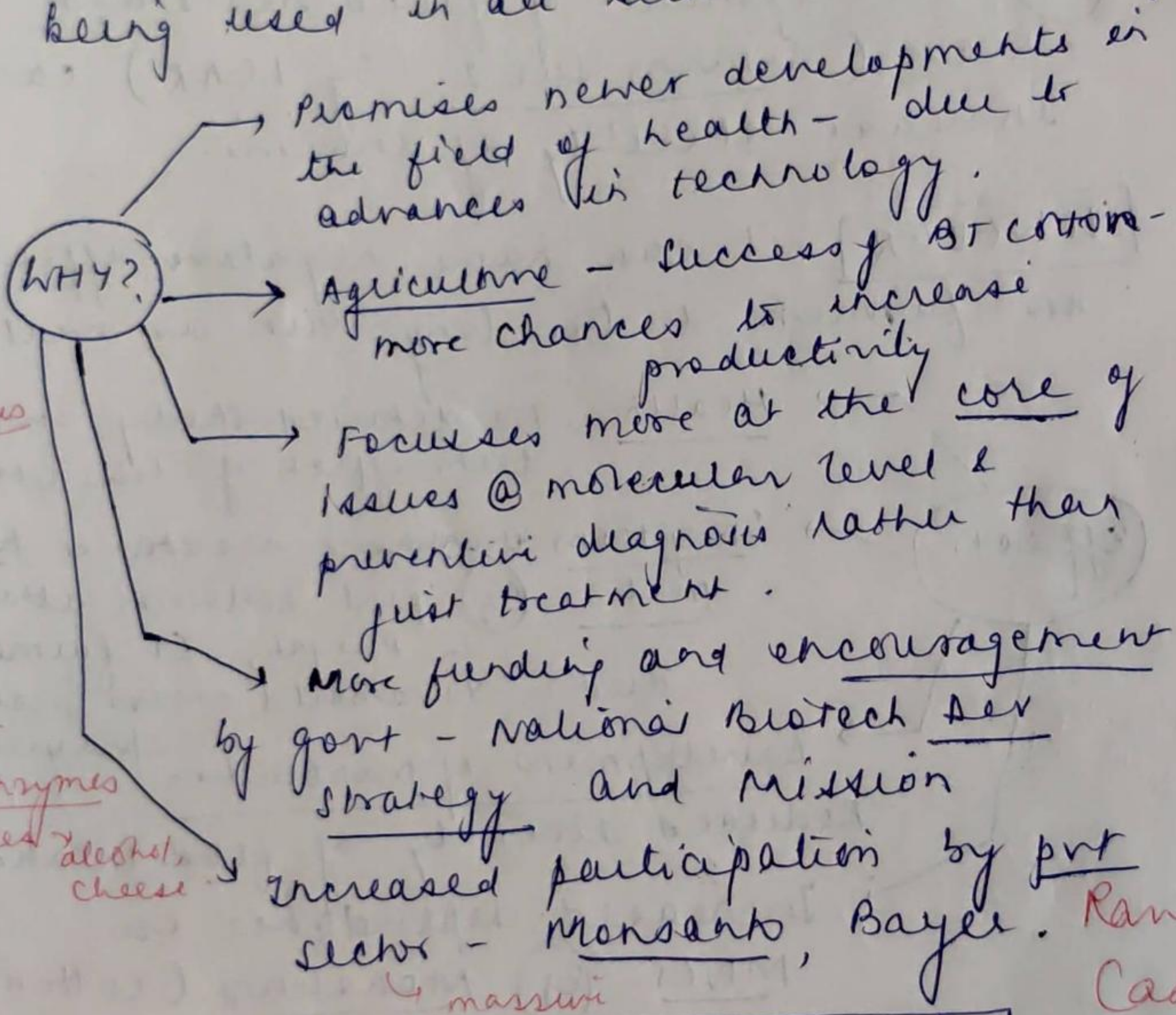
U.P.S.C.

प्रश्न संख्या
(Question No.)

इस भाग में कुछ
न लिखें
(Don't write anything
in this part)

① Why is there so much activity in the field of biotech in our country? How has this activity benefitted the field of biopharma? (10)

Biotechnology - or the use of technology dependent on harnessing cellular & molecular processes - is increasingly being used in all sectors in our country.



Govt Initiatives

Universities & Instts - Awareness

Industry - use of bio-enzymes in prod process - alcohol, cheese

Benefits to biopharma sector

① Advances in diagnostics with more than 70 million ^{cases of} inherited genetic diseases in India - biotech

has helped in effectively diagnosing them early and consequently developing a cure.

Tailoring
treatment
needs.

② Precision medicine - Helps in understanding impact and effectiveness of certain drugs for certain communities

(Eg) Impact of anasthetics at vysya community of Andhra is different from other people.

③ Pharmacogenomics - Use of recombinant DNA processes enables mass production of safe drugs - with less chances of unwanted immunological responses.

(Eg) Genetically engineered insulin.

④ Vaccine and medicine testing

④ Gene
therapy
& gene
editing

The development of transgenic animals like mice - more sensitive to the specific drug can be helpful in the pre-human trial stage.

Thus, initiatives like The Indian Genome

Pharmacy

Project and UMHIS - NIDAN centres - can provide a further impetus to the rapid developments in this sector. Care must be taken to limit its misuse through effective regulation.

U.P.S.C.

Q

What is India's plan to have its own space station and how will it benefit our space programme? (10)

with the launch of a record breaking Mars Orbiter Mission and Chandrayaan missions - with great success, India seeks to establish its position in the space arena with its very own space station in the near future.

In
5-7 yrs

artificial satellite placed in orbit,
long term base for manned operations
in space.

PLAN

* The details have not been chalked out yet but various preliminary stages have been tested

PAS
About
tests

→ The Gaganyaan mission - India's first manned space mission - with 3 astronauts in the Low Earth Orbit is a precursor to the Space Station.

→ ISRO ~~has also~~ ^{is working} carried out space docking exercises (Spadex) which is crucial in the project.

15-20 days

* The size of the Indian space station would be much smaller than the International Space Station and would house 3-5 astronauts. ^{20 tonnes}

* Purpose: To study impact of space environment on humans and microgravity experiments

Cost

ISS (football field)

\$367 ag for NASA Alone - maintain

\$100bn in assembly

U.P.S.C.

प्रश्न संख्या
(Question No.)

इस भाग में कुछ
न लिखें
(Don't write anything
in this part)

It will benefit our space programme in many ways:

① demonstration of technological capability - as establishing a space station requires extremely complex manoeuvres - laying the basis for further

② interplanetary missions. — will leave a vacuum that will need to be filled.

③ End of the ISS in 2024 — will leave a vacuum that will need to be filled.
④ decreased dependence on ISS and other countries for crucial research data - in areas of biotechnology and material science → boosting medicine research and innovation in the country.

★ Acceleration of space progress

↓
greater participation in

Space Governance

⑤ Crucial for strategic purposes and global geopolitics - with even China embarking on its own space station Tianhe (Tiangong 101.)

⑥ will encourage more students to enter the field.

Thus the International Space Station is an ambitious project - with long lasting scientific and strategic benefits - and the Gaganyaan mission is the first step towards that cherished ideal.

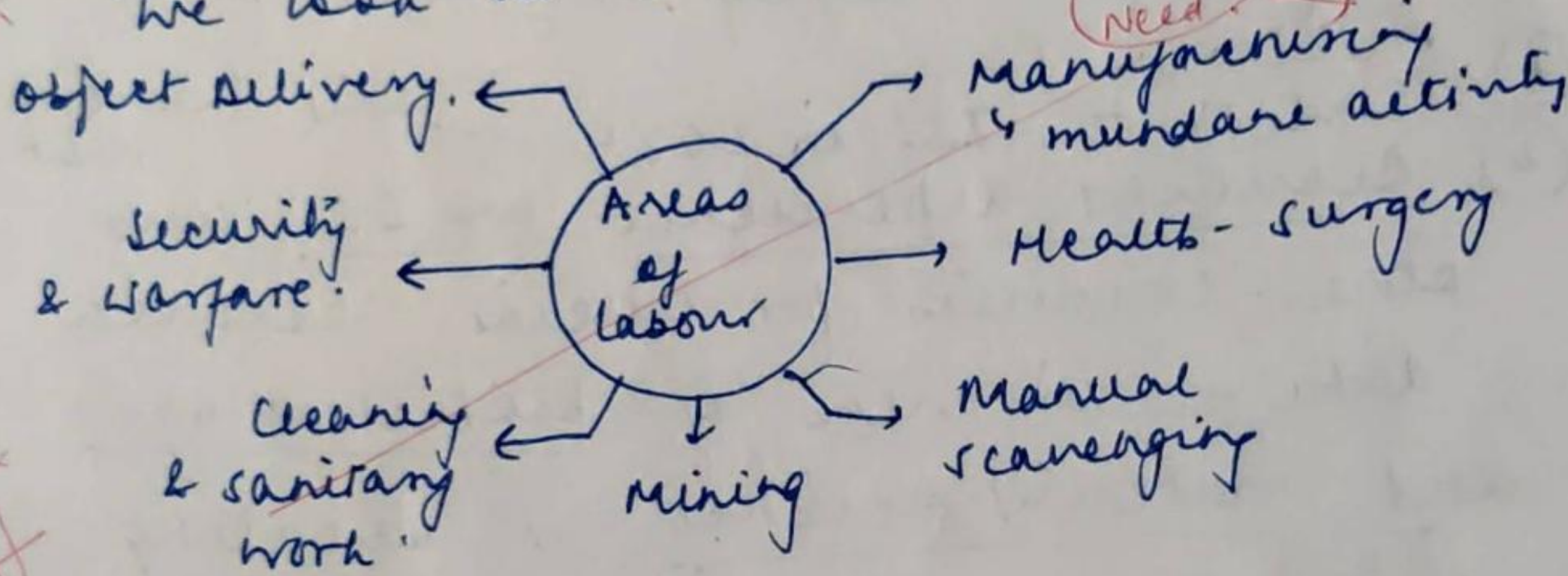
WAF Forward

• funding
• securing
• brain drain

Q.

What are the areas of prohibitive labour that can be sustainably managed by robots? Discuss the Initiatives that can propel research in premier Res. Institutes for substantive & gainful innovation.

Robotics ^{as a means of} entering all sectors of modern life has radically revolutionized how we look at labour.



① Production processes - requiring manufacturing of Integrated Circuit Boards or mass production on a large scale can be sustained by robots.

② Cleaning, sanitation and scavenging - Extremely de-humanizing labour with high health threats. — can be replaced by robots on a large scale in the interest of human dignity

(Eg) Bandicoot.

③ Mining - Detection of high methane content to save lives of people (Eg) Groundhog by the USA.

(Need)
• Precision
• Speed
• Flexibility in switching from one task to another.

* Construction & Assembly heavy stuff
Automobiles
Electronics

④ Radiation waste

Disaster management

Mayhaleya
→ Rat hole mining

④ Nursing and healthcare - Assumes importance in background of coro pandemic

④ Kerala - ASHA nurse (Robot)

⑤ Environment - nanobots can clean oil spills in an efficient and quick manner.

→ Radioactive waste

• At the same time, one must be careful in tackling the inherent biases of data that can be associated with Artificial Intelligence equipped robots.

• Moreover in a labour rich country as India the balance between technology and labour must be maintained.

Positive Initiatives

• CSIR - NMITLI

① National Mission for Integrated Cyber Physical Systems.

① All India Council for Robotics and Automation (AICRA) - Tech Startup Programme

① Estb of Centre for Artificial Intelligence & Robotics.

① National ~~Initiative~~ ^{prog} for AI.

① Estb of NEST Division in MCA

Centre for Excellence → AI & Rob. Aug

• Emerging Technology Initiatives

① Sunrise states

① Make in India

U.P.S.C.

Q With growing energy needs should India keep on expanding its nuclear energy prog? Discuss the facts & fears asso w nuclear energy.

Growing energy needs (India Energy outlook 2021)

- India - world's 3rd largest energy consuming country

- Energy use doubled since 2000, $\sim 80\%$ demand still being met by coal, oil & solid biomass.

- Per capita - Emissions less than half the world average.

Nuclear energy - $\sim 2\%$ $\otimes$ overdependence on coal

Fears.

$\otimes$ Disaster - Fukushima
- Chernobyl

$\otimes$ Env. costs.

↳ Radioactive waste
↳ coolant water (Japan)

$\otimes$ Cost wrt solar, other renews.

$\otimes$ Social cost

↳ protests. - Chernobyl
↳ Kudankulam

$\otimes$ ~~no response~~
Lack of liability of foreign mfg.

$\otimes$ Health risks

Advantages

$\otimes$ massive scale $\otimes$ ITER
 $\sim$ minimal

$\otimes$ Rise in energy demand
Need to $\uparrow$ primary energy supply (3-4 times) by 2032 (NITI Aayog)

2003-04 levels

$\otimes$ Other renewables
Water $\rightarrow$ seasonal
Solar $\rightarrow$ Not 24hr based on geography

displace mfg