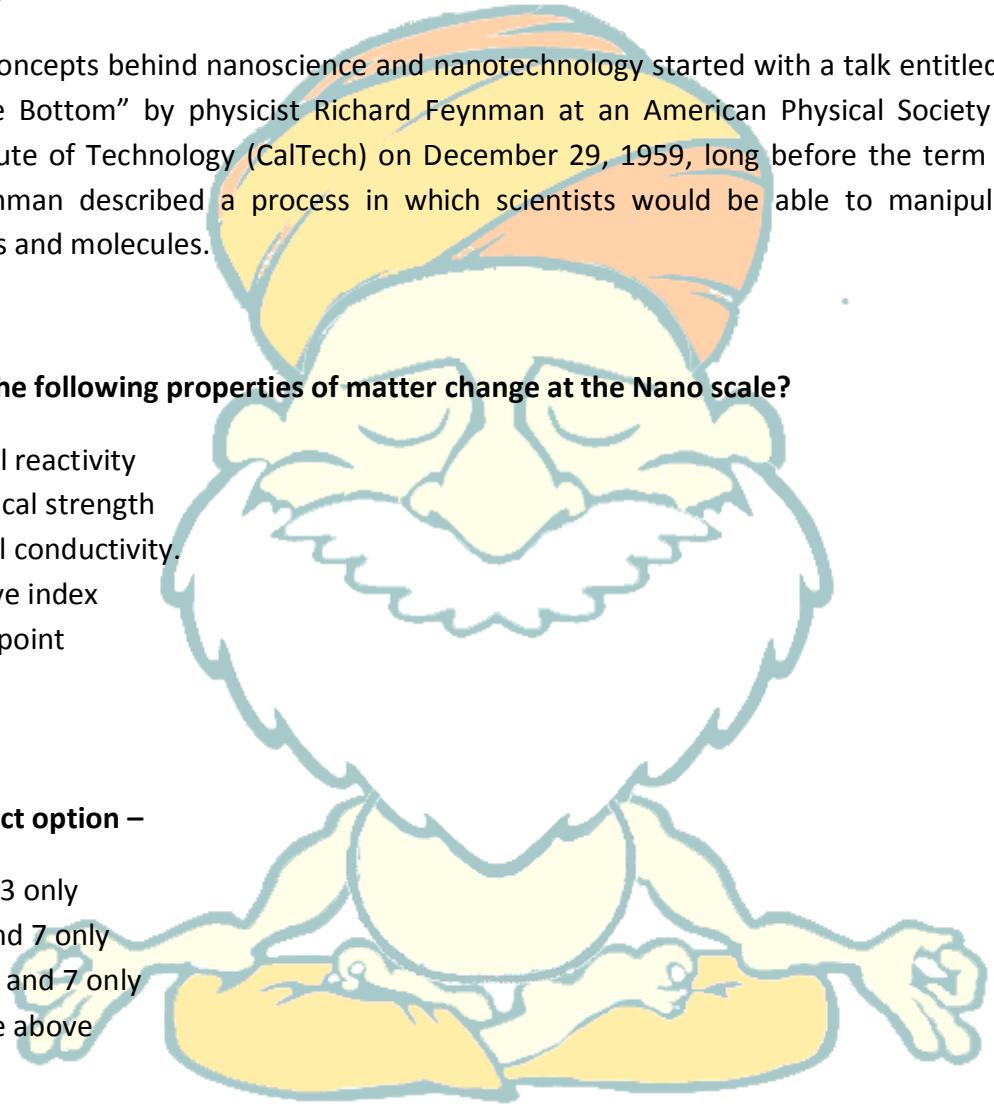
Q.1) 'There's Plenty of Room at the Bottom' was a famous talk by Richard Feynman. What was subject of the talk?

a) Deep Ocean minerals
b) Geothermal energy
c) Nanotechnology
d) Quantum computing

Q.1) Solution (c)

The ideas and concepts behind nanoscience and nanotechnology started with a talk entitled "There's Plenty of Room at the Bottom" by physicist Richard Feynman at an American Physical Society meeting at the California Institute of Technology (CalTech) on December 29, 1959, long before the term nanotechnology was used. Feynman described a process in which scientists would be able to manipulate and control individual atoms and molecules.



Q.2) Which of the following properties of matter change at the Nano scale?

1. Chemical reactivity
2. Mechanical strength
3. Electrical conductivity.
4. Refractive index
5. Melting point
6. Density
7. Colour

Select the correct option –

a) 1, 2 and 3 only
b) 1, 2, 3 and 7 only
c) 1, 2, 3, 5 and 7 only
d) All of the above

Q.2) Solution (d)

Two principal factors cause the properties of nanomaterials to differ significantly from other materials**: increased relative surface area, and quantum effects**. These factors can change or enhance properties such as reactivity, strength and electrical characteristics.

As a particle decreases in size, a greater proportion of atoms are found at the surface compared to those inside.

Chemical reactivity

Gold is considered an inert material in that it doesn't corrode or tarnish. Normally, gold would be a silly material to use as a catalyst for chemical reactions because it doesn't do much. However, break gold down to nanosize (approximately 5 nanometers) and it can act as a catalyst that can do things like oxidizing carbon monoxide.

Density

Density can be generally varied by changing the pressure or the temp. But it has been observed that density changes with the change in the thickness of the layer in nm range . Mass density of Cu,Cr,TiN film on MgO was found to be lower than the corresponding bulk value. SiO2,SiC on stainless steel showed increase in density . Cu, Ag, Au showed no significant change .

Electrical conductivity

Some materials that are conductors in bulk form may become semiconductors or poor conductors at the nanoscale. Some materials that were semiconductors may become conductors or superconductors. The confinement of electrons results in the electrical properties that occur at the nanoscale.

Melting point

At the macro scale, gold has a melting point of 1064 º C. As its particle size decreases to the 100 nm to 10 nm diameter its melting temperatures drops about 100 ºC. As the size reduces to about 2 nm the melting point decreases to about half of the melting point at the macro scales level.

Optical properties and colour

- Optical properties are also size dependent. Electrons cannot move about as freely at the nanoscale and become restricted. The confinement of the electrons causes them to react to light differently. This will affect **refractive Index.**
- Gold for example will appear gold at the macro scale in bulk form. However when it occurs as **Nano-sized particles its color is red**.

Q.3) Which of the following factors are responsible for causing significant difference in properties of nano materials as compared to normal material?

1. Decreased Density
2. Increased relative surface area
3. Increased quantum effects

Select the correct option –

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.3) Solution (b)

Two principal factors cause the properties of nanomaterials to differ significantly from other materials**: increased relative surface area, and quantum effects**. These factors can change or enhance properties such as reactivity, strength and electrical characteristics.

As a particle decreases in size, a greater proportion of atoms are found at the surface compared to those inside. For example, a particle of size 30 nm has 5% of its atoms on its surface, at 10 nm 20% of its atoms, and at 3 nm 50% of its atoms.

Thus nanoparticles have a much greater surface area per unit mass compared with larger particles. As growth and catalytic chemical reactions occur at surfaces, this means that a given mass of material in nanoparticulate form will be much more reactive than the same mass of material made up of larger particles.

In tandem with surface-area effects, quantum effects can begin to dominate the properties of matter as size is reduced to the nanoscale. These can affect the optical, electrical and magnetic behavior of materials, particularly as the structure or particle size approaches the smaller end of the nanoscale. Materials that exploit these effects include quantum dots, and quantum well lasers for optoelectronics.

As the size of their structural components decreases, there is much greater interface area within the material; this can greatly affect both mechanical and electrical properties.

For example, most metals are made up of small crystalline grains; the boundaries between the grain slow down or arrest the propagation of defects when the material is stressed, thus giving it strength. If these grains can be made very small, or even nanoscale in size, the interface area within the material greatly increases, which enhances its strength. For example, nanocrystalline nickel is as strong as hardened steel.

Q.4) Claytronics, an evolving concept, is related to which of the following?

a) Quantum computing
b) Programmable matter
c) Soil testing
d) Robot to scoop matter from celestial body

Q.4) Solution (b)

CLAYTRONICS

- It is the next-generation manufacturing technology based on **programmable matter**.
- It basically entails merger of physical and computational world.
- It combines nanoscale robotics and computer science to create individual nanometer-scale computers called Claytronics atoms, or catoms, which can interact with each other to form tangible 3D objects that a user can interact with.
- The programmable matter called C-Atoms or catoms, are the building blocks of Claytronics which interact with each other using electrostatic forces to form tangible 3D objects.

Q.5) Consider the following statements regarding 'Smart Fertilizers' –

1. Nutrient is released only on-demand by the crop
2. It has designer molecule that allows sustained release of nutrients by a plant-root activated mechanism.
3. Each molecule is a Nano-bot that helps in elimination of unwanted microorganisms from the soil.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) 1 and 2 only
d) 2 and 3 only

Q.5) Solution (c)

Smart Fertilizers have water-insoluble molecules that allow controlled release of nutrients by a plant-root activated mechanism. The molecule is water-insoluble but has a "smart" feature so that nutrient is released only on-demand by the crop. This is a designer molecule that allows sustained release of nutrients by a plant-root activated mechanism. The fertilizer molecule functions like a nutrient storehouse providing a continuous nutrient supply throughout the crop growth period.

With the Smart Fertilizers, **nutrient release is under the control of the plant itself**.

The farmer pays less per acre but gets more yield than with the current fertilizers - farmers' income will increase by 15-20%. Government can save hugely on phosphate imports. In combination with an environment-friendly nature, the Smart Phosphate and Micronutrients provides a win-win situation for all- farmers, Governments and environment.

Statement 3 is not true in the present scenario.

Q.6) Which of the following statements are correct about the Microdot patches?

1. This involves spraying of body parts of vehicles with invisible microdots, which give a unique identification.
2. They will reduce road accidents.
3. They will reduce vehicle thefts.

Select the correct answer using the code given below:

a) 1 and 2 only
b) 1 and 3 only
c) 2 and 3 only
d) 1, 2 and 3

Q.6) Solution (b)

The Ministry of Road Transport & Highways has issued a draft notification amending Central Motor Vehicle Rules, allowing motor vehicles and their parts, components, assemblies, sub-assemblies to be affixed with permanent and nearly invisible microdots that can be read physically with a microscope and identified with ultra violet light source.

Microdot technology involves spraying the body and parts of the vehicle or any other machine with microscopic dots, which give a unique identification. Use of this technology **will help check theft of vehicles** and also use of fake spare parts.

The microdots and adhesive will become permanent fixtures/affixation which cannot be removed without damaging the asset, that is the vehicle itself.

[Note – Microdots patches is not a nanotechnology based application]

Q.7) In which of the following areas Nano Technology has application?

1. RO filtration technology
2. Fuel Cell
3. Cloud Seeding
4. Solar cells
5. Quantum Computing

Select the correct answer using the code given below

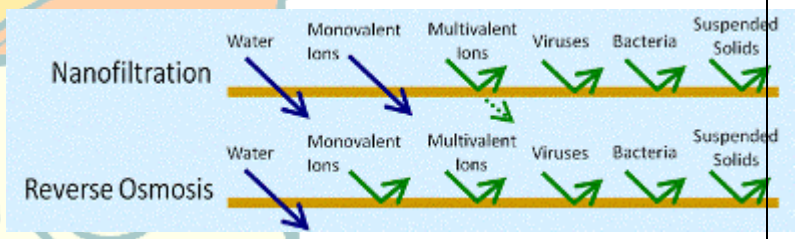
a) 1, 2, 3 and 4 only

b) 2, 3 and 4 only
c) 2, 3, 4 and 5 only
d) All of the above

Q.7) Solution (c)

1. Reverse Osmosis (RO) and Nanofiltration (Nano) are two very similar technologies. In appearance they are virtually identical and both use essentially the same technology to remove impurities from water or other liquids. In both systems, Membrane Elements (or membranes, or elements) are used to separate a liquid from contaminates.

   For better water purification or treatment processes nanotechnology is preferred. Nano was developed primarily for drinking water applications because RO was found to remove some of the minerals in water that are considered beneficial for human consumption. Nano allows these minerals to pass through the membrane with the water, but the Nano membrane will "block" pesticides and other contaminates that can be harmful to people.



2. Fuel cells contain membranes that allow hydrogen ions to pass through the cell but do not allow other atoms or ions, such as oxygen, to pass through. Nanotechnology is used to create more efficient membranes; this will allow them to build lighter weight and longer lasting fuel cells.

3. Nanotechnology has opened up the possibility of engineering unique cloud seeding particles to make the process of water condensation and rain precipitation more efficient. The UAE recently has run a new method of cloud seeding to increase rainfall. In this method, a new kind of nanomaterials is being sprayed into clouds to determine whether or not they are more effective than traditional materials.

4. Various advances have incorporated nanotechnology into solar panels to simultaneously improve efficiency while also reducing associated manufacturing and installation costs.

5. Many nanomaterials exhibit quantum properties which can then be utilized for many quantum technology applications, such as quantum computing, quantum electronics and quantum photonics. In this article, we look at why nanomaterials can be used in quantum technology and some of the quantum applications out there today.

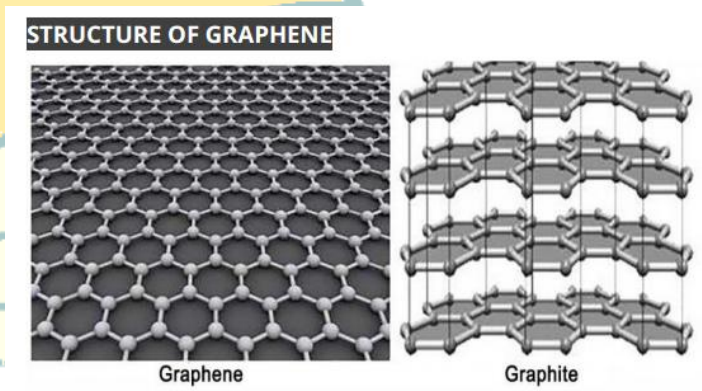
Q.8) Consider the following statements regarding Graphene –

1. It is the thinnest and lightest material known to man.
2. It exhibits both electrical and thermal conductivity.
3. It is optically Transparent.

Which of the statements given above is/are correct?

a) 1 only
b) 1 and 2 only
c) 1 and 3 only
d) All of the above

Q.8) Solution (d)



SINGLE-LAYER GRAPHENE

Next-generation wonder material that will revolutionize material science.

- 'Graphene is a 1-atom thick layer of carbon atoms arranged in a hexagonal ring shape.
- The carbon-atoms in graphene are laid out flat making it effectively a 2-D crystal.
- Imagine graphite (used in pencil) to be made up of billions of layers of carbon atoms, one such layer is what represents graphene.
- The way the carbon atoms are arranged in graphene gives it the unique combination of properties.

UNIQUE COMBINATION OF PROPERTIES

- Strength: It is a 2-d crystal stronger than diamond and 300 times stronger than steel.
- Thickness: Thinnest material known, million times thinner than human hair.
- Light: Being 1-atom thick layer, it is extremely light
- Conductor: It exhibits both electrical and thermal conductivity.
- Optically Transparent
- Flexible
- Hydro-phobic

POTENTIAL APPLICATIONS

- Aerospace, ship building and Automotive
    - Next-gen materials for aircraft bodies and ship hulls.

  - Being light and strong; it will reduce the drag of the aircraft or ship hulls, thereby increasing their fuel efficiency.
  - For the same reason mentioned above graphene may be useful automotive bodies.
- High-speed electronics: As a result of super-conductivity, it is ideal for high-speed electronics.
- High-speed computers
  - The speed and performance of any computer depends on the size of the microprocessors inside it.
  - Graphene may potentially replace silicon chips used to make transistors in microprocessors.
- Flexible Screens, sensors: Graphene may also revolutionize touch-screen technology due to its flexibility. (flexible foldable screens)
- Thermo-electric devices: Due to thermal conductivity, graphenes may be used in thermo-electrical devices which can convert heat wasted in many devices like computers, automobile etc into electricity.
- Solar panels
- Graphenes can potentially be used to make photovoltaic cells.
  - Currently P-V cells undergo degradation upto 30% a year due to exposure to radiation from sun.
  - Energy Storage: Graphenes can make the size of batteries extremely small.

Q.9) Consider the following statements –

1. The new division of 'New and Emerging Strategic Technologies (NEST)' has been established under Ministry of Science and Technology.
2. It will spearhead collaboration with foreign partners in the field of 5G and artificial intelligence.
3. It will encourage more public-private collaboration and funding to cutting edge private research.

Select the correct option –

a) 1 only
b) 2 only
c) 1 and 2 only
d) 2 and 3 only

Q.9) Solution (b)

New and Emerging Strategic Technologies (NEST)

Ministry of External Affairs has announced the setting up of a new division on New and Emerging Strategic Technologies (NEST).

The division will act as the nodal point in India's foreign ministry for all matters connected to new and emerging technologies including **exchange of views with foreign governments and coordination with domestic ministries and departments**. (**No funding of private research**)

Objective

- Assessing foreign policy and international legal implications of emerging technology and technology-based resources.
- Facilitating negotiations to safeguard Indian interests at multilateral forum like the United Nations or the G20.
- Creation of HR capacity within the ministry for technological diplomacy work.
- **Collaboration with foreign partners in the field of 5G and artificial intelligence.**

Q.10) Which of the following is planning to launch a four-armed robot, Chaser, to clean up Earth's orbit in 2025?

a) NASA
b) JAXA
c) European Space Agency
d) Roscosmos

Q.10) Solution (c)

CLEARSPACE-1 MISSION

- The European Space Agency (ESA) is planning to launch a four-armed robot, Chaser, to clean up Earth's orbit in 2025.
- Chaser is to be developed by a Swiss start-up ClearSpace under ClearSpace-1 mission.
- Once launched into space, it will grab the chosen piece of space trash, one at a time, using its robotic arms and fall back towards Earth in a controlled descent.
- The target is a piece of junk called Vespa, around 800km above the Earth.
- Earth's orbit is home to more than 3,500 defunct satellites and an estimated 750,000 smaller fragments.
- All of these pieces are flying at a velocity of around 20,000km/h.
- More debris could lead to more collisions - a cascade effect known as the Kessler syndrome which may render space eventually inoperable for important services like navigation, communications, weather forecasting etc.

Q.11) Which country has recently sent the humanoid robot to International Space Station to assist astronauts?

a) U.S.A
b) Japan
c) China
d) Russia

Q.11) Solution (d)

Relevant Information

- Recently, Russia sent the humanoid robot Fedor, also known as Skybot F850 to International Space Station. It will spend 10 days in space to assist astronauts.
- Fedor is Russia's first robot in space.
- Previously in 2011 NASA sent up Robonaut 2, a humanoid developed with General Motors and in 2013 Japan sent up a small robot called Kirobo, developed with Toyota which holds conversations in Japanese

Q.12) Consider the following statements –

1. The International Conference on Nano Science and Nano Technology (ICONSAT) is organised under the aegis of Nano Mission by Department of Science and Technology.
2. India is amongst the top five nations in the world in terms of scientific publications in Nanoscience and technology.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.12) Solution (c)

The International Conference on Nano Science and Nano Technology (ICONSAT) under the aegis of **Nano Mission,** Department of Science and Technology (DST) is being held at Kolkata focusing on **the recent advances in this frontier research field.**

Key Points

- The conference intends to bring out cutting-edge developments in the domain of physical, chemical, materials as well as biological sciences with the help of nanotechnology.

- The event emphasised on 5Ms – Mechanical, Material, Machines, Manufacturing and Manpower, and integration of these 5 Ms with nano-science and technology.
- It also aimed to integrate nanotechnology with sustainable development and new technology (machine learning, artificial intelligence and so on).
- It emphasized the need to create a network of experts in nano-science and to collaborate the knowledge across sectors like energy, agriculture, transport, health and so on.
- It also aims to provide a potential platform for young researchers and students from within the country and abroad to keep pace with the latest development in the emerging areas of Nano Science and Technology.

Mission on Nano Science and Technology (Nano Mission)

- The Government of India launched the Nano Mission in **2007** as an **"umbrella capacity-building programme".**
- It is being implemented by **the Department of Science and Technology (DST)** under the Ministry of Science and Technology.
- The objectives of the mission are:
  - Basic research promotion
  - Infrastructure development
  - Nano applications and technology development
  - Human Resource development
  - International collaborations
- As a result of the efforts led by the Nano Mission, today, India is amongst the **top five nations in the world** in terms of **scientific publications in Nanoscience and technology** (moving from 4th to the 3rd position).
- The Nano Mission has established national dialogues to promote R&D in the development of standards for nanotechnology and for laying down a **National Regulatory Framework Road-Map for Nanotechnology (NRFR-Nanotech).**

Q.13) Consider the following statements regarding Tissue Nano Transfection:

1. The process is believed to heal injuries or regrow organs with one touch.
2. A Nano-chip injects genetic code into skin cells, turning those skin cells into other types of cells required for treating diseased conditions.
3. It first converts the skin cells into pluripotent cells and then converts them into functional cells.

Which of the above statements are correct?

a) 1 and 2
b) 2 and 3

c) 1 and 3
d) All of the above

Q.13) Solution (a)

Nano Transfection

Nano-chip could heal injuries or regrow organs with one touch. A tiny device that sits on the skin and uses an electric field to reprogramme cells could be a breakthrough in the way we treat injured or ageing tissue. A novel device that reprogrammes skin cells could represent a breakthrough in repairing injured or ageing tissue. The new technique, called tissue nanotransfection, is based on a tiny device that sits on the surface of the skin of a living body.

An intense, focused electric field is then applied across the device, allowing it to deliver genes to the skin cells beneath it – turning them into different types of cells. It offers an exciting development when it comes to repairing damaged tissue, offering the possibility of turning a patient's own tissue into a "bioreactor" to produce cells to either repair nearby tissues, or for use at another site. It avoids an intermediary step where cells are turned into what are known as pluripotent stem cells, instead turning skin cells directly into functional cells of different types. It is a single step process in the body. The new approach does not rely on applying an electric field across a large area of the cell, or the use of viruses to deliver the genes.

Q.14) Which of the following statements are correct regarding Nano Composites:

1. It is a combination of a bulk matrix and nano-dimensional phase(s) differing in properties.
2. Nanocomposites differ from conventional composite materials due to the exceptionally high surface to volume ratio of the reinforcing phase.
3. Nano composites are not found in nature.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.14) Solution (a)

Nanocomposites is a multiphase solid material where one of the phases has one, two or three dimensions of less than 100 nanometers (nm), or structures having nano-scale repeat distances between the different phases that make up the material.

The idea behind Nanocomposites is to use building blocks with dimensions in nanometre range to design and create new materials with unprecedented flexibility and improvement in their physical properties.

In the broadest sense this definition can include porous media, colloids, gels and copolymers, but is more usually taken to mean the solid combination of a bulk matrix and nano-dimensional phase(s) differing in properties due to dissimilarities in structure and chemistry. The mechanical, electrical, thermal, optical, electrochemical, catalytic properties of the Nanocomposites will differ markedly from that of the component materials.

Nanocomposites are found in nature, for example in the structure of the abalone shell and bone. The use of nanoparticle-rich materials long predates the understanding of the physical and chemical nature of these materials.

In mechanical terms, Nanocomposites differ from conventional composite materials due to the exceptionally high surface to volume ratio of the reinforcing phase and/or its exceptionally high aspect ratio. The reinforcing material can be made up of particles (e.g. minerals), sheets (e.g. exfoliated clay stacks) or fibres (e.g. carbon nanotubes or electrospun fibres). The area of the interface between the matrix and reinforcement phase(s) is typically an order of magnitude greater than for conventional composite materials. The matrix material properties are significantly affected in the vicinity of the reinforcement.

This large amount of reinforcement surface area means that a relatively small amount of nanoscale reinforcement can have an observable effect on the macro scale properties of the composite. For example, adding carbon nanotubes improves the electrical and thermal conductivity.

Q.15) Which of the following is correct description of 'Vyommitra', recently in news?

a) ISRO's humanoid robot that will test-flight Gangayaan
b) ISRO's humanoid robot that will go to International Space Station.
c) Large robotic air purifiers developed indigenously by CSIR.
d) Drones installed with air guns for scattering of smog.

Q.15) Solution (a)

VYOMMITRA

- ISRO's humanoid robot that will test-flight Gangayaan in December 2020.
- It is a Gynoid (female humanoid).
- Vyom Mitra was built by ISRO's Inertial Systems Unit, Thiruvananthapuram.

OBJECTIVES

- To perform panel operations on board the spacecraft
- Act as companion to astronauts capable of recognizing, conversing and responding to their queries

- To test the Environmental Control & Life Support System of Gaganyaan in order to detect environmental Changes

Q.16) Which of the following statements are correct regarding 'Automated Guided Vehicle' Robots?

1. They are portable robots that follow along marked lines or wires on the floor.
2. They are most often used in industrial applications to transport heavy materials around a large industrial building, such as a factory or warehouse.
3. It uses lasers, camera, Electromagnetic radiation or Magnetism to navigate.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.16) Solution (d)

An automated guided vehicle or automatic guided vehicle (AGV) is a portable robot that follows along marked lines or wires on the floor, or uses radio waves, vision cameras, magnets, or lasers for navigation. They are most often used in industrial applications to transport heavy materials around a large industrial building, such as a factory or warehouse. Application of the automatic guided vehicle broadened during the late 20th century.

Q.17) Which of the following best describes Quantum Dots?

a) Interstitial spaces, at the nanoscale, in the crystal of a metal.
b) Basic units of quantum computing.
c) Nanoparticles made of Semiconductor materials.
d) Electronic state forbidden in materials at the Nano scale.

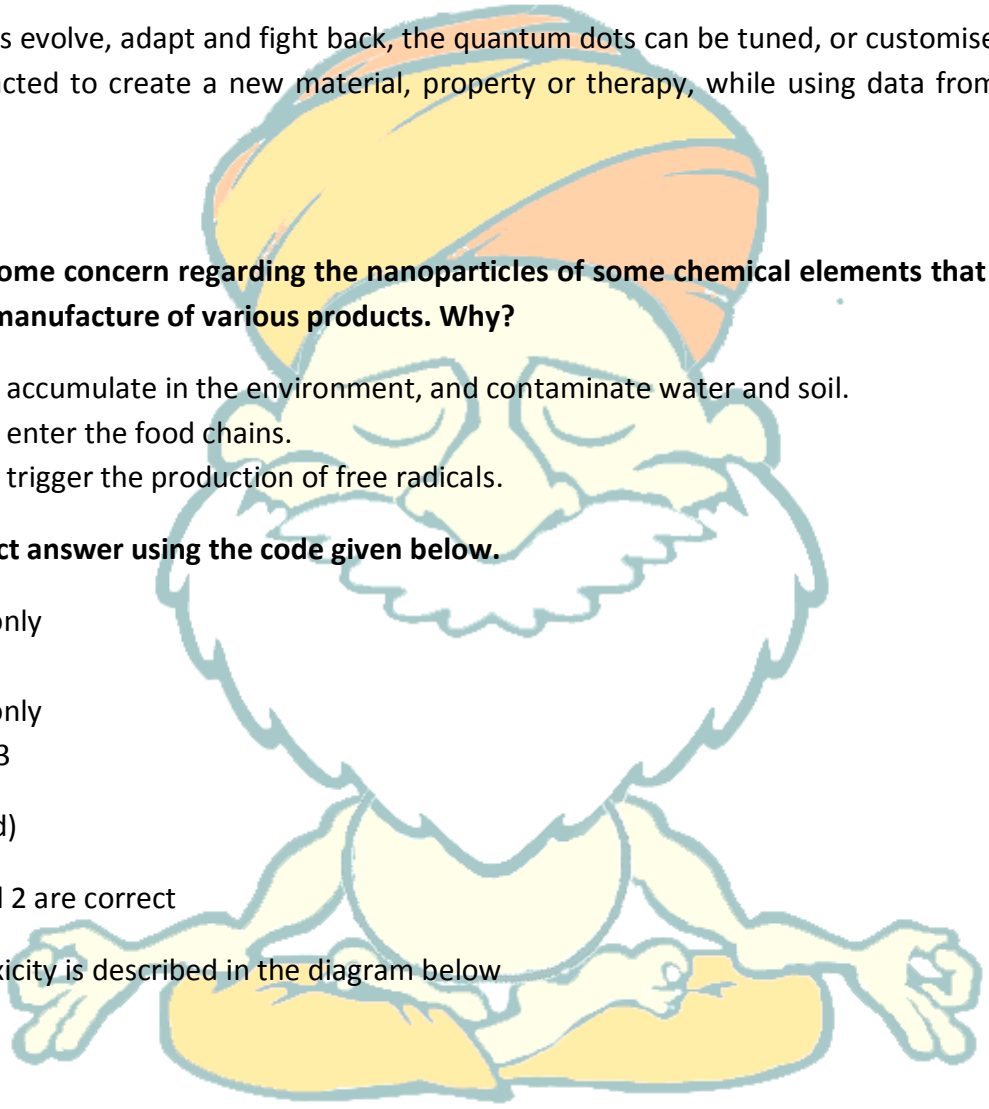
Q.17) Solution (c)

A quantum dot is a nanoparticle made of any semiconductor material such as silicon, cadmium selenide, cadmium sulfide, or indium arsenide. They are essentially small crystals of nanometer-size dimensions – they're about 20,000 times smaller than the width of a human hair. They are each one million times smaller than a millimeter. They have distinctive electrical conduction properties that are determined by the incredibly small size and structure.

Quantum-dot therapy and drug administration

Bacteria rely on "redox" reactions, those involving the addition or removal of oxygen (reduction and oxidation, respectively). And when several Quantum dots are "excited" nearby, they produce chemicals that are able to be reduced or oxidized by reactive compounds within the bacteria. This effectively interferes with their intercellular processes, disrupts their cell growth, and kills them. In a lab-grown culture, this method has been shown to kill 92% of a variety of drug-resistant bacterial cells, while leaving other cells alone.

As the superbugs evolve, adapt and fight back, the quantum dots can be tuned, or customised, with an atom added or subtracted to create a new material, property or therapy, while using data from related clinical trials or drugs.



Q.18) There is some concern regarding the nanoparticles of some chemical elements that are used by the industry in the manufacture of various products. Why?

1. They can accumulate in the environment, and contaminate water and soil.
2. They can enter the food chains.
3. They can trigger the production of free radicals.

Select the correct answer using the code given below.

a) 1 and 2 only
b) 3 only
c) 1 and 3 only
d) 1, 2 and 3

Q.18) Solution (d)

Statement 1 and 2 are correct

Nanoparticle toxicity is described in the diagram below

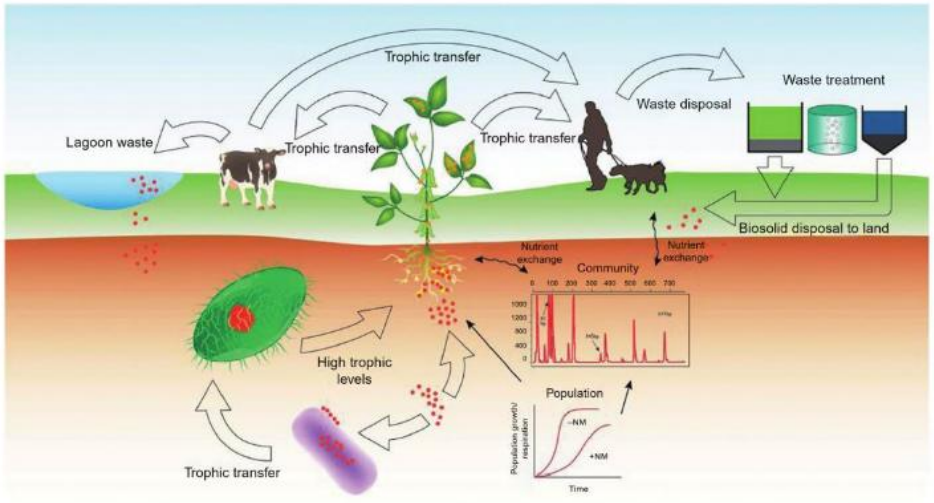


Figure 3.3 Schematic diagram showing the concept of ecological nanotoxicity. Engineered nanomaterials (red dots) entering bacteria (purple) existing in soil below ground can pass to protozoa (green). These nanomaterials can also enter plant systems via the roots. In the food chain, engineered nanomaterials propagate upwards in the ecosystem (Holden et al., 2013).

Statement 3 is also correct – Nanoparticles of titanium dioxide and Zinc oxide used in large number of cosmetics, sunscreens and personal care products are photoactive, producing free radicals and causing DNA damage to human skin cells. In fact free radical production is one of the main mechanism of nanoparticle toxicity.

Q.19) Which of the following are prospective applications of Nanotechnology?

1. Gene sequencing
2. Tissue engineering
3. Neuro-electronic devices
4. Stem Cell Technology

Select the correct option –

a) 1 and 2 only
b) 1, 2 and 3 only
c) 1, 2 and 4 only
d) All of the above

Q.19) Solution (d)

Nanotechnology is science, engineering, and technology conducted at the nanoscale, which is about 1 to 100 nanometers. Physicist Richard Feynman is the father of nanotechnology.

Applications of nanotechnology in the medical field

Nanomedicine is an application of nanotechnology which works in the field of health and medicine. Nanomedicine ranges from the medical applications of nanomaterials and biological devices to nanoelectronics biosensors and even possible future applications of molecular machines.

- **Targeted drug delivery** – the required drug dose and side-effects are minimised.
- **Tissue Engineering** - damaged tissue can be reproduced or repaired.
- **Antibacterial Treatments** - gold nanoparticles and infrared light can be used to kill bacteria.
- **Wound Treatment** – bandage can apply electrical pulses to a wound using electricity produced by nanogenerators.
- **Cell Repair** - Nanorobots could be programmed to repair specific diseased cells functioning similar to antibodies.
- **Cancer Treatment** - Iron nanoparticles or gold shells are finding important application in cancer treatment.
- **Imaging** - Using nanoparticle contrast agents, images such as ultrasound and MRI have improved contrast.
- **Blood purification** - the purification with nanoparticles allows specific targeting of substances.
- **Neuro-electronic interfacing** is a visionary goal dealing with the construction of **nanodevices that will permit computers to be joined and linked to the nervous system**.
- **Gene sequencing** - nanodevices like gold nanoparticles can be used to tag and detect short segments of DNA.
- **Stem Cell Technology**: magnetic nanoparticles (MNPs) have been successfully used to isolate and group stem cells.

Q.20) Consider the following statements –

1. Indian Nanoelectronics Users Programme (INUP) is being implemented at Centre of Excellence in Nanoelectronics (CEN) at IISc and IIT Bombay.
2. It has been initiated by Ministry of Electronics and Information Technology (MeitY).

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.20) Solution (c)

A unique initiative for accelerating research and development in nanoelectronics in India has been launched in August 2008 at the Centers of Excellence in Nanoelectronics (CEN) at Indian Institute of Science, Bengaluru (IISc) and Indian Institute of Technology Bombay (IITB). The Indian Nanoelectronics Users Program

(INUP) intends to facilitate experimentation of research ideas of Indian researchers in the general area of nanoelectronics.

The program, funded by the Department of Information Technology (DeitY), the Ministry of Communications and Information Technology (MCIT), Govt.

Q.21) 'Currency Derivatives' in Indian Pairs like 'USDINR' and 'GBPINR' are traded on

a) NFO
b) BSE
c) MCX
d) CDS

Q.21) Solution (d)

'Currency Derivatives' in Indian Pairs like 'USDINR' and 'GBPINR' are traded on CDS (NSE Currency Derivative Segment).

Q.22) Recently announced Einstein Challenge, is related to which of the following?

a) To ensure the ideals of Gandhi are remembered by future generations.
b) To build all modules in a timely manner for India's own Space station.
c) To develop innovative solutions to the social problems of India.
d) To make all urban areas within India Open Defecation Free (ODF).

Q.22) Solution (a)

- PM Modi announced **Einstein Challenge to ensure the ideals of Gandhi are remembered by future generations.**
- In this he invited thinkers, entrepreneurs and tech leaders to take the lead to spread Gandhi's ideas through innovation.

Q.23) Consider the following statements about C40 Clean Air Cities Declaration:

1. It was unveiled at the WHO Global Conference on Air Pollution and Health.
2. Delhi is the only Indian city to sign the declaration.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.23) Solution (d)

Statement 1	Statement 2
Incorrect	**Incorrect**
'C40 Clean Air Cities Declaration' was unveiled at the C40 World Mayors Summit. Through this Declaration, mayors commit to using their power and influence to reduce air pollution and work towards meeting the WHO's Air Quality Guidelines.	Among 35 cities, **Bengaluru and Delhi** are the two Indian cities signing the C40 Clean Air Cities Declaration. Six Indian cities are currently members of C40: Bengaluru; Chennai; Delhi NCT; Jaipur; Kolkata and Mumbai.

Q.24) The Future Investment Initiative (FII) is an annual investment forum held in

a) Switzerland
b) Saudi Arabia
c) Singapore
d) South Africa

Q.24) Solution (b)

- **The Future Investment Initiative (FII) is an annual investment forum held in Riyadh, Saudi Arabia.**
- It is held to discuss trends in the world economy and investment environment in the context of the Saudi Vision 2030 program of economic and social reform to diversify the kingdom's economy and reduce its dependence on petroleum products.
- It is hosted by the Public Investment Fund of Saudi Arabia (PIF), Saudi Arabia's main sovereign wealth fund.
- The Future Investment Initiative (FII) is widely described as "**Davos in the desert**". The informal name derives from the World Economic Forum's annual meeting that is held in Davos, Switzerland, where world leaders discuss agendas for pressing international issues.

Q.25) Recently seen in news, Phazolicin is

a) A semi-Dirac metal
b) An organoid grown in lab
c) A new antibiotic discovered
d) A cancer drug discovered

Q.25) Solution (c)

- **Phazolicin is a new antibiotic discovered in the soil of a tropical rainforest of Mexico**.
- Found in the root nodules of wild beans (Phaseolus vulgaris), this unusual antibiotic is produced by a symbiotic soil bacterium.
- The bacterium that produces phazolicin is an unidentified species of Rhizobium.
- The antibiotic phazolicin is a class of peptide produced in the ribosome.
- This has specific application in agriculture.

Q.26) Which of the following is/are correct regarding the 20th Livestock Census of India?

1. It covers all domesticated animals and its headcounts only in rural areas.
2. Uttar Pradesh (UP) has recorded highest livestock population followed by Rajasthan.
3. West Bengal has the highest cattle population among the Indian States.

Select the correct answer using the code given below:

a) 1 and 3 only
b) 2 only
c) 2 and 3 only
d) 1, 2 and 3

Q.26) Solution (c)

- Department of Animal Husbandry & Dairying, Ministry of Fisheries, Animal Husbandry and Dairying has released the 20th Livestock Census report.
- The total Livestock population is **535.78** million in the country showing an increase of **4.6%** over Livestock Census-2012.

Statement 1	**Statement 2**	**Statement 3**
Incorrect	**Correct**	**Correct**

Census covers all domesticated animals and its headcounts both in rural and urban areas. Various species of animals (Cattle, Buffalo, Yak, Sheep, Goat, Pig, Donkey Camel, Dog, Rabbit, Elephant etc.)/poultry birds possessed by the households, enterprises and institutions are counted at their site.	State-wise **Uttar Pradesh (UP)** has recorded **highest livestock population** in 2019 followed by Rajasthan, Madhya Pradesh, West Bengal, Bihar, Andhra Pradesh and Maharashtra.	In terms of cattle population, **West Bengal** has the **highest** population followed by Uttar Pradesh, Madhya Pradesh, Bihar and Maharashtra.

Q.27) As per Global Hunger Index (GHI) Report 2019, the severity of hunger problem of India falls in which of the following category?

a) Low
b) Moderate
c) Serious
d) Alarming

Q.27) Solution (c)

- In the recently released Global Hunger Index (GHI) Report-2019, **India** was ranked at 102nd position out of 117 countries. **With the score of 30.3, it is listed as country with 'serious' hunger problem.**
- The report is an annual publication that is jointly prepared by the Concern Worldwide (an Irish agency) and the Welt Hunger Hilfe (a German organization).
- The report is based on four GHI indicators namely, undernourishment, child stunting, child wasting, and child mortality.

Q.28) Which of the following global efforts aims to conserve Snow Leopard?

1. Global Snow Leopard and Ecosystem Program
2. Global Tiger Initiative
3. SECURE Himalaya

Select the correct answer using the code given below:

a) 1 and 3 only
b) 1 only

c) 1 and 2 only
d) 1, 2 and 3

Q.28) Solution (d)

- All the 3 programmes aim to protect the Vulnerable (IUCN status) Snow Leopard.
- The 12 Snow Leopard Range countries: India, Nepal, Bhutan, China, Mongolia, Russia, Pakistan, Afghanistan, Kyrgyzstan, Kazakhstan, Tajikistan, and Uzbekistan.
- **Global Snow Leopard and Ecosystem Program (GSLEP)** is an inter-governmental alliance of all the 12 Snow Leopard range countries.
- The GSLEP is a range-wide effort that unites range country governments, nongovernmental and inter-governmental organizations, local communities, and the private sector around a shared vision to conserve snow leopards and their valuable high-mountain ecosystems.

- The **Global Tiger Initiative (GTI)** was launched in 2008 as a global alliance of governments, international organizations, civil society, the conservation and scientific communities and the private sector, with the aim of working together to save wild tigers from extinction. In **2013, the scope was broadened to include Snow Leopards**.
- The **SECURE Himalaya** project is working in select **Snow Leopard** landscapes of Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Sikkim to develop a long-term strategy to conserve the **Snow Leopard** and its ecosystems, by adopting a landscape-based approach.

Q.29) Sometimes seen in news, Soli Chip Technology is developed by

a) Google
b) Qualcomm
c) Samsung
d) Intel

Q.29) Solution (a)

- **Google's ATAP (Advanced Technology and Projects) division** has been developing **Soli Chip technology**, which can be used in wearables, phones, computers, cars and IoT devices.
- Recently launched Google Pixel 4 uses a radar-based Soli chip to introduce Motion Sense, a feature that provides similar touchless gesture-based controls.
- Soli is a dedicated radar chip on the front of the Pixel to collect raw data of hand gestures and then interpret them correctly for the right commands.

- Soli relies on a custom-built Machine Learning (ML) model to understand a large range of possible movements.

Q.30) Consider the following statements:

1. RBI will setup the framework for Acceptance Development Fund (ADF) to increase acceptance of debit and credit cards in tier II cities.
2. It was recommended by the Nandan Nilekani Committee.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.30) Solution (b)

Statement 1	**Statement 2**
Incorrect	**Correct**
RBI has said that the **framework for Acceptance Development Fund (ADF) will be set up to increase acceptance of debit and credit cards in tier III and VI cities.**	This was indicated in the Payment System Vision Document 2021 of RBI and **also recommended by the Committee** on Deepening of Digital Payments (Chaired by **Nandan Nilekani**).