1. **Define science and technology?**

Science: "The systematic study of the natural and physical world through observation, experimentation, and evidence-based reasoning."

Technology: "The practical application of scientific knowledge to create innovative solutions, tools, and systems that improve human life."

1. **What is Gene editing?**

Gene editing is a scientific technique that allows researchers to modify an organism's DNA by adding, removing or altering genetic material. This precise manipulation aims to treat or prevent diseases, improve crop yields or develop new bioproducts.

1. **Differentiate between climate and weather?**

Climate = long-term trends Weather = short-term conditions

1. **What is a generator?**

A device that converts mechanical energy into electrical energy.

1. **Define energy. Give two examples?**

Energy is the ability or capacity to do work, causing change or producing motion. It comes in various forms, which can be converted from one to another. Electrical Energy and Chemical Energy.

1. **What is a calorie?**

A calorie is a unit of energy measuring the amount of energy contained in foods and beverages.

1 calorie = energy required to raise 1 gram of water by 1°C

1. **What is a vaccine? Give two examples?**

A vaccine is a biological preparation that stimulates the body's immune system to recognize and fight specific diseases, providing immunity. Influenza (Flu) Vaccine and MMR (Measles, Mumps, Rubella) Vaccine.

1. **Define carbon footprint?**

The total amount of greenhouse gas emissions (GHGs), primarily carbon dioxide (CO2), associated with an individual, organization, product, or activity.

1. **What is electric current?**

The flow of electric charge (electrons) through a conductor (wire, circuit).

1. **What is covid-19?**

COVID-19 is a contagious respiratory illness caused by the SARS-CoV-2 virus.

1. **What is meant by ethics in technology?**

Ethics in technology refers to the moral principles guiding the development, use, and impact of technology on society. Data Privacy, Cybersecurity, Digital Rights etc.

1. **Define exobiology?**

Exobiology, also known as Astrobiology, is the scientific study of origin of life, potential life beyond Earth and conditions necessary for life.

1. **Is there any role of war in development of science?**

Yes, war has played a significant role in the development of science: Military needs: Funding, urgency, and scale. Technological advancements: Radar, jet engines, computers. Medical breakthroughs: Vaccines, antibiotics, prosthetics.

1. **Who was Louis Pasteur?**

French chemist and microbiologist, renowned for groundbreaking contributions to Germ Theory, Vaccination, Pasteurization and Microbiology.

1. **What is sustainable energy?**

Energy that meets present needs without compromising future generations' ability to meet their own needs. Renewable, Low environmental impact, Socially equitable, Economically viable.

1. **What is greenhouse effect? What are its causes and effects?**

The natural process by which certain gases in the Earth's atmosphere (greenhouse gases) trap heat from the sun, maintaining a warm enough temperature to support life.

**Natural Greenhouse Gases**: 1. Water vapor (H2O), 2. Carbon dioxide (CO2), 3. Methane (CH4)

4. Nitrous oxide (N2O), 5. Ozone (O3)

**Causes of Enhanced Greenhouse Effect**: (Human activities increasing greenhouse gas concentrations)

1. Burning fossil fuels (coal, oil, gas)

2. Deforestation and land-use changes

3. Agriculture (livestock, rice cultivation)

4. Industrial processes (cement, steel)

5. Population growth and consumption

Effects of Enhanced Greenhouse Effect:

1. Global warming (average temperature increase)

2. Climate change (extreme weather events)

3. Sea-level rise (melting glaciers, ice sheets)

4. Ocean acidification (harm to marine life)

5. Changes in precipitation patterns

6. Increased frequency and severity of:

- Heatwaves

- Droughts

- Floods

- Storms

1. **What is photoelectric effect? Explain its characteristics and applications?**

The phenomenon where light (photons) hitting a material (typically metal) ejects electrons from its surface, converting light into electrical energy.

**Characteristics:**

1. Light intensity: Increases electron emission

2. Frequency (wavelength): Threshold frequency required for emission

3. Material: Depends on material's work function (energy required to escape)

4. Electron energy: Depends on photon energy (not intensity)

Applications:

1. Solar Cells (Photovoltaic Cells): Convert sunlight into electricity

2. Photodiodes: Detect light levels, used in:

- Optical communication systems

- Light sensors

- Camera light meters

3. Image Sensors: Digital cameras, scanners, and medical imaging

4. Photomultipliers: Amplify weak light signals in:

- Medical imaging

- Spectroscopy

- Particle detection

5. Night Vision Devices: Amplify low light levels

6. Laser Technology: Photoelectric effect initiates laser operation

7. Electron Microscopes: Use photoelectric effect to produce images

8. Space Exploration: Solar panels power spacecraft

1. **What is biotechnology? What is its role in agriculture?**

The application of biological principles, organisms, and systems to develop products, technologies, and processes that improve human life.

**Role in Agriculture (Green Biotechnology):**

1. Crop Improvement:

- Pest resistance

- Disease resistance

- Drought tolerance

- Increased yield

- Enhanced nutritional content

2. Pest Management:

- Biological control agents

- Biopesticides

3. Nutrition:

- Biofortification (e.g., Vitamin A-enriched "Golden Rice")

- Improved protein content

4. Plant Breeding:

- Marker-assisted selection

- Genetic engineering

5. Livestock Improvement:

- Vaccines

- Genetic engineering for disease resistance