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General Science & AbilityName: Maryam KurnaatQ.2Part (a)Water Pollution

Water pollution is the contamination of water bodies (rivers, lakes, oceans, groundwater) by physical, chemical, or biological ~~sub~~ substances that degrades water quality, making it harmful for human use, aquatic life, and ecosystems.

Types of Water Pollution1- Chemical Pollution

- Caused by industrial discharge, pesticides, fertilizers, heavy metals, detergents, acids, and oils.
- Leads to toxicity for humans and aquatic organisms.

2- Thermal Pollution

- The degradation of water quality by any process that changes the ambient water temperature, often from power plants and industrial cooling.
- Even small temperature changes ~~can~~

decrease water's oxygen-carrying capacity, endangering fish and aquatic life. Warmer water can also encourage harmful bacteria and algae growth, worsening pollution issues.

### 3. Groundwater Pollution

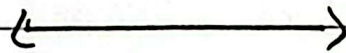
- Groundwater, stored in aquifers, is essential for drinking water, particularly in rural regions. It can become polluted through agricultural runoff, septic tank leaks, chemical spills, and fossil fuel extraction, with common contaminants including nitrates, pesticides, and petroleum products.
- Groundwater pollution poses serious risks to human health and agriculture, as it is hard to detect and remediate, resulting in prolonged issues for affected communities.

### Measures to prevent water pollution

- a- Build and maintain wastewater treatment plants to remove contaminants before discharging water into natural bodies.
- b- Use less fertilizer and pesticides, and implement best practices like creating buffer zones along waterways to

catch snuff.

- c- Establish systems for the safe disposal of industrial and hazardous waste, and encourage the proper disposal of household trash and chemicals.



## Q.2 (Part b)

### Cell

A cell is the structural, functional, and biological unit of an organism. It is the smallest unit of life that can exist on its own, providing structure, taking in nutrients, converting them to energy, and performing specialized functions. Cells make up living things, from single-celled organisms like bacteria to complex multicellular organisms like humans.

### Difference between Plant, Animal and Microorganismic (Bacteria) cell

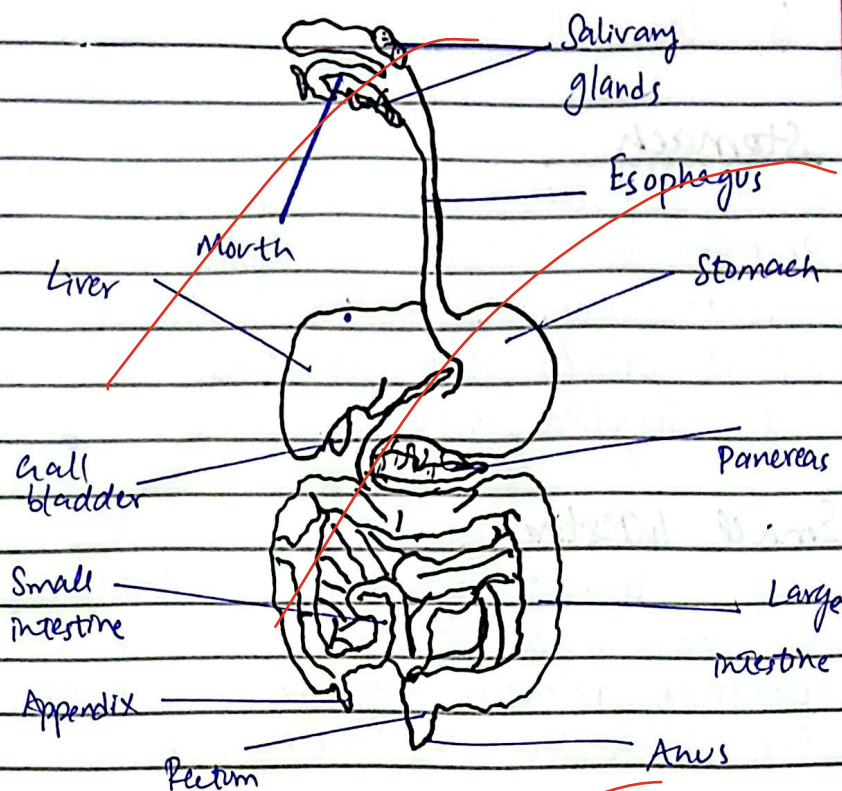
|              | Plant Cell                | Animal Cell        | Bacteria Cell          |
|--------------|---------------------------|--------------------|------------------------|
| 1- Cell Type | Eukaryotic                | Eukaryotic         | Prokaryotic            |
| 2- Cell wall | Rigid, made of cellulose; | Absent; only has a | Made of peptidoglycan; |

|    | Feature   | Plant cell                                                                         | Animal cell                                                                   | Bacteria Cell                                                                    |
|----|-----------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| 3- | Nucleus   | provides structural support.<br>Present; contains DNA and control cell activities. | flexible cell membrane.<br>Present; contains DNA and control cell activities. | provides shape and protection.<br>Absent; DNA is free-floating in the cytoplasm. |
| 4- | Shape     | Fixed and rectangular                                                              | Irregular or round                                                            | Various shapes (cocci, bacillus)                                                 |
| 5- | Cytoplasm | Gel-like; site of metabolic activities.                                            | Gel-like; site of metabolic activities.                                       | Gel-like; site of metabolic activities.                                          |

## Q.2 (Part c)

### Food Digestion in the Human Body

Food digestion is a multi-step process that begins in the mouth, moves through the esophagus to the stomach, and continues in the small and large intestines, with help from organs like the liver and pancreas. In this process, food is mechanically broken



down by chewing and churning, and chemically broken down by enzymes and acids into smaller molecules that the body can absorb for energy.

#### a. Mouth (oral cavity)

Digestion starts with chewing food into smaller pieces and moistening it with saliva. Saliva contains enzymes, such as amylase, that begins the breakdown of carbohydrates.

#### b. Esophagus

Swallowing pushes the food down the esophagus. Peristalsis, a series of muscle contractions, moves the food along

to the stomach.

### C- Stomach

The stomach muscles mix food with acid and digestive enzymes to create chyme, a thick liquid that breaks down proteins and kills ingested bacteria.

### 4- Small Intestine

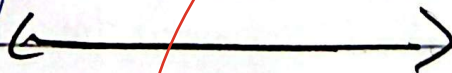
Chyme transitions from the stomach to the small intestine, where the pancreas releases digestive enzymes for the breakdown of carbohydrates, fats, and proteins.

The liver contributes bile to aid fat digestion. Subsequently, the small intestine's walls absorb essential nutrients, including proteins, carbohydrates, and vitamins, into the bloodstream.

### 5- Large Intestine and Waste Elimination

Any remaining undigested material moves into the large intestine. The large intestine processes undigested material by absorbing water and minerals, while bacteria further break it down.

The resulting solid waste is stored as feces before being eliminated from the body.



## Q.2 (Part.d)

### GIS (Geographic Information System)

A Geographic Information System (GIS) is a computer-based framework for gathering, managing, analyzing, and visualizing spatial and geographic data. GIS helps visualize complex relationships, analyze patterns, and make informed decisions for effective environmental management and conservation.

### Environmental Applications of GIS

Its key applications include:

#### a- Natural resource management

- Monitoring and managing resources such as forests, wetlands, and wildlife habitats.
- Mapping and managing marine ecosystem.

#### b- Pollution control

- Tracking pollution sources, such as industrial facilities and waste sites, to enforce regulations and plan cleanup efforts.

- Assessing air and water quality and monitoring pollution from various sources.

### c- Disaster Management

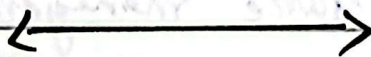
- Identifying areas prone to hazards like floods, wildfires, and landslides.
- Modelling and predicting climate change impacts, such as sea-level rise and extreme weather events.

### d- Environmental Monitoring

- Evaluating the potential impacts of new development projects on sensitive habitats and ecosystems.

### e- Climate Change Analysis

- Identifying and mapping areas vulnerable to climate-related risks.



## Q.3 (Part a)

### Working of Nephron

A nephron is the functional unit of kidney, responsible for filtering blood and forming urine. Each kidney contains about 1 million nephrons.

### 1- Filtration (in Bowman's capsule)

Blood enters the glomerulus and water, salts, urea, and small molecules filter out into Bowman's capsule. Large particles like blood cells and proteins stay in the blood.

### 2- Reabsorption (in PCT and Loop of Henle)

Useful substances like glucose, amino acids, and most water are taken back into the blood so the body does not lose them.

### 3- Secretion

Extra wastes like hydrogen and potassium ions are added into the tubule to maintain balance in the body.

### 4- Formation of Urine (Collecting duct)

The remaining liquid becomes urine, which passes to the ureter and then stores in the bladder.

Nephrons help the body maintain blood pressure, fluid balance, pH, salt levels, and remove nitrogenous wastes.

Q.3 (Part b)

Acid Rain

## Effects of Acid Rain

- a- Soil acidity increases; nutrients ~~leach~~ leach out, harming crops and forests.
- b- Lowers pH of lakes, killing fish and amphibians.
- c- Corrodes buildings, monuments, and metal structures.

## Solution for Acid Rain

- a- Shift to Clean energy (solar, hydro) and reduce  $\text{SO}_2/\text{NO}_x$  emissions.
- b- Promote public transport, catalytic converters in vehicles.
- c- Plant more trees, as trees absorb pollutants from the air.

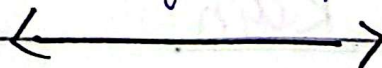
## Smog

### Effects of Smog

- a- Respiratory diseases, asthma, bronchitis, decreased lung function.
- b- Enhances global warming by trapping heat.
- c- Damages crops (ozone injures plant tissues).

### Solutions for Smog

- a- Reduce vehicle emissions; shift to electric transport.
- b- Control Industrial Emissions.
- c- Public awareness against open burning.



### Q.3 (Part.c)

#### Global Warming

Global warming is the long-term rise in Earth's temperature mainly due to greenhouse gases ( $\text{CO}_2$ ,  $\text{CH}_4$ ,  $\text{N}_2\text{O}$ ). It is considered a threat because of its multidimensional global impacts.

#### Reasons Global Warming is a Major Threat

##### a- Climatic Change and Extreme Weather

- Increased heatwaves, floods, droughts, storms, and wildfires.

##### b- Melting Glaciers and Rising Sea Levels

- Warmer oceans expand in volume (thermal expansion), and melting glaciers and ice sheets add more water to the seas, causing sea levels to rise.
- This threatens coastal communities with: Erosion and frequent coastal flooding, and saltwater intrusion.

##### c- Loss of Biodiversity

- Species extinction due to habitat loss, coral bleaching, and altered ecosystems.

##### d- Agricultural Decline

- Reduced crop productivity, food

insecurity, unpredictable rainfall.

### e- Human Health Threats

- Spread of vector-borne diseases (malaria, dengue).
- Heat strokes and respiratory illness.

Global warming threatens human survival, food systems, economies, and global stability, making it one of the most serious environmental challenges.



## Q.3 (Part d)

~~Biofuels are~~ Biofuels are fuels made from plants, crops, and organic waste (biomass). They are renewable and cleaner alternatives to petrol and diesel.

### Production of Biofuels

#### 1- Bioethanol

Produced from sugarcane, corn, and wheat. The sugar is fermented by yeast to make ethanol.

#### 2- Biodiesel

Made from vegetable

oils, animal fats, or used cooking oil through a chemical process.

### 3- Biogas

Produced from animal dung and kitchen waste in an anaerobic digester, releasing methane gas.

### Benefits of Biofuels

- a- Less pollution and lower greenhouse gases.
- b- Renewable as plants and waste can be replaced.
- c- Reduce dependence on petrol and diesel.
- d- Cost-effective for rural households (biogas).
- e- Support farmers by using crop waste and agricultural products.



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