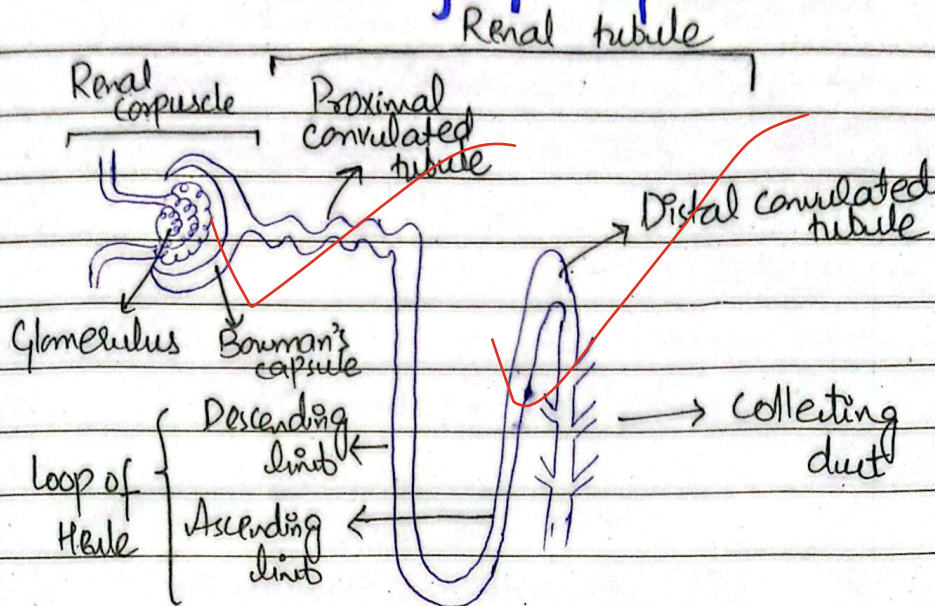


Question no: 03

29/40

Part (a) :

Working of NephronFig. Structure of Nephron

Nephron is the structural and functional unit of kidney. It plays a pivotal role in the removal of metabolic wastes from the body.

Functioning of Nephron:

The main function of nephron is the urine formation which takes place in three steps;

i) Glomerular filtration

In the first step, blood containing the nitrogenous waste is filtered by glomerulus, a network of capillaries.

As the cross-sectional area of blood capillaries is very thin, so blood flows at higher pressure. This pressure generated is called **Pressure filtration**. It filters small molecules in the blood. As proteins, amino acids and glucose are large in size, so these are not filtered. The filtrate, now is called **glomerular filtrate**.

iii) Selective Reabsorption:

Second phase is selective reabsorption of certain molecules like water, salts. Glomerular filtrate move to Bowman's capsule and then proximal convoluted tubule where water, and glucose absorption takes place. From proximal convoluted tubule, filtrate moves into loop of ~~Henle~~ - water reabsorption takes place in descending limb and salt reabsorption takes place in ascending limb.

iiii) Tubular Secretion

After selective reabsorption, in distal convoluted tubule, certain substances such as creatinine, ure acid are secreted to maintain pH of urine.

4.5

Part (b):

Effects of Acid rain :

Acid rain pH is less than 5.6. Followings are the effects of acid rain;

- (i) Acid rain increases the acidity of freshwater and marine environment, thereby affecting the reproductive life cycle of aquatic life.
- (ii) It dissolves calcium carbonate, limestone, and gypsum, thereby damages the historical building i.e. Taj Mahal, India.
- (iii) It damages the leaves of plants and reduces plant growth.
- (iv) The pollutants i.e. **nitric oxide** and **sulphur oxide** that cause acid rain, form fine particles in the air. When inhaled, these particles can cause lung diseases, heart attack and other respiratory disorders.

Solutions of acid rain :

- (i) Using technology like **scrubbers** in industrial and power plants to remove **sulphur dioxide (SO_2)**

before it enters the atmosphere

- (ii) Promote and use cleaner fuels for low emission of gases
- (iii) Tree plantation to absorb certain pollutants from the air

Effects of Smog:

Smog is a type of air pollution formed by combination of smoke and fog. Its effects are;

- (i) Smog creates a haze that significantly reduces visibility, hence increasing road accidents.
- (ii) Smog contributes to the formation of acid rain, which can damage forests and aquatic life.
- (iii) Short-term exposure of smog causes coughing, throat or eye irritation. Long-term exposure increases the risk of chronic respiratory conditions like Bronchitis, asthma etc.

Solutions of Smog:

- 4
- i) Shifting towards electric vehicles to reduce gases emission
 - ii) Investing in cleaner biofuel technologies to reduce pollutants from factories
 - iii) Prohibit the burning of agricultural waste and other debris.
 - iv) Transition to renewable energy sources like solar and hydroelectric.

Part (c):

Global warming :

Global warming is the phenomenon of gradual increase in the average temperature of earth.

Global warming results from the increasing concentration of carbon dioxide and other greenhouse gases that trap heat in the earth's atmosphere.

For the last 40 years, global annual temperature rise by 0.2°C per decade.

1. Global warming as a threat:

Global warming has severe consequences on environment such as;

a) melting of glaciers

warming temperatures reduce freshwater availability by accelerating glacial melting and altering river flows. Declining crop yields of staples like wheat, rice endanger global food supplies.

b) Threat to Human health

It increases the incidence of heatstroke, malnutrition, and vector-borne diseases like dengue and malaria. WHO estimates climate-related illnesses could cause additional 25,000 deaths annually.

c) Threat to biodiversity and ecosystems

Rising temperatures are destroying coral reefs, accelerating species extinction and delicate ecological balance.

d) Threat to coastal populations

Sea levels are rising due to melting ice caps and thermal expansion of seawater. Coastal cities like Karachi, Dhaka and Miami face heightened risk of flooding and displacement.

Part (d)

Production of biofuels:

Biofuels are renewable energy sources derived from biological materials such as plants, algae and agricultural waste. They are alternatives to fossil fuels due to concern over climate change, energy security and rising oil prices.

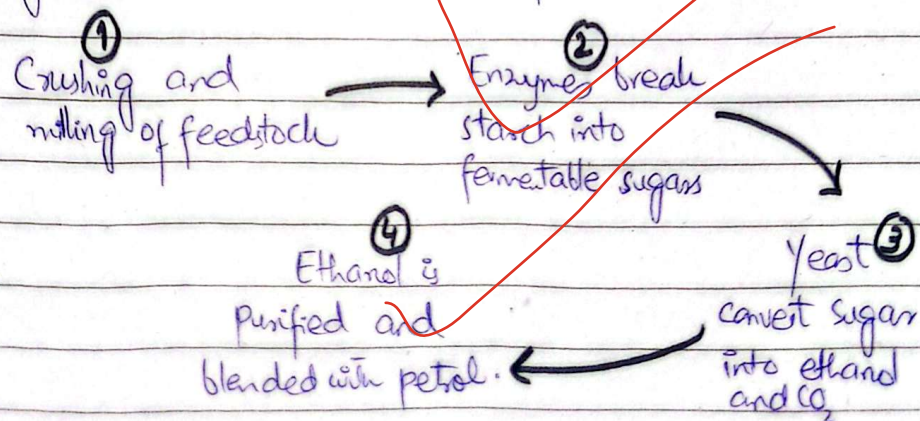
a) Feedstock selection

Biofuel production begins with the choice of raw materials (feedstocks). Common feedstocks include:

- Sugar crops - i.e. sugar beet, sugarcane
- Starchy crops - maize, wheat
- Agricultural residues - bagasse, corn stover
- Algae for advanced and high yield biofuels

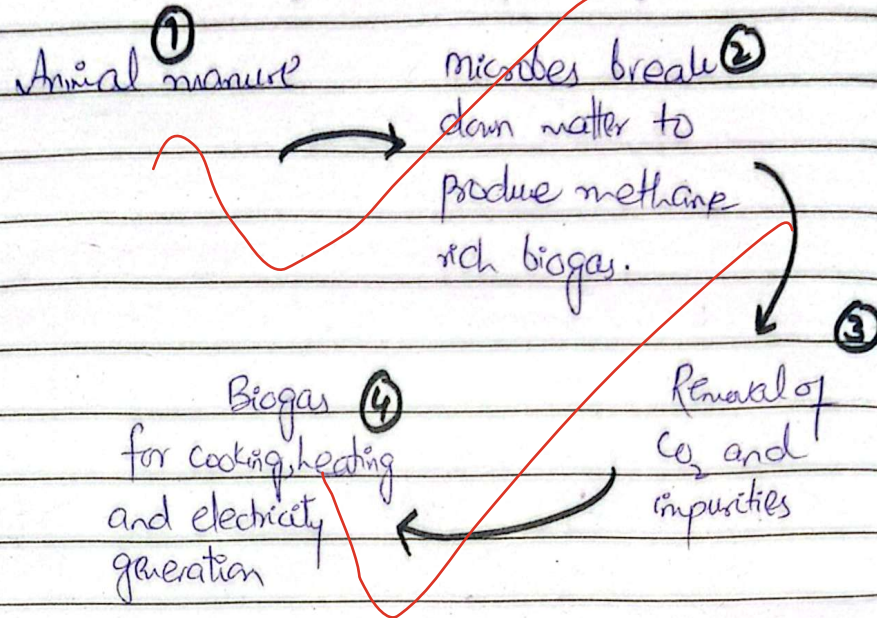
b) Bioethanol production process

Bioethanol is produced from sugar and starch-rich crops.



c) Biogas production

Biogas is produced through anaerobic digestion of organic waste.



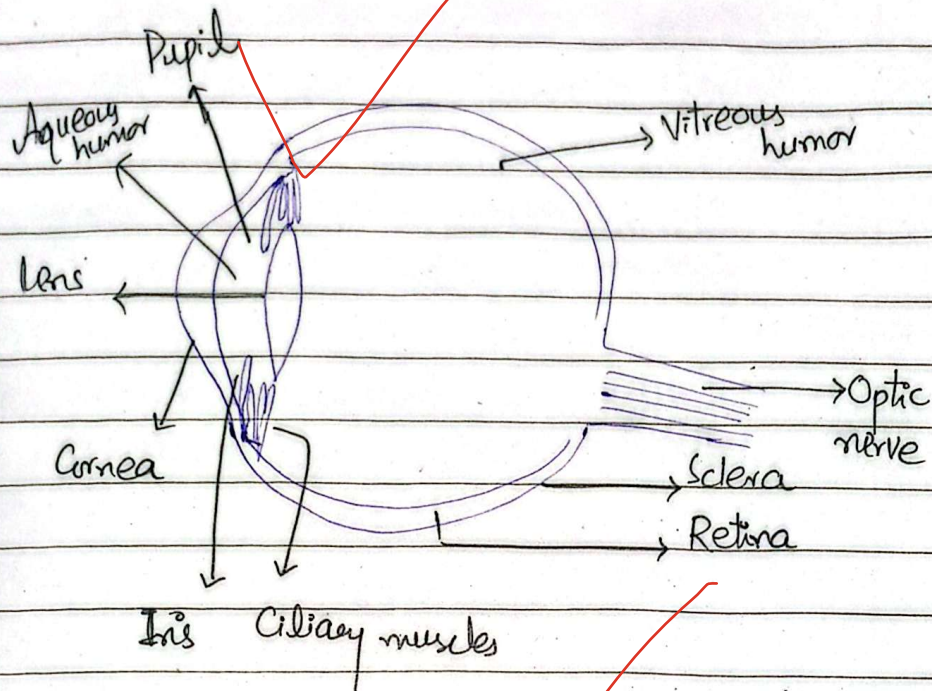
2. Benefits of biofuels:

- i) Biofuels emit significantly fewer greenhouse gases compared to fossil fuels, helping to combat global warming and air pollution.
- ii) Biofuels ensure long-term energy availability as produced from renewable biological resources.
- iii) Biofuels are non-toxic and degrade much faster than petroleum, reducing environmental harm in case of spills.

Question no: 01

Part (d) :

Structure of human eye



- i) **Cornea** — the transparent front layer of the eye, allows light to enter into eye.
- ii) **Iris** — the colored part of eye that controls the amount of light entering and adjusts pupil size.
- iii) **Pupil** — a small opening in the centre of the iris, expands in dim light and contracts in bright light.

Lens — a transparent, flexible structure located behind the pupil, changes shape to focus light for near and distant objects

Retina — a light sensitive inner-layer containing rods and cones and helps in image formation

Sclera — tough white outer layer to protect the eye

Optic nerve — carries electrical impulses to the brain for interpretation

Functioning of eye:

- Light enters through the cornea, which bends the light.
- The iris adjusts size of pupil to ensure optimal light reaches the lens.
- lens changes its shape to focus light on retina

Thicker lens → near objects
Thinner lens → distant objects

- The refracted light forms a real, inverted and diminished image on the retina.

- ➔ Photoreceptors convert light image into nerve impulses.
- ➔ Optic nerve carry these impulses to brain for upright images.

Part (c):

Waste disposal techniques

Waste disposal techniques refers to methods used to manage, treat and safely discard waste materials generated by households, industries and agriculture. Followings are the techniques employed for waste disposal;

a) Landfilling

It is the most common method of waste disposal.

Waste is dumped, compacted and covered with soil layers. Modern sanitary landfills have lines and drainage systems to prevent groundwater contamination.

b) Incineration

Incineration involves burning waste at very high temperatures. It can generate electricity from heat (waste-to-energy).

It reduces waste volume by 80-90%.

c) Recycling:

Recycling converts waste materials into new products. materials recycled are paper, plastic, glass, metals or e-waste.

d) Composting:

Composting is the biological decomposition of organic waste. It involves bacteria and fungi to break down food scraps, leaves and agricultural wastes.

e) Anaerobic digestion

A biological process in oxygen free chambers.

Organic waste is converted into biogas (methane + CO_2) and digestate (fertilizer).

Useful for agricultural and food waste.

Part (b)

Role of heart in human body

The heart is a muscular, fist sized organ that acts as the central pump of the circulatory system. Its primary role is to supply the body with

oxygen and nutrients while removing waste materials.

1. Pumping blood throughout the body

The heart contracts rhythmically to pump blood through a network of blood vessels.

→ **Oxygenated blood** is pumped from the left side of the heart to all body tissues.

→ **Deoxygenated blood** is returned to the right side of the heart and sent to the lungs.

2. Supplying oxygen and nutrients

The heart ensures that every cell in the body receives:

oxygen, glucose, amino acid, to support energy production, growth and overall functioning of organs.

3. Removing waste products

Circulating blood collects waste materials such as;

CO_2 , urea, metabolic by-products that are transported to lungs and liver for removal.

4. Supporting thermoregulation

By adjusting blood flows to the skin, the heart helps to regulate body temperature.

Blood vessels widen to release heat and constricts to preserve heat.

Part (a)

Enhanced greenhouse emission

Enhanced greenhouse emissions refer to the increased concentration of heat-trapping gases in the Earth's atmosphere due to anthropogenic activities. These gases intensify the natural greenhouse effect, leading to a rise in global temperatures known as global warming.

Major greenhouse gases :

a) Carbon dioxide (CO_2)

- Released from burning coal, oil, gas, and industrial activities
- Responsible for about 75% of greenhouse emissions

b) methane (CH_4)

- Emitted from livestock, rice paddies, landfills and oil extraction
- 25% more potent than CO_2

c) Nitrous oxide (N_2O)

From fertilizers, industrial processes and vehicle emissions

d) Industrial gases (CFC's):

- Used in refrigeration and aerosol sprays
- Traps thousands of times more heat than CO_2

Enhanced emissions produce global warming:

Enhanced greenhouse gases absorb more heat radiation from the Earth's surface.

Sunlight reaches Earth and absorbs energy and re-emits it as heat (infrared radiation). Excess greenhouse gases trap more of this heat. This heat accentuates global warming.

This results in a positive feedback loop, where warming creates conditions that release even more greenhouse gases.

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