

General Instructions

ISA - Science Part

1. Give numbering to headings
2. Do not write lengthy paragraphs. Write medium sized paragraphs with headings.
3. Do not use table for comparison and contrast questions.
4. Draw figures/diagram/flowchart where needed.
5. Start new question from fresh page
6. Write unit of the answer in ability section.
7. Explain mathematical steps and the reasoning for better score.
8. Change colour scheme for references to give them more visibility
9. Manage time well.
10. Wide page borders are discouraged. Should be reasonable.
11. Avoid writing wrong references.
12. Give more weightage to expressedly asked part/s of the question.

THE HUMAN CIRCULATORY SYSTEM

The circulatory system is an important part of the human body. It is a complex network of organs and vessels responsible for the transportation of blood, oxygen, and nutrients throughout the body. The circulatory system plays a crucial role in maintaining overall health by regulating body temperature and protecting us against infection and diseases.

This circulatory system is divided into two types:

① Open Circulatory System
 In open circulatory system, blood flows through open spaces.

② Closed Circulatory System
 In closed circulatory system blood flows through a closed network of blood vessels. •

William Harvey was the one who discovered the circulatory system. He discovered, "Human Circulatory system is the system of organs including heart, blood vessels"

ROLE OF HUMAN HEART IN BLOOD CIRCULATION

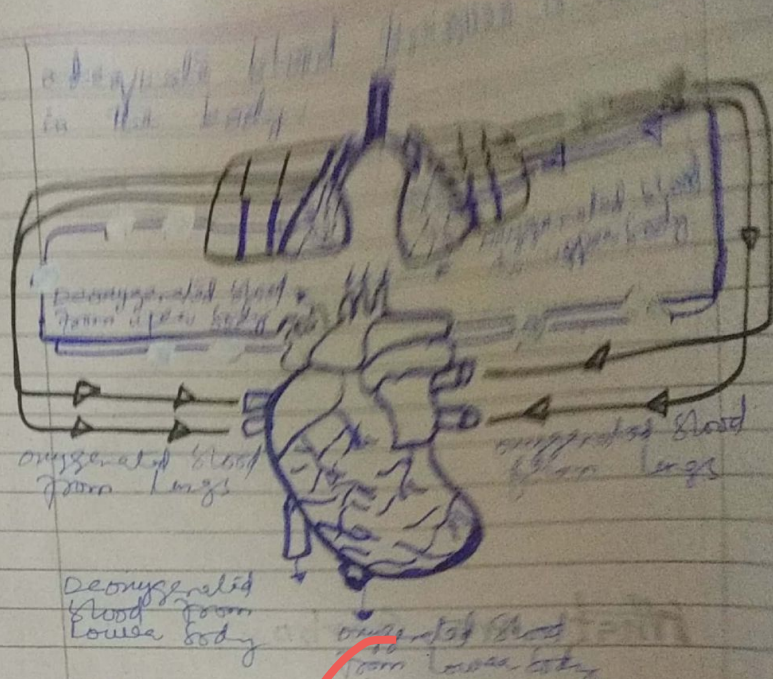
The heart is a muscular organ that is situated in the chest. It pumps blood all through the body in a process called Circulation. Apart from the heart, the blood vessels and blood as a unit constitute the cardiovascular system.

Role of Heart..

The role of heart in any organism or in human heart is to maintain a constant flow of blood throughout the body. This replenishes oxygen and circulates nutrients among the cells and tissues.

The role of human heart can be seen through given functions below.

- one of primary functions of the human heart is to pump blood.
- Blood vessels deliver oxygen, hormones, glucose and other components to various parts of the body including the human heart.
- The heart also ensures the



Pulmonary Circulation (blue) Systemic Circulation (black)

- Pulmonary Circulation is responsible for carrying deoxygenated blood away from the heart to the lungs and then bringing oxygenated blood back to the heart.
- Systemic Circulation is responsible for carrying oxygenated blood pumped from the heart to every organ and tissue in the body and deoxygenated blood comes back again to the heart.

(b) What are Carbohydrates?
Give its classification.

CARBOHYDRATES

Carbohydrates are macronutrients and are one of the three main ways by which our body obtains its energy. They are called carbohydrates as they comprise carbon, hydrogen and oxygen at their chemical level.

Carbohydrates as essential nutrients:

These are essential nutrients which include sugars, fibres and starches.

Location of Carbohydrates:

They are found in grains, vegetables, fruits and in milk and other dairy products. They are basic food group which play an important role in a healthy life.

Importance of Carbohydrates:

The food containing carbohydrates are converted into glucose or blood sugar during the process of digestion by the digestive system.

Our body utilizes this sugar as a source of energy for cells, organs and tissues. The extra amount of energy or sugar is stored in our

muscles and liver for further requirement.

The term Carbohydrate is derived from a French term 'Hydrate de Carbone', meaning that 'hydrate of carbon'.

The general formula of this class of organic compounds is $C_n(H_2O)_m$.

CLASSIFICATION OF CARBOHYDRATES :

The carbohydrates are further classified into simple and complex which is mainly based on their chemical structure and degree of polymerization.

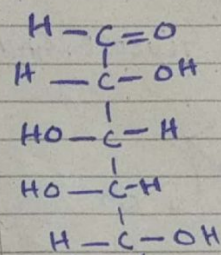
Simple Carbohydrates (Monosaccharides, Disaccharides and Oligosaccharides)

Simple carbohydrates have one or two ~~more~~ molecules. In simple carbohydrates, molecules are digested and converted quickly resulting in a rise in the blood sugar levels. They are abundantly found in milk products, beer, fruits, refined sugar, candies etc. These are called empty calories

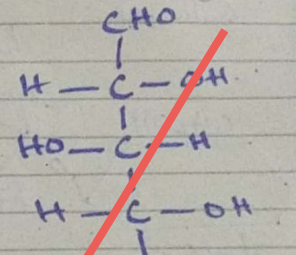
as they do not possess fiber, vitamins and minerals.

1. Monosaccharides

Glucose is an example of a carbohydrate monomer or monosaccharide. Other examples of monosaccharides include mannose, galactose, fructose etc. The structural organization of monosaccharides is as follows.



Galactose
(CH_2OH)



Glucose
(CH_2OH)

Monosaccharides may further be classified depending on the number of carbon atoms per molecule. Other examples involve:

- (i) Trioses ($\text{C}_3\text{H}_6\text{O}_3$), (ii) Tetroses ($\text{C}_4\text{H}_8\text{O}_4$)

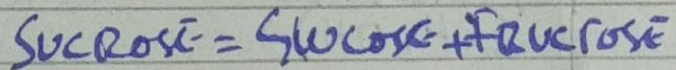
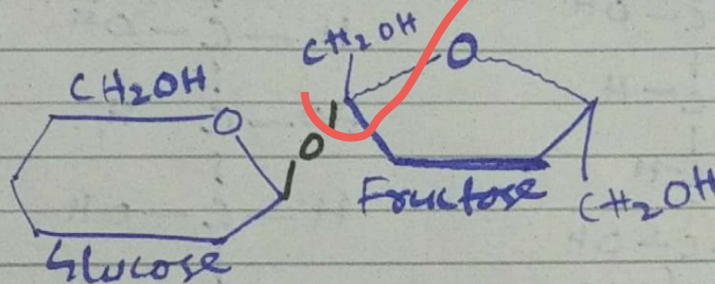
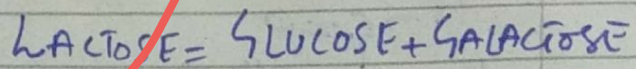
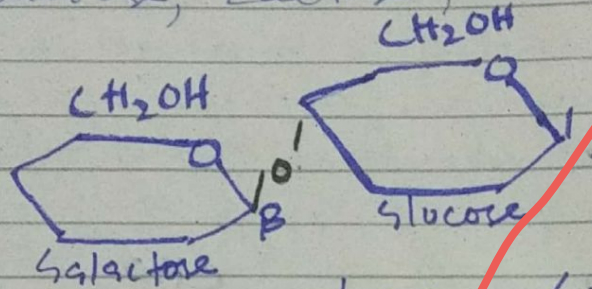
Similarly we have

- (iii) Pentoses
- (iv) Hexoses
- (v) Heptoses

2. Digaccharides :

Two monosaccharides combine to form a disaccharide.

Examples of carbohydrates having two monomers include Sucrose, Lactose, Maltose, etc.



3. OLIGOSACCHARIDES

Carbohydrates formed by the condensation of 2-8 monomers are called oligosaccharides. By this convention, trioses, pentoses, hexoses are all oligosaccharides.

- (C)
(C) What is Water Pollution?
Describe its types and causes.

WATER POLLUTION

Water pollution is the contamination of water bodies (like oceans, seas, lakes, rivers, aquifers, and ground water) usually caused due to human activities. Water pollution is any change in the physical, chemical or biological properties of water that will have a detrimental consequence of any living organism.

TYPES OF POLLUTION:

1. Chemical Pollution

Chemicals can infiltrate both underground water sources and those sitting on Earth's surface. As an integral component of the agricultural industry, it's that much of the chemical contamination comes from the pesticides and fungicides used in farming, but metals and solvents from industrial sites are also leading contributors.

2. Groundwater Pollution

As agriculture is a key source of water pollution, especially for groundwater. Fertilizers and pesticides applied to crops can seep into the ground and contaminate underground rivers and water beds, thus compromising the quality of wells, boreholes and other places from which groundwater is extracted for human use.

3. Microbiological Pollution

Microbiological pollution is a naturally occurring form of water contamination. Microorganisms such as bacteria, protozoa and viruses can infiltrate water supplies, causing diseases such as typhoid and cholera.

4. Oxygen-depletion Pollution

Those organisms which depend upon oxygen to survive are killed off, while anaerobic ones thrive. Some anaerobic microorganisms are capable of producing ammonia, sulphides and other harmful toxins which can make water even more dangerous to animals (and humans, too).

5. Nutrient Pollution:

An excess of nutrients can upset the delicate imbalance of water based ecosystems. Fertilizers contain a high concentration of nutrients which, if they contaminate rivers, lakes and coastal areas, can cause algal blooming that can block out sunlight and inhibit the growth of other organisms.

CAUSES OF WATER POLLUTION

Causes of Water Pollution —
Natural & Anthropological:

① Sewage and Wastewater

Many households dump their waste directly into water bodies. Moreover households which are not served by municipal treatment plant may use septic tanks, which eventually infiltrates into soil, causing pollution of groundwater.

② Agricultural run-offs

Agricultural run-offs include fertilizers and other chemicals that can make the water toxic. Moreover, some of these fertilizers can induce eutrophication.

③ Eutrophication

Eutrophication is caused when large quantities of nutrients are introduced into a body of water, causing the rapid growth of algae. This can decrease the oxygen level in the water, rendering the fish unable to breathe. Moreover, this phenomenon can also introduce dangerous toxins into the water body, which can kill water species.

④ Deforestation

Deforestation can cause soil erosion when these loose soil particles enter a water body. They can make the water murky. This can even make the water murky, and it also has potential to cause mechanical damage to aquatic organisms, (such as sand particles getting stuck in gills).

⑤ Industrial effluents and Industrial usage

Some industries may directly pump their untreated wastes into water bodies such as rivers. Moreover, various industries also use water as a coolant, thereby causing thermal pollution. Increased water temperatures can cause a reduction in levels of oxygen which causes death of fish & other species.

d. Liver is the chief chemist of the body. Elaborate.

LIVER AS A CHIEF CHEMIST OF THE BODY.

• Liver's Location:

The liver is located in the upper right portion of the abdomen. It is the largest gland in the human body that performs several important functions.

LIVER ANATOMY

• Structure of Liver

The liver is a triangular, bilobed structure consisting of a large right lobe and a smaller left lobe. The falciform ligament separates the two lobes. A layer of fibrous called Glisson's Capsule covers the liver.

The capsule is covered by the peritoneum. This protects the liver from physical damage.

It has two main sources of blood:

- Hepatic Portal Vein; carries nutrient-rich blood from the digestive system

Diagram?

• Hepatic Artery: Carries oxygenated blood from the heart.

o functions of liver

The important functions of the liver are mentioned below:

→ Production of Bile

Bile, which helps in the digestion and absorption of fats, vitamins and cholesterol is produced in liver.

→ Absorption of Bilirubin

Bilirubin is formed by the breakdown of haemoglobin. The iron released is stored in the liver to make next-generated blood cells.

→ Supporting Blood Clots

Bile is responsible for the absorption of vitamin K. If bile is not produced, clotting factors will not be produced.

→ Vitamins & Minerals

→ Metabolization of Fats, Carbohydrates

Bile helps in the breakdown and digestion of fats. The carbohydrates stored in the liver as glycogen are broken down into glucose and released into the blood to maintain glucose levels.

- Vitamin A, D, E, K and B12 are stored into the liver. It also stores iron in the form of ferritin to form new red blood cells.
- Bile helps in the digestion of proteins.

⇒ Filtering Blood

The compounds such as hormones, alcohol, etc are filtered by the liver from the blood.

⇒ Immunological function

The liver contains Kuffer cells involved in immune activity. These destroy any disease-causing agents.

⇒ Albumin Production

Albumin transports fatty acids and steroids to maintain correct pressure and prevent leakage of blood vessels.

⇒ Angiotensinogen Synthesis

This hormone is responsible for the narrowing of blood vessels which results an increase in blood pressure.

Regeneration of Liver.

The liver has the ability to regrow in all vertebrates. The functions of the liver are not lost during the growth process. In humans, regeneration takes 8-15 days.

In mice, the same process takes around 5-7 days.

①

Q.3 Describe the role of kidney (a) in the urine formation.

Excretion is a biological process in eliminating toxins and other waste products from the body. Animals and humans excrete in different forms such as urine, sweat, faeces and tears. Among all these, the usual and the main form of excretion is urine. The kidneys are two bean-shaped organs, each about the size of a fist. They are located just below the rib cage, one on each side of spine.

⇒ Role of kidney in Urine formation

URINE FORMATION:

Urine formation in our body is mainly carried out in three phases namely-

PHASE 1

1. Glomerular filtration

PHASE 2

2. Reabsorption

PHASE 3

3. Secretion

Let's discuss significance of these phases one by one.

1- Glomerular filtration

Glomerular filtration occurs in the glomerulus where blood is filtered. This process occurs across the three layers - the epithelium of Bowman's capsule, the endothelium of glomerular blood vessels, and a membrane b/w two layers.

Blood is filtered in such a way that all the constituents of the plasma reach the Bowman's capsule, except proteins.

Therefore, this process is known as ultrafiltration.

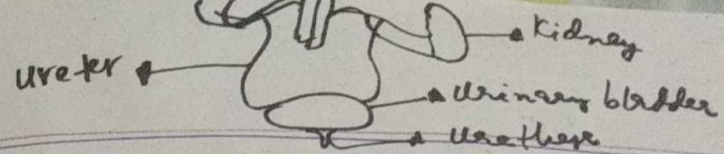
2. Reabsorption of filtrate

Around 99% of the filtrate obtained is reabsorbed by the renal tubules. This is known as reabsorption. This is achieved by active and passive transport.

3. Secretion of substances

The tubular secretion cells secrete substances like hydrogen ions, potassium ions, etc into the filtrate. Through this process, the ionic, acid-base and the balance of the other body fluids are maintained. The secreted ions combine with the filtrate and form urine then the urine passes out of the nephron tubule into a collecting duct.

→ In short, the urine produced is 95% water and 5% nitrogenous wastes. Wastes such as urea, ammonia and creatinine



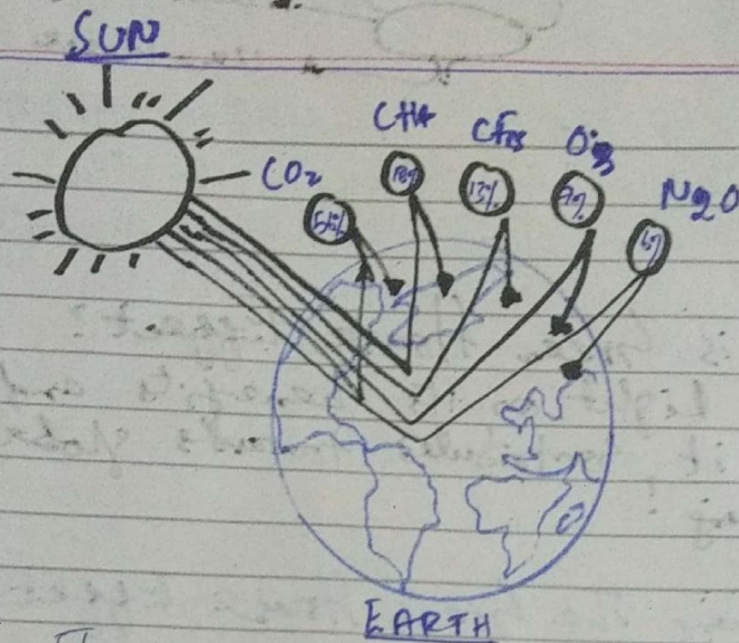
are excreted in the urine. Apart from these, the potassium, sodium and calcium ions are also excreted.

C. What is Green House Effect? Shed light on its benefits and how it contributes towards global warming.

Defining The Green House Effect.

Greenhouse effect is the process of heating of the surface of earth till the troposphere. It happens because of higher concentration of carbon dioxide, water vapor, methane and other gases.

Sunlight heats up earth's surface and subsequently, the energy is reflected back to the form infrared radiation. In the greenhouse effect, the concentrated gases absorb the energy, thereby increasing the global temperature. However due to the increased levels of greenhouse gases, the temperature of the earth has increased. This phenomenon can easily be seen in diagram below.



The Diagram shows Greenhouse Gases such as Carbon dioxide are the primary cause of the Greenhouse effect.

Benefits

Scientists describe the Carbon cycle in terms of sources (part of the cycle that add carbon to atmosphere) and sinks (parts of the cycle that remove carbon from the atmosphere). The Carbon cycle's links and sources help to regulate the amount of greenhouse gases in our atmosphere. Without any greenhouse gases, Earth would be an icy wasteland.

Greenhouse gases keep our planet livable by holding onto some of Earth's heat energy so that it doesn't all escape into space.

Role in global warming?

This heat trapping known as the greenhouse effect and where CO_2 finds a path from the atmosphere into living organisms, then turning into dead organic matter, going into the oceans and back into the atmosphere hence making a balance between atmosphere.

(b) What is Remote Sensing? Describe its role/applications in the Environmental Science?

(c) Defining Remote Sensing

The word "remote sensing" was initially used in the 1950s in the USA by Ms. Evelyn Pruitt worked for the U.S. Office of Naval Research, which stated that, remote sensing is science filled technology which helps to gather data and to analyze a body without making any kind of physical contact.

Explanation

This Technology is, Vastly used in sectors like hydrology, geography, ecology, faciology, oceanology, geology. A geographic information system is a tool that is used for mapping and analyzing features events on Earth.

The remote sensing and GIS technology combine major database operations like statistical analysis and query, with maps. The GIS manages information on locations and provides tools for analysis and display of different statistics that include population, economic, development, characteristics, and vegetation

It also allows linking databases to make dynamic displays. These abilities make GIS different from other systems and make it wide range of private and public remote applications for planning and predicting outcomes from remote sensing satellites.

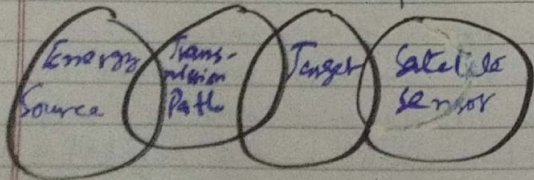
The important design of remote sensing systems is the signal to noise ratio.

The following points are some essential elements for remote sensing -

- ① An object or target
- ② A stand to hold the instrument
- ③ A sensor for the observation of the target.

Principles of Remote Sensing

The principles of remote sensing involve detection and measurement of the radiation of different wavelengths which are reflected or emitted from the surface of distant objects or materials, which help in their identification and categorization. It has four basic components to measure.



- Among these components, the energy source electromagnetic energy fulfills a medium for transmitting the information from the target to sensor.
- This spectrum includes visible light, radio waves, microwaves, heat waves, IR rays, UV rays & X-rays and gamma rays.
- It is a synopsis of continuum of electromagnetic waves and energy from extremely short wavelengths like cosmic gamma rays to extremely long wavelengths these divisions are not absolute and definite as overlapping can occur.

d) Describe the Food Preservation Methods?

Defining Food Preservation:

"Food preservation is the technique to prevent food spoilage, food poisoning and microbial contamination in food."

Food Preservation Methods:

Food preservation started long back in ancient times. Cooling, freezing, fermentation, sun-drying, etc. are few age-old food preservation techniques. With the advent of technology, modern methods of food preservation

developed. Chemicals and other natural substances were used for preservation. These substances are known as preservatives.

Let us discuss some of the methods of food preservation in detail.

Methods for food Preservation

1) Chemical Method

Salt and edible oils are two main preservatives which are used since ages to prevent microbial growth. This is why we add extra oil to pickles.

Preservation by salt is known as salting. Salting helps to preserve fruits for a long term. Meats and fishes can also be preserved by salting.

Other synthetic preservatives include Vinegar, Sodium benzoate, Sodium metabisulphite, etc.

2) Sugar

Sugar is another common preservative used in jams and jellies.

Sugar is a good moisture absorbent. By reducing moisture content it restrains the microbial growth.

3) Heat and Cold Methods

Boiling and refrigeration prevent around 70 percent of microbial growth. Boiling kills the microorganisms

that cannot tolerate extreme temperatures. Thus, it helps in food preservation.

Refrigerators have very low temperatures. Since microbes do not get optimum temperatures they need for growth, Pasteurization developed by Louis Pasteur is used until today to preserve milk.

4. Smoking

Smoking prevents dehydration in fish and meat and thus prevents spoilage. The wood smoke contains a large number of anti-microbial compounds that slow the rancidification of animal fats.

5. Canning

Food contents are sealed in an airtight at high temperatures. Meat, fish, fruits are also preserved by canning.

6. Sterilization

This method is carried out to remove microbes from food. For instance, milk sterilization at 100°C kills the microbes.

7. Dehydration

It is the process of removal of water from food. It is the simplest method and prevents food spoilage by removing water.

Contribution of Greenhouse effect in global warming:

Global warming is a type of climate change marked by an increase in global average temperature which has long term effects on weather patterns and ecosystems.

It is directly related to the increase in greenhouse gases in the atmosphere which exacerbates the greenhouse effect. Below ^{are} the factors leading to global warming.

- ① **Fossil Fuels:** Burning oil, coal and gas produces carbon dioxide, a most major greenhouse gas inside the atmosphere, as well as nitrous oxide, which is certainly the initial source of global warming.
- ② **Deforestation:** Forest exploitation is a significant contributor to global warming. By absorbing CO_2 from the air, trees aid in climate regulation. When trees are cut down, the carbon contained in them is discharged into the air, negating the positive effect.
- ③ **Intensive Farming:** Intensive farming includes not just even increasing livestock but also plant-protection products like fertilisers, is another contributor to global warming. When cattle and sheep digest their food, they

produce enormous volume of methane, whereas fertilisers emit nitrous oxide.

- ④ **Waste Disposal:** Landfills and incineration, for example, discharge greenhouse and hazardous gases, including methane, into the atmosphere, soil, or waterways, contributing to the greenhouse effect.
- ⑤ **Mining:** Both mining and metal industries are very important in modern life. Metals and minerals are indeed the raw materials needed to create, transport, and manufacture items. This market is responsible for 5% of total greenhouse gas emissions, from extraction to distribution.
- ⑥ **Overconsumption:** Finally, excessive consumption contributes significantly to global warming. In fact, it is to blame for the overuse of natural resources as well as emissions through international freight movement, both of which cause global warming.