MOCK TEST #02

GENERAL SCIENCE AND ABILITY

SECTION - I

QUESTION NO. 04

(a) RENEABLE ENERGY SOURCES IN PAKISTAN :

Renewable energy sources is generally defined as energy that is collected from the resources the which are naturally replenished on a human timescale, such as wind, rain, tides, waves and geothermal heat. Fortunately, there is abundance of renewable energy sources in Pakistan which can be utilized for its prosperity.

(i) **Wind Power:**

Airflows can be used to run wind turbines. Modern utility scale wind turbines range from around 600kW to 5MW of rated power, although turbines with rated output of 1.5 - 3 MW have become the most common for commercial use; the power available from the wind is a function of cube of wind speed so as the wind speed increases, the power output dramatically increases and hence maximum electricity generation. Gharo - Keti Bandar and Jhimpir wind corridors are examples of areas in Pakistan where wind energy is utilized to generate electricity.

(ii) **Hydro Power:**

Energy in water can be harnessed and used. Since water is about 800 times denser than air, even a slow stream of water, or moderate sea swell, can yield considerable amounts of energy. Hydroelectric energy is a term usually reserved for large-scale hydroelectric dams - examples of dams in Pakistan utilizing hydro power are Tarbela dam and Mangla dam. Micro-hydro electric systems are often used in water rich areas as a remote-area power supply of 100kW.

(iii) Solar Energy:

Solar energy applies energy from the sun in the form of solar radiation for heat or to generate electricity. Solar powered electricity generation uses either photovoltaics or heat engines. A partial list of solar power applications includes space heating or cooling through solar architecture, day lighting, solar cooking and high temperature process heat for industrial processes.

(iv) Biomass and Biofuels:

Biomass and biofuels are significant renewable energy sources in Pakistan due to country's substantial agricultural base and the availability of organic waste materials. Pakistan produces large quantities of crop residues such as wheat straw, rice, sugarcane, maize, cotton stalks can be used for power generation. Similarly with a significant livestock population, Pakistan has ample animal manure that can be converted to biogas through anaerobic digestion. Likewise, waste from agro industries such as food processing and pulp and paper can be converted into energy.

(v) Geothermal Energy:

Hot water and steam from deep underground can be used to drive turbines called geothermal energy. Several types of rocks contain radioactive substances such as Uranium, the decay of these radioactive substances release heat energy, which warms up the rocks. These rocks then heat the water and generates steam. This steam can be used to drive turbines and electricity generation.

POLICY OPTIONS TO OVERCOME ENERGY CRISIS

In the fast-changing global trends, there are numerous opportunities for Pakistan to find a solution to its energy crisis

(i) Research and Development:

First and foremost option, like other states, Pakistan needs to impose proper rules and regulations regarding the operating hours of industries. Our think tanks and research centers should publish research articles and policy papers that are Pakistan-centric containing "robust implementation mechanisms" considering local challenges. Pakistan needs to combine all energy-related institutions' needs under a single ministry, which will create efficiency in a dysfunctional energy sector and the whole sector will be streamlined.

(ii) Investing in Renewable Energy Industry:

Similarly, it is a golden chance for local and overseas investors to invest in Pakistan's renewable energy program for which the government of Pakistan has given an Alternate and Renewable Energy Policy in 2019. This is updated version of renewable energy policy for Development of Power Generation in 2006. Importing clean coal, less expensive than imported oil and gas, will allow Pakistan to diversify its energy mix. Pakistan should develop ways to make it easier for businesses to get loans and investments for biomass and biofuel projects. and look for funding from international organizations like the Green Climate Fund.

(iii) Include Biomass and Biofuel in Energy Plans:

Pakistan should also improve energy security by using biomass and biofuels to reduce reliance on imported fuels. It should also utilize biomass energy projects to create jobs and improve energy access in rural areas.

(iv) Train people and Raise Awareness:

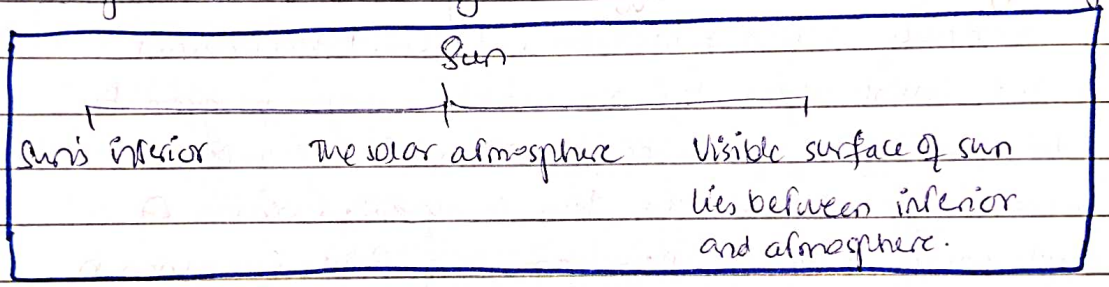
Conducting training programs for farmers, technicians, and entrepreneurs on growing crops and making biofuels and running

campaigns to educate people about its benefits, supporting farming practices that increase biomass production by promoting sustainable practices can ~~lead~~ to solve energy crisis in Pakistan.

part (b):

STRUCTURE OF SUN :

Sun is a star. A star is a huge ball of gas, mostly hydrogen and helium. Nuclear fusion reactions inside the star release enormous amounts of energy. - Thus they are very hot and give off their own light. Scientists usually divide the Sun into three main regions:



SUN'S INTERIOR :

There are three main parts of Sun's interior:

1. The core
2. The radiative zone
3. The convective zone

(i) The core :

The core is the at the center of the sun. It is the hottest region, where nuclear fusion reactions that power the Sun occur. The core of the sun is considered to extend from centre to about 25% of the solar radius. Its density is about 150 times the density of water. It is the only section of the sun that produces heat through fusion. The temperature is 15 million degree Celsius.

(ii) Radiative zone:

The second part is the radiative (or radiation) zone. It's name is derived from the way energy is carried outward through this layer, carried by photons as thermal radiation. The radiative material is hot and dense enough that the thermal radiation and not fusion transfers the intense heat of the core outwards.

(iii) Convective zone:

It is the third part of sun's interior. It is named after the dominant mode of energy flow in this layer, heat moves through upward convection. The convection plasma is not dense or hot enough to transfer heat energy of the interior outward through radiation - As a result, thermal convection occurs. Once the material cools off at the surface, it plunges downward to the base of the convection zone, to absorb more heat from top of radiative zone and then repeats the cycle.

PHOTOSPHERE :

The boundary between the sun's interior and solar atmosphere is called photosphere. It's the surface of the Sun that we see. The Sun also has an atmosphere. The lower region of the solar atmosphere is called **chromosphere** - Its name originated from Greek word chroma (meaning color), for it appears bright red when viewed during a solar eclipse. A thin transition region, where temperatures rise sharply, separates chromosphere from vast corona above. The uppermost portion of the Sun's atmosphere is called **corona** and is much hotter than Sun's photosphere.

Fig 1 - shows the structure of Sun. and illustrates its key parts.

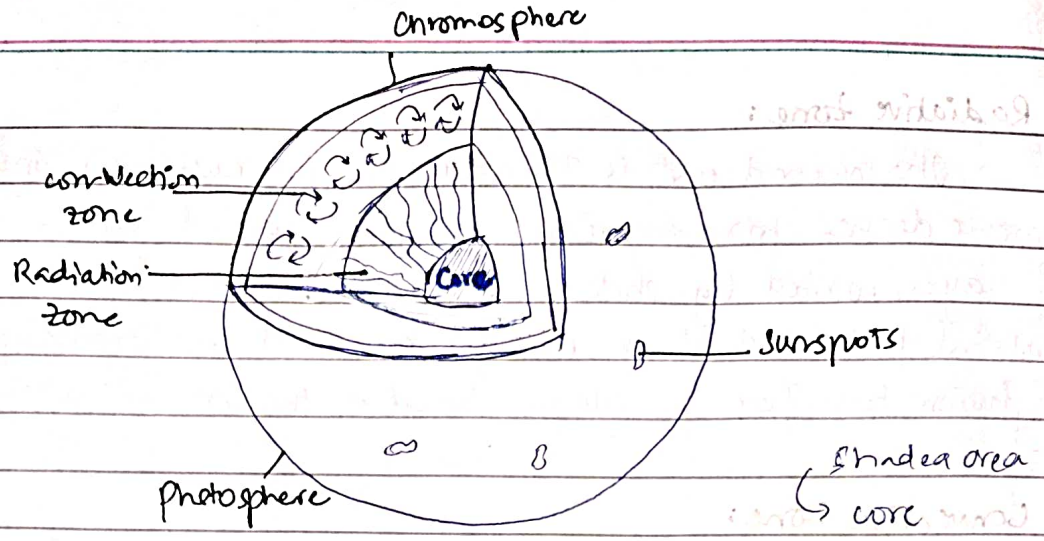


fig 1- Structure of the sun.

part(C) :

CERAMIC MATERIAL :

A ceramic is an inorganic non-metallic solid made up of clay that have been shaped and then hardened by heating to high temperatures. Ceramics are all around us. They include tile, bricks, plates, glass, and toilets.

Properties exhibited by ceramic materials:

1- They are hard, extremely strong, showing considerable stiffness under compression and bending.
2- Ceramics are wear-resistant and durable and thus used in industry.
3- ceramics are refractory material with high melting point used to line the inside walls of furnace.
4- These are corrosion resistant.
5- Ceramics are inert to chemical action and generally do not react with most liquids, gases and acids.
6- Ceramics are oxidation-resistant.
7- Ceramics are thermal and electrical insulators except for some certain ceramics which conduct electricity like chromium dioxide and most metals.

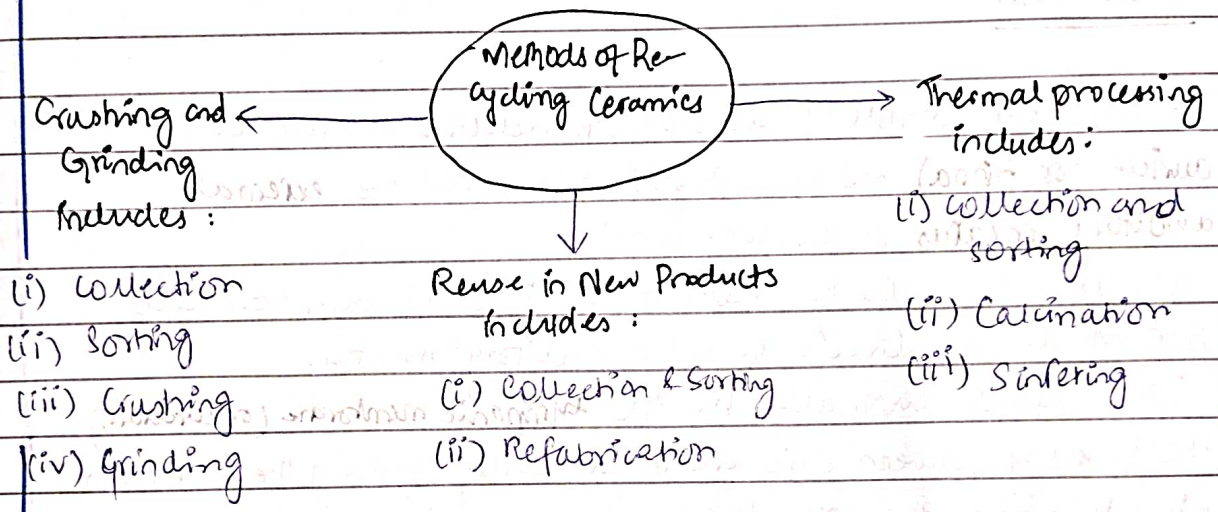
Can ceramics be recycled?

Yes, ceramics can be recycled but the process is more complex compared to metals and plastics due to their properties.

Methods:

By following methods, ceramics can be recycled:

1- Crushing and grinding
2- Reusing in new products
3- Thermal processing.



part (d):

Our ears are in-charge of collecting sounds, processing them, and then sending sound signals to brain. Also they help keep the balance.

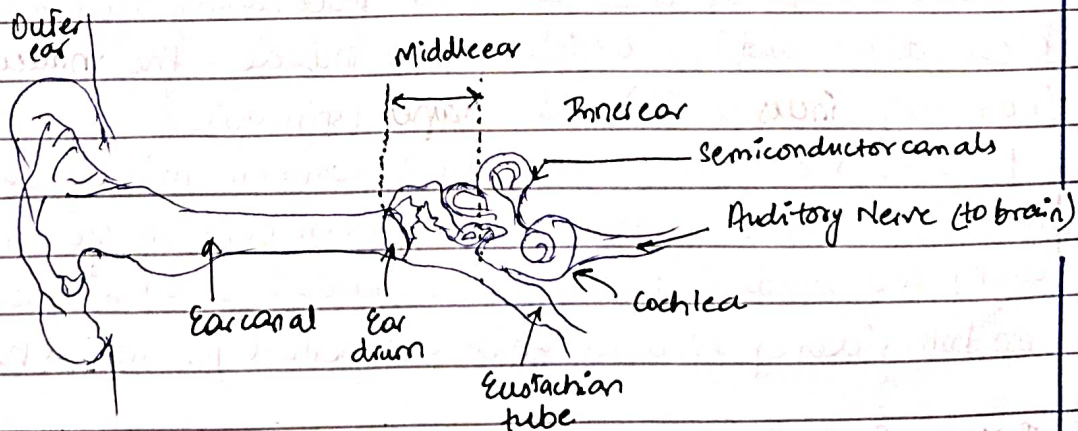


Figure: Structure of human ear.

STRUCTURE OF HUMAN EAR:

The ear is made up of three sections: The outer ear, the middle ear and the inner ear. These parts work together so we can hear and process different sounds. The outer and ~~inner~~ middle ear structures are involved in hearing only while the inner ear is responsible for equilibrium and hearing.

(1) OUTER EAR:

(i) The outer ear consists of an outer, funnel-like structure called the auricle (or pinna) and an S-shaped tube called the external auditory meatus or auditory canal.

(ii) The auricle of the ear helps to collect sound waves travelling through air and directs them into auditory meatus.

(iii) Sound waves eventually hit the tympanic membrane (or eardrum) - the boundary between outer and middle ears, making the eardrum vibrate which then transfers sound energy to tiny bones of middle ear.

(2) MIDDLE EAR:

(i) Middle ear consists of an air-filled space having three small bones called auditory ossicles. These include - the malleus (hammer), incus (anvil), and stapes (stirrup).

(ii) A Eustachian tube (auditory tube) connects middle ear to the throat, which allows the air to pass between the tympanic cavity and outside of the body and maintain equal air pressure on both sides of eardrum which is important for normal hearing.

(3) INNER EAR:

(i) The inner ear consists of a complex system of inter-communicating

chambers and tubes called labyrinth.

(ii) The parts of labyrinth include a cochlea that functions in hearing and three semi-circular canals (anterior, posterior and lateral) that function in providing a sense of equilibrium.

(iii) A body chamber called vestibule located between cochlea and canals, contains membranous structures that serve both hearing and equilibrium.

(iv) The cochlea contains perilymph that has many stiff, elastic fibres. Vibrations entering the perilymph cause movements in these ~~movements~~ fibres or cilia. They generate a message that is sent to the brain through auditory nerve.

QUESTION NO. 05

part(a)

ARTIFICIAL INTELLIGENCE:

Artificial intelligence is a branch of computer science focused on creating systems capable of performing tasks that typically require human intelligence. These tasks include problem-solving, learning, understanding, recognizing patterns and making decisions. There are different types of artificial intelligence (AI):

(i) **Narrow AI:** It is also known as weak AI. It is designed and trained for a specific task, like facial recognition or language translation. Most of AI we interact today is narrow AI.

(ii) **General AI:** It is strong AI; referring to a machine with the ability to understand, learn and apply intelligence across a wide range of tasks, similar to human intelligence. AI exa- the AI model is an example.

(iii) Superintelligent AI: It refers to an AI that surpasses the human intelligence across all fields. Given the circumstances, it is we are more likely to be introduced with superintelligent AI.

Can AI outsmart Humans:

Our technology has advanced significantly within the last decade and there are many accomplishments that we would have considered impossible - one of these accomplishments was made by Apple with the launch of SIRI, a virtual assistant created to aid those using Apple products - a SIRI has voice recognition technology that allows it to listen to an individual and respond accordingly. In order to for AI to take over such important aspects of our society they would have to jump through numerous hoops that are much more challenging one might expect.

Examples of AI outsmarting humans:

AI outsmarted humans in specific tasks, For example, AI systems have beaten humans at chess, Go, and jeopardy. They have also been used to develop self-driving cars and medical diagnostic systems.

In 2016, an AI system called Alpha Go defeated the world champion Go player, Lee Sedol. This was a major breakthrough as Go is considered to be much more complex game than chess.

In 2017, an AI system called Watson won the jeopardy! - quiz show. Watson was able to defeat two human champions by using its vast knowledge base and its ability to learn and adapt.

As AI technology continues to evolve, it's likely that machines will become increasingly capable of outsmarting

humans But only in specific tasks.

Analysis:

AI and human intelligence operate in fundamentally different ways. While AI ~~and human intelligence~~ excels at processing vast amounts of data quickly and identifying patterns that humans may overlook, human intelligence brings creativity, emotional intelligence, and critical thinking skills to the table. Similarly, humans and AI don't speak the same language, even though we have created codes that allow us communicate the task we are trying to achieve- these are unarguably complex but as we dig deeper the algorithms and how they impact the flow of consciousness in an individual's mind, we can see the true complexity and challenges AI would face before reaching to a point where it could outsmart us!

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part (b):

Rock FORMATION:

Rock is any coherent, naturally occurring solid materials consisting of one or more minerals. They form through various geological processes over million of years. The formation of rocks is influenced by different factors such as temperature, pressure and presence of chemical substances.

Rock CYCLE:

The rock cycle is a continuous process from the making or formation of rocks as they change. The rock cycle helps to explain how rocks are formed from other rocks. It is defined as the time-consuming transitions through geologic time among

three main rock types: sedimentary, metamorphic and igneous.
The rock cycle is driven by two forces:
(1) Earth's internal heat which moves material around in the core and mantle and leads to the slow but significant changes within the crust and
(2) The hydrological cycle, which is the movement of water, ice and air at the surface and is powered by the sun.

STAGES INVOLVED IN ROCK CYCLE:

1- Magma and formation of Igneous Rocks:
Magma is molten rock beneath the Earth's surface. When it cools and solidifies, it forms igneous rocks.
- Intrusive (Plutonic): Those igneous rocks which are formed beneath the surface (granite rock).
- Extrusive (Volcanic): Those igneous rocks which are formed at the surface (e.g; basalt).

The igneous rocks can be broken down into sediments through withering and erosion.

2- Formation of Sedimentary Rocks:
Sediments are broken small parts of an existing rock. They are transported and deposited in layers. Over time, these layers are compacted and cemented to form sedimentary rocks.
- Clastic: Those sedimentary rocks formed from weathering debris (e.g; sandstone).
- Chemical: Those sedimentary rocks formed from dissolved minerals precipitating from solution (e.g; limestone).
- Organic: Those sedimentary rocks formed from the accumulation of plant or animal debris (e.g; coal).

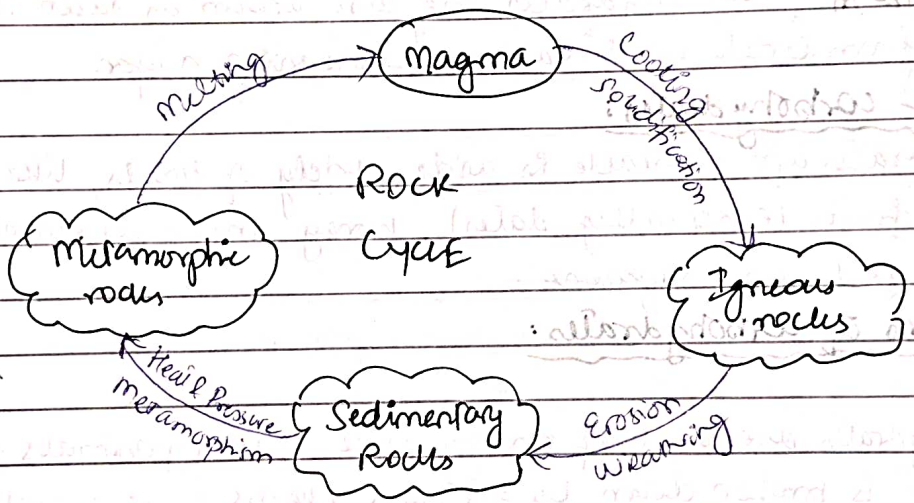
Sedimentary rocks can be buried and subject to heat and pressure leading to metamorphism

3. Metamorphic Rocks formation:

When existing rocks (igneous or sedimentary) undergo metamorphism due to intense heat, pressure, or chemically active fluids, metamorphic rocks are formed.

- Foliated: These metamorphic rocks have a banded or layered appearance (e.g., schist)
- Non-foliated: These metamorphic rocks don't have a layered appearance (e.g., marble).

Metamorphic rocks can melt and then become magma, and recycling the cycle.



TYPES OF ROCKS:

IGNEOUS ROCKS:	SEDIMENTARY ROCKS:	METAMORPHIC ROCKS:
- Formed from cooling and solidification of magma or lava.	- Formed from compaction and cementation of sediments.	- Formed from existing rocks transformed by heat and pressure.
Examples:	Examples:	Examples:
- Granite (Intrusive)	- Sandstone (Clastic)	- Schist (Foliated)
- Basalt (Extrusive)	- Limestone (Chemical)	- Marble (Non-foliated)
	- Coal (Organic)	

part (c)

CARBOHYDRATES:

Carbohydrates are the biomolecules and human's key source of energy, providing 3.9 calories of energy per gram. When carbohydrates are broken down by the body, glucose is produced. Carbohydrates are organic compounds, these comprise of only carbon, hydrogen and oxygen. The hydrogen : oxygen ratio is usually 2:1. The empirical formula of carbohydrates is $C_m(H_2O)_n$. Carbohydrates are also known as saccharides - word from Greek word "sakkharon" - meaning sugar.

Sources of carbohydrates:

Carbohydrates are available in wide variety of foods, like: cereals, fruits (especially dates), honey, milk, sugarbeet, potato, pasta and sugarcane.

Functions of carbohydrates:

1- Carbohydrates are a chief energy source in many animals.

2- Glucose is broken down by glycolysis / Kreb's cycle to yield ATP. It is stored as glycogen in animals and starch in plants.

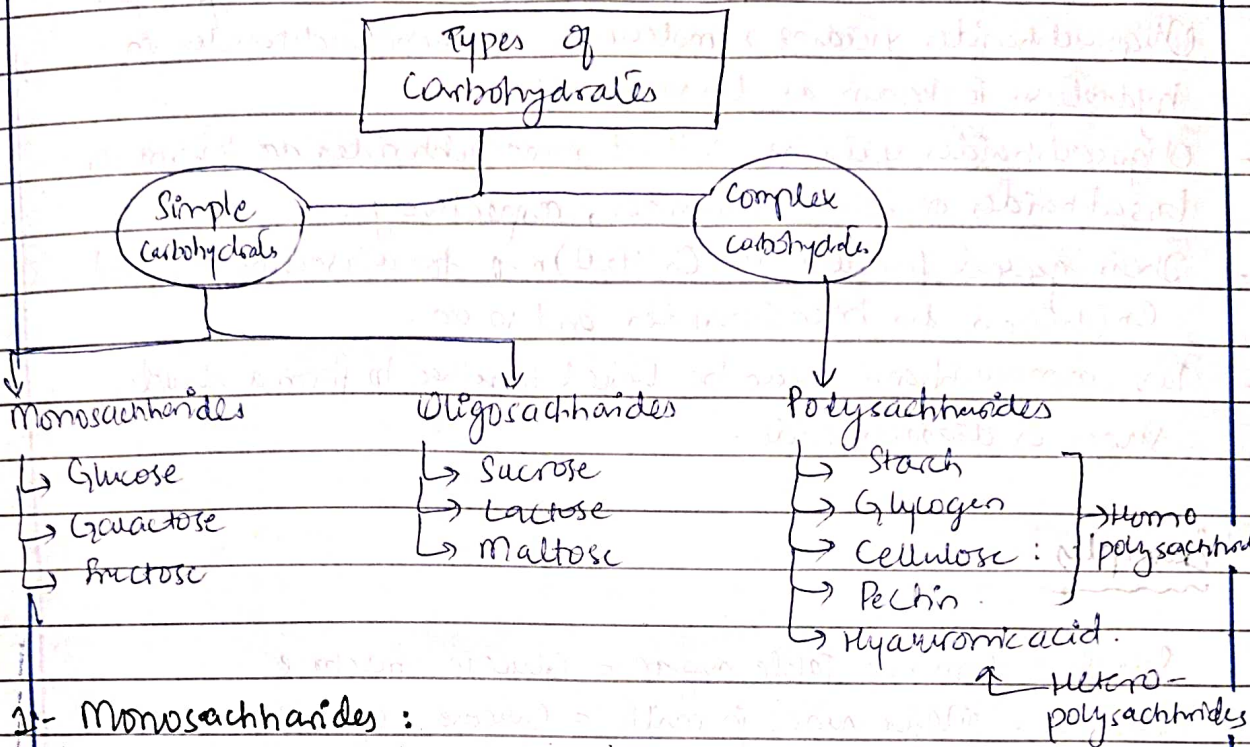
3- ~~Stored~~ Carbohydrates aid in regulation of nerve tissue and is the energy source for the brain.

4- Carbohydrates get associated with lipids and proteins to form surface antigens, receptor molecules, ~~or~~ vitamins and antibiotics.

5- They participate in biological transport, cell-cell communication and activation of growth factors.

6- These are rich in fibre content and help to prevent constipation.

CLASSIFICATION OF CARBOHYDRATES



1- Monosaccharides :

- These are often called as simple sugars.
- They are simple sugars and cannot be hydrolyzed.
- Originated from Greek word, mono = one and sakcharon = sugar.
- Their general formula is $C_n(H_2O)_n$.
- The monosaccharides are subdivided into trioses, tetrose, pentose, hexose, heptose etc.

Examples :

1- Glucose : The immediate source of energy for cellular respiration and "blood sugar".
2- Galactose : A sugar in milk and yoghurt.
3- Fructose : A sugar found in honey.

2- Oligosaccharides :

- In Greek, oligo means, "few" - Oligosaccharides or

Oligosaccharoses are compound sugars that yield 2 to 10 molecules of same or different monosaccharides on hydrolysis.

- Oligosaccharides yielding 2 molecules of monosaccharides on hydrolysis is known as disaccharide.
- Oligosaccharides yielding 3 to 4 monosaccharides are known as trisaccharides or tetrasaccharides, respectively.
- Their general formula is $C_n(H_2O)_{n-1}$ for disaccharide and $C_n(H_2O)_{n-2}$ for trisaccharides and so on.
- Two monosaccharides can be linked together to form a double sugar or disaccharide.

Examples:

1. Sucrose: Common Table sugar = Glucose + fructose
2. Lactose: Major sugar in milk = Glucose + Galactose
3. Maltose: Product of starch digestion = Glucose + Glucose.

3. POLYSACCHARIDES:

- In Greek, poly means "many". Polysaccharides are the compound sugars and yield more than 10 molecules of monosaccharides on hydrolysis.
- Polysaccharides are further classified depending on the type of molecules produced as a result of hydrolysis.

(i) Homopolysaccharides i.e., monosaccharides of same type.
(ii) Heteropolysaccharides ie., monosaccharides of different types.

- Their general formula is $(C_6H_{10}O_5)_n$.

Examples:

(1) Homopolysaccharides: Starch, Glycogen, Cellulose, Pectin
(2) Heteropolysaccharides: Hyaluronic acid, Chondroitin.

part (d):

BALANCED DIET:

A balanced diet is a diet which includes right amount of all nutrients such as proteins, vitamins, minerals, fats, carbohydrates etc. for proper growth, development and normal functioning of the body.

A balanced diet is required for the growth of and development of a person especially the children.

Components of Balanced diet:

- **Carbohydrates:** our main source of energy.
- **Proteins:** essential to growth and repair of muscles and tissues
- **Fats:** source of energy and important for body
- **Vitamins:** role in chemical processes in the body
- **Minerals:** inorganic elements critical to body's normal functioning
- **Water:** 65–75% of human body is water and so necessary for normal body functioning.

BENEFITS OF BALANCED DIET:

1- **Nutritional Adequacy:**
A balanced diet ensures adequate intake of essential nutrients such as vitamins, minerals, proteins, carbohydrates, fats and fiber, necessary for proper functioning of the body. Consuming a variety of foods helps prevent nutrient deficiencies which can lead to ~~various~~ body metabolism.

2- **Weight management:**
Eating nutrient-dense foods and controlling portion sizes can reduce the risk of obesity and related conditions such as type 2 diabetes and cardiovascular diseases.

3- Disease Prevention:
A balanced diet rich in fruits, vegetables, whole grains, proteins and healthy fats can lower the risk of chronic diseases such as cardiovascular problems, stroke, hypertension and certain types of cancer. It also ensures a strong immune system, helping the body defend against infections and illnesses.

4- Improved Digestion:
A balanced diet that includes plenty of fibre from fruits, vegetables and legumes promotes healthy digestion and regular bowel movements. Consuming such food supports a diverse gut microbiota which is associated with better overall health and reduced risk of gastrointestinal disorder.

5- Energy and stamina:
Consuming balanced meals and snacks throughout the day provides a steady supply of energy, ~~ma~~ helping maintain alertness and productivity. It also supports physical performance and endurance in daily activities as well as exercise and sports.

SECTION-II

QUESTION NO. 06

part (a):

Initial population = 18 000
After a decade final population = 22500
Duration = 10 years.
Increase in population = final population - Initial population
= 22500 - 18000

Increase in population after 10 years = 4500

Percentage increase per year = $\left(\frac{\text{Total increase in pop.}}{\text{Initial population}}\right) \times 100$

Percentage increase per year = $\left(\frac{4500}{18000}\right) \times 100$

$= 25\%$

$\Rightarrow$ ~~Population~~

Percentage increase in population over 10 years = 25%.

part (b): Let the units made in 12 days be = x

Units	Days	machines
600	9	20
x	12	18

$$\frac{600}{x} = \frac{9}{12} \times \frac{20}{18} = \frac{5}{6}$$

$\Rightarrow 5x = 600 \times 6 = 3600$

$x = \frac{3600}{5}$

$x = 720$ units

By using direct proportion method, 720 units can be made in 12 days by 18 machines.

part (c):

Car Distance = d_c = 450 m

Car Time = t_c = 1 minute = 60 seconds

Train distance d_t = 69 km = 69000 m

Train time = t_t = 45 minutes = 2700 seconds

Let the speed of car be v_c and train be v_t.

Using formula for speed:

$$v = \frac{d}{t}$$

where v = speed, d = distance, t = time.

Calculating speed for car:

$$v_c = \frac{d_c}{t_c} = \frac{450m}{60s} = 7.5m/s$$

Calculating speed of train:

$$v_t = \frac{d_t}{t_t} = \frac{69000m}{2700s} = 25.5m/s$$

Calculating ratio $v_c : v_t$

$$\frac{v_c}{v_t} = \frac{7.5m/s}{25.5m/s} \quad \text{—①}$$

$$\Rightarrow \boxed{\frac{v_c}{v_t} = 0.294}$$

converting the ratio to simple form by eliminating decimals using eq ①

$$\frac{v_c}{v_t} = \frac{7.5}{25.5} = \frac{75/10}{255/10}$$

$$\frac{v_c}{v_t} = \frac{750}{2550}$$

$$\Rightarrow 750 : 2550 \approx 1 : 3.4$$

$$\Rightarrow \boxed{v_c : v_t \approx 1 : 3.4}$$

Thus the speed of train is 3.4 times more than car.

part (d):

Each side of pentagon = 15cm

Number of sides = 5

In case of pentagon

Using formula for perimeter of polygons:

Perimeter = number of sides × length of each side

$\Rightarrow$ Perimeter = 5 × 15

Perimeter = 75cm.

Perimeter of pentagon with length of each side 15cm is 75cm.

QUESTION NO.08

part (a):

2	B ⟷ Q	17
18	R ⟷ D	4
15	O ⟷ G	7
20	T ⟷ S	19
8	H ⟷ N	14
5	E ⟷ Q	17
18	R ⟷ A	1

Assigning the specific numbers for alphabets we can see in B ⟷ Q, there is a shift of 15, in R ⟷ D the shift is of 14, in O ⟷ G, there is shift of 8, T ⟷ S, shift of 1, H ⟷ N implies shift of 6, then E ⟷ Q have shift of 12 and R ⟷ A has shift of 17 -

Noting the specific trend, for the word SISTER, we will follow the same technique:

(19) S first with a shift of +15 → (34)
(9) I shift of -14 → (26)
(19) S shift of -8 → (11)
(20) T shift of -1 → (19)
(5) E shift of 6 → (11)
(18) R shift of 12 → (30)

For positive shifts : alphabets having numbers greater than total number of alphabets i.e., 26, we'll take mod of that number with 26.

S(19) + 15 : 19 + 15 = 34 ⇒ 34 mod (26) = 8
R(18) + 12 : 18 + 12 = 30 ⇒ 30 mod (26) = 4

For negative shifts to be positive, add +26.
I(9) - 14 = -5 + 26 = 21

(19) S ⟷ (8) ↔ H
(9) I ⟷ (21) ↔ U
(19) S ⟷ (11) ↔ K
(20) T ⟷ (19) ↔ S
(5) E ⟷ (11) ↔ K
(18) R ⟷ (4) ↔ D

Now incorporating letters with numbers

Thus SISTER is encoded as **HUKSKD**.

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part(b)

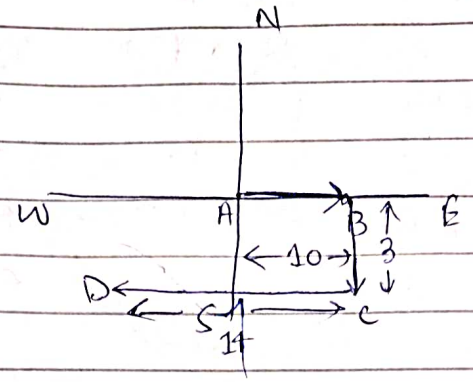
1, 2, 6, 21, ——.

Analysing the given pattern we have :

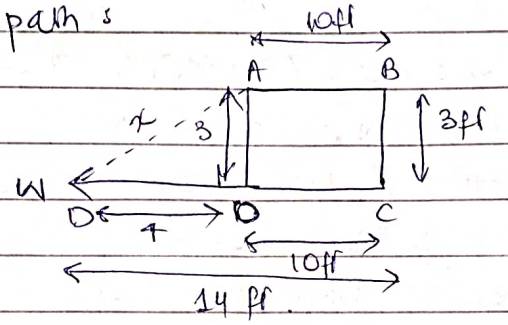
1 → 1
1 × 1 + 1 → 2
2 × 2 + 2 → 6
6 × 3 + 3 → 21
21 × 4 + 4 → 88

So the next missing Term = 88

Part (c):



Tracing the path:



If |AB| = 10ft, |BC| = |AO| = 3ft, |OD| = 4ft

then,

Let x be the distance Naseer is far from point A to D which is actually hypotenuse.

Base = |OD| = 4ft

Perp = |AD| = 3ft

Hyp = x = ?

Using pythagoras theorem:

$$(Hyp) = \sqrt{(Base)^2 + (Perp)^2}$$

$$= \sqrt{(3)^2 + (4)^2}$$

$$= \sqrt{9+16}$$

$$= \sqrt{25}$$

Hyp = 5ft = x

Hence Naseer is 5 ft from point A.

18 ⟺ 1

part (d) :

Average temp of a week (7 days) = 33°C

Average temperature of 1st 3 days = 30°C

Average temperature of last 3 days = 35°C

Let Temperature of forth day = x

Converting to temperatures based per day:

Avg. temp. of week = 33 × 7 = 231°C

Avg. temp. of 1st 3 days = 30 × 3 = 90°C

Avg. temp of last 3 days = 35 × 3 = 105°C

Given the conditions, we can form an equation:

$105°C + 90°C + x = 231°C$ ∵ (Avg. temp of all days = Sum of avg. temperatures of each day)

$x = 231°C - 105°C - 90°C$

$x = 36°C$

Hence,

The temperature on forth day is 36°C.