

Q.2 (a)

1. Octet Rule:

Octet rule is defined as:
"The tendency of atoms to have eight electrons in their valence shell is known as octet rule."

When the atoms have less than eight electrons, they tend to react and form more stable compounds. In octet rule, only s and p electrons are involved.

2. Covalent Bond:

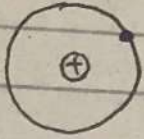
a) **Definition:**

A bond which is formed by the mutual sharing of electrons between the atoms is called covalent bond.

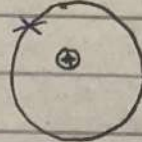
b) Explanation with Example

Consider hydrogen gas (H_2) having atomic number "1", it means that it has 1-proton and 1-electron.

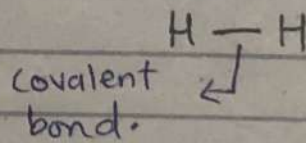
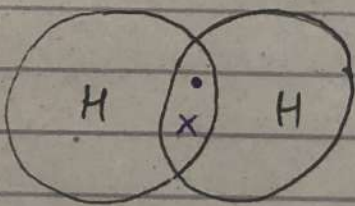
H



H



Here, complete transfer of electron is not possible as each atom wants to attain maximum stability. Therefore, hydrogen gas forms the simplest covalent bond in the di-atomic hydrogen molecule. For attaining the nearest noble gas electronic configuration, each hydrogen atom shares its valence electron with other hydrogen atom and form a covalent bond in hydrogen molecule.



Part (b)

Water molecule is angular in structure.

1. Reason

oxygen complete Hydrogen electron In the bond As a are l outerm

present of a repulsion water or

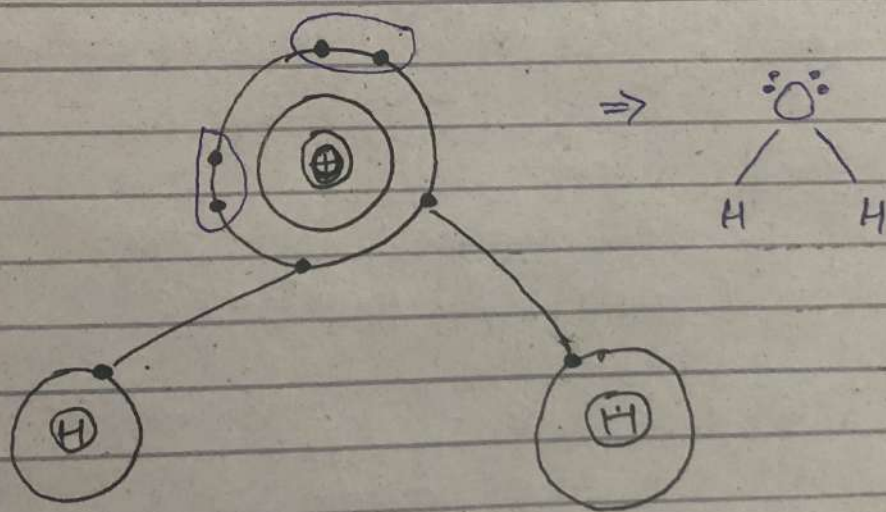
1. Reason:

In case of water molecule, oxygen required two electrons to complete its outermost shell.

Hydrogen molecules have two electrons in their valence shell.

In order to attain stability, the ~~at~~ unpaired electrons form a bond with another unpaired electron.

As a result, the paired electrons are left as lone-pairs in the outermost shell of oxygen atom.



The lone-pair electrons, present in the outer-most shell of oxygen atom, have more repulsion. Due to this repulsion, water molecule shows angular or non-linear V-shape structure.

Part : (c)

1. Structure of Human Brain:

The human brain is made of three main parts:

- i. Fore brain
- ii. Mid brain
- iii. Hind brain

i. The Fore Brain:

It consists of the cerebrum, thalamus and hypothalamus.

ii. The Mid Brain:

It consist of the tectum and tegmentum.

iii. The Hind Brain:

It is made of cerebellum, pons and medulla.

The mid brain, pons and medulla are often referred to as brain stem.

a) Cerebrum:

Brain has wrinkles on its exterior surface, this wrinkly

Part is called cerebrum or cortex. It is the largest portion of our brain. Not every individual has equal amount of these wrinkles which indirectly determines the intelligence of an individual. Larger wrinkles increase the surface area of brain tissue. Hence, more the surface area, more number of neurons in the nerves tissue. And more the neurons, more intelligent an individual is. Therefore, cerebrum is associated with the intelligence of an individual.

i) Lobes of Cerebrum:

Cerebrum is divided into 4-parts which are called lobes and each lobe has different functions that they perform for the body.

Frontal Lobe:

It is present at the front which controls problem solving and intellectual activities. Some other functions performed by this section are judgement,

behaviour, and muscle movement

Parietal Lobe:

It controls & senses pains, readings and understanding statements. Also, it controls senses of pressure, touch and visual functions.

Temporal Lobes:

This section controls visual and auditory memory.

Occipital Lobes:

It helps in recognition of colour, words and movements.

b) The Cerebellum:

The smallest bulge out at the end of the human brain is the cerebellum. It is divided into two halves. It is also called little brain and is very important part of the brain. Compare to the cerebrum, cerebellum has more number of neurons, and it controls essential

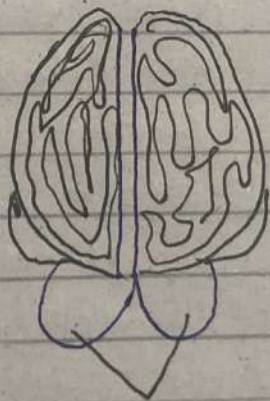
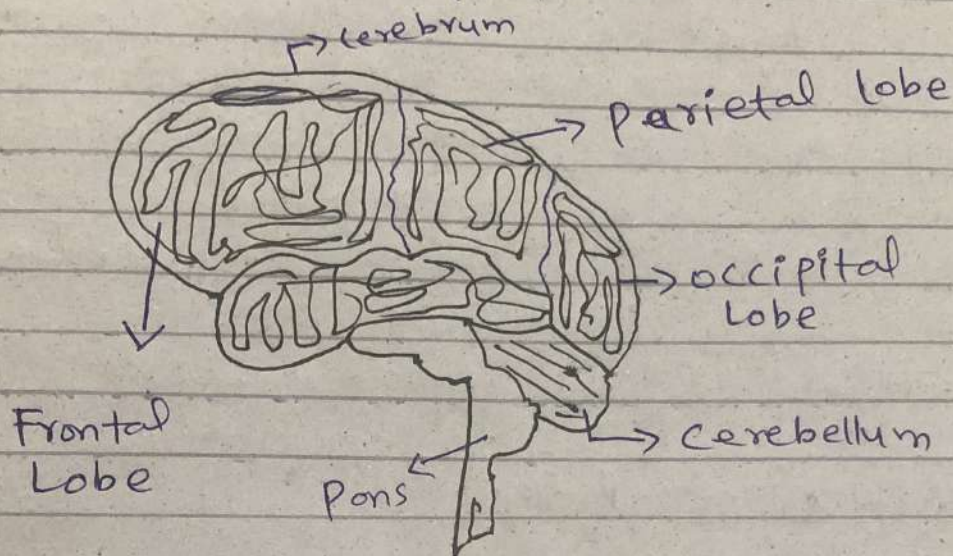
body
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c) Lim

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body functions like balance, co-ordination and posture allowing us to move properly.



Cerebellum (two halves.)

c) Limbic System:

It is often referred to as emotional brain, it is found buried within the cerebrum. This system contains the

thalamus, amygdala and hippocampus.

d) Brain Stem:

Underneath the limbic system is the brainstem. This structure is responsible for basic vital life functions such as breathing, heartbeat, and blood pressure. The brain stem is made of the mid-brain, pons and medulla.

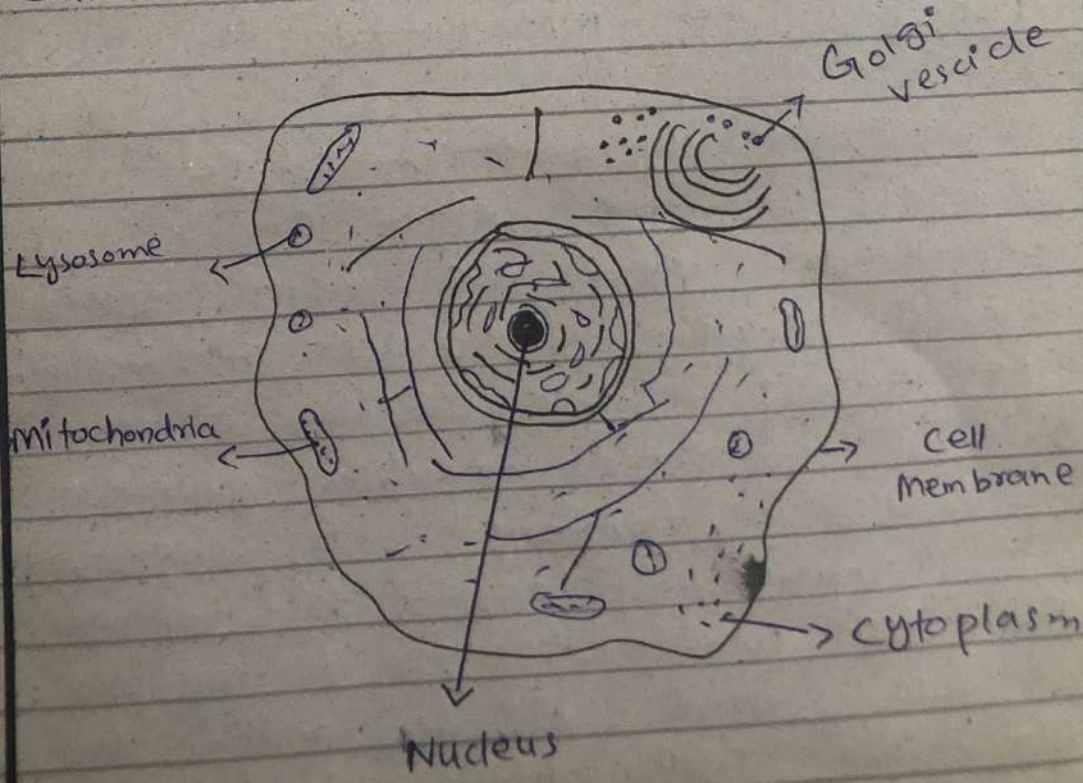
2. Working of Brain:

The brain sends and receive chemical and electrical signals throughout the body. Different signals control different processes, and brain interprets each. Some signals make feel tired while others make ~~feel~~ feel pain. Some messages are kept within the brain, while others are relayed through the spine and across the body's vast network of nerves which is called peripheral nervous system.

Part (a)

1- Structure of Cells

There are many different types, sizes and shapes of cells in the body. A cell consist of three parts, the cell membrane, the nucleus, and between the two, the cytoplasm. Within the cytoplasm lie intricate arrangements of fine fibers and hundreds or even thousands of miniscule but distinct structures called organelles.



2- Functions of Subcellular Organelles:

a) Functions of Nucleus:

i- It controls all the activities of the cells.

ii- It controls the transfer of hereditary characters from parents to offsprings.

iii- The three types of RNAs, i.e. mRNA, tRNA, rRNA are synthesized in the nucleus.

b) Functions of Mitochondria:

Many important metabolic processes are take place in mitochondria, these are kerbs cycle, aerobic respiration, fatty acid metabolism, etc. Energy is released from organic food during these metabolic processes. This energy is transferred to energy rich compound adenosine tri-phosphate (ATP). ATP provides energy to cell on demands and ATP is broken to ADP. This ADP absorbs energy

from mitochondria and again becomes ATP. That is why mitochondria is called the power house of the cell.

c) Function of Cytoplasm:

i- It acts as storage house.

Most of important compounds like starch are stored in the cytoplasm.

ii- Some metabolic processes like glycolysis take place in cytoplasm.

iii- Cytoplasm contains several cell organelles like mitochondria, golgi bodies, endoplasmic reticulum; etc. These cell organelles perform many important functions of cell.

Q.4 (b)

1- Geographic Information Systems

According to Redlands CA:
Environmental System Research
Institute 1990, GIS is:

"An organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information."

2- Components of GIS:

A working GIS integrates five key components.

a) Hardware:

It is the computer on which a GIS operates. Today, GIS software runs on a wide range of hardware types, from centralized computer servers to desktop computers used in stand-alone or networked configuration.

b) Software:

GIS software provides the functions and tools needed to store, analyze and display geographic information. Key software components are:

- i- Tools for the input and manipulation of geographic information.
- ii- Tools that support geographic queries, analysis, and visualization.
- iii- A geographic user interface (GUI) for easy access to tools.

c) Data:

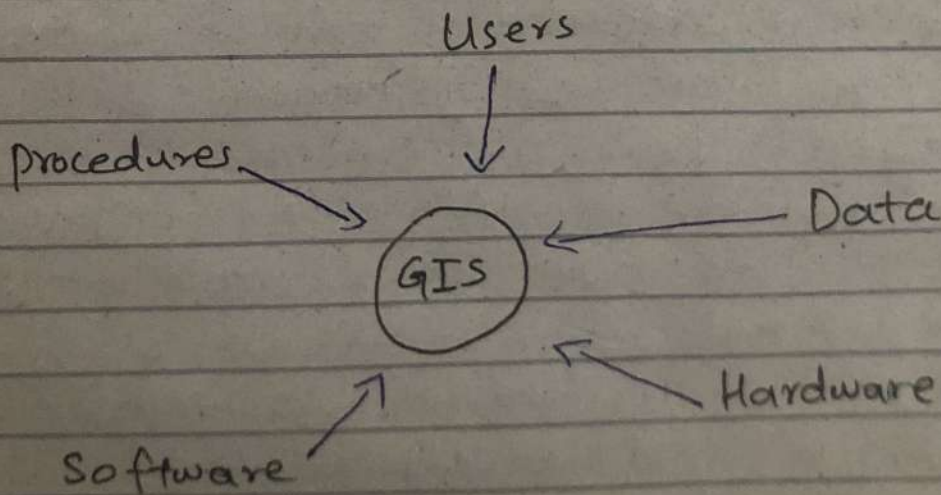
The most important component of GIS is the data. Geographic data and related tabular data can be collected in-house or purchased from a commercial data provider. A GIS will integrate spatial data with other data resources and can even use a DBMS, used by most organizations to organize and maintain their data.

d) People:

GIS technology is ~~not~~ limited value without the people who manage the system and develop plans for applying it to real-world problems. GIS users range from technical specialists who design and maintain the system to those who use it to help them perform their everyday work.

e) Procedures:

A successful GIS operates according to a well-designed plan and business rules, which are the models and operating practices unique to each organization.



Part (c)

1- Causes of Population Explosion in Pakistan:

a- Lack of family planning and Birth Control:

The lack of sufficient family planning and birth control measures stands as a significant factor contributing to the country's rapid population growth. A prevalent issue, particularly in rural areas, is the limited awareness and reluctance to adopt modern contraceptive methods. As a result many families have larger number of children than they can adequately support.

b- High Infant Mortality rate:

Pakistan has grappled with high infant mortality rates, primarily attributed to limited access to adequate healthcare.

and sanitation facilities. This unfortunate reality compelled families to have larger number of children, as they hoped some would survive to adulthood.

C- Low Literacy rate and Education:

The persistently low literacy rate, particularly among women, plays a significant role in driving higher population growth. The lack of access to education limits individuals' understanding of the importance of family planning and reproductive health. The prevailing educational disparities, particularly in rural and marginalised communities, hinders the dissemination of crucial information about reproductive health and family planning.

2- Control Measures for Massive Population Explosion:

According to the latest digital census conducted by the Pakistan Bureau of Statistics 2023,

The population of ~~pa~~ Pakistan has reached over 240 million. This is alarming and control measures are required to be implemented in the country:

a) Family Planning and Awareness Programs:

To control population growth effectively, Pakistan must prioritize family planning and create awareness about its benefits. Family planning allows individuals to make informed choices regarding numbers and spacing of their children, leading to healthier and more sustainable families.

b) Educational Campaigns on Family Planning:

Contraceptive methods and reproductive health should be promoted through various media platforms and community outreach programs. Engaging religious leaders and influencers in these campaigns can help dispel misconceptions and

myths surrounding family planning methods.

c) Women empowerment and reproductive rights:

When women are educated, financially independent, and have access to reproductive healthcare, they can make informed decisions about their reproductive choices. Investing in women's education and healthcare is an investment in the future of the country.

Section (B)

Q.8 (a)

1- Given:

Speed during first half = 40 km/h

Speed during second half = 60 km/h

2- To Find out:

Average speed of a car?

3- Formula:

$$\text{Average} = \frac{\text{Sum of observations}}{\text{Total number of observations}}$$

4- Solution:

Putting values in the above formula

$$\Rightarrow \text{Average} = \frac{40 + 60}{2}$$

$$\text{Average} = \frac{30 \times 2}{2}$$

$$\text{Average} = 30 \text{ km/h}$$

5- Results

Hence, the average speed of a car will be 30 km/h.

Part (b)

1- Given:

Code for ROSE = 6821

Code for CHAIR = 73456

Code for PREACH = 961473

2- To Find out:

Code for SEARCH = ?

3- Solution:

As in the given codes, S corresponds to 2, E corresponds

to 1, A corresponds to 4, R corresponds to 6, C corresponds to 7 and H corresponds to 3. Therefore, the code for the word SEARCH is 214673.

4- Result:

Hence, the code is:

$$\text{SEARCH} = 214673$$

Part (c)

1- Given:

A is the brother of B

B is the sister of C

C is the father of D

2- To Find out:

Relation of D and A = ?

3- Solution:

So A is the brother
of B and B is the sister of
C, C is the father of D.

Then, being a male member,
A and D are brothers.

4- Results

A and D are brothers.

Part (d)

1- Givens:

Kashmala travels west = 35 km

After turning right, ^{travels} ~~moves~~ = 50 km

Another right turn = 35 km travels

2- To Find Out:

How far is she from original
position = ?

3- Solut

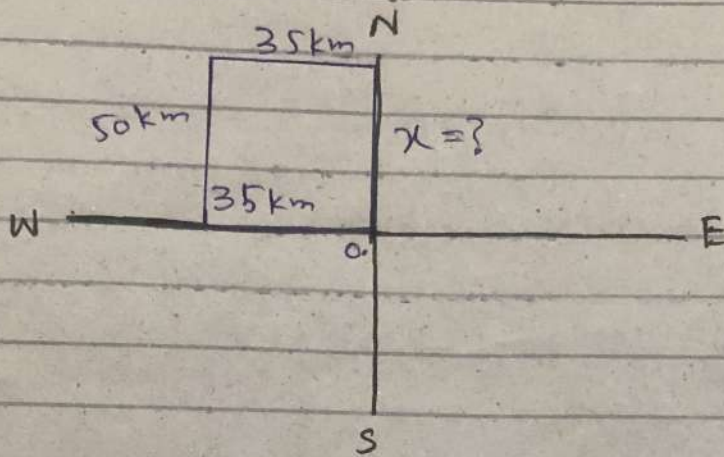
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4- Result

Kash

3- Solutions



From above figure, it is a rectangle with four straight lines, means all angles are equal, and opposite sides are equal. Therefore, if one side is 50km, then the other must be 50km.

So, Kashmala is 50 km away from her original position.
i.e. $x = 50 \text{ km}$

4- Result:

From her original position, Kashmala is 50 km away.

Q.6 (a)

1- Given:

$$\text{Total sum} = \$370$$

Ratio between first and third part = 3:5

2- To Find out:

Each part = ?

3- Solution:

Let, a, b, and c are three parts

$$\Rightarrow a + b + c = \$370 \rightarrow (1)$$

As given,

$$b = \frac{1}{4} (c)$$

$$\Rightarrow b = \frac{c}{4} \rightarrow (2)$$

~~$a =$~~

Also given; $\frac{a}{c} = \frac{3}{5}$

$$\Rightarrow c = \frac{5a}{3} \quad \text{use in (2)}$$

$$\Rightarrow b = \frac{5a}{12}$$

using values of (b) and (c) in (1)

$$\textcircled{1} \Rightarrow a + \frac{5a}{12} + \frac{5a}{3} = \$370$$

$$\Rightarrow 37a = \$4440$$

$$\boxed{a = \$120}$$

$$\Rightarrow b = 5 \times \frac{\$120}{12}$$

$$\boxed{b = \$50}$$

$$\Rightarrow c = 5 \times \frac{\$120}{3}$$

$$\boxed{c = \$200}$$

4- Result

Hence each part has \$120, \$50 and \$200 respectively.

Part (b)

1- Given:

Total Money required = 800

Money borrowed from brother = 20%

Money from mother = 30%

His own money = 200

2- To Find out:

Remaining money he needed?

3- Solution:

$$\Rightarrow \frac{20}{100} \times (800) = 160$$

So, RS. 160 was funded by brother

$$\frac{30}{100} \times 800 = 240$$

RS. 240 was funded by his mother.

Total Money he have now

$$\Rightarrow 160 + 240 + 200 = 600$$

Remaining Money he needed

$$\Rightarrow 800 - 600$$

$$= \boxed{200}$$

4- Result:

So, the remaining money needed by Kashif for paying his fee is Rs. 200

Part (c)

1- Given:

$$\text{Total bags} = 3$$

2- To find out:

Probability of the red ball to be drawn from third bag = ?

3- Formula:

$$\text{Prob}(E) = \frac{\text{Nos of ways of occurrence of event}}{\text{Total possible outcomes}}$$

4- Solution:

Bag 1 = 3 red, 7 black

Bag 2 = 8 red, 2 black

Bag 3 = 4 red, 6 black

$$\text{Prob (bag 1)} = \frac{1}{3}$$

$$\text{Prob (bag 2)} = \frac{1}{3}$$

$$\text{Prob (bag 3)} = \frac{1}{3}$$

Now,

$$\text{Prob (red ball of bag 1)} = \frac{3}{10}$$

$$\text{Prob (red ball of bag 2)} = \frac{8}{10}$$

$$\text{Prob (red ball of bag 3)} = \frac{4}{10}$$

Now,

Prob (Red from bag 3)

$$= \frac{1}{3} \times \frac{4}{10}$$

$$\frac{1}{3} \times \frac{3}{10} + \frac{1}{3} \times \frac{8}{10} + \frac{1}{3} \times \frac{4}{10}$$

$$= \frac{4}{15}$$

$$\Rightarrow \text{Prob (Red from Bag 1)} = \frac{4}{15}$$

Part (d)

1- Given

Traffic lights change after =
24 sec, 36 sec and 72 sec

Simultaneously changed at
= 8:20

2- To Find out:

Again change Simultaneously
at = ?

3- Solution:

$$\begin{aligned} \text{L.C.M of } 24, 36, 72 \\ = 72 \end{aligned}$$

So, time when they change

again = 72 seconds

But we need after 8:20

$$\Rightarrow \frac{72}{60} \text{ minutes}$$

Time = 1 minutes and 12 seconds

Therefore, Required time is

$$8:20:00 \text{ hr} + 00:01:12$$

$$\Rightarrow \boxed{08:21:12 \text{ hrs}}$$