Duration = 4 hours lag gae (:))

PART-II

SECTION-I

Q2.

(a)

Cell

A cel is a basic unit of life that combine together to form tissues, organs and living organisms.

Main Components Of Cell

Cell consist of different orgenelles that have different functions to maintain working of a body of an organism. Some of the orgenelles are given below:

i. **Cell Membrane** : It is the outermost part of cell composed of phospholipids, glycoproteins, and glycolipids. It is hydrophobic in nature. It controols which substances should enter the cell or not.
* Cell membrane is selectively permeable that allows certain substance while reject others to enter into cell.

(ii) **Nucleus**= It is the central unit of cell

that controls all the functions, processes occurings inside cell.

iii) **Mitochondria**: It is the power house of cell that produces energy in the form of ATP (adenosine triphosphate) by utilizing glucose.

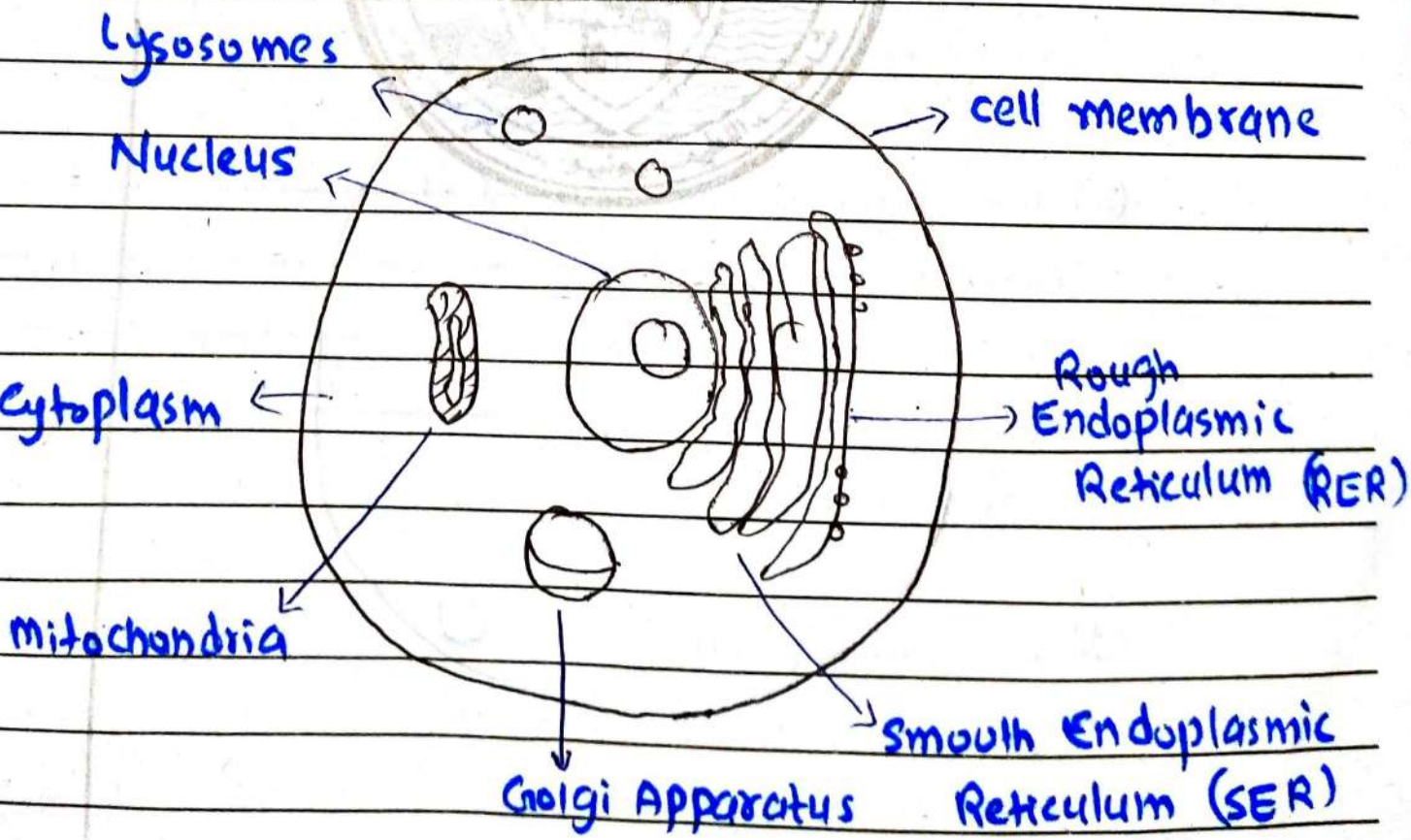
iv) **Ribosomes:** These are the small orgenelles that are present inside cytoplasm. There ako ako found on Rough Endoplastic reticulum. Ribosomes are the protein factories that synthesize protein.

v. **Endoplasmic Reticulum**: It extends from nucleus towards cytoplasm proving shape to the cell. There are two types of endoplasmic reticulum. Rough endoplasmic reticulum contains ribosomes and second is smooth endoplasmic reticulum that helps in lipid metabolism and packaging.

vi. **Golgi Apparatus**: These are the circular bodies that receive, package and send different substances towards cytoplasm.

vii. **Lysosomes**; Lysosome is a self-eating body. Whenever any foreign body, micro-organism or waste material present in cell, then lysosomes engulf them and release chemicals to destroy and remove them outside the cell.

viii) **Cytoplasm**; Present between nucleus and cell-membrane. It is gel-type fluid in which all the above orgenelles reside. Cytoplasm provide shape & support to the cell and also maintains a suitable environment for proper functioning of cell.



STRUCTURE OF CELL

Difference between Prokaryotic and Eukaryotic cell

Eukaryotic Cell	Prokaryotic cell
① It consist of true double membranes around the orgenelles like mitochon-dria, cytoplasm chloroplast and nucleus.	① It lacks true double membrane around the orgenelles.
② Eu' means true. It is a true cell that is present in all multi-cellular living organisms.	② Prokaryotes are mostly unicellular organisms like bacteria, fungi etc.
③ The nuclear material (DNA, RNA) and chromo-somes are present inside a membranous nucleus.	③ Nuclear material is present widely spreaded and not inside the nucleus.
④ It contain many orgenelles like endoplas-mic reticulum, ribosomes, mitochondria, nucleus, golgi bodies, lysosomes.	④ It doesn't contain all orgenelles. It consist of nuclear material in cytoplasm, lysosomes and phagusomes mainly.

Eukaryotic cell	Prokaryotic cell
(5) e.g animals, plants and human beings	(5) e.g Bacteria, fungi

How do cells maintain homeostasis?

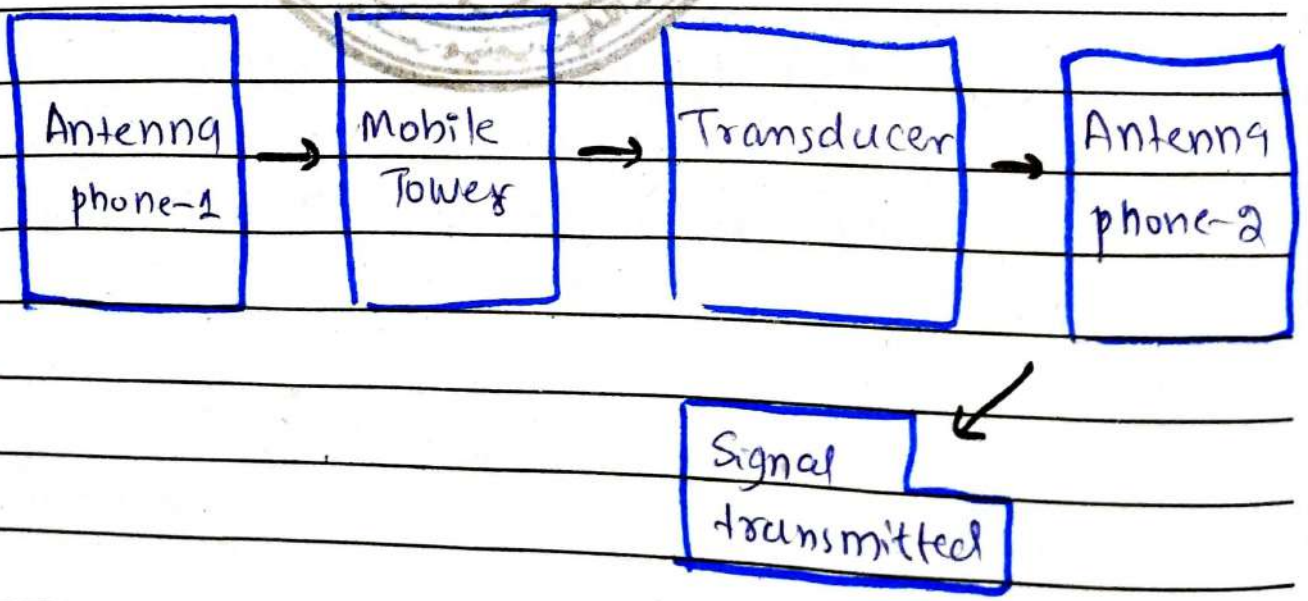
Cells have ability to adapt themselves according to external stimuli through different process like osmosis, diffusion, and selectively permeable nature of cell membrane. If pressure increases or decreases inside the cell, it regulated through osmosis. Similarly, PH regulation maintained through Na^+/K pump and movement of H^+ ions across cell membrane. If external stimuli is changed, for example increased temperature then skin cells open their pore to release sweat and cool down temperature inside the body. In this way, cells maintain their homeostasis.

b.

How do mobile phones work?

Mobile phones are the mechanical devices that send signals in the form of radio waves and receive them on another phone to connect at far distances if the person is in region of mobile tower.

A mobile phone has antenna that sends and receive signals. These signals are received by mobile power, processed and transfered to another region where another phone's antenna receives and transducer inside the phone convert those signals back into sound energy.



Key Technologies that enable mobile communication

① **Transducer**- It converts sound signals into electrical signals to transmit them.

② **Carrier waves**; They ~~help~~ carry signals alongwith them as original wave has smaller amplitude and can't be transmitted easily.

③ **Amplifier**; It increase the magnitude of signal to allow easy communication.

Advantages of mobile phone

① Mobile phones allow easier communication at further distances.
② They can be used for messages, emails, voice calls, videocalls, voice messages, hence, advanced level connection is allowed.
③ Through smart phone, people can access GPS (global positioning system), see forecast weather, connect to internet and also access different social media platforms like facebook, instagram, snapchat etc.

Disadvantages of mobile phone

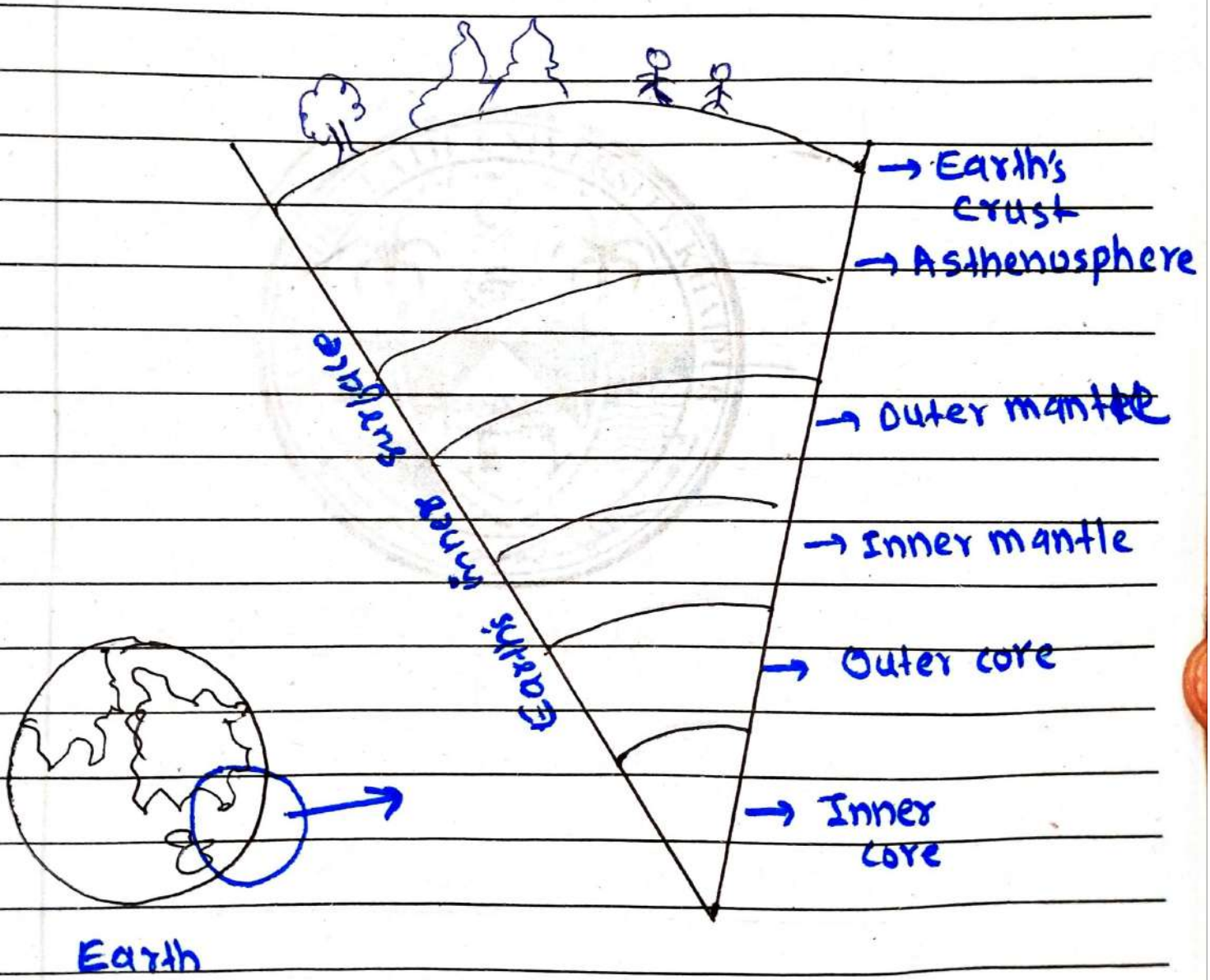
Though easier communication and 24/7

connection is possible through smart phones, they can't be equitable to real time connection aquired through physical presence. Mobile phones have transformed social interactions through social media where hundreds and millions of people remain connected. They watch eachother's IDs. to stay connected with friends, family and colleques. Similarly, mobile phones have completely changed the pattern of how the information is accessed. ~~Previously,~~ ~~people~~ In past, people used to watch news channels and read newspaper to stay updated. However, nowadays. everything is ~~accessable~~ accesable through different social media platforms. These kinds of virtual interactions have negative impacts on mental health because people face anxiety, depression, ~~lonli~~ loneliness.

C.

Layers of Earth

Earth is the only planet that supports life. It is present in milky way galaxy. It consist of different layers:



i. **Inner core** - It is the hottest layer of earth present deep inside earth. It is composed of Iron and Nickle. It is extremely hot with temperature upto 5500°C. With the immense

heat, it is the engine room of earth.

ii. **Outer core;** It is second deep layer of Earth is composed of Iron and nickle. It is liquid layer of earth and extremely hot.

iii, **Mantle** ; It is the widest section of earth that is divided into two parts upper and lower. It contain semi-molten rock called magma. Upper part of mantle is solid whereas in lower part rocks are molten.

iv. **Earth's Crust:** It is the outer most layer of ~~key~~ earth that is solid where life exists. It contains different components such as mountains, rocks, oceans, river etc. It contains Silicates, Ox, Iron and Aluminium. Almost three-fourth part covered with water and one-fourth is land. Its depth is 70-80km.

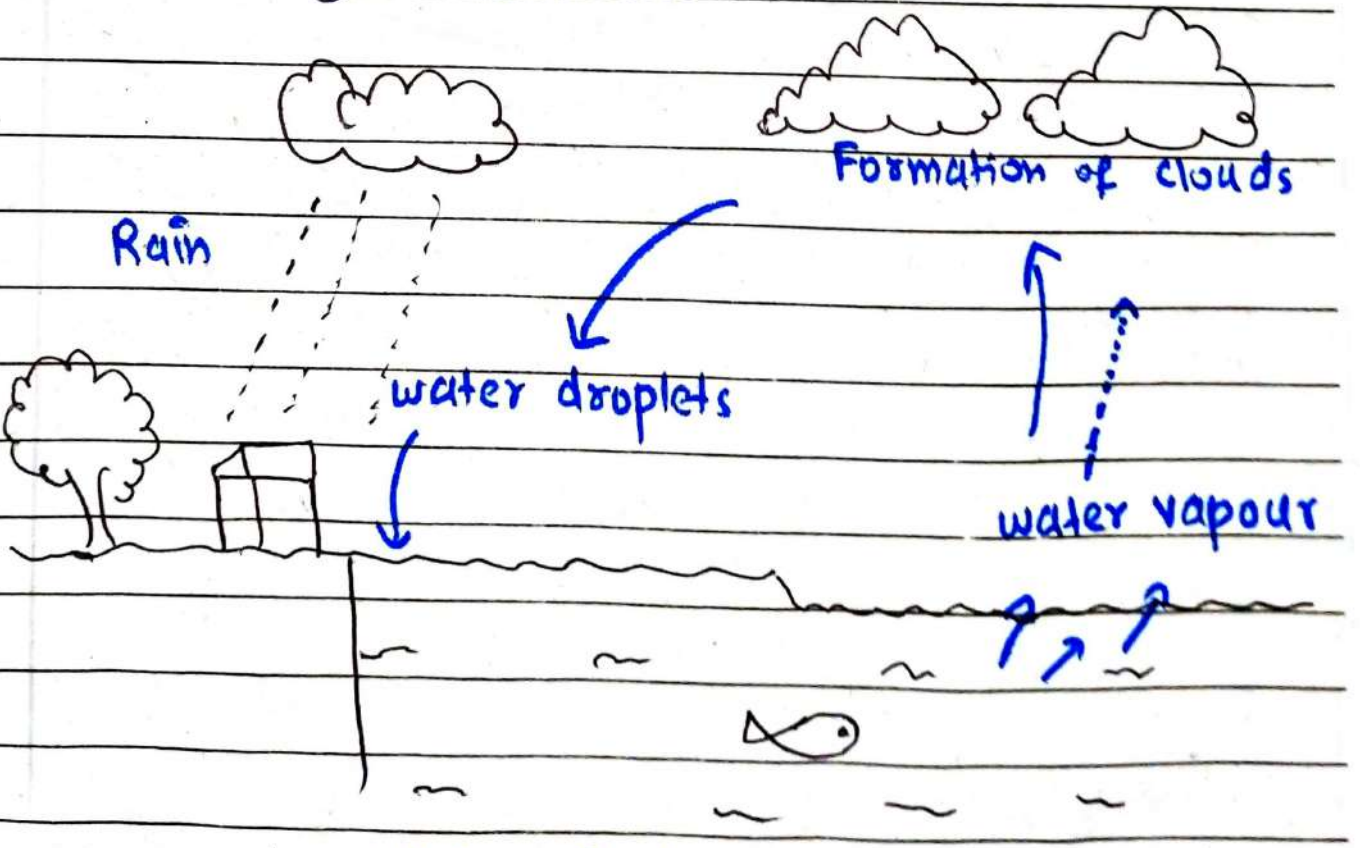
How do these layers interact with eachother?

Below the earth's crust tectonic plates are present that move towards or away from eachother. Sudden movement may result in earthquake. Additionally, magma which is liquid boiling inside earth, sometimes comes out in

the form of lava called volcano.

Water Cycle

As already mentioned, almost 3/4th of land is covered with water. When sun rays fall on this water, it evaporate in the form of water vapours. These vapours condense ~~combine~~ together to forms clouds in the sky. When these clouds become saturated with enough vapour, they start pouring rain in the form of water droplets. These droplets again reach earth and stored in oceans. Again, at high temperature this water converted into water vapours. In this way, earth's water cycle continues.



Water cycle

How do human activities impact on earth's ecosystem and natural resources

Human activities such as fossil fuel burning, deforestation, industrialization, urbanization, and overpopulation disrupt the natural ecosystem of earth. these all activities release green house gases (GHGs) into environment and ~~cause~~ enhance the green house effect resulting in global warming and environmental degradation.

d.

Air Pollution

Addition of contamination (solid, liquid or harmful gases) into atmosphere is called air pollution.

Sources of air pollution

a. Green house gases CO_2, CO, CH_4, Chlorofloro-carbon (CFCs), N_2O emitted from air conditioners, ovens, refridgerators, etc.
b. Motor vehicles (cars, buses, aeroplanes, trains, rickshaws, motorbikes)
c. Industries (fertilizer, cement, cotton, textile, steel, metal industry) etc.
d. Agricultural emission through use of artificial and organic fertilizers.
e. Burning of fossil fuels such as coal, natural gas, Petroleum, deisal etc that emit CO_2, CO and other harmful gases.
f. Deforestation
g. Rapid urbanization
h. Over-population that accelerate all above cause and cause air pollution.

Effects of Air pollution

a. Enhanced green house effect (GHE)
b. Global warming
c. Heat waves
d. Frequent disasters such as floods, earthquake, cyclone, Tsunami, famine, acid atmosphosphere
e. Raised sea levels (almost 8 inches)
f. Threats to coastal population
g. Frequent respiratory tract infections, allergy Asthma, bronchitis, lung cancer, death
h. Harmful effects on aquatic life due to acid rain and loss of biodiversity
i. Abcission, necrosis, witing, and curling of leaves in plants that leads to dwarfism, delayed growth or death of plants.
j. Acid rain that may contain SO_x, N_2O, CO_x, HCl. It can erode buildings and ancient symbols.
g. Smog that is mixture of fog and smoke

Impact of air pollution on human health and Environment

Human health ; Air pollution contains lethal gases such as CO_x, CO, CH_4, N_2O, SO_x and CFCs. These gases when inhaled produce

allergic reaction and inflammation in the respiratory tract such as bronchi, trachea, alveoli. Inflammation results in blockage of air pipe and difficulty in breathing. If inflammation involves trachea that is called asthma and if it reaches bronchi that is called bronchitis. Additionally, it can result in cellular mutations, lung cancer and even death if continuously inhaled.

Environment; air pollution increases temperature of environment. It traps green house gases in the atmosphere that may cause global warming and heatwaves. Additionally, acid rain, smog, smoke, and extreme weather are results of air pollution.

Difference between primary and secondary air pollutants

Primary air pollutant	Secondary air pollutant
① It arises directly from source of air pollution and pollutes the environment.	② It is formed as a result of chemical reaction of primary air pollutants.

(2) It is more dangerous.	(2) It is comparatively less harmful.
(3) e.g CO_2, COx, CO, SO_2, N_2O etc.	(3) Smog Acid Rain.

Steps to reduce air pollution

(1) Shift from non-renewable fossile fuels to renewable sources of energy like hydropower, solar, geothermal and wind energy.
(2) Reforestation, Afforestation to increase number of carbon sinks in atmosphere.
(3) Shift from old engines to new sustainable engines in motor vehicles.
(4) Government should provide incentives to those who promote clean energy and use new engines.
(5) Promote use of public transport and walking small distances to reduce traffic emissions
(6) Strengthen environmental institutions to discourage air pollution.
(7)

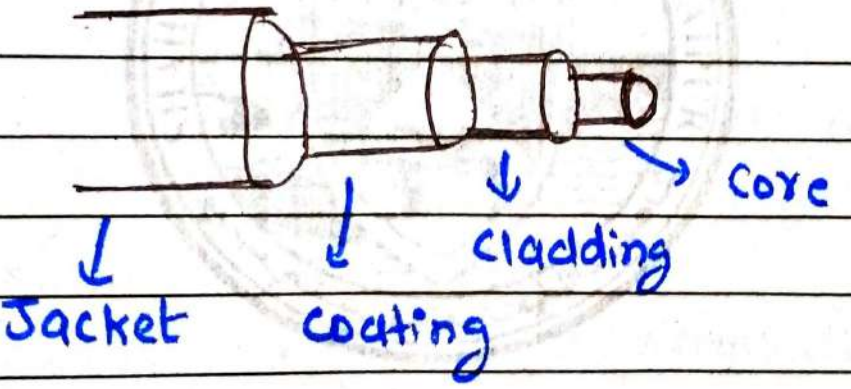
Q4.

Fibre Optics

It is a hair-like thin fibre wire that transmit signal with the help of light waves. Light wave carries the signal in the form of pulses through thin strands of glass / plastic.

Construction of Fibre optic

It consist of following parts.;



Working of Fibre optics : Total Internal Reflection

Light transmission

Light signal typically generated through LED or laser is introduced into core of the fiber. It transmits in the core in the form of pulses.

Total internal reflection; When light signal enters the core it undergoes total internal reflection because of higher refractive index of the core as compared to cladding. When light signal is reflected as ~~too~~ shallow angle, it undergoes total internal reflection. In this way, signal is confined inside the core.

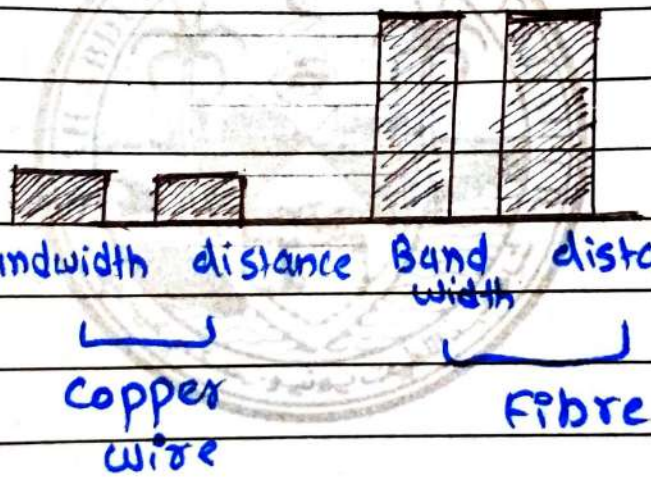
Signal transmission

The light signals travel in the form of binary data ~~that~~ is received at other end. This design helps in minimal signal loss at maximum distances.

Advantages of Fibre Optics over copper wire

Fibre optics	Copper Wire
(1) Fibre optics have large bandwith so minimal signal loss.	(1) They have smaller bandwidth and more chances of power loss.
(2) It has minimal area as compared	(2) They have larger-cross sectional area, hence,

to copper that prevents power loss and enables high-speech transmission	chances of signal loss are more.
③ signal transmit in the form of dielectric, hence, no chances of spark hazard. so it is safer.	③ signal transmission is slow as compared to fibre optics and can't be effectively used for longer distances.



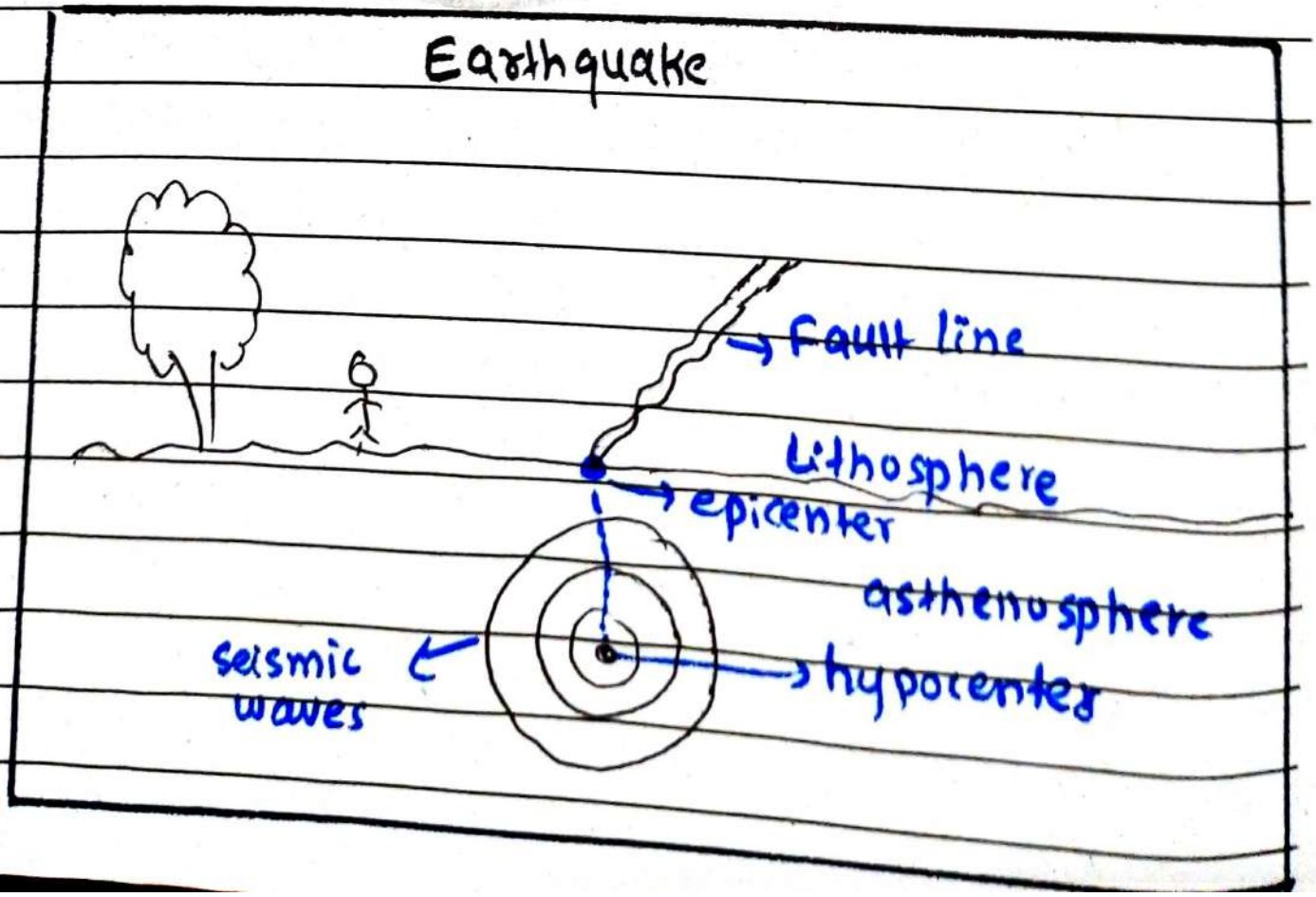
b.

Earthquake

It is temporary shaking of earth's surface that may or may not cause destruction of property or lives.

Cause of Earthquake

① **Tectonic plate Theory:** There are several tectonic plates in lithosphere of earth. These plates move over the asthenosphere (lower liquid layer of earth). When ~~movem~~ stress between different tectonic plates increase, then they suddenly move towards, away from eachother and that shaking of earth is earthquate.



② **Elastic bound Theory** Whenver elastic is stretched, it stores elastic energy. When elastic energy increase, it is suddenly broken and energy released in the form of kinetic energy. Similarly, earth's crust stores elastic energy, whenever it increases its potential, energy is suddenly release and produces earthquake.

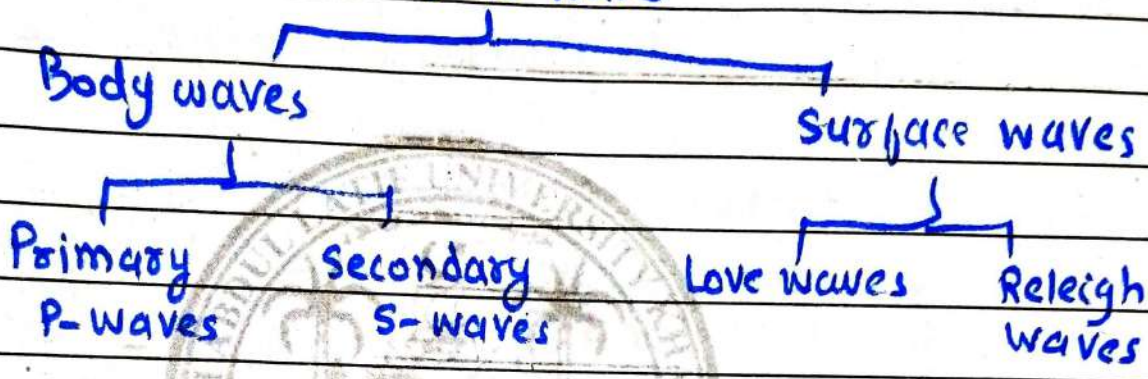
③ Volcanic eruption
④ Explosions by humans
⑤ Dams – huge accumulation of water
⑥ Local cause such as landslides

Effects of Earthquake

① Destruction of infrastructure (Roads, bridges, buildings, etc)
② Loss of human lives, animals, plants
③ Tsunami
④ Volcanic eruption
⑤ Formation of mountains,
⑥ Exposure of different earth's substances, rare elements, metals etc.

Types of Seismic Waves

Seismic waves are released during earthquake that move away from the hypocenter



1. **Body waves** - These are measured from the focus, they travel inside the surface of earth and have higher frequency than surface waves. Following are the types:

(a) **Primary waves;** These are longitudinal waves that travel parallel to the medium. These are the fastest waves.

(b) **secondary waves ;** These are transverse waves, medium is perpendicular to the propagation of wave.

2. **Surface waves ;** They have lower frequency as compared to body waves. These are highly destructive waves. Surface waves have two types;

(a) **Love waves;** These are perpendicular waves same as primary waves

(b) **Releigh waves;** These are longitudinal waves that travel parallel to the medium. These are slowest waves of earthquake and responsible for to and fro movement of earth causing maximum destruction.

Benefits of Earthquake resistant construction

In earthquake resistant building a gap is left between base and earth's crust that functions as a buffer and reduces impacts of even larger scale earthquakes.

c.

Balanced diet

A balanced diet : it taking of adequate level of macro and micronutrients. Macronutrients are those nutrients which are required in larger quantity like carbohydrates, proteins, fats, and micronutrients are required in smaller quantity such as vitamins and minerals.

Balanced diet ; essential for maintaining good health

It is because whenever any nutrients taken is smaller or higher quantity, it disrupts normal functioning and meterbolism of body. Excess or deficiency will result in diseases or illness. For example excess of vitamin D and calcium produces rigid and breakable bones whereas deficiency produces rickets. Hence, balanced diet is essential for maintaining good health.

Macronutrients ; These are required in larger quantity such as carbohydrates, fats, proteins. Carbohydrates are important

to maintain energy level of body. Proteins are essential for muscle mass, hairs, nails, ~~eg~~ functioning of organs. Fats are essential for absorption of fat-soluble vitamins, energy of body, excess energy stored in form of fat.

Micronutrients ; Vitamins and minerals are micronutrients essential for human health.

Vitamin A B → for eyesight, skin, hair

Vitamin B → hairs, skin, nails

Vitamin C → immune system, anti-oxidant, aging

Vitamin D → Bones, teeth

Calci~~um~~ → Bones, teeth, muscles

(K) potassium → Heart, muscles

Sodium → Homeostasis, kidney function.

(d)

Water Pollution

Contamination of water by addition of pollutants from industries, chemical wastes, domestic waste or sewage water.

Sources of water pollution

1. Industrial and municipal waste from cement industry, fertilizer industry, chemical industry etc.
2. Domestic waste.
3. Municipal waste
4. Throwing harmful chemicals

Effects of water pollution

1. Harmful effect on aquatic life and biodiversity loss
2. Water-borne diseases in humans
3. Diarhea, dysentry, cholera, malaria, dengue etc.
4. Mosquitoes and different parasites live in polluted water.

Prevention / Control of water pollution

1. Prevent chemical industries from dumping waste directly into water
2. Strengthen law and order authorities to maintain / control sewage.
3. At individual level, people should be given awareness regarding future losses
4. Avoid dumping plastic and domestic waster into river and ponds.
5. Local government should create dumping sites away from cities and ensure the waste collection and recycling process.

SECTION- II

Q7.

(a)

A two-digit number is given,

suppose it is 'T U' T = tens, U = unit

As unit digit exceeds its ten's digit by 2

$U = 2T \rightarrow (1)$

Sum of the digits $= T + U = 144 \rightarrow (2)$

the number 'TU' = ?

From eq (2)

$T + U = 144$

Putting eq (1) in (2).

$T + 2T = 144$

$3T = 144$

$T = \frac{144}{3}$

$T = 48 \rightarrow (3)$

Putting value of 'T' from eq (3) in eq (2)

$T + U = 144$

$U = 144 - T$

$U = 144 - 48$

$\boxed{U = 96}$

Hence the numbers are 48 and 96.

b. Missing terms

(i) 53, 53, 40, 40, 27, 27, ____

Following criteria is applied;

53 − 40 = 13.

40 − 27 = 13.

27 − x = 13

So 'x' should be ~~13~~ 27 − 13 = **14**

pattern = 53, 53, 40, 40, 27, 27, 14, 14

(ii) 14, 28, 20, 40, 32, 64, ____

The pattern is; (multiplication by 2)

14 × 2 = 28.

20 × 2 = 40.

32 × 2 = 64

Another pattern at alternating number is

14 + 6 = 20.

20 + 12 = 32

32 + 24 = 58

Hence, next number should be **58**

pattern = 14, 28, 20, 40, 32, 64, 58

(iii) 8, 6, 9, 23, 87, _____

(iv) B, F, R, _____

As we number these alphabets in ascending order.

B = 2

F = 6

R = 18

Hence the next number ~~should~~ can be found from number pattern;

2 x 3 = 6

6 x 3 = 18

18 x 3 = 54 — Hence next number should be 54.

~~As~~ ~~SH~~ As there as 26 english alphabets, the double of 26 is 52 — Hence 54 denotes [B] alphabet

the pattern should be:

B, R, R, B

v. V, U, W, V, X, W, ____

Similar pattern will be used as in previous question.

- Firstly, number the alphabets.

V	U	W	V	X	W	____
22	21	23	22	24	23	____

observing the above pattern, alternating numbers are increasing. as 22, 23, 24 hence next number should be 25 that denotes 'Y' alphabets.

Pattern = V, U, W, V, X, W, Y.

(c) Data.

As, 20% of a = b

b% of 30 = ?

20% of a = b

$\frac{20}{100} \times a = b$.

$0.2a = b \rightarrow (1)$

b% of 30 = x

$\frac{b}{100} \times 30 = x$

$0.2b = x$

$x = 0.2b \rightarrow (2)$

From eq① $b = 0.2a$ putting in eq②

$x = 0.2b$

$x = 0.2\ (0.2)a$

$x = 0.04a$

Converting in percentage.

$x = 0.04a \times 100$.

$x = 4\%$ of a

hence the ~~number~~ b% of 20 is same as 4% of a

d. Before 10 years:

age of father $= 3(x - 10)$

son's age $= (x - 10)$

After 10 years:

Son's age $= (x + 10)$

father's age $= 2(x + 10)$

Ratio of ther present ages = ?

$3(x-10) = y-10 \rightarrow (1)$

$2(x+10) = y+10 \rightarrow (2)$

Solving eq (1).

$3(x-10) = y-10$

$3x-30 = y-10$.

$3x-y = 20 \rightarrow (3)$

Solving eq (2)

$2(x+10) = y+10$.

$2x+20 = y+10$.

$2x-y = -10 \rightarrow (4)$

multiplying both sides of eq (3) by 2 & eq (4) by (3).

$(3x-y)2 = (20)2$ $\quad$ $3(2x-y) = (-10)3$

$6x-2y = 40 \rightarrow (5)$ $\quad$ $6x-3y = -30 \rightarrow (6)$

substracting eq (6) by (5)

$6x-2y = 40$

$-6x+3y = -30$

$y = 70$

putting value of 'y' in eq (3)

$3x-y = 20$

$3x-70 = 20$

$3x = 70 + 20$

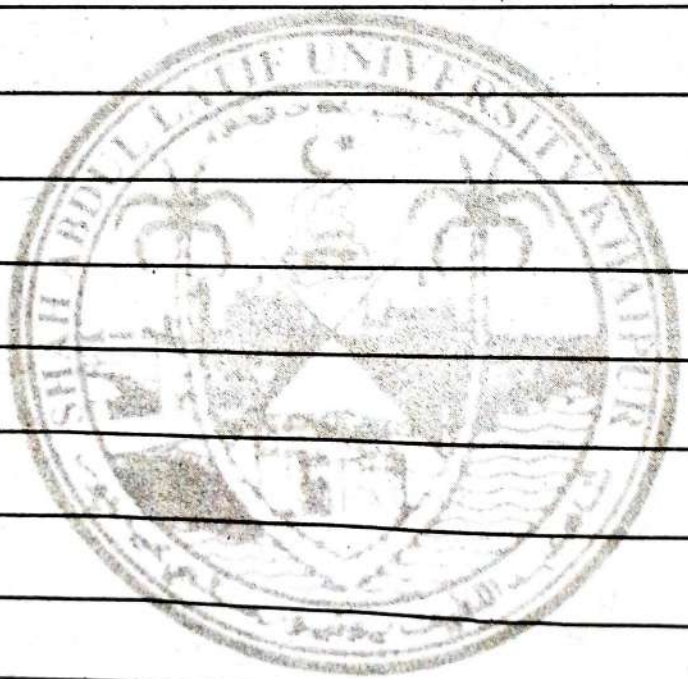
$3x = 90$

$x = 30$

Ratio of their age will be

$70 : 30$

$7 : 3$



Q5.

(a)

sum of 3 consequetive prime numbers = 187

As there are 3 numbers, we estimate a middle number. For that purpose, we will divide 187 by 3

$$\frac{187}{3} = 62.33$$

Close to 62.33 the prime numbers are

57, 59, 61, 67, 69

— 61 is close to 62 hence adding 3 consecutive numbers close to 61

$$59 + 61 + 67 = 187$$

Hence, numbers are 59, 61, 67 Ans

(b)

Given equation is a number increased by 17 is equal to 60 times the reciprocal of the number. suppose number is "x"

$$x + 17 = 60\left(\frac{1}{x}\right)$$

Solving the equation.

$$(x + 17)x = 60$$

$$x^2 + 17x - 60 = 0$$

To solve above quadratic equation,
~~or~~ factorize

$$x^2+17x-60=0.$$

$$(x+20)(x-3)=0.$$

There are two possible numbers from above factor

$x=-20$

$x=3$ As -20 is not a positive number hence, the +ve number is "3"

$$\boxed{x=3}$$

Verification

$$x+17=\frac{60}{x}$$

$$3+17=\frac{60}{3}$$

$$\boxed{20=20} \rightarrow \text{verified}$$

(c)

The population of town increased from 175000 to 262500

averge percentage change per year = ?

Population change = $262500-175000=87500$ per decade

Formula for %age change = $\frac{\text{change}}{\text{Total}} \times 100$.

$= \frac{87500}{175000} \times 100 = 50\%$.

$= \frac{33.3\%}{50\%}$ is percentage change per decade.

For 1 year, we divide it by total number of years

$\frac{50}{10} = 5\%$.

Hence, average %age change (increase) of population per year is 5%.

(d)

purchased C.P = 20 dozen eggs at rate = Rs 375/dozen

S.P/egg = 33 Rs/Egg

Percentage profit = ?

$C.P = \frac{375}{12} = 99.9 \text{ Rs/egg}$

$C.P = 22.9 \times 20 \times 12$

$C.P = 5496 \text{ Rs}$

$S.P = 33 \times 20 \times 12$

$S.P = 7920$.

Formula for %age change = $\frac{\text{change}}{\text{Total}} \times 100$.

$= \frac{87500}{175000} \times 100 = 50\%$.

= 50% is percentage change per decade.

For 1 year, we divide it by total number of years.

$\frac{50}{10} = 5\%$.

Hence, average %age change (increase) of population per year is 5%.

(d)

purchased C.P = 20 dozen eggs at rate = Rs 375/dozen

S.P/egg = 33 Rs/egg

Percentage profit = ?

$C.P = \frac{375}{12} = 31.9$ Rs/egg

C.P = 31.9 x 20 x 12

C.P = 5496 Rs

S.P = 33 x 20 x 12

S.P = 7920.

Percentage profit = $\frac{\text{Profit}}{\text{C.P}} \times 100$.

$= \frac{7920 - 5496}{5496} \times 100$.

Percentage profit = 44.1 %