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PART - II

SECTION- I

Q.NO. 02

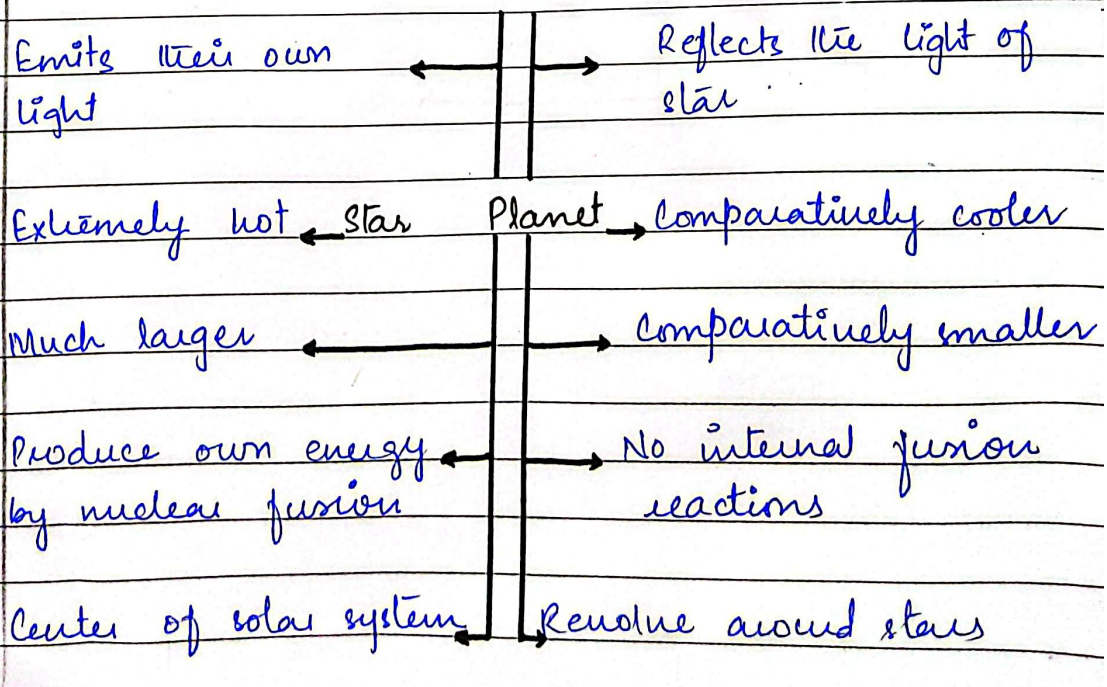
(a) What is a star

A star is a massive, glowing ball of hot gases (mainly hydrogen and helium) that produces its own light and heat through nuclear fusion in its core.

What is a Planet

A planet can be defined as a celestial body that orbits a star, does not produce its own light, has enough gravity to be spherical, and has cleared its path of other objects.

Differences Between a Star and a Planet



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Life Cycle of a Star (from Nebula to a Black Hole)

Stars begin as clouds of gas and dust pulled together by gravity

Nebula → The gas compresses and heats up, forming a young, developing star

Protostar → Hydrogen fusion starts, and the star shines steadily for millions of years

Main Sequence Star → When hydrogen runs out, the star expands and turn into a red-giant

Red-Giant → Very massive stars explode when their fuel is exhausted

Supernova → The gravity becomes so strong that it collapses the massive body to a point called singularity and forms a Black Hole

Black Hole

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b) Definition of Semi-conductors

A semiconductor can be defined as a material with the electrical conductivity between a conductor and an insulator.

The conductivity of semiconductors can be regulated by adding impurities called doping or by changing the physical conditions.

Types of Semi-Conductors

- n-type semi-conductors
  - negative charge-carriers
- p-type semi-conductors
  - positive charge-carriers

p-type

- Acceptor impurities used for doping ← e.g: Boron (B).
- Carry majority positive charge called Holes
- Conducts via movement of Holes.

n-type

- Donor impurities used - elements with extra electrons e.g: P.
- Carry majority electrons - negative charge.
- Conduct via movement of electrons.

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Use of Semi-Conductors In Modern Applications

Transistors: The n-type semi-conductors are used in CPU transistors, memory chips, and switching circuits

N-TYPE

Solar cells: In solar cells, free electrons are easily collected from light.

Transistors: P-type semi-conductors are used to build efficient logic gates in computers and smartphones.

P-TYPE

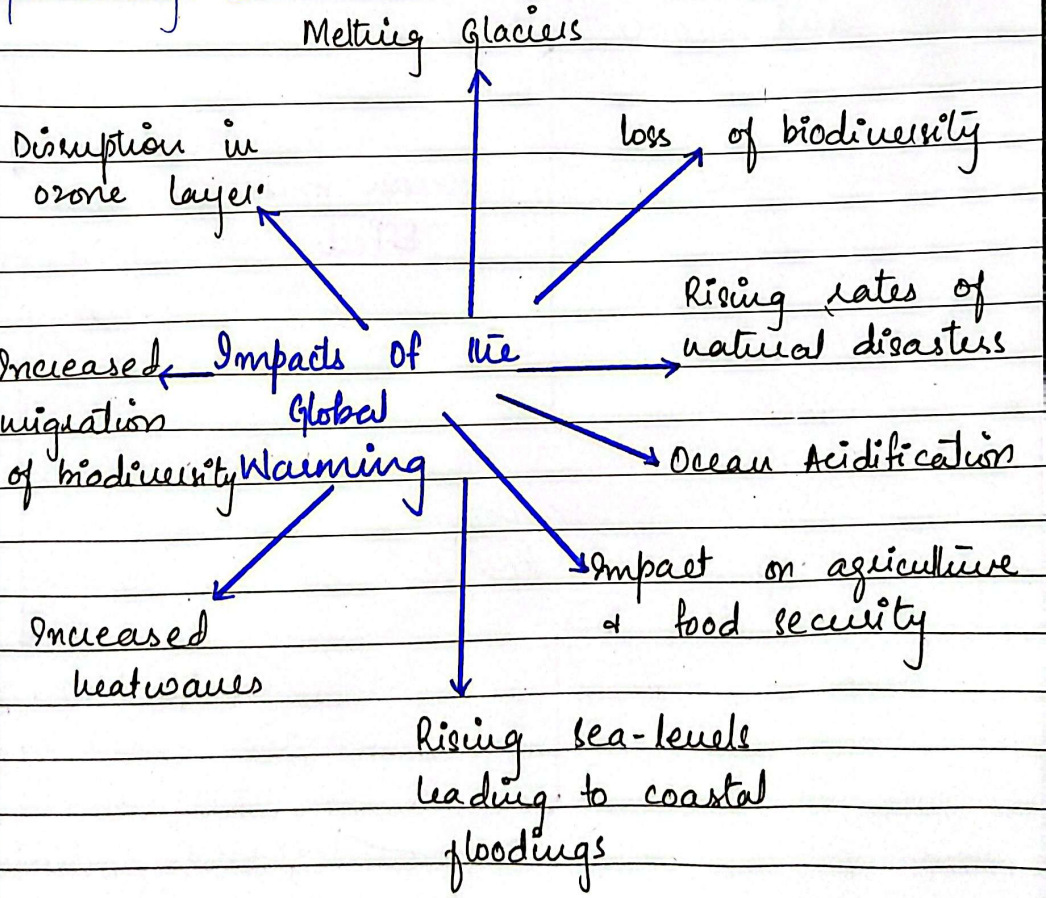
Photovoltaic cells: P-type silicon layers are also used in photovoltaic cells and solar panels.

Date: _____

c) Defining Global Warming

Global warming refers to the long-term increase in the Earth's average surface temperature due to the excessive build-up of Green House Gases (GHGs) in the atmosphere.

The GHGs are primarily accumulated in the atmosphere as a result of human activities e.g: burning fossil fuels, deforestation, industrial processing, etc.



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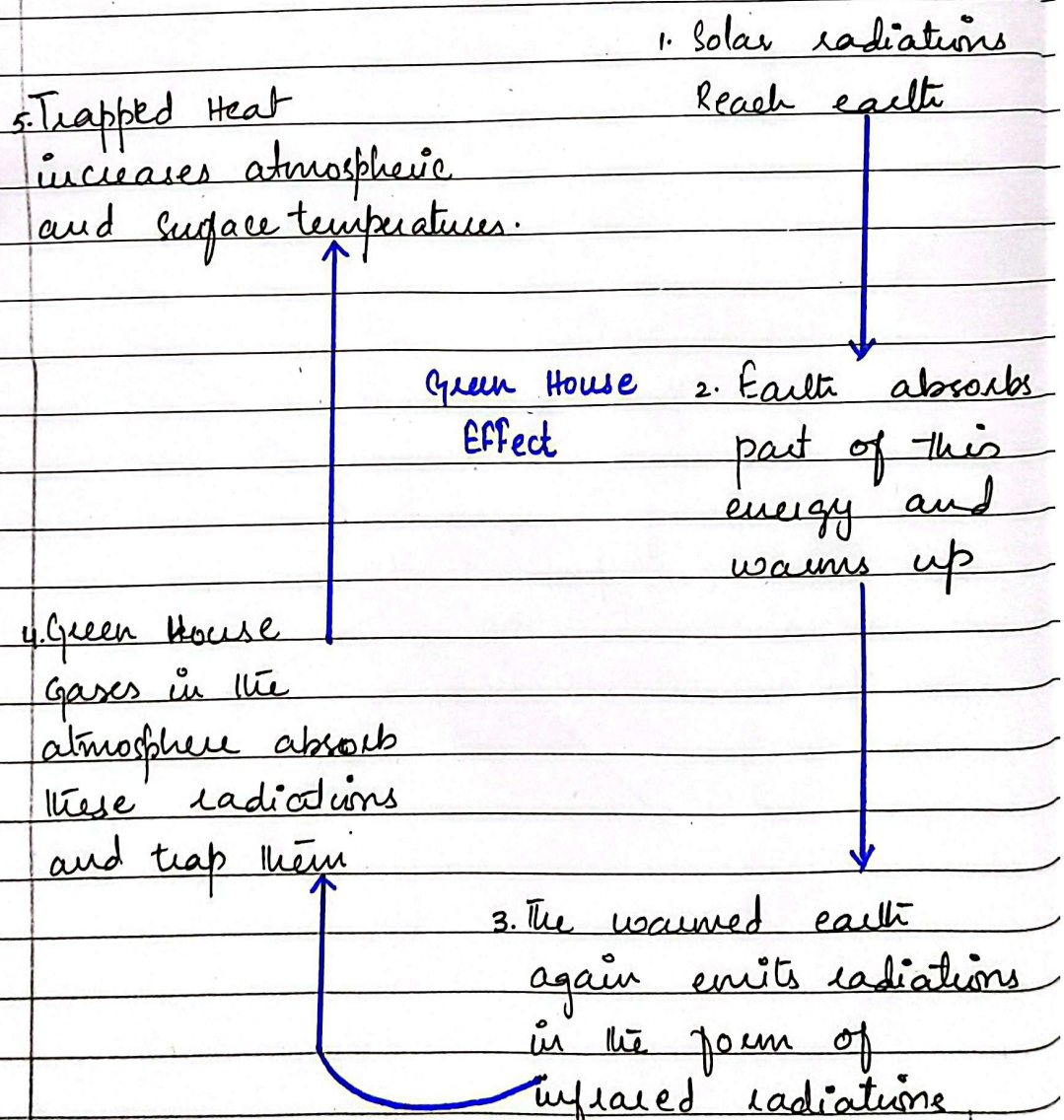
Mechanism of the Green House Effect

The Green House Effect is a natural atmospheric process in which greenhouse gases trap a portion of the sun's heat, keeping the Earth warm enough to support life.



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Major Green House Gases:

CO_2 (Carbon dioxide): life span 300-1000 years.
CH_4 (methane): life span 12 years
N_2O (Nitrous oxide): life span 114 years.

d) Defining a Tsunami

A tsunami is a series of a large, powerful sea-waves caused by the sudden displacement of a large volume of water, usually in oceans.

For example:
2004 Indian ocean Tsunami, triggered by Earthquake near Sumatra.

Natural Processes that trigger Tsunami

1) Undersea Earthquakes: Most common cause. Teetonic plates shift suddenly, displacing water above.

2) Volcanic Eruptions: collapse of volcanic islands can push large volumes of water outward.

3) Landslides: Rocks and sediments falling into sea displace water quickly.

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Potential Impact on Coastal Areas:

1. Massive flooding over coastlines

2. High-speed waves result in loss of lives

3. Massive waves reshape coastal lines and washes the coastal soil away.

4. Cause destruction of infrastructure

5. Impacts trade via sea-routes and disrupts tourism

6. Contaminates fresh water resources and disrupts the ecosystem.

7. Rapid spread of water-borne diseases e.g: Nigleria, Cholera, etc.

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Q. NO. 03

(a) Mitochondria In An Animal Cell

Structure:

Mitochondria is a double-membrane organelle; an outer membrane which is smooth and protective, and an inner membrane which is folded into wave-like structures called as cristae [to increase surface area for reactions].

Matrix: It is the inner fluid in mitochondria containing enzymes, DNA, and ribosomes.

Functions of Mitochondria:

1. Energy Production
Converts Glucose into ATPs (adenosine triphosphate) through cellular respiration.

2. Regulation of metabolism
Controls biochemical reactions.

3. Apoptosis
Helps in programmed cell death by releasing signalling molecules.

Powerhouse of the Cell: Mitochondria are called powerhouse of the cell because they produce ATPs.

Date: _____

Ribosomes In An Animal cell

Structure:

1. Ribosomes are non-membrane bound organelles made of rRNA (ribosomal ribonucleic acid) and proteins.

2. They are found floating freelying into the cytoplasm or attached to the rough endoplasmic reticulum.

Functions of Ribosomes:

1. Protein Synthesis

Ribosomes translate mRNA into amino acid chains, forming proteins.

2. Free ribosomes

They make protein used inside the cells to function.

3. Bound ribosomes

They make protein for export or for cell-membrane.

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(b) Understanding Enzymes:

Enzymes are the biological catalysts made up of proteins that speed up the chemical reactions in living organisms.

1. They are highly specific (each enzyme has a different function).
2. They lower the activation energy of all reactions thereby speeding them up.

The Lock and Key Model for Enzyme Action:

This model was introduced by Emil fischer in 1894. It explains how enzymes recognize and act on their specific substrates. It is based on the idea that both enzymes and substrates have complementary shapes.

Mechanism of Locke and Key:

1. The active site: The specifically shaped region in enzymes.
2. Complementary site at the substrate.

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3. Enzyme - substrate complex: formed when substrate enters the active site.

4. Catalytic Action: the enzyme then lowers the activation energy of the reaction thus expediting it.

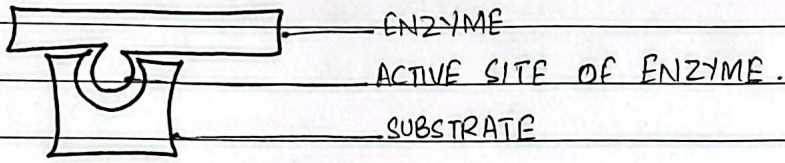

figure: Lock and Key Mechanism of Enzymes.

Factors affecting the Enzyme Activity:

1. **Temperature:**
Enzyme activity is directly proportional to the temperature. It increases with rise in temperature (until the optimum temperature is reached).

2. **pH level:**
Enzymes have specific pH to work. Too acidic or too basic conditions alter the course of action of enzymes.

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(c) Renewable Energy Resources:

Renewable energy resources are naturally replenished in a short time and do not run out. Examples include: solar energy, wind energy, geothermal energy, biomass. They are environment friendly, and produce low emissions thereby do not pollute the atmosphere.

Non- Renewable Energy Resources:

Non- renewable energy resources are the ones that are limited and take millions and thousands of years to replenish. Examples include: coal, oil, natural gas, and nuclear fuels.

Differentiating between Renewable and Non- Renewable Energy Resources

Renewable	Non- Renewable.
Replenish time span	
Replenish quickly	Take millions of years to form
Exhaustion	
Inexhaustible when managed properly.	Finite and will eventually deplete.

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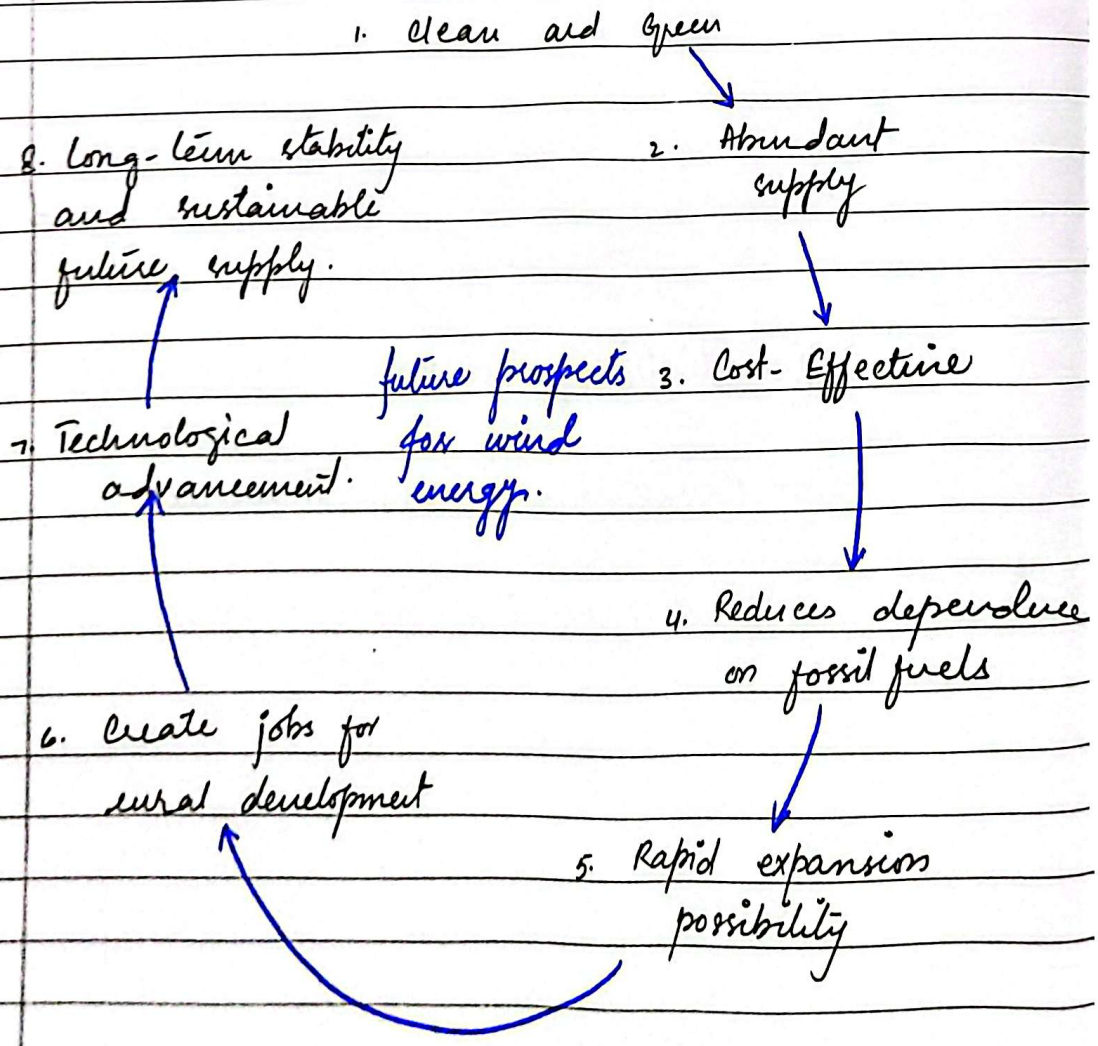
Carbon footprint

Low carbon emissions. High carbon-footprint

Environmental Impact

Environment friendly — Lead to environmental pollution and climate change.

Potential of Wind Energy for future:



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(d) Defining Dengue fever:

Dengue fever is a viral infection caused by the Dengue virus (DENV) transmitted primarily through mosquito bites.

→ It is most common in tropical and sub-tropical regions like Pakistan.

Vector Responsible for Transmission of Dengue Fever:

This disease is transmitted by Aedes mosquito. These mosquitoes bite during the day-time (mostly), breed in clean stagnant water, and have black and white stiped legs.

Common symptoms of Dengue fever:

1- Sudden high fever (pyrexia) 104°F - 105°F

2- Severe (throbbing) headaches

3- Pain behind the eyes

4- Joint and muscle pain

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5- Nausea and vomitting

6- Skin rash (not always)

7- low platelet count

8- Abdominal pain.

Key Preventive Measures against Dengue Fever.

1- Frequent cleaning of stagnant water sites.

2- Use of mosquito repellents and nets.

3- Proper fumigation and sprays to prevent growth.

4- Use of insecticides when needed.

5- Use of anti-virals according to medical advice.

6- Symptomatic treatments.

Date: _____

SECTION-II

Q. NO. 06:

(a)

Data Given:

Pipe A: fills in 10 hours

Pipe B: fills in 15 hours.

Pipe C: empties in 30 hours.

Required:

Time required to fill the tank = T = ?

condition: all pipes are open.

Solution:-

Rate at which each pipe is filling/emptying the tank can be given by;

Pipe A = $\frac{1}{10}$; Pipe B = $\frac{1}{15}$; Pipe C = $-\frac{1}{30}$

Taking LCM of Pipes A, B, and C;

2	10, 15, 30
3	5, 15, 15
5	5, 5, 5
	1, 1, 1

$$\Rightarrow \frac{1}{10} + \frac{1}{15} + \left(-\frac{1}{30}\right)$$

$$\Rightarrow \frac{1^{\times 3}}{10} + \frac{1^{\times 2}}{15} - \frac{1^{\times 1}}{30}$$

$$\Rightarrow \frac{3+2-1}{30}$$

$$\Rightarrow \frac{5-1}{30}$$

$$\Rightarrow \frac{4}{30} \text{ or } \frac{2}{15}$$

Date:

$\therefore$ Time $= \frac{1}{\text{rate}}$

$\therefore$ Time $= \frac{1}{2/15}$ or $T = \frac{15}{2}$

$\therefore$ **Time = 7.5 hours**

Hence, when Pipe A, B, and C are opened simultaneously, the tank will filled in 7.5 hours.

(b) Data Given:

Ratio of salaries;

$X : Y : Z = 4 : 5 : 7$

If:

Y's salary increased by 10%.

Z's salary decreased by 25%.

new total combined = 1,69,500 RS.

Required:

original salary of 'X' = ?

Solution:

let common multiplier be 'a'

Salaries become;

$X = 4a$

$Y = 5a$

$Z = 7a$

changed salaries;

$Y = 5a \times 1.10 = 5.5a$

$Z = 7a \times 0.75 = 5.25a$

X = unchanged = $4a$.

New total = $5.5a + 5.25a + 4a$

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new total = 14.75 a

Given that;

$14.75a = 1,69,500$ RS.

Hence,

$$a = \frac{1,69,500}{14.75}$$

Since;

X's salary = 4a

Therefore; multiplying by 4 on both sides;

$$4a = \frac{1,69,500 \times 4}{14.75}$$

$$= \frac{678000}{14.75}$$

Thus,

X's salary ≈ 50,000 RS

169500004
1475
2169500
4
678000
2712000
59
2712000
59
590
x 6
3540
2712000
60 51866.
30
18

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(c) Data Given:

At 3/5 work of road in 60 days.

hires: 10 add. workers.

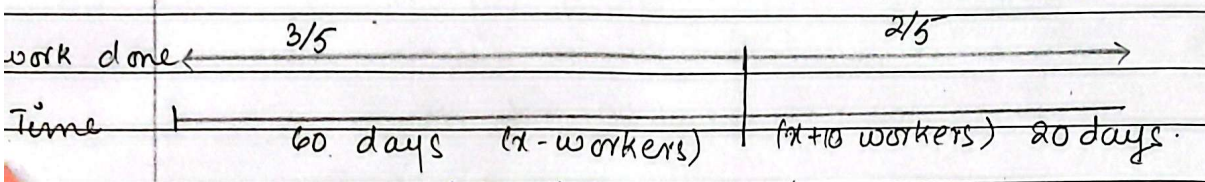
Remaining work = $\frac{2}{5}$ in 20 days.

Required:

original number of workers contractor had = ?

(condition: all work at same rate)

Solution:



∴ work = work per day by workers × days.

for first 60 days;

$$\frac{3}{5} = x \times 60 \quad \rightarrow (1)$$

for next 20 days;

$$\frac{2}{5} = (x+10) \times 20 \rightarrow \text{eq } (2)$$

=

where x = work being done in one day.

Dividing eq. (1) by eq (2)

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$$\frac{(x+10)\times 20}{x\times 60} = \frac{2/5}{3/5}$$

$$\frac{(x+10)\times 20}{x\times 60} = \frac{2}{3}$$

$$\frac{x+10}{x} = \frac{\cancel{120}\ 2}{\cancel{60}\ 1}$$

$$x+10 = 2x$$

$$\therefore \boxed{x = 10}$$

Thus, the initial number of worker that the contractor had was 10 workers.

(d) **Data Given:**

Average = 78.

Top 5 scores removed: (98, 95, 92, 90, 85).

New Average = 75.

Required:

Total no. of students = ?

Solution:

Let, the total no. of students = n

Average score of all students = 78

Total sum of all scores = 78 × n or 78n

On removing top 5 scores; no. of student

$\Rightarrow n-5$

New average = 75

Total sum of new scores (rest) = 75(n-5).

Total sum = Sum of top 5 + Sum of rest.

$78(n) = (98+95+92+90+85) + 75(n-5)$

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$78n = 460 + 75(n-5)$

$78n = 460 + 75n - 375$

$3n = 85$

$n = \frac{85}{3} = 28.33$

$\therefore \boxed{n = 28.33 \approx 28}$

Thus, the total no. of students in the class is 28.

Q. NO. 08.

(a) code:

ROAD ⟶ UGDG

LAKE ⟶ ?

Explain the rule:

(A)	B	C	(D)	R = U
E	F	G	H	O = G
I	J	K	L	A = D
M	N	(O)	P	D = G
Q	(R)	S	T	
U	V	W	X	
Y	Z			

"LAKE" will be "ODNH"

The rule is to substitute the original letters with the 3rd letter in the sequence.

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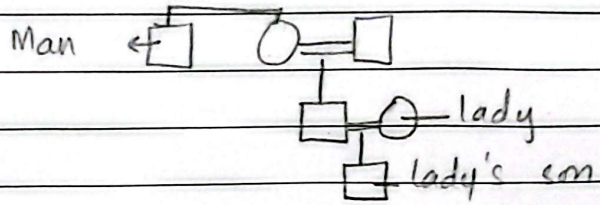
(b) The son of my sister's husband is the father of your son.



The man is the uncle in law of the woman. (i.e: The man is the maternal uncle of the woman's husband).

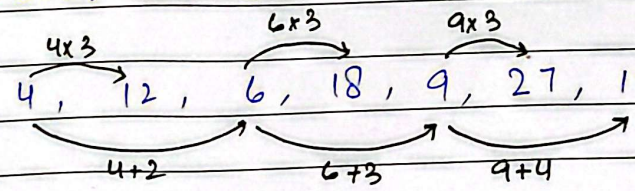
(c)

1- 4, 12, 6, 18, 9, 27, 13

4x3 = 12 4+2 = 6

6x3 = 18 6+3 = 9

9x3 = 27 9+4 = 13

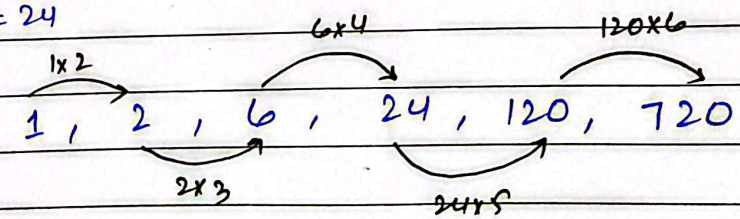


2- 1, 2, 6, 24, 120, 720

1x2 = 2 24x5 = 120

2x3 = 6 120x6 = 720

6x4 = 24



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(d)

T → 180 cm.

S

Q → third tallest

P

R → 150 cm.

Thus, 'Q' is the third tallest.

The range and difference between their heights is:

$$180 - 150 = 30 \text{ cm}$$