Mian Farzeen.
Umar

General Science and Ability

Section A: General Science

Question 2

a)

1. Introduction

Igneous and metamorphic rocks are two major categories in Earth's rock cycle. Igneous rocks form through the cooling and solidification of molten magma or lava. Metamorphic rocks originate when existing rocks undergo transformation under condition of intense heat and pressure. Both rock types play a vital role in shaping the Earth's surface and have a diverse application in construction and industrial use.

2. Difference Between Igneous Rocks and Metamorphic Rocks

i) Formation Process

- Igneous Rocks:
  - Formed by the cooling and solidification of magma below the surface (intrusive)

- Cooling and solidification of lava on the surface (extrusive)

- **Metamorphic Rocks:**

- Formed when existing rocks such as igneous or sedimentary are subjected to intense heat, pressure, or chemical process.

ii) **Examples**

- **Igneous Rocks:**

- Intrusive: Granite, Diorite
- Extrusive: Basalt, Pumice

- **Metamorphic Rocks:**

- Slate from shale
- Marble from limestone
- Schist from mudstone

iii) **Appearance, Texture, and Hardness**

- **Igneous Rocks:**

- Appearance may have crystals depending on cooling rate

- Texture is coss-grained (e.g, Granite) or fine-grained (e.g, Basalt)
- Generally hard due to rapid cooling of molten material.

Metamorphic Rocks:

- Appearance often shows foliation (layered structures) which is common distinctive feature or may have non-foliated texture.
- Texture is banding or interlocking crystal (e.g, Gneiss).
- Harder than igneous rocks due to compaction and recrystallisation under heat and pressure.

iv) Mineral Composition

Igneous Rocks	Metamorphic Rocks
• Rich in silicates like feldspar, quartz, and mica.	• Mineral composition changes due to recrystallisation (e.g., limestone → marble)

v) Environment of Formation

- **Igneous Rocks:**
  - Found at volcanic sites, mid-ocean

ridges, or tectonic plate boundaries.

Metamorphic Rocks:

- Found in mountain ranges, subduction zones, or regions with tectonic activity.

vi) Application (Utilisation)

→ **Igneous Rocks:**

- Granite for construction
- Basalt for road bases

→ **Metamorphic Rocks**

- Marble for sculptures and buildings.
- Slate ~~for~~ for roofing and flooring

3. Conclusion

Igneous and metamorphic rocks are fundamental to understanding Earth's geological processes. While igneous rocks represent the formation of new material from molten magma, metamorphic rocks showcase the transformation of existing rocks under extreme conditions.

b)

1. Definition of Smog

Smog is a type of intense air pollution characterized by a combination of smoke and fog. It is primarily caused by the accumulation of pollutants in the atmosphere, such as Nitrogen oxides (NOx), Sulfur oxides (SOx), volatile organic compounds (VOCs), and particulate matter.

- **Key Features of Smog:**

i) Forms when pollutants interact with sunlight or moisture.

ii) Reduces air quality which is measured by standardised air quality index (AQI).

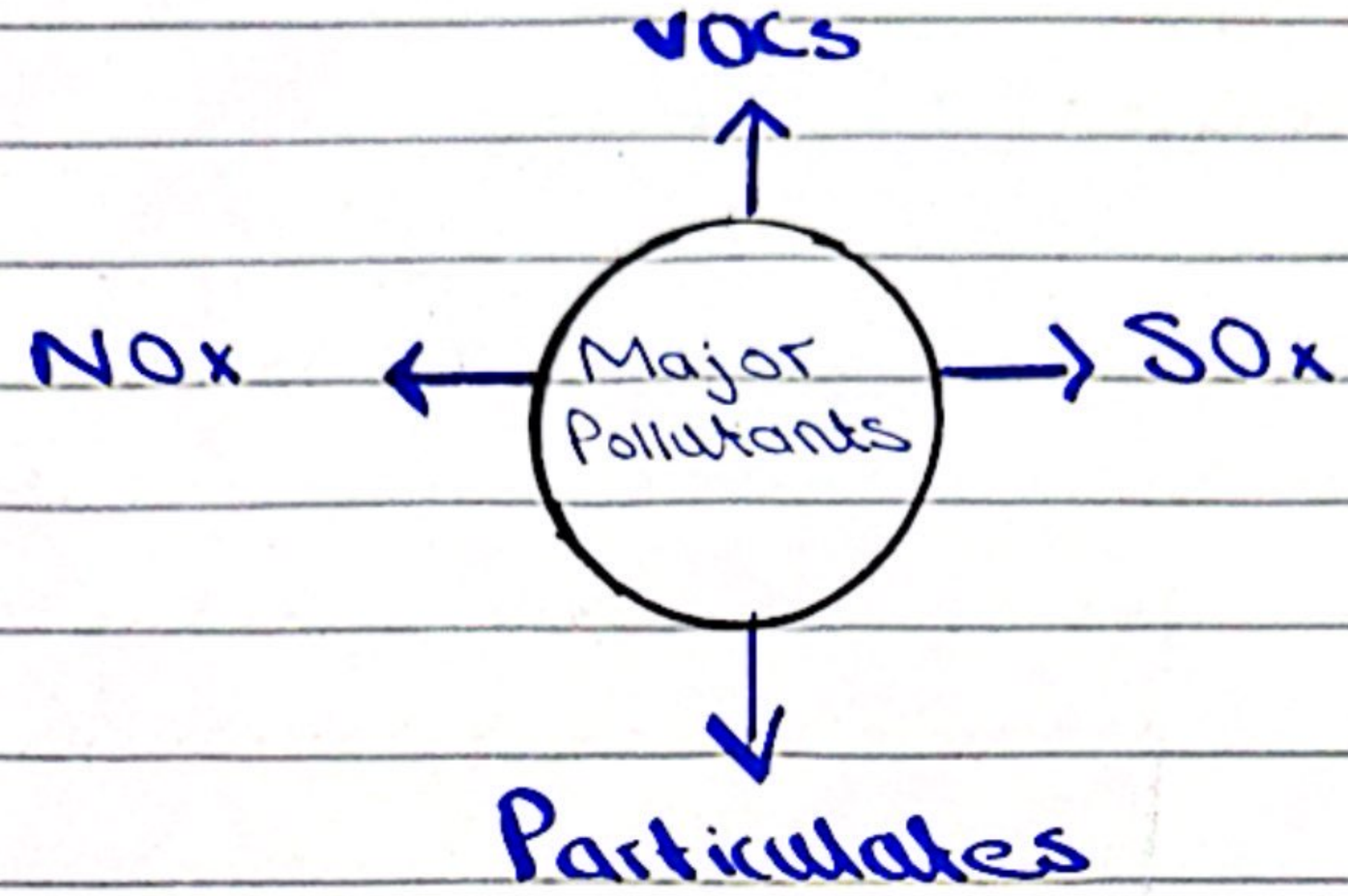
iii) Harmful to human and animal health, plants, and ecosystem.

2. Phenomenon of Smog Formation

Smog forms through complex chemical reactions in the atmosphere:

i) Emission of Pollutants:

- Sources: vehicles, industries, biomass burning, and fossil fuel combustion.



ii) Interaction with Environmental Factors:

- **Sunlight ⇒** Triggers photochemical reactions
- **Moisture ⇒** Combines with pollutants to form dense fog-like conditions.

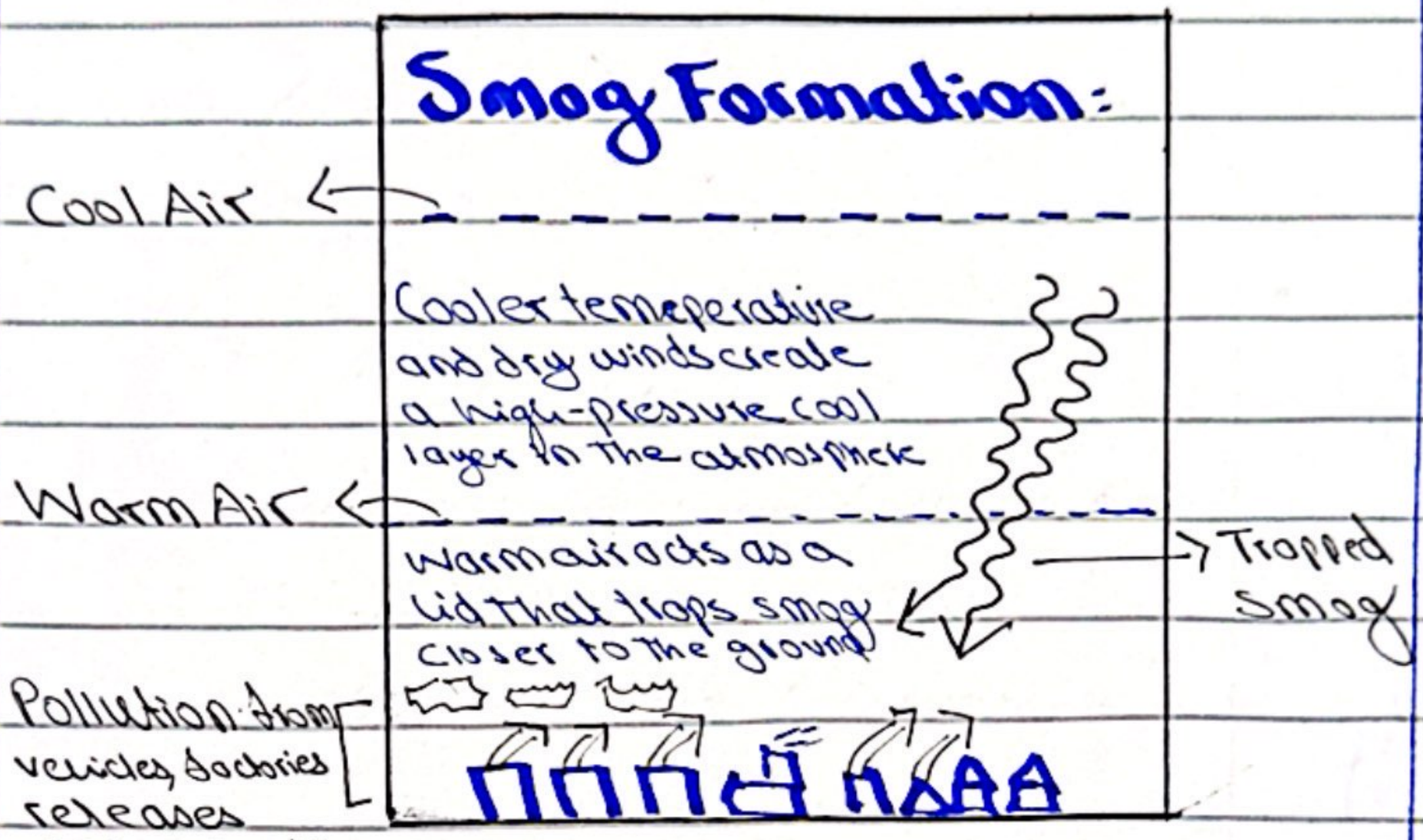
iii) Chemical Reactions:

Photochemical reactions produce ground-level ozone (O_3), a major component of smog.

iv) Formation of Smog Layer:

Pollutants and reactions accumulate

under temperature inversions, trapping smog close to the ground.



3. Types of Smog

i) Classical (Sulfurous) Smog:

- Formation:
  - Combustion of fossil fuels releases SO_2 and particulates
  - Moisture in the air reacts with SO_2 to form sulfuric acid aerosols.
  - Accumulates under cool, humid, and stable atmospheric conditions.
- Effects:
  - Eye irritation and breathing issues.
  - Damage to crops and ecosystems.
  - Contributes to global warming.

- Effects:
  - Reduced visibility
  - Respiratory problems (e.g bronchitis, asthma)
  - Corrosion of buildings and infastructure.
- Case-Study: The Great Smog of London (1952)
  - Caused by coal combustion in cold and stagnant weather.
  - Resulted in 4,000 deaths within a week.

ii) Photochemical Smog:

- Formation:
  - Sunlight interacts with Nox and VOCs to produce ground-level ozone and secondary pollutants.
  - Common in urban areas with higher vehicular emissions.
- Effects:
  - Eye irritation and breathing issues.
  - Damage to crops and ecosystems.
  - Contributes to global warming

- Case-Study: Photochemical Smog in Los Angeles
  - Regular occurrences due to vehicular emissions and sunny climate.
  - Inspired the introduction of strict air quality standards in California

4. Conclusion

Smog, whether classical or photochemical, is a pressing environmental challenge with severe health, environmental, and economic impacts. Effective mitigation requires a combined effort with strict regulations and public awareness as it is human activities which has led to its formation.

c)

1. Introduction

Risk assessment is a critical component of Disaster Risk Management (DRM) That involves identifying, analysing, and prioritising potential hazards. It serves as the foundation for designing effective mitigation strategies, enhancing preparedness, and reducing the adverse impacts of

disasters on communities and infrastructure.

2. Importance of Risk Assessment in Disaster Risk Management (DRM)

i) Identifying Potential Hazards

- Risk assessment helps identify natural and human-induced hazards such as earthquakes, floods, or industrial accidents.
- Provides a clear understanding of potential threats to life, property, and the environment.
- Data analysis & potential economic costs gives clearer image of intensity of the situation.

ii) Prioritising Risks:

- Allows the classification & risks based on their severity and likelihood.
- Ensures resources are focused on the most critical threats.
- Helps government and organisations allocate budgets efficiently for mitigation efforts.

iii) Developing Effective Mitigation Strategies

- Provides data to design tailored measures like flood barriers and seismic-resistant structures.
- Facilitates long-term planning for infrastructure resilience.

iv) Enhancing Preparedness:

- Improves emergency response plans by anticipating the scale and scope of potential disasters.
- Enables training of first responders and communities for effective disaster management.

v) Supports Decision-Making:

- Provides actionable insights for policymakers to implement corrective measures.
- Helps integrate risk reduction into development policies
- Example: Japan's earthquake resistant building policy.

vi) Reducing Economic Losses:

- Early identification minimises financial losses
- Enables cost-effective investment in risk reducing measures.

vii) Meeting International Standards:

- Aligns DRMs with global frameworks: SENDAI Framework for Disaster Risk Reduction
- Risk assessment a key priority of the Framework

3. Conclusion

Risk assessment is the cornerstone of effective DRM, enabling informed decisions, resource optimization, and proactive measures to minimise disaster impacts. It ensures a safer, more resilient society by bridging gaps between hazard identification and actionable strategies.

d)

1. Short-Sightedness (Myopia)

i. Definition:

Short-Sightedness, or myopia, is a common vision condition where a person can see nearby objects clearly but distant objects appear blurry.

ii. Causes:

- Occurs when the eyeball is too long, or the cornea is too curved.
- It causes light rays to focus in front of the retina instead of directly in it.

iii. Symptoms:

- Difficulty in seeing distant objects clearly (e.g., road signs, blackboard)
- Frequent squinting
- Eye strain
- Headaches due to prolonged focus on distant objects

iv. Correction:

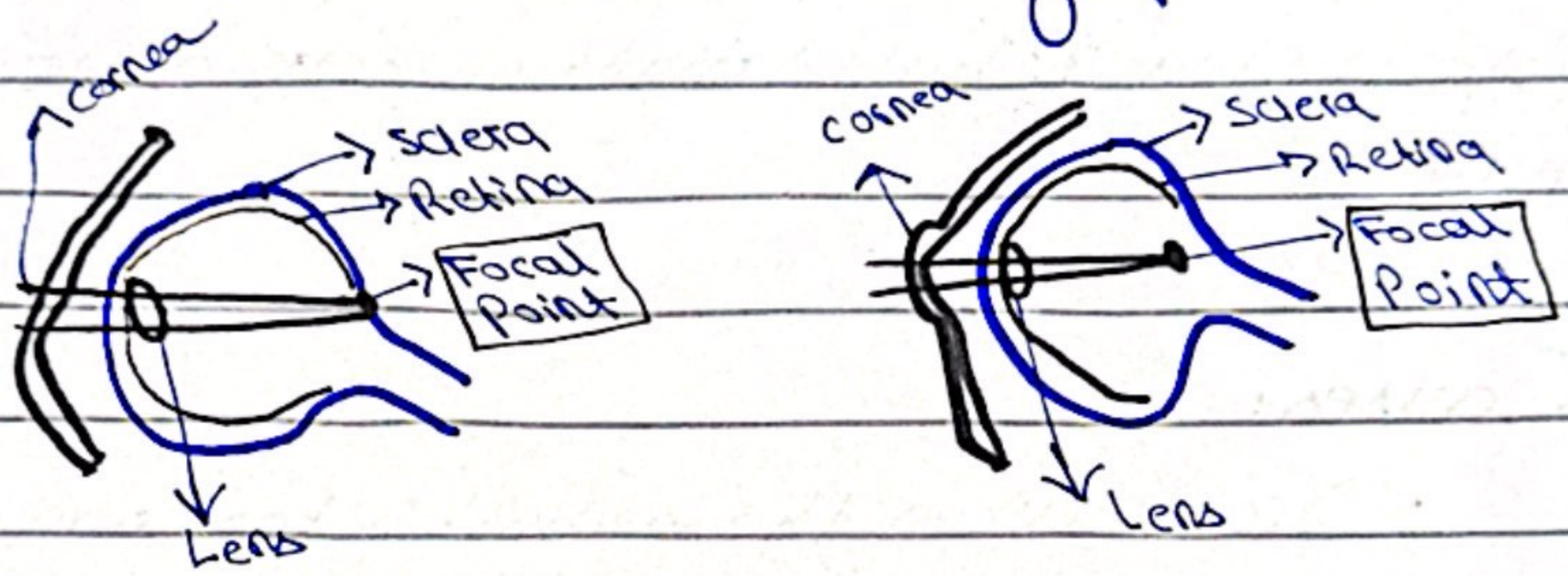
i) Concave Lenses:

Diverge light rays before they enter the eye, allowing them to focus directly on

the retina.

iii) Laser eye surgery (e.g., LASIK):
Reshapes the cornea to correct focus.

v. Diagram



2. Far-Sightedness (Hyperopia)

i. Definition

Far-sightedness, or hyperopia, is a condition where a person can see distant objects clearly but struggles to focus on nearby objects.

ii. Cause:

- Occurs when the eyeball is too short, or the cornea is too flat.
- This causes the light rays to focus behind the retina instead of directly on it.

iii. Symptoms:

- Difficulty focusing on nearby objects (e.g., reading a book)
- Eye strain during close-up tasks
- Fatigue during close-up tasks
- Blurred vision for close objects

iv. Correction

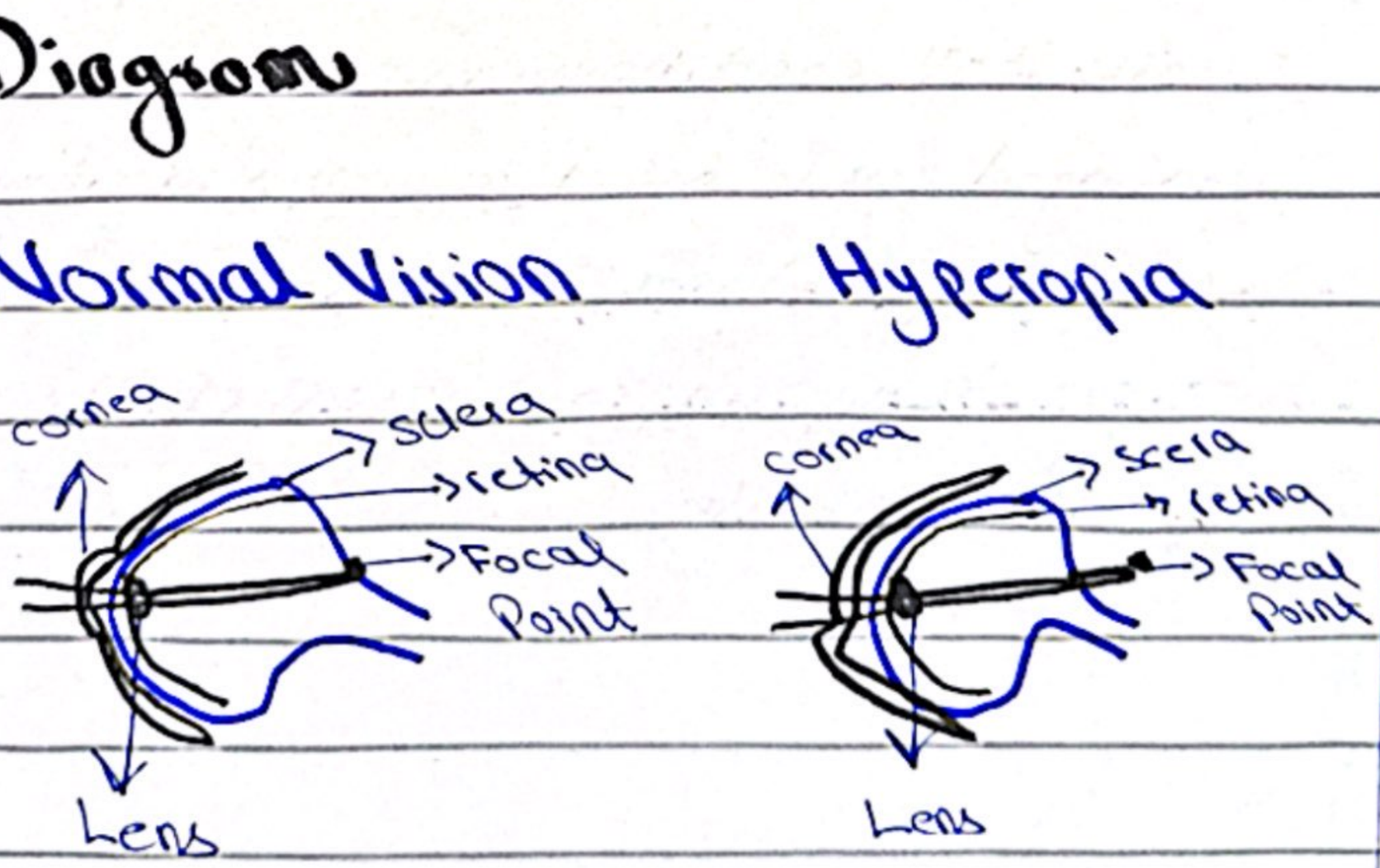
i) Convex Lenses:

Converge light rays before they enter the eye, focusing them directly on the retina.

ii) Contact lenses or refractive surgery:

Used or conducted to adjust the focal point.

v) Diagram



3. Key Facts

i) Both conditions are refractive errors caused by improper focusing of light on the retina

ii) Myopia is more common in younger individuals

iii) Hyperopia increases with age

iv) Regular eye exams are crucial for early detection and management of these conditions

4. Conclusion

Short-sightedness and far-sightedness are common vision problems caused by refractive errors. Both conditions can be effectively managed with corrective lenses or advanced surgical procedures. The corrective measures significantly improve visual clarity and quality of life.

Question # 3

a)

1. Definition of Solar System

The Solar System consists of the Sun, its eight planets, their moons, and various celestial bodies all bound by Sun's gravitational pull. Age is 4.6billion years.

2. Key Components of The Solar System

i) The Sun:

- The center of the solar system
- Composed mainly of hydrogen and helium
- Produces energy Through nuclear fusion
- Sustains life on Earth

ii) Planets:

- Terrestial Planets: Mercury, Venus, Earth, Mars; rocky surfaces
- Gas Giants: Jupiter and Saturn; composed mainly of hydrogen and helium
- Ice Giants: Uranus and Neptune; contain water, ammonia, and methane ices.
- Largest planet is Jupiter

iii) **Dwarf Planets:**

- Pluto, Eris, Ceres, Makemake, and Haumea
- Smaller than planets but orbit the Sun
- Have enough gravity to maintain a nearly spherical shape.

iv) **Moons:**

- Natural satellites orbiting planets
- Example: Earth's Moon
- Jupiter's Ganymede is the largest moon in the solar system

v) **Asteroids:**

- Small rocky belts
- Mainly found in the asteroid belt between Mars and Jupiter

vi) **Comets:**

- Icy bodies that release gas and dust
- Form a glowing coma and tail when near the sun.

vii) **Meteoroids, Meteors, and Meteorites:**

- Meteroids: small rocky fragments in space
- Meteors: Burn up in Earth's atmosphere, shooting stars
- Meteorites: Meteorids that reach the Earth's surface

3. Importance of The Solar System

- Support life
- Aids in scientific research on gravity and origin of universe
- Important resources provides potential mining of asteroids
- Planetary exploration for future expansion

4. Conclusion

The Solar System is a dynamic and intricate network of celestial bodies. Each body contributes to the balance and functioning of the entire system.

(b)

1. Introduction

The pituitary gland, commonly referred to as the "master gland", plays a central role regulating various physiological processes. It is located at the base of the brain, and it controls the function of other endocrine glands and maintains body homeostasis through hormone secretion.

2. Function and Importance of The Pituitary Gland

i) Regulation A Growth

- Secretes growth hormone (GH)
- GH stimulates growth, cell reproduction, and repair
- It's underproduction can lead to dwarfism

ii) Control of Thyroid Function

- Produces thyroid-Stimulating hormone (TSH)
- TSH regulates the thyroid gland
- Ensures proper metabolism, energy production, and temperature regulation.

iii) Reproductive Fundions

- Secrets:

i) Follicle-Stimulating hormone (FSH):

- promotes egg and sperm production

ii) Lutheinizing hormone (LH):

- triggers ovulation and testesterone production
- Essential for sexual health and fertility

iv) Milk Production

- Produces prolactin which stimulates milk production in breastfeeding mothers.

v) **Water Balance and Blood Pressure Maintainance:**

- Releases antidiuretic hormone (ADH) which regulates retention kidney and maintains blood pressure

vi) **Stress Response:**

- Produces ACTH which stimulate the adrenal glands to release cortisol.
- Helps body respond to stress
- Helps body maintain glucose metabolism

3. **Conclusion**

The pituitary gland ensures vital processes take place that sustain life and regulate the body's equilibrium. It's proper functioning is crucial for growth, reproduction, stress management, and overall health.

(13)

Section B: General Ability

Q7. (a) We assume 7 consecutive numbers as follows:

i) $x-3$, ii) $x-2$, iii) $x-1$, iv) x, v) $x+1$,

vi) $x+2$, vii) $x+3$

Step 1: Formula

$$\text{Formula (Average)} = \frac{\text{Sum of all numbers}}{\text{Total Numbers}}$$

Step 2: Substitution and Simplification

$$20 = \frac{(x-3)+(x-2)+(x-1)+(x)+(x+1)+(x+2)+(x+3)}{7}$$

Equation becomes:

$$20 = \frac{7x}{7} \Rightarrow 20 = x$$

Step 3: Identification of largest number

Largest number:

$$x+3 = 20+3 \Rightarrow 23$$

Final Answer: Largest Number:

23

b) Step 1 : Understanding Provided Relations

i) C is A's father's nephew :

- Means "C" is the son of A's uncle or aunt ⇒ A's cousin

ii) D is A's cousin but not the brother of C

- D is also the child of another uncle or aunt of A
- D and C have different parents

Step 2 : Relationship between D and C

- C and D both cousins of A but not siblings
- Relationship of brother non-existent So They are cousins

Final Answer :

Relationship between D and C is **Cousins**

Q7

(c) i)

ii) 1, 2, 10, 37, 101, x

- Step 1: Identifying Pattern

1, 2, 10, 37, 101, x

Diff of 1 8 27 64 ?

2^3 3^3 4^3

1 1 +1

- Step 2: Applying the Pattern

$(4+1)^3 = 5^3 = 125$

- Add 125 to 101 = 226

- Missing Number in The Sequence is:

⇒ 226 (Final Answer)

iii) 11, 17, 39, 85, x

- Step 1: Identifying The Pattern

11, 17, 39, 85, ?(x)

Diff of: 6, 22, 46, ?

=

16, 24, 32

4×4, 4×6, 4×8

common factor : Table of (+2)

Step 2: Applying the Pattern

- $4 \times \overset{8}{\cancel{8}}$ (Next in sequence as per the pattern identified)
  (~~8~~) 32

- Last diff : 24
  New diff : 32

- Adding 32 with 46 = 78
- Add 78 with last number before "x"
  ⇒ 78+85 = 163

Step 3: Final Answer

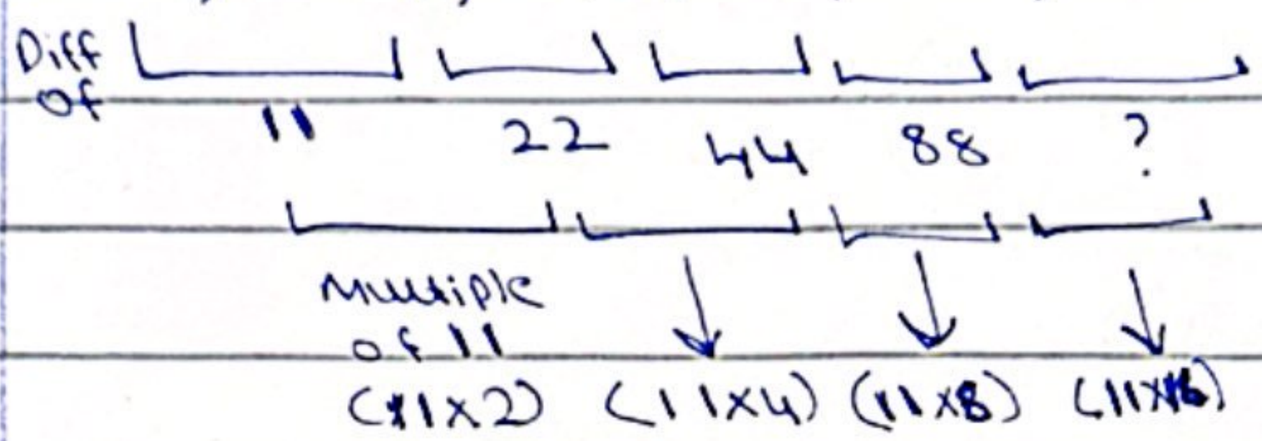
- The missing number in the pattern is :

⇒ **163**

iv) 13, 24, 46, 90, 178, x

- Step 1: Identifying the Pattern

13, 24, 46, 90, 178, x(?)



- Step 2: Apply the Pattern

$(11 \times 16) = 176$

- Add 176 with previous number: 178
  - 178 + 176 = 354

- Step 3: Final Answer

- The missing number in the pattern is:

⇒ 354

Q7 (d)

Step 1: Ratios for A, B, C, and D

(Provided)

i). A : B = 1 : 2

ii). B : C = 3 : 2

iii) C : D = 3 : 4

iv) D - A = 2240

- Step 2 : Combining The Ratios

  - Combining A:B:C:D into 1 ratio

i) $A:B = 1:2$

Let: $A = x, B = 2x$

ii) $B:C = 3:2$

Let "B" in common variable terms:

$B = 3y, C = 2y$

Since $B = 2x$:

$2x = 3y \Rightarrow y = \frac{2x}{3}$

iii) $C:D = 3:4$,

Let "C" and "D" in terms of x:

$C = 3x, D = 4x$

(Since $C = 2y$), equate:

$2y = 3x \Rightarrow z = \frac{2y}{3}$

- Substitute $y = \frac{2x}{3}$:

$x = \frac{2x \times 2x/3}{3} = 4x/9$

- Step 3: Express A:B:C:D

- $A = x, B = 2x, C = \frac{4x}{3}, D = \frac{16x}{9}$

(simplified):

$A:B:C:D = 9:18:12:16$

- Step 4 : Use difference between A and D

  - Provided difference = 2240
  - From ratio substitute : A = 9x and D = 16x

$\Rightarrow 16x - 9x = 2240$

$\Rightarrow 7x = 2240$

$\Rightarrow x = 320$

- Step 5 : Use x to find B's share

  - B = 18x

$\Rightarrow B = 18 \times 320$

$\Rightarrow B = 5760$

Final Answer : Share of B is **5760 PKR**

Question 6

(a) - Step 1 : Formula

$$\text{Initial value (P)} = \frac{\text{Present value (A)}}{\left(1 - \frac{\text{annual depreciation rate (r)}}{}\right)^{t}}$$

T : Number of years

- Step 2 : Substitute provided values in formula and simplify

$$P = \frac{8748}{(1-0.10)^3}$$

- $(1-0.10) = 0.90$
- $(0.90)^3 = 0.729$

$$P = \frac{8748}{0.729} = 12{,}000$$

- Final Answer: Price of washing machine 3 years ago was Rs. 12,000

(b)

- Step 1: Awarding variables

Let "F" = Father's Age
Let "D" = Daughters Age

- Step 2: Equation Formation

i) Father four times the daughter's age
$\Rightarrow F = 4D$

ii) After 5 years, father would be Three times his daughter's age
$\Rightarrow F+5 = 3(D+5)$

- Step 3: Solve The Equation
- Substituting $F = 4D$ into Second equation

- $4D+5 = 3(D+5)$

$\Rightarrow 4D-3D = 15-5$

$\Rightarrow D = 10$

- Find F using $F=4D$

$\Rightarrow F = 4 \times 10 = 40$

- Step 4: Calculate Their ages after 10 years

- Daughter's age after 10 years

$\Rightarrow D+10 = 10+10 = 20$

- Father's age after 10 years

$\Rightarrow F+10 = 40+10 = 50$

- Step 5: Determine how many times The father's age would be The daughter's age after 10 years

- $\text{Ratio} = \frac{F+10}{D+10}$

$\Rightarrow \frac{50}{20} = 2.5$

- Final Answer: After 10 years, the father would be **2.5 times** the age of his daughter

(c) Soccer ball is sphere and volume A sphere will be applied

- Step 1: Calculate radius of The football

- $\text{radius} = \frac{\text{diameter}}{2}$

$\Rightarrow \frac{12}{2} = 6cm$

- Step 2: Substitute radius in The formula of volume A sphere

formula: $V = \frac{4}{3}\pi r^3$

$\Rightarrow V = \frac{4}{3} \times (6)^3$

$\Rightarrow V = \frac{4}{3} \times 216$

$\Rightarrow V = \frac{864}{3} \times \pi$

$\pi = 3.142$

- Final answer:

$\Rightarrow V = \boxed{905 cm^3}$