

Dos and Don'ts for the General Science & Ability Paper
Hi there — you've prepared well! Remember, knowing the content is one thing, but presenting it in the paper exactly as required is another. Here are a few key points to keep in mind:

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- Section-I
Question #3
1. For a 5-mark part, aim to write at least 2 and at most 3 sides of the answer sheet. Often, a question has two or three parts, and the marks are divided accordingly — so address each part fairly.
 2. Manage your time wisely — you have about 35 minutes per full question, which comes down to around 8 minutes for each 5-mark part. Stick to this to avoid rushing later.
 3. Make your answers look scientific, not just theoretical. Use flowcharts and diagrams wherever they add clarity.
 4. Neatness matters — keep your handwriting clean, avoid cutting or overwriting.
 5. Mind your spelling and grammar — while GSA doesn't deduct marks for these, your expression leaves an impression.
 6. In the ability portion, explain analytical ability questions in words. For a 5-mark part, show all steps and provide clear explanations.

Here's a brief key/sample of your Ability questions

Q.6 Mitochondria:

a) Candy ratio problem

Given: Packets in flavors Apple : Berry : Cherry : Date = 3 : 6 : 2 : 5.

Asked: If Apple candies exceed Date candies by 35, how many Berry candies are there?

Note (consistency check): The ratio shows Apple = 3 parts

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- The inner membrane has folds called cristae, which increase the surface area for chemical reactions.
 - Inside is a fluid called the matrix containing enzymes, DNA and ribosomes.
2. **Function:** Mitochondria produce energy in the form of ATP (Adenosine Triphosphate) through cellular respiration.
- They breakdown glucose and oxygen to release energy.
 - They also play a role in cell death (apoptosis) and regulation of metabolism.
3. **Unique Feature:** Mitochondria have their own DNA and can replicate independently, suggesting they originated from ancient bacteria through endosymbiosis.

→ Conclusion:

Cells form organelles to perform life functions efficiently. Among them, mitochondria are vital energy producers that power nearly all activities of human cell.

_____ (b) _____

Doping:

It is the process of adding small amounts

of impurities (foreign atoms) to a pure semiconductor (like silicon or germanium) to damage its electrical conductivity.

Pure semiconductors (called intrinsic semiconductors) have very low conductivity at room temperature. By adding impurities, the number of free charge carriers (electrons or holes) increases, making semiconductors more useful in electronic devices i.e; diodes, transistors and integrated circuits.

Types of Semiconductors:

There are two main types of doped (extrinsic) semiconductors.

1. N-Type Semiconductor:

Doping element is a pentavalent impurity (an element with five valence electrons), such as phosphorus (P), Arsenic (As) or antimony (Sb), is added to silicon or germanium.

Working: The four valence electrons of the impurity bond with four silicon atoms. The fifth electron remains free to move in the crystal.

Charge Carriers: Majority carriers are electrons while holes are minority carriers.

Result: Conductivity increases due to large number of free electrons.

2. P-type Semiconductor:

Doping element is a trivalent impurity (an element with three valence electrons), such as boron (B), aluminium (Al), or gallium (Ga), is added to silicon or germanium.

Working: The trivalent atom forms three covalent bonds with neighboring silicon atoms but lacks one electron to complete the fourth bond. This creates a hole (a positive charge carrier).

Charge Carriers: Majority carriers are holes while electrons are minority carriers.

Result: Conductivity increases due to movement of holes.

Conclusion:

Doping is a technique of adding controlled impurities to a semi-conductor to improve its conductivity. Depending on the type of impurity used, the semiconductor becomes either N-type (electron rich) or P-type (hole-rich).

———— (C) ————

Merits of Volcanic Eruption:

1. Fertile Soil: Volcanic ash and lava breakdown to form rich, fertile soil that supports agriculture.

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(coffee and rice grown near volcanoes).

2. **Mineral Resources:** Volcanoes bring valuable minerals like copper, gold, silvers and diamonds to the surface.

3. **Geothermal Energy:** Heat from volcanic areas can be used to produce geothermal energy, a clean and renewable power source.

4. **Tourism:** Volcanoes attract tourists, providing economic benefits and job opportunities (Mount Fuji in Japan)

5. **Land Formation:** Volcanic eruption create new landmasses such as islands (Hawaii) and mountains.

De-merits of Volcanic Eruption:

1. **Loss of Life and property:** Eruptions can cause death, injuries, and destruction of homes, roads and crops.

2. **Air Pollution:** Volcanic ash and gases (like sulfur dioxide) pollute the air and can lead to acid rain.

3. **Climate Change:** Volcanic dust can block sunlight, leading to temporary cooling of Earth's climate.

4. **Health Problems:** Inhalation of ash causes respiratory issues and eye irritation.

5. **Displacement:** People living near volcanoes may

be forced to evacuate and lose their livelihoods.

Conclusion:

Volcanic eruptions are both destructive and beneficial. They bring disaster and loss, but also create fertile land, valuable minerals, and new sources of energy.

(d)

Dengue:

It is a viral disease transmitted to humans through the bite of an infected female 'Aedes' mosquito, mainly *Aedes aegypti*. It is common in tropical and subtropical regions, including Pakistan, and is sometimes called 'breakbone fever' because of the severe joint and muscle pain it causes.

Causative Agent:

- Dengue is caused by Dengue virus (DENV), which belongs to the Flavivirus genus.
- There are four types of dengue viruses: DENV-1, DENV-2, DENV-3 and DENV-4.
- Infection with one type gives lifelong immunity against that type but not against the others, meaning a person can get dengue multiple times.

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Symptomology:

Symptoms usually appear 4-10 days after the mosquito bite and may last about a week.

Common symptoms include high fever (upto 104°F or 40°C), severe headache, pain behind the eyes, joints and muscle pain, nausea and vomiting, skin rash appearing 2-5 days after fever and, fatigue and weakness. In severe cases (Dengue Hemorrhagic fever) shows symptoms of bleeding from gums, nose, or under the skin, abdominal pain, difficulty in breathing and sudden drop in blood pressure which can be life-threatening.

Remedies:

Patient should take plenty of rest, drink lots of fluids to prevent dehydration, use paracetamol to reduce fever and pain and in severe cases, hospitalization is required for fluid replacement and monitoring.

Conclusion:

Dengue is a mosquito-borne viral disease caused by Dengue virus. It leads to high fever, body pain, and sometimes bleeding. While there is no specific cure, early medical care, rest, hydration and mosquito control can prevent severe illness.

Question #4

(a)

Plant Kingdom: Chlorophyll:

Chlorophyll is green pigment found in the plant kingdom that plays a vital role in photosynthesis—the process by which plants make their own food. It is mainly present in the chloroplasts of plant cells, especially in the leaves.

Structure and Location:

→ Chlorophyll molecules are located inside the chloroplasts, which are tiny green structures in plant cells.

→ It has a magnesium ion (Mg^{2+}) at its centre and a long carbon chain that helps absorb light energy.

Types of Chlorophyll:

Most common types of chlorophyll are:

1. Chlorophyll-a (The primary pigment involved in photosynthesis. (Blue-green in color))
2. Chlorophyll-b (An accessory pigment that helps absorb additional light. (Yellow-green in color))

Functions:

1. Chlorophyll absorbs sunlight, especially blue and

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red light, and converts it into chemical energy.

2. This energy helps the plant convert carbon dioxide and water into glucose and oxygen.



3. It releases oxygen into the air, which is essential for all living organisms.

Importance:

1. It gives green color to plants.
2. It is foundation of life on Earth as it enables plants to make food and support all other living beings through the food chain.
3. It also helps maintain the balance of oxygen and carbon dioxide in the atmosphere.

Conclusion:

Chlorophyll is the green pigment in plants responsible for capturing sunlight to make food through photosynthesis. It not only sustains plants but also supports all forms of life by providing oxygen and energy.

(b)

Role of Ribosomes:

Ribosomes are small, dense structures found in all living cells. They are often called the

'protein factories' of cell because they are the main sites where proteins are synthesized. Ribosomes can be found free in the cytoplasm or attached to endoplasmic reticulum (ER), forming the rough ER.

Structure of Ribosomes:

- Each ribosome is made up of two subunits - a large subunit and a small subunit.
- They are composed of ribosomal RNA (rRNA) and proteins.
- In eukaryotic cells (like human cells): ribosomes are 80S type (60S + 40S).
- In prokaryotic cells (like bacteria): ribosomes are 70S type (50S + 30S).

Role in Protein Synthesis:

Protein Synthesis occurs in two main stages:

1. Translation Initiation:

- Process begins with mRNA, which carries the genetic code from DNA, attaches to the small subunit of the ribosome.
- A start codon (AUG) signals the beginning of protein synthesis.
- The tRNA carrying the amino acid methionine binds to this start codon.

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2. Elongation:

- Large subunit of ribosome joins forming a complete ribosome.
- Ribosomes read the codons (three letter sequence) on the mRNA.
- Each codon corresponds to a specific amino acid, which is brought by a matching tRNA.
- The ribosome helps link amino acids together through peptide bonds, forming a polypeptide chain.

3. Termination:

- When the ribosome reaches a stop codon, it releases the completed protein molecule.
- The ribosome then detaches from the mRNA and becomes available for another round of protein synthesis.

Conclusion:

Ribosomes read genetic instructions from mRNA and assemble amino acids into proteins. They are essential for growth, repair and functioning of all living cells - truly the cell's protein-making machinery.

(C) Solid Waste Management:

It refers to collection, treatment and disposal of solid materials produced by human activities to keep environment clean and healthy. Proper waste management helps prevent pollution, protect public health, and conserve natural resources.

Here are main methods of managing solid waste:

1. Open Dumping (Traditional Method):

- Waste is dumped in open areas or pits without any treatment.
- It is simple and inexpensive.
- It causes bad odor, air pollution, water contamination and spread of diseases through flies and rodents.
- It is not environment friendly method.

2. Land filling:

- Waste is buried in ground in specially designed sites called sanitary landfills.
- Waste is compacted, covered with soil daily, and treated to prevent leakage of harmful liquids (leachate).
- It is simple and cost-effective for large

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volumes of waste.

- Requires large land area; may cause groundwater pollution if not managed properly.

3. Incineration (Burning):

- Waste is burned at high temperature in furnaces to reduce its volume.
- It reduces waste volume by up to 90% and can produce energy (waste-to-energy plants).
- Expensive and produces air pollution.
- It is best for medical waste and non-recyclable materials.

4. Composting:

- A biological process in which organic waste (like food scraps and leaves) is decomposed by microorganisms to form compost - a nutrient-rich fertilizer.
- It produces natural manure, reduces landfill waste, and improve soil fertility.
- It is a slow process and require space and proper conditions.

5. Recycling:

- The process of collecting, sorting and reprocessing materials like paper, glass, metals, and plastics to make new products.

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- It saves raw materials, conserve energy and reduces pollution.

Conclusion:

Solid waste can be managed through landfilling, incineration, composting, recycling, reuse and waste reduction.

(d)

1. Biofuel:

It is a renewable fuel made from organic materials i.e; plants, animal waste, or algae. These are used as alternatives to fossil fuels for running vehicles and generating energy.

Ex: Ethanol (from sugarcane) biodiesel (from vegetable oil)

2. Adulteration:

It means mixing impure, harmful, or cheaper substances with food, fuel, or other products to increase profit or quantity. It makes products unsafe for human use and cause serious health problems.

Ex: Mixing water in milk or sand in sugar.

3. Hydrosphere:

It includes all the water present on Earth - in oceans, rivers, lakes, glaciers, underground

water, and even water vapor in the air. It supports all forms of life and plays major role in water cycle.

4. Troposphere:

It is the lowest layer of Earth's atmosphere, where weather changes like rain, wind and clouds occur. It extends upto about 9 to 15 km above Earth's surface. It contains about 75% of atmosphere's mass and most of the oxygen we breathe.

5. Isotopes:

These are atoms of the same element that have the same number of protons but different numbers of neutron. These are used in medicine, archaeology (carbon dating), and nuclear energy.

Ex: Carbon-12 and Carbon-14 are isotopes of carbon.

SECTION-II

Question #6

_____ (a) _____

Apple : Berry : Cherry : Date

3 : 6 : 2 : 5

$3x : 6x : 2x : 5x$

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Apple exceeds donut candies by 35,

$$5x - 3x = 35$$

$$2x = 35 \Rightarrow x = 17.5$$

So, Berry Candies are $6x = 6(17.5) = 105$

(b)

Original Price = \$200

Discount = 25% of 200 = $\frac{25}{100} \times 200 = \50

Price after discount = $200 - 50 = 150$

Tax = 6% of 150 = $\frac{6}{100} \times 150 = 9$

Total amount paid = $150 + 9 = 159$

(c)

Distance = 36 km

Speed = 18 km/hr

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{36}{18} = 2 \text{ hrs}$$

So, Bicycle will reach at 3pm.

(d)

STSTATISTICS = Statistics

LGEBMAR = Algebra

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Question #7

(a)

Volume of sphere = $\frac{4\pi r^3}{3}$

$$= \frac{4}{3} \pi \left(\frac{d}{2}\right)^3$$

$$= \frac{4}{3} \pi \left(\frac{14}{2}\right)^3$$

$$= \frac{4}{3} \pi (7)^3$$

$$= \frac{4 \times 22 \times 7 \times 7 \times 7}{3 \times 7}$$

$$= 1437.33 \text{ cm}^3$$

(b)

Total savings = Rs 25000

Sum of parts = $1 + 2 + 3 + 4 + 5 = 15$

Smallest share = $\frac{1}{15} \times 25000$

$$= \text{Rs } 1666.67$$

(c)

(i) $2, 6, 18, 54, 162, 486$
 $\underbrace{\quad}_{\times 3} \quad \underbrace{\quad}_{\times 3} \quad \underbrace{\quad}_{\times 3} \quad \underbrace{\quad}_{\times 3} \quad \underbrace{\quad}_{\times 3}$

So, sequence is correct.

(ii) $3, 5, 7, 11, 13, 17$

It is set of prime numbers