



NATIONAL OFFICERS ACADEMY
Mock Exams for CSS 2026
October 2025(Mock-4)
GENERAL KNOWLEDGE-I
GENERAL SCIENCE AND ABILITY

TIME ALLOWED: THREE HOURS	PART-I (MCQS)	MAXIMUM MARKS = 20
PART-I(MCQS): MAXIMUM 30 INUTES	PART-II	MAXIMUM MARKS = 80
NOTE: i. Part-II is to be attempted on the separate Answer Book. ii. Attempt ONLY FOUR questions from PART-II by selecting TWO questions from EACH SECTION. ALL questions carry EQUAL marks.		

PART-II
SECTION-I

Q. No. 2

- a. "Data is the new oil." Do you agree? Justify with your simple opinion and 3 everyday examples.
- b. Universe is expanding, how it resembles with balloon blowing in working?
- c. What do you mean by a balanced diet? Deficiency of vitamins A, D and E can result into what type of imbalances in human body?
- d. Discuss working of GPS. What is fiber optic? How 2D & 3D locations are measured by satellites?

Q. No. 3

- a. Why cells form organelles? Discuss mitochondria in a human cell.
- b. What is doping? Discuss different types of semiconductors.
- c. State some of the merits and demerits of volcanic eruption.
- d. What is dengue? Discuss symptomology, causative agents and remedies.

Q. No. 4

- a. Write a note on plant kingdom "Chlorophyll".
- b. Describe role of ribosomes in protein synthesis.
- c. Discuss different methods of Solid Waste Management.
- d. Define the terms:
 - i) Biofuel ii) Adulteration iii) Hydrosphere iv) Troposphere v) Isotopes

Q. No. 5

- a. Pakistan is the fifth most populous country of the world. What are the causes of population explosion in Pakistan? What can be the control measures?
- b. What is remote sensing? Discuss role of GIS in environmental science
- c. "The Atmosphere is the blanket of Earth." Justify with your opinion.
- d. Define the following terms:
 - i) Hydrometer ii) Epicenter iii) Eye wall of cyclone iv) Deep focus v) Light Year

SECTION-II

Q. No. 6

- a. A store has packets of candies in flavors Apple, Berry, Cherry and Date in the ratio 3 : 6 : 2 : 5. If Apple candies exceed Date candies by 35, how many Berry candies are there?
- b. A camera priced at 200\$ gets 25% off plus 6% tax. Calculate the total amount paid.
- c. A bicycle covers 36km at 18km/hr starting at 1pm. What time does it reach?
- d. Unscramble these math terms: i. STSTAICITS ii. LGEBMAR

Q. No. 7

- a. Calculate volume of a sphere with diameter 14cm. (Use $\pi = 22/7$)
- b. Five friends' total savings = 25,000 Rs, ratio 1:2:3:4:5. Find the smallest share.
- c. Spot the error/Complete the Series:
 - i. 2, 6, 18, 54, 162, 486 (Which number doesn't fit?)
 - ii. 3, 5, 7, 11, 13, __.
- d. A triangle with sides 5cm, 12cm, 13cm. Find all three angles.

Q. No. 8

- a. A hiker walks a right triangle path (legs 7km & 24km). After one loop, goes 10km straight, turns 90° for 5km. Find Total distance walked by hiker and Distance from start?
- b. Six siblings share Rs. 9000. $A = \frac{1}{2}B$, $B = 3C$, $C = 4D$, $D = 2E$, $E = F$. Find each amount.
- c. A rectangular box is $8m \times 6m \times 4m$. Find total surface area and volume.
- d. In a family of 8, the men eat on average 72kg of food and women eat on an average 50kg of food. The men and women are equal in number. A hungry woman named Amna joined the family for dinner and the average consumption became 67. How much did Amna eat (in kgs)?

We wish you Good Luck for CSS 2026

Part - II
Section - I

day / date:

Question No: 03 (A)

- Cells form organelles because they provide intricate structures and specialized components necessary for the carrying out of complex processes of life.

These specialized structures allow the cellular material to be subdivided into numerous tiny components. Organelles perform specific, localized functions within the cell, such as storing and releasing energy, managing and distributing information, and creating the internal structure that gives the cell its shape.

The presence of organelles, including the nucleus and mitochondria, is a defining characteristic of eukaryotic cells. This includes human and plant cells, distinguishing them from simpler prokaryotic cells like bacteria, which lack these structures.

Mitochondria in a Human Cell

Mitochondria are vital organelles often referred to as the "power house of the cell." They are small cell structures found in almost all animal and plant cells, with human red blood cells being a notable exception.



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Functions and Role in Energy Production ^{day / date:}

The primary function of mitochondria is to act as the energy mediators of cell. They are responsible for taking the energy released from the metabolism of substances like sugars, fats, and proteins and storing it in energetic molecules. This stored energy is typically in the form of adenosine triphosphate (ATP), which fuels virtually all cellular processes.

Key Aspects of Mitochondrial Function Include

- **ATP Synthesis:** Mitochondria are the actual sites of oxidative phosphorylation, a crucial reaction in living tissue and that produces ATP using molecular oxygen.
- **Efficiency:** They are capable of handling oxygen with remarkable efficiency and storing the energy obtained from the breakdown of substances. For example, aerobic respiration, which occurs in eukaryotes, yields approximately 38 molecules of ATP, offering a major advantage for organisms equipped to use it.
- **Fuel Metabolism:** Mitochondria facilitate the metabolism and breakdown of sugars, fats, and proteins to liberate and store energy.

Structure and Genetic Material:

Mitochondria possess unique structural and genetic characteristics within a human cell.

- **Quantity:** Each human cell can contain *hundreds or thousands* of mitochondria.
- **Mitochondrial DNA (mtDNA):** Mitochondria contain their own small quantities of DNA. This DNA exists as circular loop and is located in the cell nucleus and the mitochondria.
- **Maternal Inheritance:** Mitochondria and their associated DNA are *inherently exclusive from Mother*. This unique inheritance pattern makes mitochondria DNA useful for typing old, degraded forensic samples where nuclear DNA may not be present, such as bones, teeth or hairs without roots.

Q. No. 3 (B)

Doping is a fundamental process used in semi-conductor technology, and it is crucial for creating the different functional types of semi-conductors used in modern impurities.

Doping: It is a process of intentionally introducing small amount of impurities into a semi-conductor material. This method significantly enhances the material's ability to conduct electricity.

Substances such as silicon and germanium are known as semi-conductor. Unlike metallic conductors which allow electrons to flow readily, semi-conductors conduct electricity only moderately well.

Their resistance to electrical flow actually decreases as their temperature rises.

Doping allows inherent electrical properties of semi-conductor to be tailored, enabling them to serve as either a conductor or an insulator depending upon the applied voltage.

Types Of Semi-conductors

The type of semi-conductor created depends on the types of impurity introduced during doping process. The resulting doping materials are classified primarily into n-type and p-type semi-conductors.

- N-Type Semiconductors (-ve)

- These are created when impurities, such as arsenic, ~~are~~ are added to the the semi-conductor element.
- The designation 'n' stands for "negative".
- The addition of these impurities results in a mobile or "wandering electron".
- These mobile electrons are the primary charge carrier.

- P-type Semiconductor (+ve)

- These are created by adding impurities such as boron, to the semi-conductor element.
- The designation 'p' stands for "positive".
- The resulting alteration in the crystal structures creates a "wandering hole".
- This hole behaves as if it were positively charged.



Application Of Doped Semi-conductors

The combination of n-type and p-type materials forms the basis for many modern electronic components:

- **P-N Junction:** When an n-type and a p-type semi-conductor are joined, the resulting p-n junction allows current to flow easily in one direction but restrict flow in the reverse direction. This functionality is essential for diodes and transistors.
- **Transistors:** Transistors are made up of semi-conductors, often silicon embedded with these materials, and they exploit this electrical property to represent the two states of binary code (conducting electricity for 1, or not conducting for 0).
- **Photovoltaic Cells:** These devices, which convert sunlight into electrical current (solar energy), are constructed as a flat "sandwich" of n-type and p-type semiconductor materials. The electric field at the junction forces electrons freed by sunlight to travel through an external circuit, creating the current.

The development of Transistors and integrated circuits using these doped semiconductors enabled the construction of microprocessors and Central Processing Units (CPUs), which are the core processing units or the "brains of modern electronics" - in all digital systems.

Qno 3 (C)

day / date:

Volcanic eruptions, while often associated with immense destruction, also provide certain long-term geological and ecological benefits.

Merits Of Volcanic Eruption

- **Creation Of Fertile Soils:** Over time, the weathered materials released during volcanic activity contribute to the formation of many of the world's fertile soils. Soils classified as Andisols, for instance, are formed where more than half of the parent mineral matter consists of volcanic ash.
- **Environment Creation:** Volcanoes are responsible for creating new environment.
- **Temporary Climatic Cooling:** Large eruptions can have a climatic influence, specifically a cooling effect. When sulfur emissions combine with atmospheric moisture to produce (sulfuric acid) (H_2SO_4) aerosols in the stratosphere, these droplets interfere with solar radiation and can significantly cool the world climate. For example, the 1991 eruption of Mt. Pinatubo cooled the Earth by 1°C and postponed global warming for several years.

Demerits and Negative Effects Of Volcanic Eruption:

Volcanic eruption can be categorised as natural hazards and produce widespread local and global negative effects.

Local And Regional Destruction:

- **Destruction of Settlement:** Eruptions can destroy local towns and cities, such as the Roman cities of Pompeii and Herculaneum, which were buried by ash and mudflows from Mount Vesuvius in 79 CE., killing thousands. The 1902 eruption of Mount Pelée also destroyed St. Pierre on Martinique, killing about 30,000 people.

- **Lava Flows:** Relentless lava flows are a destructive and deadly feature that can engulf entire cities.

- **Pyroclastic Flows:** These are deadly denser than air mixtures of hot gases and ash, sometimes called as *nubes ardentes* (glowing clouds). They can sweep down volcano slopes at high speeds (over 100 km/hr) with extremely high temperature (exceeding 1000°C), searing everything in their path.

- **Ash, Cinders, and Volcanic Bombs:** Showers of these ejected fragments (collectively called as *pyroclastics*) can cause terrible devastation. Volcanic bombs are large, semisolid masses of lava ejected from the volcano.

- **Mudflows (Lahars):** These are destructive and deadly mudflows of ash, mud and water that

face downslope, burying everything in their path. For instance, the 1985 eruption of Nevado del Trujillo triggered a mudflow that killed over 20,000 people.

- **Toxic Gases:** Volcans release gases, besides water vapor, including sulfur dioxide, chlorine, and fluorine. High quantities of fluorine can kill livestock and aquatic animals that consume contaminated vegetation after rainfall. Sulfur dioxide can also affect local weather by reducing sunlight.

Global Climate Effects

Eruptions can have a climatic influence, which although typically small and short in duration, can be global if material is injected into the stratosphere.

- **Tsunamis:** Volcanic eruption can trigger immense tsunamis. The Krakatoa eruption in 1883 generated tsunamis as high as 100 feet, leading to death of tens of thousands of people.

- **Global Cooling:** Sulfur emissions combine with atmospheric moisture to produce sulfuric acid (H_2SO_4) aerosol droplets in the stratosphere. These aerosols can interfere with solar radiation leading to a significant cooling effect on the world climate. The 1991 eruption of Mount Pinatubo, for example, emitted 20 million tons of sulfur dioxide, cooling the entire earth by $1^\circ C$ for two years and postponing global warming for several years.



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- **Blocking Sunlight:** Dust and ash particles ejected into the atmosphere can block sunlight, reducing incoming solar radiation.
- **Ozone Depletion:** Chlorine released during eruptions can destroy the protective reduction in stratospheric ozone, allowing increased ultraviolet light to reach the Earth's surface.
- **Acid Rain:** Sulphur dioxide released during eruptions can contribute to acid rain.
- **Carbon Dioxide Release:** Carbon dioxide is also released during eruptions.
- **Atmospheric Dust:** Dust left in the stratosphere after an eruption can brighten sunsets for years.

Question No: 03

day / date:

d) Dengue:

Dengue fever is classified as an insect-borne illness and a disease caused by a pathogen/virus.

Causative Agents:

Dengue fever is transmitted by animal carriers known as vectors. Specifically the disease is spread by various species of mosquito. The ultimate cause is the virus/pathogen carried by mosquito.

Symptomology:

- High fever, pain, rash, fatigue, Headache

Remedies And Prevention:

The primary strategies for addressing fever focus on preventing transmission by controlling its vectors.

a) Vector Control: Prevention involves controlling insect vectors such as mosquitoes, by identifying and destroying their breeding sites.

b) Environmental Management: Since rising temperatures associated with global warming allow mosquito populations to expand into new habitats and effectively increase the season, efforts to mitigate climate could indirectly

Control the spread of diseases like dengue fever.

Abnormal weather pattern such as intense temperature, rainstorms or flooding can also cause increases in mosquito populations.

c) Biological Control: Protecting species that prey on the vectors such as birds, fishes, amphibians, and insects that are predators of certain insects, can help control their population numbers.

Question No: 04

(a) Chlorophyll:

Chlorophyll is the green pigment found in plants that is essential for the process of photosynthesis.

Chlorophyll is located in tiny organelles in plant cells called chloroplasts. Its chemical structure is that of an organic magnesium compound. Plants, defined as multicellular organisms characterized by possessing chlorophyll, use this pigment to carry out photosynthesis.

The function of chlorophyll is centered on energy conversion.

- Light absorption: Chlorophyll absorbs light energy, particularly from the blue and red parts of electromagnetic spectrum. It reflects green light, which is why plants appear green.



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- **Energy Conversion:** It uses absorbed light energy to create high energy chemicals for the cellular metabolism. This conversion of sunlight energy into chemical energy is the initial step of photosynthesis enabling plants to synthesize organic compounds like simple sugar from carbon dioxide and water.

- **Location:** Chloroplasts, which house the chlorophyll, are the specific sites where the photosynthesis occurs. The presence of chlorophyll enables plants to capture solar energy.

The presence of chloroplasts and chlorophyll is a key distinction of plant cells, as animal cells lack these components and cannot perform photosynthesis.

(b) Ribosomes in Protein Synthesis

Ribosomes are minute subcellular particles found in the cytoplasm of cells. They are described as the main sites of protein synthesis or enzyme manufacture within the cell. Ribosomes are rich in RNA.

The ribosome's sole is to act as the location and machinery for translating genetic instructions into functional protein molecules, following these steps:

1) **Receiving the Code:** The genetic instructions, originally from DNA in the nucleus, are copied

into a molecule called messenger RNA (mRNA). This mRNA molecule then makes its way to the ribosome in the cytoplasm.

2- Assembly Site: At the ribosome, the genetic code imprinted on the mRNA's nucleotide pattern is read in sequences of three nucleotides (codons).

3- Lining up Amino-Acids: Transfer = RNA (tRNA) molecules - another variety of small RNA - carry specific amino acids. These tRNA molecules attach sequentially to the complementary triplets (codons) on the mRNA chain positioned at the ribosome.

4- Forming the Protein: The amino acids are brought into the correct order and linked together one after the another by the ribosome to form a polypeptide chain, which then folds to create a specific enzyme or protein molecule.

This process ensures that the complex proteins needed for all cellular functions are built accurately according to the cell's genetic blueprint.

© Methods Of Solid Waste Management

Solid waste management involves controlling the disposal of materials resulting from human activity, including household garbage, industrial waste, and agricultural waste. The waste management

hierarchy prioritizes reduce, reuse and recycle.

Key methods for managing solid waste:

1) Source Reduction and Reuse (Most Effective)

This is generally the most effective and least costly approach.

It involves producing less waste in first place, using products multiple times, and substituting less water polluting materials.

2) Recycling:

This involves processing discarded materials like paper, metal, glass and plastic food and beverage containers so they can be used again.

Challenge: Plastics are among the most difficult and expensive materials to recycle due to the presence of many different types, of which require precise sorting. Contamination by small amounts of food residue or other parts of plastic types can render large batches useless.

3) Landfilling (Primary Disposal Method)

This is the dominant method for municipal solid waste disposal in the US.

a) Sanitary Landfills: Confine, compact, and cover waste daily with soil to manage odors, vermin and litter.



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b) **Containment:** Modern landfills utilize safeguards like impermeable liners (clay/plastic) and drainage systems to prevent the formation of and contamination by hazardous liquid waste called leachate.

c) **Methane Management:** Decomposition of organic materials in landfills produces methane gas, a potent greenhouse gas, which must be managed by collection for use as fuel or by burning.

d) **Secure Landfills:** They are specifically designed with even stricter containment measures to handle hazardous or toxic industrial waste.

④ Incineration (Waste to Energy):

Involves burning solid waste (municipal or sorted) in incinerators to generate energy (heat or electricity). This method is more common in areas with limited landfill space.

Hazards: Burning mixed waste can release hazardous air pollutants, including dioxins, furans, and heavy metals. The ash remaining after incineration is often concentrated and toxic, requiring careful disposal in specially designed landfills.

⑤ Other Methods and Issues:

a) **Open Dumping:** is largely forbidden in developed countries, but illegal dumps still exist.

b) **Ocean Dumping** of sewage sludge was common historically, and plastic waste from land remains a significant problem in the oceans.

① Biofuel:

day / date:

A biofuel is a fuel derived from biomass, which is material derived from plants. Examples include ethanol, methanol and biodiesel derived from crops like corn or sugarcane. Biofuels are considered helpful in promoting clean energy because the carbon dioxide released when they are burned is precisely the amount absorbed by the fuel crops during their growth through photosynthesis, resulting in carbon recycling.

ii.) Adulteration is a legal term applied to food that is unsafe or unfit, or deceptively altered. Food is considered adulterated if it contains poisons, or harmful substances, is decomposed or unfit, or it was prepared under unsanitary conditions. Adulteration also includes intentional acts such as omitting valuable constituents, substituting ingredients, concealing facts, or changing the food's bulk or weight to make it appear better than it is.

iii.) Hydrosphere: The hydrosphere is one of the distinct spheres or ~~or~~ regions of the Earth's surface along with the lithosphere, atmosphere, and biosphere. It is the region of the Earth that encompasses water in all of its forms, including liquid (ocean, rivers, lake), solid (ice), and gaseous (vapor). The circulation of water through this realm is described by the hydrologic cycle.



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iv. Troposphere: It is the lowest layer of the atmosphere, immediately adjacent to Earth's surface. It is the layer where all human activity takes place and where virtually all everyday weather occurs. Air in the troposphere is in a constant motion, redistributing heat and moisture. It extends ~~to~~ upwards to about 10-12 km, and temperature generally decreases with increasing altitude within this layer.

v. Isotopes: They are forms of same element that have the same number of protons but different number of neutrons in their atomic nucleus. Because the number of protons defines the element, isotopes are chemically identical or nearly identical to other forms of that element. However, the variation in neutron count means they differ in atomic mass. Examples include Carbon-12, Carbon-13, and Carbon-14, which differ by their neutron count.



Q.No. 6 (d)

day / date:

i- STATISTICS

ii- ALGEBRA

→ STATISTICS

→ ALGEBRA

(c)

Distance = 36 Km, Speed = 18 km/hr, time = $36/18$

$$t = \frac{D}{S} = \frac{36}{18} = 2 \text{ hr}$$

Starting → 1pm → 3pm

(b)

- Original Price = 200 \$, Discount of 25% × 200
 $= \frac{25 \times 200}{100} = 50 \$$

- Price after discount = $200 - 50 = 150 \$$

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

- Total Amount

$$\text{Paid} = 150 + 9 = 159 \$$$

(a)

- Total parts = $3 + 6 + 2 + 5 = 16$

Let multiplier x

- Then Apple $3x$, Date = $5x$

- Given = $3x - 5x = 35 \rightarrow x = -17.5$

- Apple exceeds dates by 35 $\rightarrow 3x = 5x + 35$
 $x = -17.5$

$$\checkmark 3x - 5x = -35 \rightarrow -2x = -35 \rightarrow x = 17.5$$

$$\text{Berry} = 6x = 6 \times 17.5 = 105$$



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Q. No 8

day / date:

(a) Two parts $\rightarrow$ Right Triangle and Straight Path

① Right Triangle Loop Distance

Legs of Right Angle 7km and 24km

Using Pythagorean $\rightarrow (a^2 + b^2 = c^2)$

$$c = \sqrt{7^2 + 24^2} = \sqrt{49 + 576}$$

$$= \sqrt{625} \rightarrow 25 \text{ km}$$

$\rightarrow$ Distance from one loop

Sum of all sides of perimeter

$$\text{Loop distance} = 7 + 24 + 25 = 56 \text{ km}$$

② Total Distance Walked

Hiker walks 56 km in loop + 10 km straight + 5 km at 180°

$$\text{Total Distance} = 56 + 10 + 5 = 71 \text{ km}$$

Distance from Start

Hiker ends at same loop = distance 0 km

$$\text{Displacement } D = \sqrt{10^2 + 5^2}$$

$$\sqrt{100 + 25} \rightarrow \sqrt{125} \rightarrow 5\sqrt{5} \text{ km}$$

$$\approx 11.18 \text{ km}$$

Total Distance $\rightarrow 71 \text{ km}$

Distance from start $5\sqrt{5} \text{ km} \approx 11.18 \text{ km}$



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⑤

day / date:

⑤

Total 9000, 6 Sibling

$$A = \frac{1}{2} B, B \rightarrow 2A$$

$$B = 3C$$

$$C = 4D$$

$$D = 2E$$

$$E = F$$

$$D = 2E$$

$$C = 4D = 4(2E) = 8E$$

$$B = 3C = 3(8E) = 24(E)$$

$$A = \frac{1}{2} B = \frac{1}{2} (24E) = 12E$$

$$F = E$$

Total of E

$$A + B + C + D + E + F = 9000$$

$$12E + 24E + 8E + 2E + E + E = 9000$$

$$48E = 9000$$

$$E = \frac{9000}{48} = 187.5$$

$$E \rightarrow 187.5 \text{ Rs}$$

$$F = E = 187.5 \text{ Rs}$$

$$D = 2E = 2 \times 187.5 = 375 \text{ Rs}$$

$$C = 8E = 8 \times 187.5 = 1500 \text{ Rs}$$

$$B = 24E = 24 \times 187.5 = 4500 \text{ Rs}$$

$$A = 12E = 12 \times 187.5 = 2250 \text{ Rs}$$

$$2250 + 4500 + 1500 + 375 + 187.5 + 187.5 = 9000$$



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③

day / date:

③

Dimension of box (cube) = $L = 8m$, $W = 6m$, $H = 4m$

Total Surface Area

$$TSA = 2(LW + LH + WH)$$

$$TSA = 2((8 \times 6) + (8 \times 4) + (6 \times 4))$$

$$TSA = 2(48 + 32 + 24)$$

$$TSA = 2(104)$$

$$TSA = 208 m^2$$

Volume $\rightarrow V(L \times W \times H)$

$$V = 8 \times 6 \times 4$$

$$V = 192 m^3$$

④

Initial Total Consumption

$$\text{Initial men} = \frac{8}{2} = 4, \text{ Avg men} = 72 \text{ kg}$$

$$\text{Initial women} = \frac{8}{2} = 4, \text{ Avg women} = 50 \text{ kg}$$

$$\begin{aligned} \text{Total} &= (4 \times 72) + (4 \times 50) \\ &= 288 + 200 = 488 \text{ Kgs} \end{aligned}$$

Final Consumption

$$\text{Final} = \frac{\text{Total}}{\text{members}} \times \text{New avg} = \frac{488}{9} \times 67 = 603 \text{ kg}$$

Amira Consumption

$$\begin{aligned} &= \text{Final} - \text{Initial consumption} \\ &= 603 - 48 \text{ kgs} = 115 \text{ kgs} \end{aligned}$$



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