

General Science Mock Exam.

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Part II Section - I

Question TWO

a) Differentiate between a Star and a Planet.
Briefly describe the life cycle of a star from a Nebula to a Black Hole.

- i) A star is a mixture of gases leading to a self-luminous body. A planet is a non-luminous body.
- ii) Stars are usually large and massive, whereas planets are smaller.
- iii) Planets revolve around stars whereas stars are centers of a solar system.
- iv) Stars are extremely hot as compared to planets.
- v) Stars originate from vast clouds of dust called nebula → protostar → main sequence star → red giant → Supernova → black hole.

b) What are semiconductors? Explain the difference between n-type and p-type semiconductors and list two of their modern applications.

- a) Semiconductors are crystals made of certain materials like silicon, germanium, and selenium.
- b) In n-type semiconductors the doping element is pentavalent impurity whereas in p-type semiconductor it is trivalent impurity.
- c) In n-type, the majority charge carriers are electrons whereas in p-type they are holes.
- d) N-type example: silicon doped with phosphorus.
p-type: Silicon doped with boron.
- e) Modern applications:
N-type: Computer processors.
P-type: Diodes and transistors.

c) Define global warming. Explain the mechanism of the greenhouse effect and list three major greenhouse gases.

a) Global warming is the long term increase in earth's average surface temperature caused mainly by the accumulation of greenhouse gases in the atmosphere which trap heat and prevent it from escaping into space.

b) Greenhouse effect is when solar radiation warms the earth's atmosphere. The earth releases this energy as infrared (long-wave) radiation. Greenhouse gases absorb part of this outgoing heat. The gases re-radiate heat in all directions, including back towards earth, raising atmospheric and surface temperatures.

c) Examples: Carbon Dioxide, Methane

d) What is a Tsunami? Explain the natural processes that trigger a tsunami and the potential impact on coastal areas.

a) A tsunami is a series of large ocean waves caused by a sudden displacement of a huge volume of seawater, usually due to geological disturbances beneath or near the ocean floor.

b) Natural processes that trigger it:

- i) Undersea earthquakes: The seabed uplifts/drops
- ii) Volcanic eruptions: Lava displaces the sea.
- iii) Underwater landslides.

c) Potential impact on coastal areas

- i) Physical damage & severe coastal erosion.
- ii) Loss of human life.
- iii) Death of marine and coastal species.

QUESTION THREE

a) Describe the structure and function of the mitochondria and ribosomes within an animal cell. Why is the mitochondria often called the "powerhouse" of the cell?

a) Mitochondria have a double membrane, an intermembrane space and a matrix inside which contains enzymes, mitochondrial DNA and ribosomes.

b) Their function is that they are the site of cellular (aerobic) respiration. They produce ATP - the energy currency of the cell.

c) Ribosomes are very small, non membrane bound particles. Made of ribosomal RNA and proteins, they are found free in the cytoplasm and attached to RER. They are responsible for protein synthesis.

b) What are enzymes? Explain the "lock and key" model of enzyme action and list two factors that affect enzyme activity.

a) Enzymes are biological catalysts (mostly proteins) that speed up chemical reactions in living cells without being used up in the process.

b) Lock and key model: i) Each enzyme has a specifically shaped region called the active site. The substrate fits exactly into the active site, like a key fitting into a lock. An enzyme-substrate complex is formed. The enzyme remains unchanged and ready to be used again.

c) Two factors affecting enzyme activity:
i) Temperature
ii) pH

c) Differentiate between renewable and non-renewable energy resources. Discuss the potential of wind energy as a sustainable source for the future.

a) Renewable energy consists of sources that are naturally replenished. Non-renewable energy consists of resources that exist in limited amounts. Renewable energy is continuous/infinite (in human timescale) whereas non-renewable energy is finite and exhaustible. The impact of renewable energy is low. Pollution whereas non-renewable energy is high pollution.

b) Renewable energy has strong natural potential with the Thimpu wind corridor in Sindh. Having potential of 50,000 MW. It is cost effective in long run. It has no carbon emissions.

d) What is Dengue Fever? Describe the vector responsible for its transmission, its common symptoms and key preventive measures.

a) Dengue fever is a viral disease caused by the dengue virus and transmitted to humans through the bite of an infected mosquito.

b) The main vector responsible for it is "Aedes aegypti" which breeds in clean water.

c) Symptoms include high fever, headache, pain behind the eyes, muscle and joint pain, nausea and fatigue.

d) Key preventive measures include controlling mosquito breeding, personal protection, fumigation and spraying.

SECTION - II

QUESTION SIX

- a) Two pipes, A and B can fill a tank in 10 hours and 15 hours respectively. A third pipe, C, can empty the full tank in 30 hours. If all three pipes are opened simultaneously, in how much time will the tank be full?

A $\rightarrow$ 10 hours.

B $\rightarrow$ 15 hours.

Full tank = x l.

$$A = \frac{x}{10}$$

$$B = \frac{x}{15}$$

$$\frac{1}{10} + \frac{1}{15} - \frac{1}{30}$$

combined rate = $\frac{2}{15}$ tank per hour

$$\frac{x}{10} + \frac{x}{15} = \frac{5x}{30}$$

$$15x + 10x = \frac{25x}{30}$$

$$\text{Time} = \frac{1}{\text{Rate}} = \frac{1}{2/15} = 7.5 \text{ hours}$$

- b) the ratio of the salaries of three employees, X, Y and Z is 4:5:7. If Y's salary is increased by 10% and Z's salary is decreased by 25%, the new total of their combined salaries is Rs. 1,96,950. Find the original salary of employee X.

$$X : Y : Z$$

$$\frac{4x}{16} + \frac{5x}{16} + \frac{7x}{16} = y$$

$$\begin{array}{r} 10 \times 5 \\ 100 = \\ 5.50 \\ + 5.25 \\ \hline 10.75 \end{array}$$

$$\frac{10 \times 5}{100} = 1.20$$

$$\begin{array}{r} 4 \times 7 \\ 4 \\ \hline 36 \\ 28 \\ \hline 64 \end{array}$$

$$4x + 5.5x + 5.25x = 169500$$

$$14.75x = 169500$$

$$x = \frac{169500}{14.75}$$

$$\frac{10 \times 5x}{100} = \frac{5x}{10}$$

$$\frac{550x}{100} = 5.5x$$

c) A contractor completed $\frac{3}{5}$ of a road construction project in 60 days. If he then hires 10 additional workers, he finishes the remaining work in 20 days. How many workers did the contractor originally have? (Assume all workers work at the same rate).

$$\begin{aligned} \text{Rate} &= \frac{\frac{3}{5}x}{60 \text{ day}} \\ \text{number of workers} & \end{aligned}$$

$$60y = \frac{3x}{5}$$

$$300y = \frac{3x}{100} \quad y = \frac{x}{100}$$

$$y + 10 = \frac{\frac{2}{5}x}{20 \text{ days}}$$

$$20\left(\frac{x}{100} + 10\right) = \frac{2x}{5}$$

$$20\left(\frac{x + 1000}{100}\right) = \frac{2x}{5}$$

$$\frac{20x + 20,000}{100} = \frac{2x}{5}$$

$$x = 25966$$

d) A class has an average score of 78 on a test. If the top 5 scores (98, 95, 92, 90, 85) are removed, the average score of the remaining students drops to 75. Calculate the total number of students in the class.

$$\text{Total} = x$$

QUESTION EIGHT

- a) In a certain code language, if 'ROAD' is coded as 'UQDG', how would 'LAKE' be coded in the same language? Explain the rule of coding.

LAKE = ODNH

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

Reasoning = Two letters ahead of the original alphabet

- b) A man tells a woman, "the son of my sister's husband is the father of my son". How is the woman related to the man?

Man - Sister - Husband

Son - wife.

Son.

The woman is wife of the man's nephew.

c) find the next number in each of the following sequences and explain the pattern.

i) $4 \times 3, 12 \times 2, 6 \times 3, 18 \times 2, 9 \times 3, 27 \times 2, \underline{\hspace{2cm}}$

$$\frac{27}{2}$$

$$\begin{array}{r} 13. \\ 2 \overline{) 27} \\ \underline{2} \\ 07 \\ \underline{6} \\ 1 \end{array}$$

$$= \boxed{13.5}$$

ii) $1 \times 2, 2 \times 3, 6 \times 4, 24 \times 5, 120 \times 6, \underline{\hspace{2cm}}$

$$\begin{array}{r} 120 \\ \times 6 \\ \hline 720 \end{array}$$

$$= \boxed{720}$$

d) Five friends (P, Q, R, S, T) have different heights.

- P is shorter than Q but taller than R.
- S is shorter than T but taller than Q.
- The shortest person is 150 cm tall, and the tallest is 180 cm tall. Who among the friends is the third tallest and what is the maximum possible range of their heights?

P, Q, R, S, T

180cm. 150cm.
T, S, Q, P, R
↑
ascending height.

a) Q is the third tallest

b) the maximum possible range of their heights is 30 cm.