APPOLO STUDY CENTRE

TNPSC GROUP I MAIN 2017

MODEL EXAM PAPER – I SCIENCE KEYS

3 MARKS

23. During a storm, the roofs of huts or tinned roofs are blown off without any damage to other parts of the hut. The blowing wind creates a low pressure on top of the roof. The pressure under the roof is however greater than on the top of the roof. Due to this pressure difference, the roof is lifted and blown off with the wind.

24. The polar satellites revolve around the Earth in a north−south orbit passing over the poles as the Earth spins about its north – south axis. The polar satellites positioned nearly 500 to 800 km above the Earth travels pole to pole in 102 minutes. The polar orbit remains fixed in space as the Earth rotates inside the orbit. As a result, most of the earth's surface crosses the satellite in a polar orbit. Excellent coverage of the Earth is possible with this polar orbit. The polar satellites are used for mapping and surveying.

25. Interference vs diffraction

S.No	Interference	Diffraction
1	It is due to the superposition of secondary wavelets from two different wavefronts produced by two coherent sources.	It is due to the superposition of secondary wavelets emitted from various points of the same wave front.
2	Fringes are equally spaced.	Fringes are unequally spaced.
3	Bright fringes are of same intensity	Intensity falls rapidly
4	Comparing with diffraction, it has large number of fringes	It has less number of fringes.

26. An **Arrhenius acid** is a substance that dissociates in water to form hydrogen ions (H^+). An **Arrhenius base** is a substance that dissociates in water to form hydroxide (OH^-) ions. In other words, a **base** increases the concentration of OH^- ions in an aqueous solution.
Any one example
27. Thermal methods include methods as carbonyl method, decomposition of hydrides etc. The carbonyl method is used for the refining of metals like Ni and Fe. For example, in case of nickel, the impure metal is heated with CO. The nickel carbonyl thus formed is then decomposed (after distilling off the impurities) to get pure nickel metal and CO. The process is known as **Mond's process.**

$Ni + 4CO \rightarrow Ni(CO)4 \longrightarrow Ni + 4CO$

28. Cells take in liquids continuously through microscopic capillary structures on their cell membranes. This method of transport of substances is called pinocytosis. Pinocytosis (cell drinking)-Substances are taken up in liquid form. Vesicles which are very small are formed during intake. Pinocytosis is often associated with amoeboid protozoans in certain kidney cells involved in fluid exchange.
29. Phytoremediation ('Phyto' means plant) is a generic term for the group of technologies that use plants for remediating soils, sludges, sediments and water contaminated with organic and inorganic contaminants. Phytoremediation can be defined as "the efficient use of plants to remove, detoxify or immobilise environmental contaminants in a growth matrix (soil, water or sediments) through the natural biological, chemical or physical activities and processes of the plants". Phytoremediation involves growing plants in a contaminated matrix, for a required growth period, to remove contaminants from the matrix, or facilitate immobilisation (binding/containment) or degradation (detoxification) of the pollutants. The plants can be subsequently harvested, processed and disposed.
30. A population is a group of similar individuals. All the genes of a population is called gene pool.
31. TB Infection is caused by airborne droplets (produced by coughing or sneezing). The bacteria breathed into the lungs multiply to form an infected "focus". In a high proportion of cases, the body's immune system then halts the infection and healing occurs. The infection can also occur in intestines, bones and kidneys.
32. Gross deficiency of vitamins B_1, leads to a condition known as beri beri. Beriberi affects nervous and cardiovascular systems.
    Vitamin B2: Loss of appetite and other gastro-intestinal symptoms, soreness and burning of lips, mouth and tongue.
    Vitamin B12: Its deficiency causes pernicious anaemia, typical sore tongue and several neurological problems related to the spinal cord.
33. It is a cyber attack that involves tricking someone into giving confidential information. In computing terms, phishing is a criminal activity wherein phishers impersonate as a trustworthy organisation/entity in emails and other electronic communication, to fraudulently acquiring sensitive information like bank account or credit card details.
34. Packet switching
    A transmission method in which messages containing the data are broken into fixed length packets that are transmitted separately and possibly alog different routes
    Circuit Switching
    A type of communications in which a dedicated channel (or **circuit**) is established for the duration of a transmission.
35. Defined as total amount of GHG produced to directly and indirectly support human activities, usually expressed in equivalent tons of CO2.

8 marks

47. Dengue Haemorrhagic fever
Mode of transmission:
Causative agent: Four dengue viruses
Vector: Mosquito Aedes aegypti
Favourable condition: Grounds with water logging favourable for mosquito breeding.
Mode of transmission: Transmitted to humans through the bites of infective female Aedes mosquitoes. **Incubation for 8-10 days**, an infected mosquito is capable, during probing and blood feeding, of transmitting the virus to susceptible individuals for the rest of its life.

Symptoms:
DHF is characterized by **high fever, haemorrhagic phenomena**-often with **enlargement of liver** Which results in circulatory failure.
Facial flush and other non-specific constitutional symptoms of dengue fever.
Usually fever continues for two to seven days and can be as high as 40-41.
In moderate cases, all signs and symptoms abate after the fever subsidies.

Treatment:
No specific treatment for dengue fever. However, careful clinical management by experienced physicians and nurses frequently saves the lives of DHF patients.
Blood volume replacement therapy.

Preventive treatment: Vector control

48. CDMA:
Code Division Multiple Access or CDMA is a digital cellular technology that uses spread-spectrum techniques. Unlike competing systems, such as GSM, that uses TDMA, **CDMA does not assign a specific frequency to each user**. Instead, **every channel uses the full available spectrum**.

It provides better capacity for voice and data communications that other commercial mobile technologies, allowing more subscribers to connect at any given time, and it is the common platform on which 3G technologies are built.

Set-TOP Box:
A set-top box is a device that enables a television set to become a user interface to the internet and also enables a television set to receive and decode digital television (DTV) broadcasts; DTV set top boxes are sometimes called receivers. A set top box is necessary to television viewers who wishes to use analog television sets to receive digital broadcasts.

49. Chemical Nature of Cell Wall

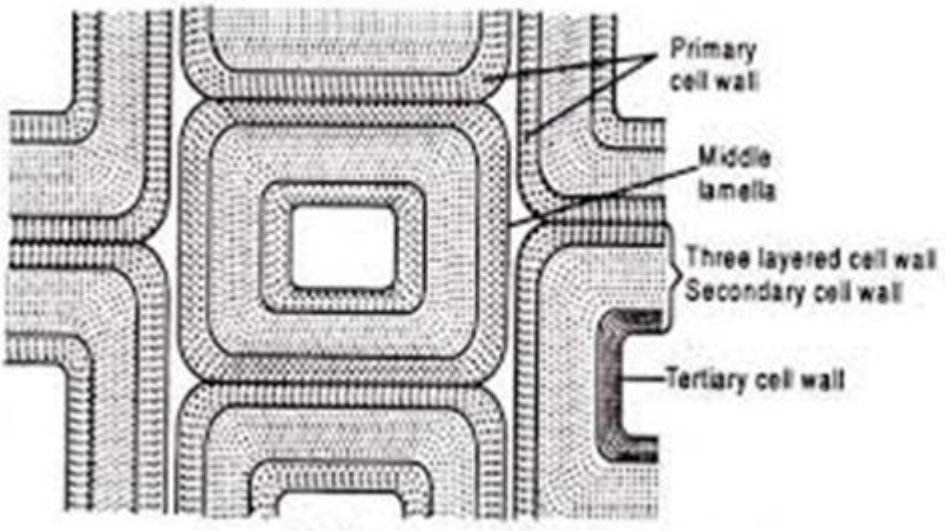
The cell walls of plant cells are composed of carbohydrate known as cellulose.

Beside the cellulose various chemical substances as hemicellulose, pectin, lignin, cutin and chitin also occur singly or along with the cellulose. The cell wall also contains certain minerals as Ca and Mg in the form of carbonates and silicates. The cellulose is a polysaccharide and it is most abundantly occurring chemical substance of most plant cell walls.

No.	Substance	Chemical Unit
1.	Cellulose	Glucose
2.	Hemicellulose	Arabinose, xylose, mannose, galactose
3.	Pectin substances	Glucoronic and galacto uronic acids
4.	Lignin	Coniferyl
5.	Cuticular substances	Fatty acids
6.	Mineral deposits	Calcium and magnesium in the form of carbonates or silicates

Ultrastructure of Cell Wall:

Electron microscopic observations of cell walls of plant cell have revealed the, fact that each cell wall is composed of two main parts— (1) the micro fibrils of cellulose which are left if hemicellulose and pectic materials are removed and (2) the ground substance or matrix *in* which fibrils are embedded. The amount and orientation of micro fibrils may vary from cell wall to cell wall. Primary cell wall usually contains micro fibrils which runs in all planes of the wall and constitutes loose frame work; while secondary wall contains thicker micro fibrils which remain parallel and more densely packed.



Gross Structure of Plant Cell Wall

Plasmodesmata :

The cell walls and the middle lamella of plant cells never occur in the form of continuous layers but have many minute apertures through which the cells of a tissue maintain cytoplasmic relations with each other. Such cytoplasmic junctions or bridges between the adjacent cells are known as plasmodesmatas.

The plasmodesmatas of meristamatic cells have been found to be continuous with the plasmodesmatas of adjacent cells. Through these plasmodesmatas the cytoplasm and the endoplasmic-reticulum remain continued to the adjacent cells. Most probably through the plasmodesmatas the intercellular circulation of solutions containing nutritional products, dissolved gases, ions or other substances takes place.

50. Treatment of alcoholics:
    a. Detoxification in hospitals
    b. Role of family
    c. Alcoholic anonymous – group interaction
    d. Role of psychological treatment centres
    e. Role of education

51. Hazardous Waste disposal:

Management of hazardous wastes

Hazardous wastes may remain dangerous for thousands of years. The hazardous waste include radioactive refuse, metallic compounds, organic solvents, acid asbestos, organic cyanides, pathological hospital wastes, disposable medical equipments and tools.

The following methods are adopted for the disposal of hazardous wastes.

1. Land fills :

There are permanent storage facilities for military related liquid and radioactive waste materials in secured lands. High level radio active wastes are stored in deep underground storage.

Wastes are carefully contained to prevent cross – mixing of reactive substances. The land fill is capped with impervious clay to prevent infiltration and percolation of water through the fill. Fill bottom is lined and provided with drainage system to contain and remove any leakage that occurs. Monitoring the wells provides a final check.

2. Deep – well injection :

It involves drilling a well into dry, porous material below groundwater. Hazardous waste liquids are pumped into the well. They are soaked into the porous material and made to remain isolated indefinitely. However fractures in the impermeable layer may permit the injected wastes to escape and contaminate ground water.

3. Surface impoundments :

This method is used to dispose large amounts of water carrying relatively small amounts of chemical wastes. Surface impoundments are simple excavated depressions (ponds) into which liquid wastes are drained. Solid wastes settle and accumulate while water evaporates. If the pond bottom is well sealed and if evaporation equals input, wastes may be stored in the impoundment indefinitely.

4. Incineration :

The hazardous biomedical wastes are usually disposed off by means of incineration. Human anatomical wastes, discarded medicines, toxic drugs, blood, pus, animal wastes, microbiological and biotechnological wastes etc are called **Bio-medical wastes**.

5. Bioremediation :

This is another rapidly developing clean up technology. Cleaning the environment with biological options such as microbes and plants is called bioremediation. Some naturally occurring bacteria and other microorganisms have the capability to degrade or absorb or detoxify the wastes such as heavy metals. Many plant materials are successfully used as adsorbents for xenobiotics (phytoremediation).

Genetically Engineered Microorganisms (GEMS) are currently produced in large scale to remove the hazardous radionuclides and heavy metals such as mercury, chromium, cadmium etc. Certain plants such as *Gibberella fusarium* were able to breakdown cyanide and reduce it to a non-toxic form. The bacteria *Pseudomonas*, nicknamed as 'super – bug' are capable of degrading variety of toxic compounds and also degrade oil.

52. Radar

53.
a. Ostwald process

Large quantities of ammonia manufactured by Haber's process are converted into nitric acid by Ostwald's process.

$$4\,NH_3 \xrightarrow{\text{Platinum gauze}} 4NO + 6H_2O$$

$$2NO + O_2 \xrightarrow{1155K} 2\,NO_2$$

$$4NO_2 + 2H_2O + O_2 \rightarrow 4\,HNO_3$$

Dilute nitric acid may be concentrated by distillation until a constant boiling point mixture is obtained (98%). Fuming nitric acid is obtained by distilling this acid with concentrated sulphuric acid. Crystals of pure nitric acid may be obtained by cooling 98% acid in a freezing mixture.

B. Buckminster fullerenes

15 marks

59. Biofertilizers

Bacterial Biofertilizer

(a) பாக்டீரிய உயிரி உரங்கள்

Biofertilisers : Definition : Biofertilisers may be defined as nutrients of biological origin used for plant growth. There are different kinds of biofertilisers.

1) Bacterial Biofertilisers : Include bacteria such as *Azotobacter, Rhizobium* and *Azospirillum* which enrich the soil with nitrogen compounds (by way of nitrogen fixation). Crops grown in such soil show increase in yield. These bacteria can be added to the soil by

(1) Soaking the seeds in a bacterial solution before sowing.
(2) By mixing it with irrigation water.
(3) Mixing it directly into the soil.

(b) Agal Biofertilizer

(b) உயிரி உர பாசிகள்

Algal Biofertilisers : Blue green algae such as *Anabaena, Nostoc, Cylindrospermum, Plectonema* and *Tolypothrix* are used as biofertilisers which multiply faster in the soil and fix up atmospheric nitrogen, thus increasing the soil fertility.

(c) Mycorrhiza as Biofertilizer

(c) உயிரி உரமாக வேர்ப்பூஞ்சைகள்

Mycorrhiza as biofertiliser : The association between roots of certain plants like *Pinus* and a fungus is called mycorrhiza. This is mutually beneficial for both.

The fungal component makes the insoluble nutrients in the soil to soluble form which can be easily absorbed by the roots.

(d) Green manure crops as Biofertilizers

(d) பசுந்தாள் உயிரி உரம்

Green manure crops as biofertilisers : It is a farming practice adopted by farmers from time immemorial. This involves growing leguminous plants like *Glyricidia, Indigofera* and *Sesbania* soon after harvesting a crop particularly paddy. These plants, rich with nitrogenous compounds are ploughed in the soil before planting the next crop. *Azolla pinnata*, aquatic fern is also used as a biofertiliser. Leaves of this plant harbours nitrogen fixing bacterium *Anabaena azollae.*

(e) Organic manures as Biofertilizers

(e) உயிரி உரமாக கரிம எருக்கள்

Organic Manures as Biofertilisers :

Farm yard refuses, fallen leaves, twigs, rotten vegetable matter are subjected to composting. During composting the complex nutrients are converted into simple soluble forms by a variety of microorganisms. It improves soil conditions as well as soil fertility. Crops grown in such soil show increase in yield upto 30%.

61. Meiosis:

Meiosis

Meiosis is a process of cell division of the reproductive cells of both plants and animals in which the diploid number of chromosomes is reduced to haploid.

Meiosis is also known as **Reduction Division (RD)** since the number of chromosomes is reduced to half. It takes place only in the reproductive cells during the formation of gametes. Meiosis consists of two complete divisions.

As a result of this a diploid cell produces four haploid cells. The two divisions of meiosis are **meiosis I** or heterotypic division and **meiosis II** or homotypic division. The first division is **meiotic** or reductional in which the number of chromosomes is reduced to half and the **second division** is **mitotic** or **equational**.

In all the sexually reproducing organism the chromosome number remains constant generation after generation. During sexual reproduction the two gametes male and female, each having single set of chromosomes (n) fuse to form a zygote. The zygote thus contains twice as many chromosome as a gamete(**n + n = 2n**). In these two sets of chromosomes one set is derived from the male parent and the other set from the female parent. This is how diploids come to possess tow identical sets of chromosomes called **homologous chromosomes.** Meiosis may take place in the life cycle of a plant during any one of the following events.

1. At the time of spore formation ie. During the formation of pollen rains in anther and megaspores in ovules.
2. At the time of gamete formation
3. At the time of zygote germination.

Each meiotic division cycle is divided into same four stages as in mitosis.

Prophase, Metaphase, Anaphase and Telophase.

The name of each stage is followed by **I** or **II** depending on which division of cycle is involved.

Meiosis I

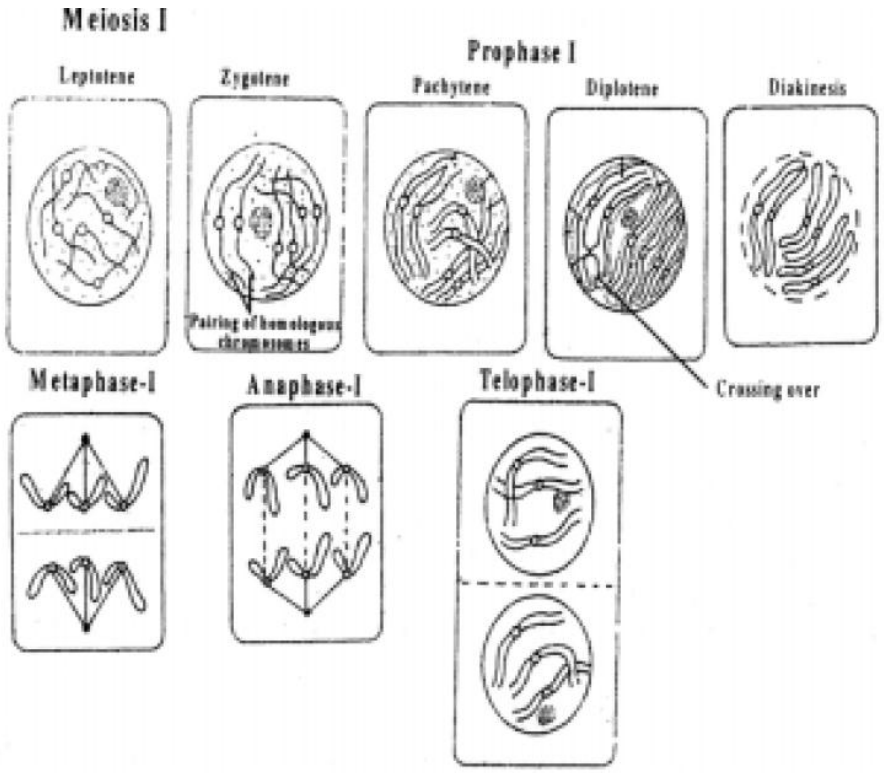
It consists of four stages namely.

1. Prophase I

2. Metaphase I

3. Anaphase I

4. Telophase I



Prophase I :

It is the first stage of first meiosis. This is the longest phase of the meiotic division. It includes 5 sub stages namely **1.Leptotene 2. Zygotene 3. Pachytene 4. Diplotene 5. Diakinesis.**

1. Leptotene :

The word Leptotene means **'thin thread'**. The chromosomes uncoil and become large and thinner. Each chromosome consists of two chromatids.

2. Zygotene :

Homologous chromosomes come together and lie side by side throughout their length. This is called **pairing** or **synapsis.** The paired chromosomes are now called **bivalents.** The adjacent non-sister chromatids are joined together at certain points called **chiasmata.**

3. Pachytene :

The chromosomes condense further and become very shorter and thicker. They are very distinct now. The two sister chromatids of each homologous chromosome become clearly visible. The bivalent thus becomes a **tetrad** with four chromatids. In the region of chiasmata, segments of non-sister chromatids of the homologous chromosomes are exchanged and this process is called **crossing over.**

4. Diplotene :

The homologous chromosomes condense further. They begin to separate from each other except at the chiasmata. Due to this separation the dual nature of ambivalent becomes apparent and hence the name **diplotene.**

5. Diakinesis :

The Chromosomes continue to contract. The separation of chromosome becomes complete due to **terminalisation**. The separation starts from the centromeres and goes towards the end and hence the name terminalisation. The nucleolus and nuclear membrane disappear and spindle formation starts.

Metaphase I :

The spindle fibres become prominent. The bivalents align on the equatorial plane. Spindle fibres from opposite poles get attached to the centromeres of homologous chromosomes.

Anaphase I :

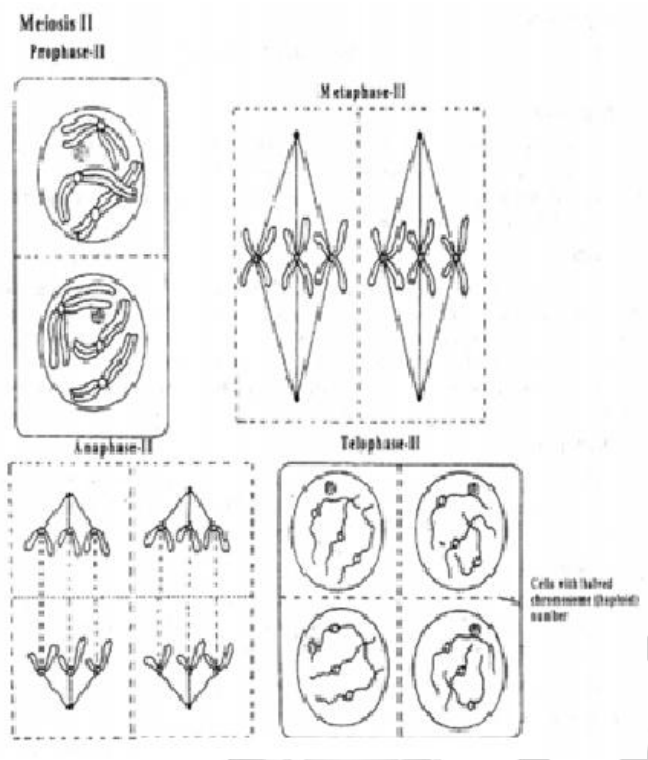
The two chromosomes of each bivalent (with chromatids still attached to the centromere) separate from each other and move to the opposite poles of the cell. Thus, only one chromosome of each homologous pair reaches each pole. Consequently at each pole only half the number of chromosomes (haploid) is received. These chromosomes are, however not the same as existed at the beginning of prophase. Each chromosome consists of one of its original chromatids and the other has a mixture of segments of its own and a segment of chromatid from its homologue (due to crossing over).

Telophase I :

This is the last stage of meiosis I. Reorganization of the chromosomes at poles occurs to form two haploid nuclei. Nuclear membrane and nucleolus re-appear. The spindle disappears. There is no cytokinesis after meiosis I. The second meiotic division may follow immediately or after a short inter phase. The DNA of the two haploid nuclei does not replicate.

Meiosis II :

The second meiotic division is very much similar to mitosis.



Meiosis – Reductional Cell Division

Prophase II :

The events of prophase II are similar to mitotic prophase. Nucleolus and nuclear membrane disappear. Spindle fibres are formed at each pole.

Metaphase II :

Chromosomes move to the centre of the equatorial plane. They get attached to spindle fibres centromere.

Anaphase II :

The sister chromatids separate from one another and are pulled to opposite poles of the spindle due to contraction of the spindle fibres.

Telophase II :

The chromosomes begin to uncoil and become thin. They reorganize into nucleus with the reappearance of nucleolus and nuclear membrane in each pole.

Cytokinesis follows and **four haploid daughter cells** are formed and thus the meiotic division is completed.

Significance of Meiosis :

1. Meiosis helps to maintain the **chromosome number constant** in each plant and animal species. In meiosis four haploid daughter cells are formed from a single diploid cell. This is very important in sexual reproduction during the formation of gametes.

2. The occurrence of crossing over results in the **recombination of genes.**

3. The recombination of genes results in **genetic variation.**

4. The genetic variations form raw materials for **evolution.**