



## Result : IIT-JEE (Advanced) 2017

# ALLEN PROVES AGAIN Best Result in **QUALITY & QUANTITY**

**AIR  
8**



**ONKAR M. DESHPANDE**

**AIR  
9**



**RACHIT BANSAL**

**AIR  
10**



**LAKSHAY SHARMA**

**25**

**STUDENTS  
SECURE AIR  
IN TOP 100 CLUB**

HIGHEST FROM ANY INSTITUTE OF KOTA

✓ **10** in TOP 25 All India Ranks

✓ **130** in TOP 500 All India Ranks

✓ **54** in TOP 200 All India Ranks

✓ **239** in TOP 1000 All India Ranks

**AIR-12**



Yateesh Agrawal  
Classroom

**AIR-15**



Aman Kansal  
Classroom

**AIR-16**



Yash Khemchandani  
Classroom

**AIR-19**



Devansh Garg  
Classroom

**AIR-21**



Arpit Aggarwal  
Classroom

**AIR-23**



Abhay Goyal  
Classroom

**AIR-24**



Tushar Gautam  
Classroom

**AIR-37**



Piyush Tibarewal  
Classroom

**AIR-42**



Satvik Mashkaria  
Classroom

**AIR-45**



Irin Ghosh  
Distance

**AIR-50**



Shourya Aggarwal  
Distance

**AIR-52**



Chitrang Gupta  
Classroom

**AIR-56**



Kritin Garg  
Classroom

**AIR-59**



Himanshu Sheoran  
Classroom

**AIR-66\***



Mayank Dubey  
Classroom

**AIR-66\***



Saksham Dhull  
Classroom

**AIR-82**



Vedant Raval  
Classroom

**AIR-86**



Vardhan Jain  
Classroom

**AIR-94**



Aaron John Sabu  
Distance

**AIR-96**



Prateek Garg  
Classroom

**AIR-98**



Hrithik Maheshwari  
Classroom

**AIR-100**



Pranay Reddy  
Classroom

**6289**

Total Selections

**Classroom**

**4383**

**Distance**

**1906**

#Similar Ranks Declared by JEE

### Admission Announcement KOTA CENTER ( Session 2017-18 )

Stream	Course Name (Eligibility)	Batches Start Date
<b>JEE (Advanced)</b>	Nurture (X to XI Moving)	19 June, 03 July, 19 July
	Leader (XII Pass/Appeared)	12 June, 26 June, 10 July
<b>JEE (Main)</b>	Nurture (X to XI Moving)	03 July
	Leader (XII Pass/Appeared)	14 June, 28 June, 10 July

Stream	Course Name (Eligibility)	Batches Start Date
<b>PRE-MEDICAL (NEET-UG, AIIMS)</b>	Nurture (X to XI Moving)	11 June, <b>26 June</b> , 10 July
	Leader (XII Pass/Appeared)	25 June, 09 July, 30 July
	Achiever (XI Pass/Repeaters)	12 June, 02 July, 23 July, 07 Aug
<b>Pre-Nurture &amp; Career Foundation</b>	For Class VI to X NTSE & Olympiads	26 June

For Further Batches  
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ADMISSION DETAILS**  
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Maharashtra State

100/100

Total 619/650

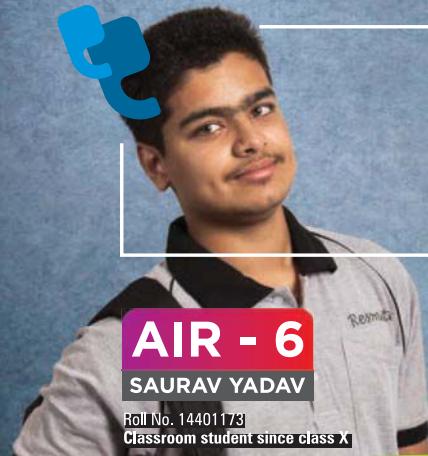
## Admission ANNOUNCEMENT

- NEET Repeater (2018)
- NEET XI (2019)
- DLP (XI + XII) (Distance Learning Program)

### ADDRESS :

Vimal Enterprises, Industrial Estate, Udyog Bhavan, Latur - 413512. (M.S.) Website : [www.ddsbc.in](http://www.ddsbc.in)

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I AM THE ONE WHO DREAMS BIG.

I AM THE ONE WHO STUDIES HARDER.

I AM THE ONE WHO AIMS TO WIN.

I AM THE ONE IN  
**RESONANCE**

## ALL INDIA RANKS IN TOP 100

## 9 STUDENTS

from classroom programs


**ARPIT MENARIA**  
Roll No. 13405464  
Classroom student since class IX

**YASH JAIN**  
Roll No. 15151117  
Classroom student since class XI

**RITIK ROONGTA**  
Roll No. 15102234  
Classroom student since class XI

**SHASHANK KUMAR**  
Roll No. 15172599  
Classroom student since class XI

**SHIVAM GOYAL**  
Roll No. 15102189  
Classroom student since class XI

**NISARG BHATT**  
Roll No. 15155942  
Classroom student since class XI

**DIVYANSHU**  
Roll No. 15172744  
Classroom student since class XI

**PRAKHAR MANGAL**  
Roll No. 13401340  
Classroom student since class IX

**KALPIT VEERWAL**  
AIR - 1 (SC)  
Roll No. 12405642  
Classroom student since class VIII

**DEEPAK MEENA**  
AIR - 1 (ST)  
Roll No. 15107439  
Classroom student since class XI

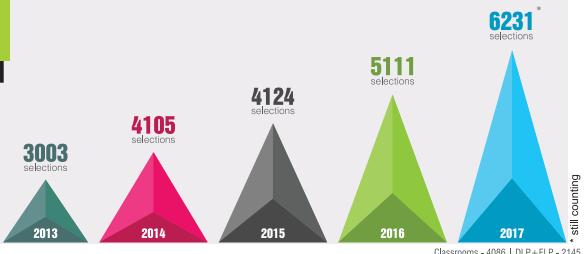
**CATEGORY TOPPERS**

The only institute from Kota to deliver highest no. of girl student's selections (351) from classroom programs.

The only institute from Kota to deliver highest no. of selections (568) from hindi medium classroom programs.

## SELECTIONS SOARING YEAR BY YEAR

21.91% growth this year \*



## ADMISSIONS OPEN (FOR 2017-18) for Classes: V to XII &amp; XII+

• JEE (MAIN+ADVANCED) • JEE (MAIN) • PRE - MEDICAL • BOARD / IJSO / OLYMPIADS / NTSE / KVPY

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of students



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## TOTAL SELECTIONS IN VARIOUS PMTs 2016

**512**

NEET  
For MBBS

**28**

AIIMS

**133**

JHARKHAND  
MEDICAL

**124**

CHHATISGARH  
MEDICAL

\* According to survey done by Kayakalp society in 2016.

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Specially Designed for  
Students of Class 10<sup>th</sup>  
Passed/Appeared

### TARGET PROGRAM

**FOR MEDICAL 2018**  
Specially Designed for  
Students of Class 12<sup>th</sup>  
Passed/Appeared

### ACHIEVER PROGRAM

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Patna

9334594165/66/67

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TVS Showroom, Patna

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Classroom & Test Centre

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## IIT-JEE (ADVANCED) 2017 RESULT

AIR  
**5**



The Best Rank In Kota  
For 2<sup>nd</sup> Consecutive Year

**SURAJ**

2 Year Classroom Programme

Selections From Classroom Programme

**1503\***

RECORD JEE (MAIN) TO JEE (ADVANCED) CONVERSION

**51.84%**

**29**

IN TOP 500 AIR

\* AIR received so far

### SELECTIONS IN TOP 500 AIR



ALL ABOVE SELECTIONS FROM OUR CLASSROOM PROGRAMME ONLY

**DISTANCE  
LEARNING  
PROGRAM**

**737\***  
SELECTIONS

**Tarang  
2017**

All selected Vibrantians  
are invited for felicitation  
function to be held on  
17th June, 2017,  
at 4.30 PM in  
UIT Auditorium,  
Shreenathpuram, Kota

Team Vibrant - Stronger Than Ever

### ADMISSION ANNOUNCEMENT

JEE (Main + Advanced) | JEE (Main) for Academic Session 2017-18

#### GOOGOL

For XII passed students  
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& JEE (Main 2018  
Medium- English / हिन्दी  
Course Commencement  
Phase IV - 21/06/2017

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18/06/2017

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Class XII

Competition Edge

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# ਮਿਲਾਈ-ਦੁਰ्ग ਮਾਸਕਰ

સુપ્રદીપ 16 જૂન, 2017 અધ્યક્ષાદ, ગુજરાત પટે-07, 2074

२. यारी आग से भी अधिक दुख  
होती है, इसलिए खेलने से पहले एक  
प्रियार जम्मर करो।

कालारी > भिलाई-३ > करोला > गुर्हा > पात्र

पहली बार एम्स के टॉप 30 में भिलाई से दो छात्र, दोनों बचपन के दोस्त

12वीं के साथ ही एम्स की तैयारी, बेहतर किताबों के सिलेक्शन से पढ़ाई में मिली मदद, परिवार को दिया कामयाकी का श्रेय, कहा-पैरेट्स ने कभी भी अतिरिक्त दबाव नहीं बनाया

**कामयाची के वे 4 लक्ष पाईं**

उद्योग के लक्ष याची लक्ष  
उद्योग अस याची तो भूमिका  
उद्योग याची तो भूमिका  
उद्योग कर्तव्य कर्तव्य निर्णयी  
उद्योग कर्तव्य कर्तव्य निर्णयी

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**पदार्थ के लिए कौन सोचता  
मीडिया का इस्तेमाल**

देखे मेंकी काहे का कहना है कि वे टेलीविजन और फ़िल्म निकल और इन्हीं पांच के दिल ही करते हैं। निकलता या लगता करते हैं कि वे अपनी दृष्टिकोण से उनका जन-जनकारी कुछ बदलता जाएं। और उनकी विचारों पर उनका अवलोकन करता रहता है। जिसको उनका अवलोकन करता रहता है। उनका जब भी कोई कौशल का दृष्टिकोण से उनका विचारों का अवलोकन नहीं करता।

## **Almost after a decade, a girl tops AIIMS entrance**

**F**ive friends who hung out together, ate together and studied for their medical entrance exam together for two years in Kota, will be together at AIIMS-Delhi for another five years.

Buddies Nishita Purohit (ranked 1<sup>st</sup>), Harsh Agarwal (5<sup>th</sup>), Rishab Raj (6<sup>th</sup>), Harshit Anand (7<sup>th</sup>) and Abhishek Dogra (9<sup>th</sup>) bagged five places in the top 10 of the AIIMS MBBS-2017 exam.

Coming from different states, they met in Kota exactly two years ago. While Nishita is from Gujarat, Harsh and Harshit are from West Bengal, Rishab from Bihar and Abhishek from Maharashtra. They came to Kota with dreams of securing a seat in any top medical institute. On Thursday, 15<sup>th</sup> June they found out destiny had the best in store for them.

The others in the top 10 were Archit Gupta (2<sup>nd</sup>), Tamoghna Ghosh (3<sup>rd</sup>), Nipun Chandra (4<sup>th</sup>), Rinku Sarmah (8<sup>th</sup>) and Manish Mulchandani (10<sup>th</sup>).

Soon after the results were announced early Thursday morning, the five friends

thanked each other for the healthy competition among themselves and for keeping each other's spirits high.

"The display of competence by friends or batchmates in every class acted as motivation to perform better than them," Purohit said. It's almost after a decade that a girl has topped AIIMS exam. Purohit, who wants to become a cardiac surgeon, said, "I am expecting the same results in NEET also."

Another thrilling coincidence was their ranking sequence - Harsh Agarwal (5<sup>th</sup>), Rishab Raj (6<sup>th</sup>) and Harshit Anand (7<sup>th</sup>). The trio scored in a similar manner in most of their tests. The cluster rankings, they said, are almost as though they had contested the exam among themselves.

Rishab Raj, from Bihar, said, "Ranks don't matter, what matters is many more fun-filled days with old buddies. Our club was not restricted to seeing who solved a puzzle first but always built our confidence when we had scored beneath our expectations in tests."

Their sense of achievement doubled when they were told that never in the history of AIIMS had a group of five friends qualified together.

The remaining five students of the top 10 to qualify for AIIMS this year are from the same batch of Kota's Allen Career Institute, Kota institutes also sent 45 of the top 100 who qualified for the Indian Institute of Technology this year with Allen contributing 25.

"We decided to study subjects a day in advance. It kept us in the limelight in the classroom. Similarly, every evening we would discuss among ourselves any problems or confusion that arose." said Anand. They felt this approach helped save the time they would have spent asking the teacher.

Raj said they were aware that studying in AIIMS meant mountains of expectations. Their only disappointment: Some candidates who were part of their group did not qualify for a seat at AIIMS.

Courtesy : The Times of India



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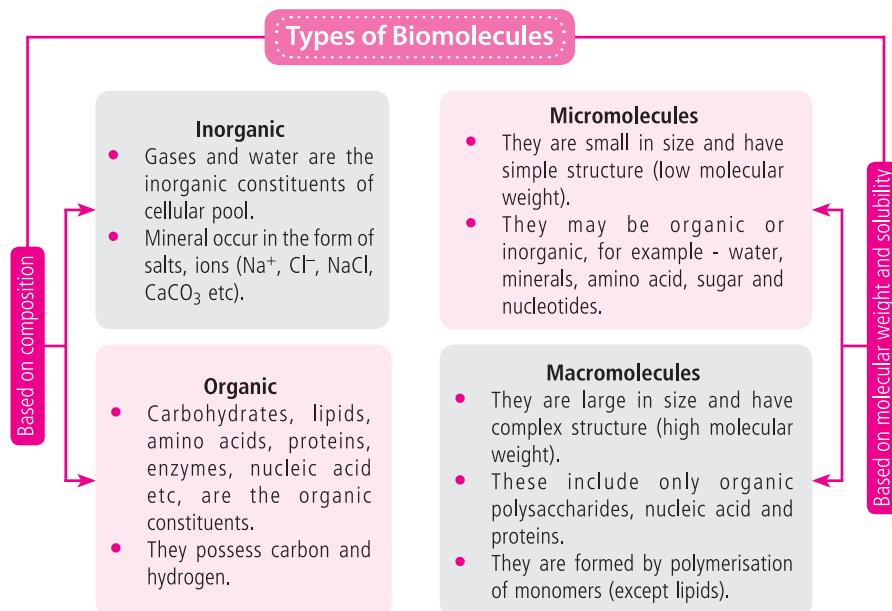
# HIGH YIELD FACTS



Class XI

## Biomolecules-I

- Biomolecules** are chemicals or molecules present in living organisms.
- Cellular pool is the sum total of different types of biomolecules, compounds and ions present in a cell. It consists of two parts:
  - Aqueous phase** contains chemicals dispersed in water forming true solution (homogenous particles) or colloidal solution (heterogenous particles).
  - Non aqueous phase** contains chemicals deposited in various structures like chromatin, cell wall and cell membrane.



	Analysis of various PMTs from 2013-2017				
	2013	2014	2015	2016	2017
AIPMT/NEET	4	2	2	6	2
AIMS	2	1	4	2	-
AMU	5	10	3	-	-
Kerala	-	5	5	-	-
K-CET	-	1	1	-	-
J & K	-	2	2	-	-

## CARBOHYDRATES (SACCHARIDES)

- These are the most abundant organic molecules in nature having C, H and O, where H and O are in the ratio 2 : 1 as found in water ( $\text{H}_2\text{O}$ ).

- They can be represented by the empirical formula  $C_n(H_2O)_n$ .
- Carbohydrates** are polyhydroxy aldoses containing aldehyde group or ketoses containing ketone group and their condensation products.
- In addition to aldehyde ( $-CHO$ ) and ketone ( $-CO$ ) groups, the **polyhydric alcohols** also occur naturally in foods. In this these groups are reduced to an alcohol group.
- In these molecules, the carbon atom forms chains or rings with two or more hydroxyl group and either an aldehyde or a ketone group, hence called **polyhydroxy aldehydes** and **ketones**.
- Based on the number of sugar units and the complexity, carbohydrates can be classified into following types:

### Monosaccharides

- They are the simplest carbohydrates which cannot be hydrolysed further into simpler carbohydrates. Depending upon the number of carbon atoms, monosaccharides can be classified as follows:

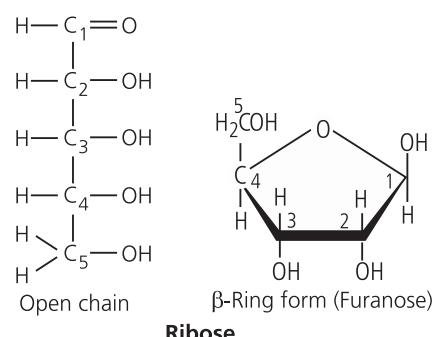
**Table: Classification of monosaccharides**

	Aldoses	Ketoses
<b>Trioses (<math>C_3H_6O_3</math>)</b>	Glycerose (glyceraldehyde)	Dihydroxy-acetone
<b>Tetroses (<math>C_4H_8O_4</math>)</b>	Erythrose	Erythrulose
<b>Pentoses (<math>C_5H_{10}O_5</math>)</b>	Ribose	Ribulose
<b>Hexoses (<math>C_6H_{12}O_6</math>)</b>	Glucose	Fructose
<b>Heptoses (<math>C_7H_{14}O_7</math>)</b>	Glucoheptose	Sedoheptulose

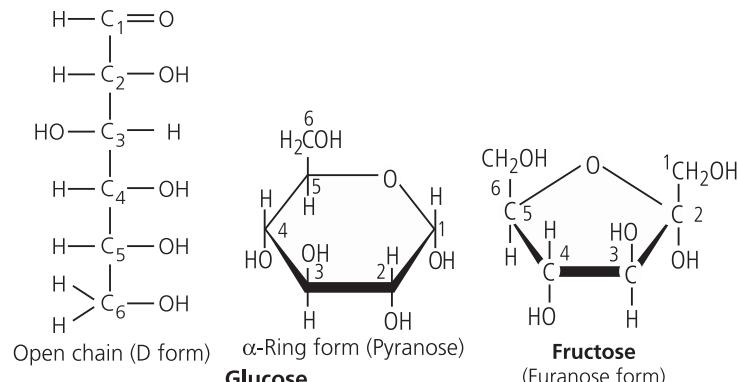
- Pentose sugars like arabinose and xylose form polymers which are constituents of hemicellulose.
- Glucose is the main respiratory substrate.
- Sucrose serves as reserve food for sugarcane and sugarbeet.
- Trioses, glyceraldehyde and dihydroxy acetone, are important intermediates of both respiratory and photosynthetic pathways.

- They are linked by glycosidic bond ( $C-O-C$ ) to form oligosaccharide or polysaccharide.
- Pentose and hexose are found in both forms: Open chain and ring. Hexoses are mainly white crystalline and sweet in nature e.g., fructose is the sweetest of all naturally occurring sugars. It is also called fruit sugar. Glucose is the most important monosaccharide in living system and is also called as "grape sugar".

**Pentose ( $C_5$ )**



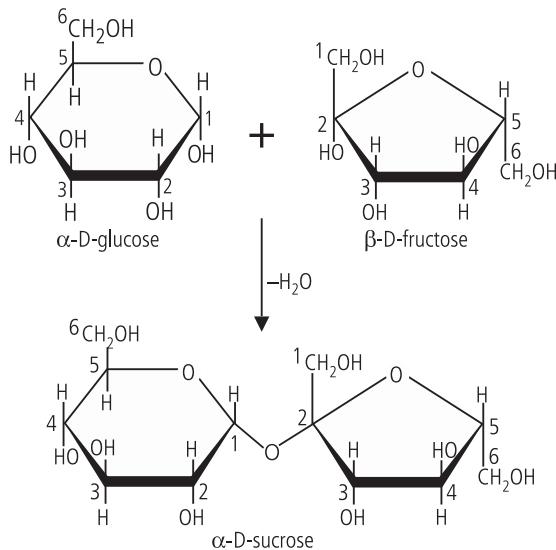
**Hexose ( $C_6$ )**



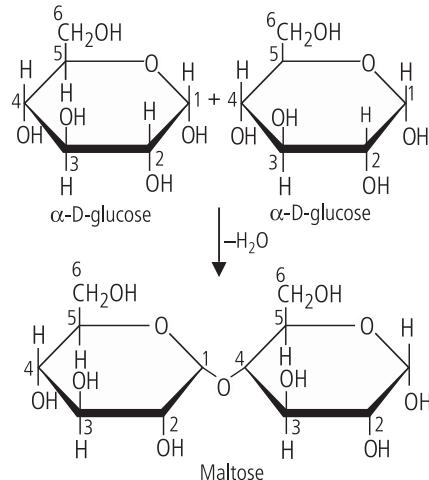
### Oligosaccharides

- They are small carbohydrates formed by condensation of 2 to 9 monosaccharides.
- Based on the number of monosaccharide molecules condensed to form oligosaccharides, they are classified as follows:
- Disaccharides** : The smallest and the commonest oligosaccharides are disaccharides. They are formed by the condensation of 2 molecules of monosaccharides. Example: lactose, sucrose and maltose etc.
- Lactose** or **milk sugar** is a **reducing sugar** which is formed by  **$\beta\ 1 \rightarrow 4$  condensation** of one **glucose** and one **galactose molecule**.

- Sucrose**, the commercial sugar or **cane sugar** is obtained from sugarcane (*Saccharum officinarum*). It is formed by condensation of one molecule each of **glucose** and **fructose**. Glycosidic bond is formed between carbon 1 of glucose and carbon 2 of fructose ( **$\alpha$  1 → 2 linkage**). Sucrose is a **non-reducing sugar**.



- Maltose** or malt sugar is named so because of its occurrence in malted grains of barley. It is also found in most germinating seeds and tissues where starch is being broken down. It is a **reducing sugar** formed by condensation of two molecules of glucose. Glycosidic bond ( **$\alpha$  1 → 4**) is established between carbon 1 of one glucose molecule and carbon 4 of second glucose molecule.



- Trisaccharides**: They are formed by the condensation of 3 molecules of monosaccharides (e.g., raffinose).
- Tetrasaccharides**: They are formed by the condensation of 4 molecules of monosaccharides (e.g., stachyose).
- Pentasaccharides**: They are formed by the condensation of 5 molecules of monosaccharides and so on.
- Oligosaccharides** are important for **cell recognition, cell attachment and act as receptor molecules**.

**Table:** Differences between reducing and non-reducing Sugars

	Reducing Sugars	Non-reducing Sugars
(i)	The sugars have a free aldehyde ( $-CHO$ ) or ketonic ( $-CO$ ) group.	A free aldehyde or ketonic group is absent.
(ii)	The sugars can reduce cupric ions ( $Cu^{2+}$ ) of Benedict's or Fehling's solution to cuprous ions ( $Cu^+$ ), during which blue colour of copper sulphate changes to brick red.	They do not reduce cupric ions of Benedict's or Fehling's solution to cuprous ions.

## Polysaccharides

- They are complex carbohydrates, formed by polymerisation of more than 10 monosaccharide monomers. They are also called **glycans**. They are long chained that may be branched or unbranched.
- On the basis of the composition, polysaccharides are of two types:

### Types of polysaccharides

#### Homopolysaccharides

- Homoglycan are complex carbohydrates formed by polymerisation of only one type of monosaccharide monomers.
- E.g., glucan, fructan, xylan etc.

#### Polysaccharides (On the basis of composition)

#### Heteropolysaccharides

- Heteroglycans are complex carbohydrates produced by condensation of two or more types of monosaccharides or their derivatives.
- E.g., agar, chitin peptidoglycan etc.

## Polysaccharides (On the basis of functions)

### Storage polysaccharides

- Some homopolysaccharides are stored form of fuel. They are those polysaccharides which serve as reserve food.
- When needed, storage polysaccharides are hydrolysed. Sugars thus released become available to the living cells for production of energy and biosynthetic activity. The two main storage polysaccharides are starch and glycogen.

#### **Starch**

- It is the storage polysaccharide of most plants. It is polyglucan homosaccharide and is formed as an end product of photosynthesis. Starch consists of two components, amylose and amylopectin. Both of these are formed by condensation of  $\alpha$ -D-glucose. In amylose, the successive glucose units (100-200) are linked by  $1-4\alpha$ - linkages that is in the form of continuous straight chain but arranged helically. Amylopectin contains larger number of glucose units in a straight chain which bears several side chains.

#### **Glycogen**

- It is the polysaccharide food reserve of animals, bacteria and fungi. It is popularly called **animal starch**. Chemically, it is similar to starch. It has about 30,000 glucose residues joined together by  $\alpha(1 \rightarrow 4)$  glycosidic bonds and  $\alpha(1 \rightarrow 6)$  glycosidic bonds at branching points.

#### **Inulin**

- It is a fructan storage polysaccharide of roots and tubers of *Dahlia* and related plants. Inulin is not metabolised in human body and is readily filtered through the kidney.

### Structural polysaccharides

- These polysaccharides make the structural framework of the cell wall in plants and skeleton of some animals.

#### **Chitin**

- It is the second most abundant organic substance. Chitin is a complex heteropolysaccharide which is found as the structural component of fungal walls and exoskeleton of arthropods. It provides both strength and elasticity to the structure it forms. In chitin, monomer unit is a nitrogen containing glucose derivative known as **N-acetyl glucosamine**. It has an unbranched configuration and monomers are joined together by **1-4 $\beta$ -linkages**.

#### **Cellulose**

- It is a fibrous, tough, water insoluble substance found in the cell wall of plants, some fungi and protists. Cellulose is a homopolysaccharide composed of  **$\beta$ -D glucose units** linked by  **$\beta(1 \rightarrow 4)$  glycosidic bonds**. Cellulose molecules have **unbranched and linear chains**.

### Mucosubstances

- Some heteropolysaccharides serve as mucosubstances. These are mucus or slime forming substances. They are of two types.

#### **Mucopolysaccharides**

- They are slimy substances which possess acidic or aminated polysaccharides formed from galactose, mannose, sugar derivatives and uronic acids. Mucopolysaccharides are found in both plants and animals. They may be attached to a protein molecule to form a proteoglycan. **Proteoglycans** provide the ground or packing substance of connective tissue. E.g., hyaluronic acid, chondroitin sulfate and heparin.
- Mucopolysaccharides in human body have several functions such as lubrication of ligaments and tendons, formation of some types of body fluids like cerebrospinal fluid, synovial fluid, vitreous humor, providing strength and flexibility to skin, connective tissue and cartilage, binding of proteins in cell walls and holding water in interstitial spaces.

#### **Mucoproteins (glycoproteins)**

- The protein with conjugated mucosaccharides form mucus. These are found in stomach, nasal secretion, intestine, vagina and are antibacterial and protective in function.

## LIPIDS

- Lipids are **fatty acid esters of alcohols** and related substances which are insoluble in water but get dissolved in a number of nonpolar organic solvents like ether, benzene, chloroform, acetone, etc. They may also form colloidal complex that get dispersed uniformly in water in the form of minute droplets. Such complex is called **emulsion**.
- Lipids are basically made of carbon, hydrogen and sometimes oxygen. The content of oxygen is always small as compared to hydrogen and carbon. They occur mainly in natural fats and oils. Their general formula is  $R-(CH_2)_n-COOH$ .

### Classification of fatty acids

(On the basis of the nature of hydrocarbon chain):

#### Unsaturated fatty acids

- The carbon chain contains one or more double bonds with unsaturated C atoms.
- Chain bends at the double bond.
- Its general formula is  $C_nH_{2n-2x}O_2$ . E.g., oleic acid  $C_{18}H_{34}O_2$  (with one double bond), linolenic acid  $C_{18}H_{30}O_2$  (with three double bonds).
- Unsaturated fatty acids have lower melting point than the saturated fatty acids. Most plant lipids have unsaturated fatty acids.

#### Saturated fatty acids

- The carbon chain lacks double bonds and C atoms are fully saturated.
- They have straight chain.
- Its general formula is  $C_nH_{2n}O_2$  e.g., palmitic acid ( $C_{16}H_{32}O_2$ ) and stearic acid ( $C_{18}H_{36}O_2$ ).
- Most animal lipids have saturated fatty acids.

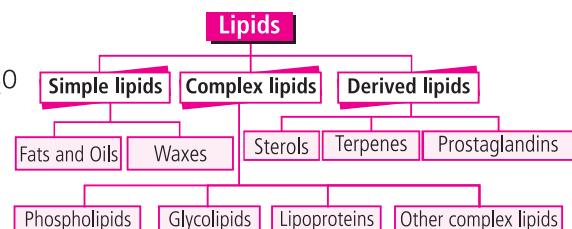
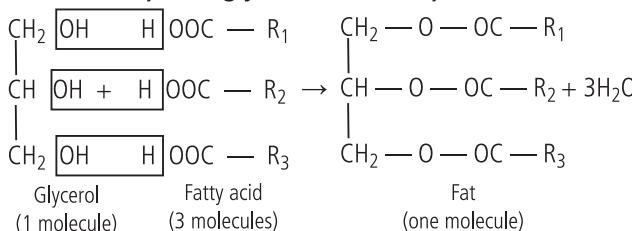
## Classification of Lipids

- Lipids are classified into three types : simple, compound and derived.

### A. Simple Lipids

- They are formed from fatty acids and alcohol. They do not have any additional group, e.g., fats and wax.

(i) **True fat** : They are **triglycerides**, formed by esterification of 3 molecules of fatty acids and 1 molecule of glycerol.



**Pure fats** - Fats with three similar fatty acids, e.g., tripalmitin, tristearin.

**Mixed fats** - Fats having different fatty acids, e.g., butter.

**Oils** - Fats which are liquid at room temperature. They are rich in unsaturated fatty acids, have low melting point and forms hard fats on hydrogenation, e.g., groundnut oil, sesame oil, mustard oil.

**Hard fats** - Fats that are solid at room temperature of about 20°C. They contain long chain saturated fatty acids, e.g., animal fat.

(ii) **Waxes** : They are fatty acid esters of long chain monohydric alcohols like cytol, ceryl or mericyl. E.g., Beewax a complex of several wax. Tuberculosis and leprosy bacteria produce a wax called **wax-D** which is a major factor in their pathogenicity.

**Paraffin wax** is obtained from petroleum. Candles are made of paraffin wax and stearic acid. **Sebum** is a fatty secretion of the sebaceous glands of the skin. **Cerumen** is a soft, brownish, waxy secretion of the ceruminous glands of the external auditory canal. It is commonly called **earwax**.

- Cutin**: It is a complex lipid produced by cross-esterification and polymerisation of hydroxy fatty acids as well as other fatty acids with or without esterification by alcohols other than glycerol.
- Suberin**: It is a mixture of fatty material having condensation products of glycerol and phellonic acid or its derivatives.

### B. Compound Lipids

- These are esters of fatty acids with alcohol, containing some other groups also. They are of 3 types:

(i) **Phospholipids** : These are composed of a **molecule of glycerol** or **other alcohol** having a **phosphate group** joined to one of its outer OH groups. A **Nitrogen-containing base** is bound to this phosphate group. **Two fatty acid molecules** are linked to other two -OH groups. The phospholipid molecule has a **nonpolar and hydrophobic "tail"** consisting of fatty acid chains and a **polar and hydrophilic "head"** comprising a negatively charged phosphate group and a positively charged base.

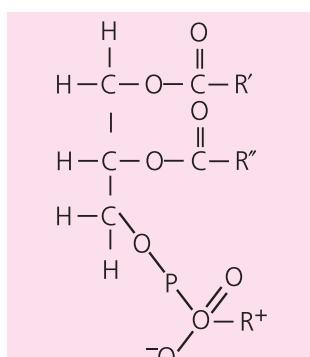
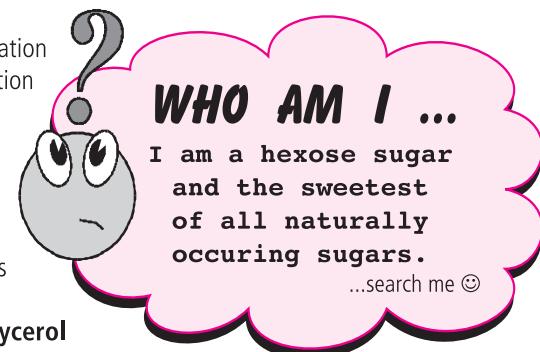
(ii) **Lipoproteins**: These consist of **lipids** (mainly phospholipids) and **proteins**. They are main constituent of membranes and also occur in the milk and egg yolk. Lipids are transported in the blood plasma and lymph as lipoproteins. There are five types of lipoproteins, namely **chylomicrons, very low density lipoproteins (VLDL), low density lipoproteins (LDL), high density lipoproteins (HDL) and free fatty acid-albumin complex**.

(iii) **Glycolipids**: They consist of a fatty acid, an amino alcohol sphingosine and a sugar residue. The brain and neurons are rich in glycolipids which help in nerve conduction and myelin formation.

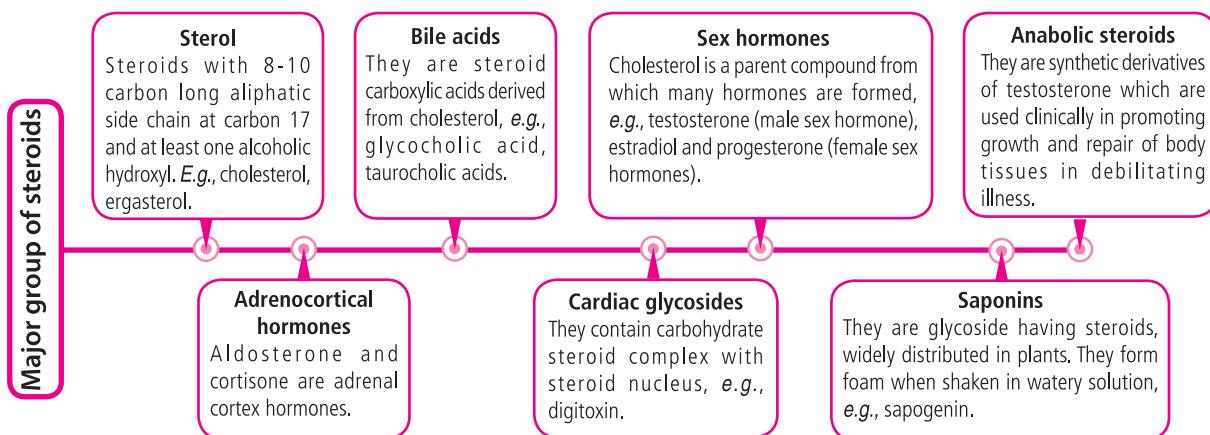
### C. Derived Lipids

- These are derivatives of lipid, e.g., steroids, terpenes and prostaglandins.

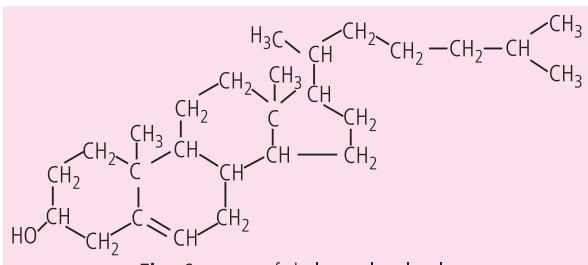
(i) **Steroids** : They are a group of complex lipids that contains a hydrogenated cyclopentano-perhydrophenanthrene ring system. The steroids do not contain fatty acids but are included in the lipids because they have fat-like properties.



**Fig.:** Structure of a phospholipid molecule. (R' and R'' are fatty acids, R<sup>+</sup> is nitrogen containing base).



- (i) **Cholesterol** : It is the most abundant steroid in the animal tissues. It is present in food, especially that is rich in animal fats and is also synthesised in liver. Its formula is  $C_{27}H_{45}OH$ . Cholesterol and its esters are **insoluble in water** hence their deposition on the lining of the blood vessels, leads to high blood pressure and many heart diseases.
- (ii) **Terpenes** : They are lipid like hydrocarbons formed of **isoprene** ( $C_5H_8$ ) units. These are major component of essential oils produced by certain plants. Natural rubber and carotenoids are terpenoid compounds.
- (iii) **Prostaglandins** : They are hormone like compounds derived from the 20-carbon polyunsaturated fatty acid, e.g., arachidonic acid. Their richest sources are the secretion of seminal vesicles in males and menstrual secretion fluid in the females. The prostaglandins have a variety of effects such as vasodilation, vasoconstriction, stimulation of intestinal smooth muscle, etc. They perhaps act by regulating the production of cyclic AMP by adenyl cyclase.



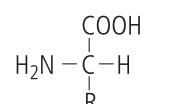
**Fig.:** Structure of cholesterol molecule

## Functions of Lipids

- It serves as food reserves in both plants and animals.
- In animals, fat occurs as droplets (adipocytes), and provides protection against low temperature.
- Plant oils are used as low cholesterol in fat.
- They act as chemical co-ordinators and also stimulate anabolism.
- Steroids are essential for growth and flowering in plants. Steroids also control sex expression.
- Cholesterol is an essential component of animal plasma membrane. Cholesterol produces bile salt.
- Cholesterol forms vitamin D on exposure to UV rays.
- Fats can be converted to carbohydrates. Therefore, fats stored in oil seeds (e.g., groundnut, mustard, castor, sunflower, cotton, coconut) not only provide energy but also raw materials for growth of embryo.
- Subcutaneous fat rounds off the body contours of animals and human beings. In animals, the fats produce a shock absorbing cushion around eye balls, gonads, kidneys and other vital organs.
- Waxes form a protective layer over the animal fur. They protect the floating leaves of aquatic plants against wetting. In land plants, they reduce the rate of transpiration.
- Myelin sheath around nerve fibres takes part in insulation.

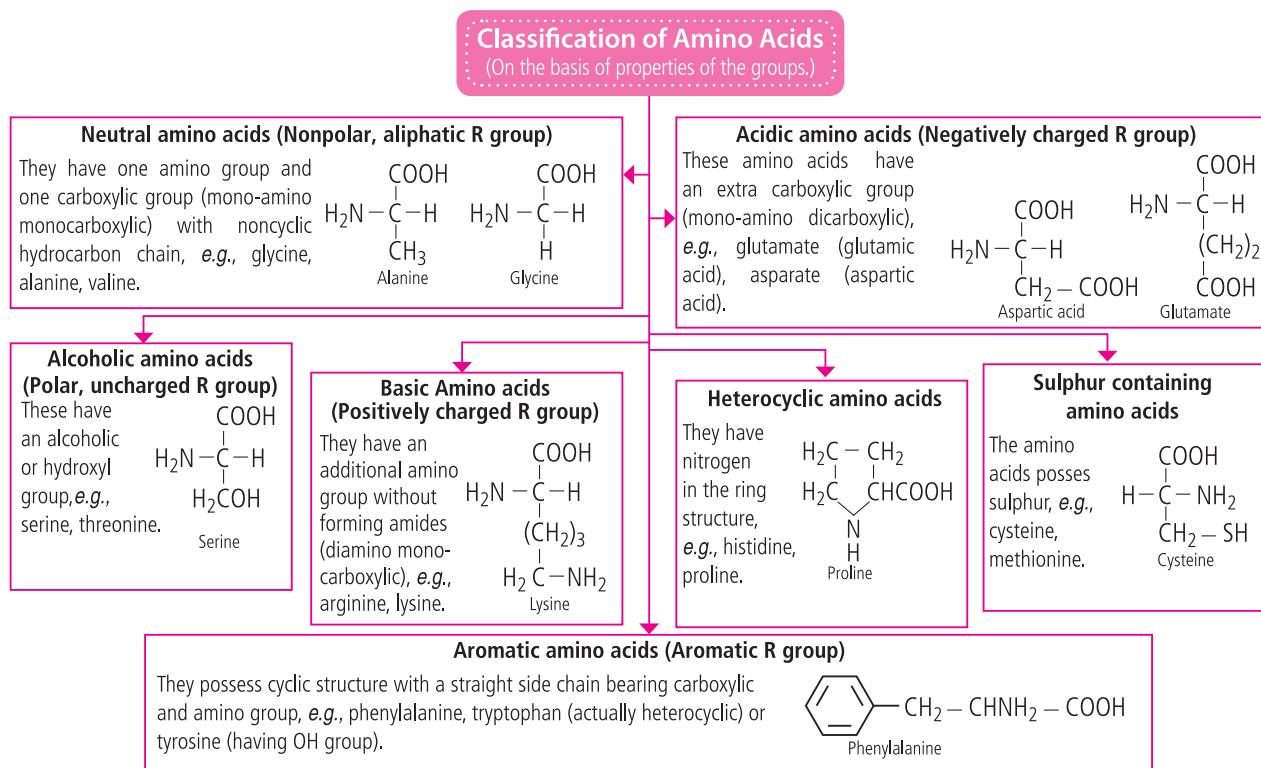
## AMINO ACIDS

- They are the building blocks of proteins. Amino acids are organic acids (with carboxylic group  $-COOH$ ) having amino group ( $-NH_2$ ) generally attached to  $\alpha$ -carbon or carbon next to the carboxylic group. Carboxylic group provides an acidic property to the amino acid while amino group imparts basic nature to it. The  $\alpha$ -carbon also bears a variable hydrocarbon or alkyl group R and hydrogen. There are 20 amino acids that are normal components of cell proteins. These are called protein amino acids.

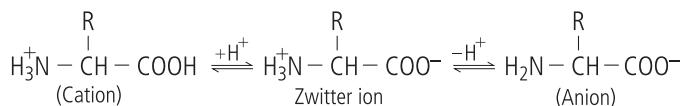


**Fig.:** Typical structure of amino acid

- Many amino acids found in cells do not form proteins. These are called non-protein amino acids. Among these are ornithine, citrulline, gamma-aminobutyric acid (GABA).



- Due to the presence of ionisable nature of  $\text{NH}_2$  and  $\text{COOH}$  groups, the structure of an amino acid changes in the solution of different pH.



- Plants can synthesise all the protein amino acids they require but animals are unable to manufacture all of their own amino acids from raw materials. For this they are dependent upon the plants. However, animals can form several amino acids through transformation or transamination. The amino acids which cannot be synthesised by animals through transformation or transamination are called **essential amino acids**. These are 7 in number and must be present in their diet, viz., leucine, isoleucine, valine, tryptophan, phenylalanine, lysine and methionine.
- The amino acids that can be synthesised by human body from raw materials are called **non-essential amino acids**. They are 13 in number and need not to be present in the diet.
- Peptide Formation**-Amino acids condense to form peptides by linking the successive amino acids through peptide bond ( $-\text{NH}-\text{CO}-$ ) is formed between two amino acids by elimination of a water molecule.

### Functions of Amino Acids

- They are building blocks of proteins, enzymes and participate in biosynthetic pathways. They are the components of antibiotics. Amino acids also serve an important role in gluconeogenesis.
- Amino acid **glycine** provides nitrogen and carbon atoms for the synthesis of protoporphyrin and heme (=haem) and **tryptophan** produces plant hormone indole 3-acetic acid (IAA).
- Amino acid **tyrosine** gives rise to two hormones (thyroxine and adrenaline) and skin pigment melanin.
- Histamine** is derived from amino acid histidine through decarboxylation. It is required for optimum functioning of muscles, blood capillaries and gastric secretion.

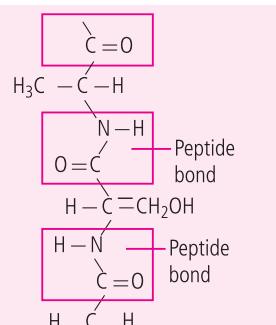


Fig.: A part of peptides showing peptide bonds linking amino acids

## PROTEINS

- Proteins are linear, unbranched polymers of amino acids (linked together by peptide bond). They are large-sized, heteropolymeric macromolecules having one or more chains of amino acids or (polypeptide). Being macromolecules, proteins are not freely soluble in water but form colloidal complex with the same. Chemically, a protein is made of carbon, hydrogen, oxygen, nitrogen and sulphur. Some proteins additionally contain phosphorus, iron and other elements. **Collagen** is the most abundant protein of animal world and **RuBisCo** is the most abundant protein in plants.

### Structure of Protein

- Every protein has a three-dimensional structure that corresponds to its functions. The four level structural organisation in proteins are primary, secondary, tertiary and quaternary.

#### Primary Structure

It is the linear sequence of amino acids in a polypeptide chain. Primary structure describes the basic structure of a protein i.e., number and sequence of amino acids in each polypeptide constituting the protein.

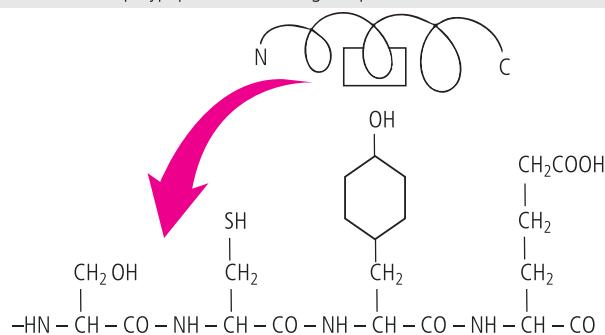


Fig.: Primary structure of a protein, N and C represent its first and last termini

#### Quaternary Structure

It is found only in multimeric proteins and consist of two or more polypeptide chains. Each polypeptide develops its own tertiary structure and functions as subunit of protein, e.g., insulin, collagen, haemoglobin etc.

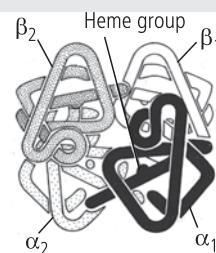


Fig.: Quaternary structure of haemoglobin showing four polypeptide chains— two  $\alpha$ -chains and two  $\beta$ -chains

#### Secondary Structure

It is the development of new steric relationships of amino acids present in the linear sequence inside the polypeptides. Secondary structures depend on **hydrogen bonds** between  $-C=O$  group of one amino acid and  $-NH$  groups of next fourth amino acid. There are 3 types of secondary structures.

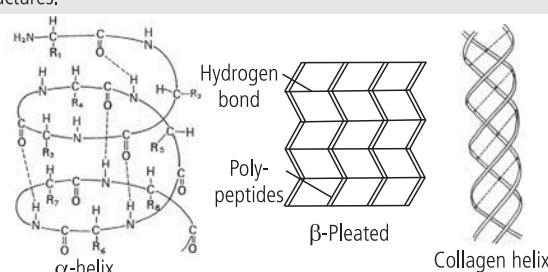


Fig.: Secondary structures of proteins

#### Tertiary Structure

It is formed by the further complex bending and folding of secondary structure to form various types like sphere, rod or fibre. Tertiary structure is stabilised by several types of bonds – hydrogen bonds, ionic bonds, disulphide bonds, hydrophobic bonds, vander Waals interactions, etc. This structure imparts a 3-D conformation to the protein.

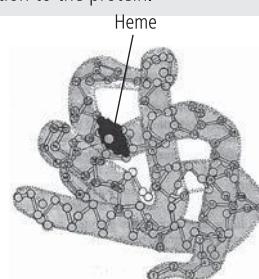


Fig.: Tertiary structure of protein myoglobin

### MPP-3 CLASS XI

### ANSWER

### KEY

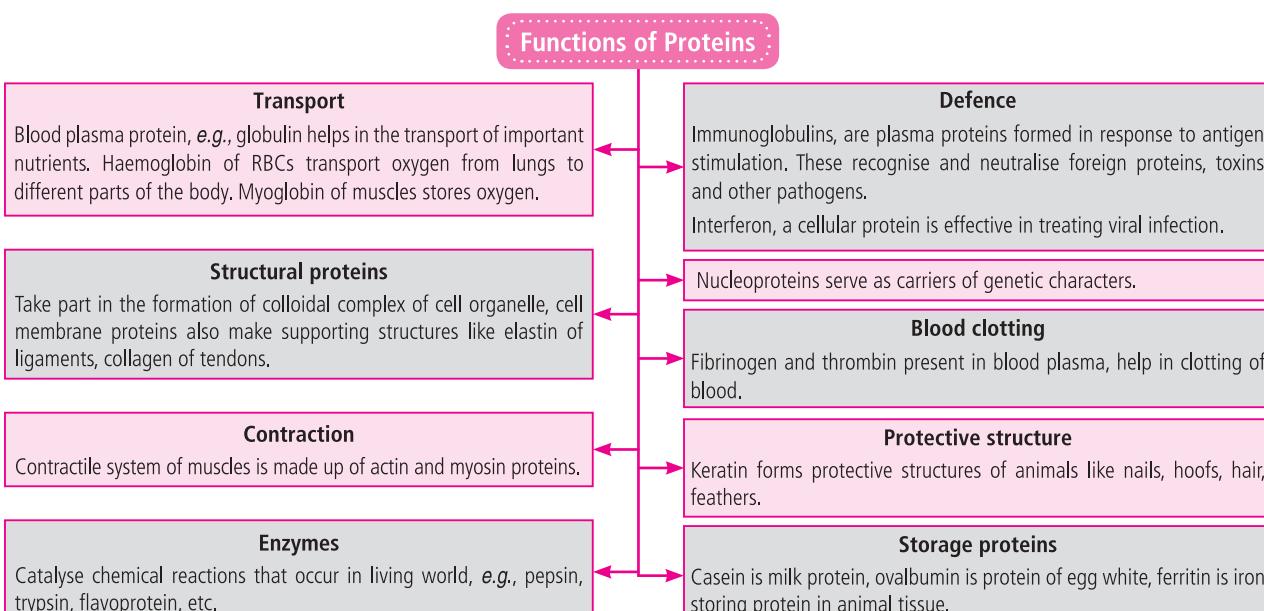
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|---------|---------|---------|---------|---------|
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| 6. (b)  | 7. (c)  | 8. (a)  | 9. (b)  | 10. (c) |
| 11. (a) | 12. (d) | 13. (a) | 14. (d) | 15. (b) |
| 16. (c) | 17. (b) | 18. (d) | 19. (c) | 20. (a) |
| 21. (d) | 22. (a) | 23. (a) | 24. (b) | 25. (c) |
| 26. (b) | 27. (c) | 28. (d) | 29. (c) | 30. (b) |
| 31. (a) | 32. (b) | 33. (d) | 34. (a) | 35. (a) |
| 36. (a) | 37. (c) | 38. (a) | 39. (d) | 40. (b) |

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Based on composition		
Simple Proteins	Conjugated Proteins	Derived Proteins
These proteins are made up of amino acids only. Additional non-amino groups are absent, e.g., histones, keratin.	These proteins have non-amino substances called prosthetic groups. Depending upon the type of prosthetic group, conjugated proteins are of several types, i.e., nucleoproteins, glycoproteins, lipoproteins etc.	They are derived from proteins through denaturation, coagulation and breakdown, e.g., metaproteins, proteoses, peptones, peptides, fibrin.
Based on shape		
Fibrous Proteins	Globular Proteins	
They are thread like proteins which may occur singly or in groups. They are tough, non-enzymatic and structural proteins. Fibrous proteins generally possess secondary structure. They are insoluble in water. Keratin of skin and hair are fibrous proteins. Some of the fibrous proteins are contractile, e.g., myosin of muscles and elastin of connective tissue.	They are rounded in outline. Contractility is absent. Final structure is tertiary or quaternary. Globular proteins may be enzymatic or non-enzymatic. Smaller globular proteins are mostly soluble in water. They are usually not coagulated by heat, e.g., histones. Egg albumin, serum globulins and glutelins (wheat, rice) are examples of large globular proteins which get coagulated by heat.	

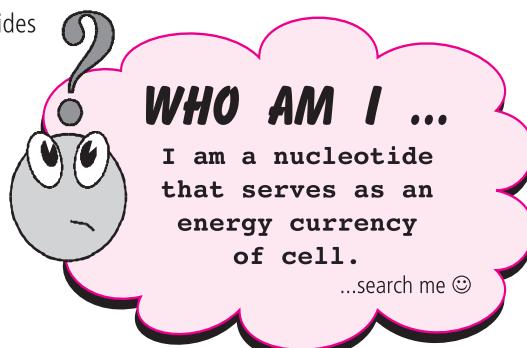
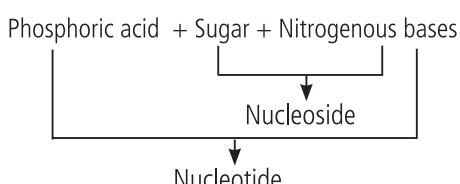


## NUCLEOTIDES

- These are the basic units of nucleic acids (DNA and RNA). Nucleotides consist of carbon, hydrogen, oxygen, nitrogen and phosphorus.

### Composition of Nucleotides

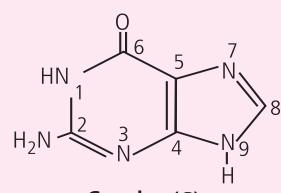
- Each nucleotide consists of three distinct units: a phosphate group, pentose sugar and a nitrogenous base. The base-sugar combination without phosphate group is called as a nucleoside.



### Nitrogenous bases

The nitrogenous bases are heterocyclic compounds found in nucleotides. They may be either a single ringed **pyrimidine** or a double ringed **purine**. A **pyrimidine** molecule is smaller and has one 6-membered ring, with nitrogen at 1 and 3 positions. A **purine** molecule is larger and has two rings, a 6-membered ring joined to a 5-membered ring. These rings are joined at 4 and 5 positions. The 5 membered ring carries nitrogen at 7 and 9 positions while the 6 membered ring carries nitrogen at 1 and 3 positions.

#### Purines-



#### Pyrimidines-

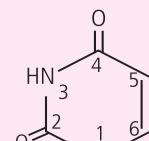
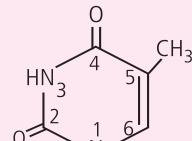


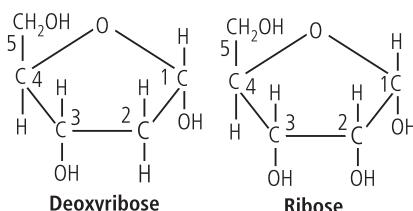
Fig.: Structure of purines (A, G) and pyrimidines (C, T, U)

### Nucleotides

(Building blocks of nucleic acids)

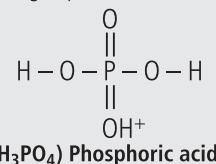
#### Pentose sugar

In nucleotides, pentose sugars are of two types : Ribose ( $C_5H_{10}O_5$ ) and deoxyribose ( $C_5H_{10}O_4$ ). Both sugars are present in furanose form. Deoxyribose sugar (oxygen absent at 2' Carbon) occurs only in DNA while ribose sugar occurs in RNA and biologically active nucleotides such as AMP, ADP, ATP, etc.



#### Phosphate group

Nucleotides are phosphate esters of nucleosides. A nucleotide may have 1, 2 or 3 phosphate groups. But in nucleic acid composition only nucleotides with one phosphate group are involved.



- Adenosine triphosphate (ATP)**

- It is the principal energy carrying molecules of all cells composed of adenine, ribose sugar and phosphoric acid. There are two additional phosphate groups that make it a **high energy molecule**.

### Functions of Nucleotides

- Nucleotides produced by nicotinamide and riboflavin function as coenzymes ( $NAD^+$ ,  $NADP^+$ , FMN and FAD) of dehydrogenases or oxidases.
- They are building blocks of nucleic acid.
- Cyclic GMP (cGMP) is functional in  $Ca^{2+}$  or calmodulin mediated chemical reaction.
- Nucleotides, such as ATP are high-energy compounds that act as energy carriers.
- Cyclic AMP acts as second chemical messenger in many hormone controlled chemical reactions.

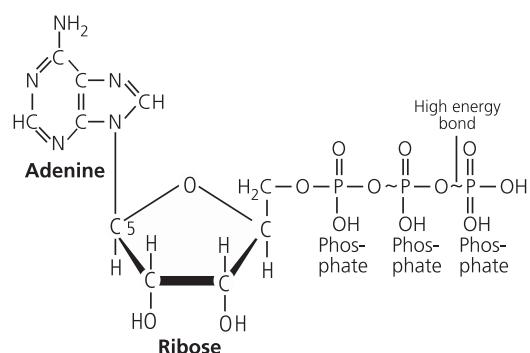


Fig.: Structure of ATP

## NUCLEIC ACIDS

- These are the polymers of the nucleotides, hence called polynucleotides. They contain genetic information that determines all the heritable characteristics of a living organism. They show a wide variety of secondary structures.
- The two types of nucleic acids are:
  - Deoxyribonucleic acid (DNA)
  - Ribonucleic acid (RNA)

## DNA

- DNA is the largest macromolecule. It is a polymer of **deoxyribonucleotides**. It is composed of monomeric units namely deoxyadenylate (dAMP), deoxyguanylate (dGMP), deoxycytidylate (dCMP) and deoxythymidylate (dTTP). DNA does not contain uracil. The monomeric deoxynucleotides in DNA are held together by **3', 5'-phosphodiester bridges**. It constitutes the genetic material of all organisms with the exception of riboviruses.
- Various forms of DNA are B-DNA, Z-DNA, A-DNA, C-DNA and D-DNA.

## Double Helix Structure of B-DNA

- The double helical structure of DNA was proposed by **James Watson** and **Francis Crick** in 1953 (Nobel prize, 1962).
- The key points of double helical structure of DNA are-
  - (i) DNA molecules consist of two polypeptide chains helically coiled around a common axis to form a right handed double helix.
  - (ii) The two strands are antiparallel, i.e., they run in opposite directions. One strand runs in the 5' to 3' direction while the other in 3' to 5' direction.
  - (iii) The **width** (or diameter) of a double helix is **20 Å** (2 nm). Each turn (**pitch**) of the helix is **34 Å** (3.4 nm) with **10 pairs** of nucleotides, each pair placed at a distance of about **3.4 Å** (0.34 nm).
  - (iv) Each strand of DNA has a **hydrophilic deoxyribose phosphate backbone** (3' – 5' phosphodiester bonds) on the outside (periphery) while the **hydrophobic bases are stacked inside** (core).
  - (v) The two strands are held together by **hydrogen bonds** formed by **complementary base pairs**. There are 2 hydrogen bonds between adenine and thymine (A = T) and 3 hydrogen bonds between cytosine and guanine (C ≡ T).
  - (vi) Both the strands are complementary with each other.
- (vii) The double helix has **major grooves** and **minor grooves** along the phosphodiester backbone.

- **Denaturation** or melting of DNA is breaking of hydrogen bonds between nitrogen bases of complementary DNA strands by heating at high temperature. DNA rich in A-T base pairs have low melting point and undergoes denaturation easily, as A-T base pairs have two hydrogen bonds. G-C rich regions are more stable due to presence of three hydrogen bonds and requires high temperature for melting.
- **Renaturation** is the phenomenon by which DNA strands separated by melting can reassociate and form duplex on cooling at low temperature.

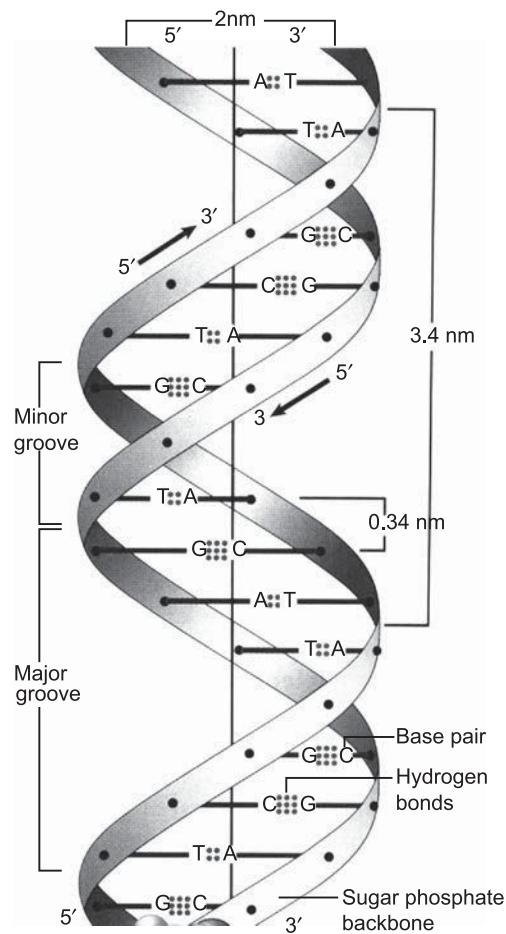


Fig.: Watson-Crick double Helical DNA Molecule

### Chargaff's Rules

The purines and pyrimidines are always present in equal amounts i.e.,  $A + G = T + C$ .

The deoxyribose sugar and phosphate components occur in equimolar proportions.

The base ratio  $A + T / G + C$  may vary from one species to another, but is constant for a given species. This ratio can be used to identify the source of DNA and can help in classification.

The amount of adenine is always equal to that of thymine, and the amount of guanine is always equal to that of cytosine, i.e.,  $A = T$  and  $G = C$ .

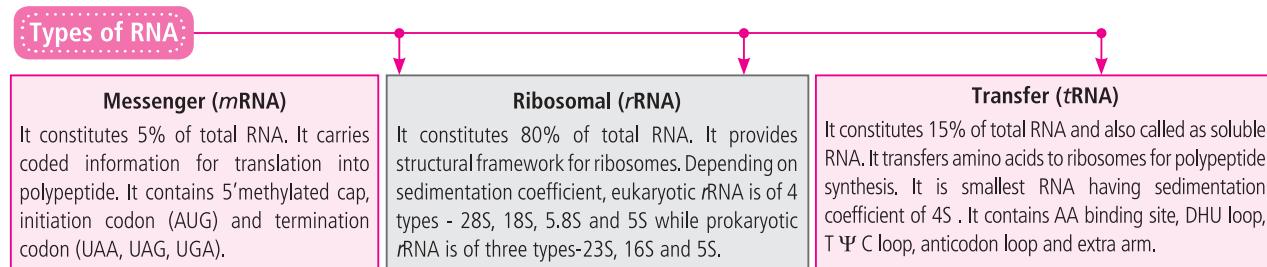
## Functions of DNA

- (i) DNA is the genetic material which carries all the hereditary information coded in the arrangement of its nitrogen bases.
- (ii) By replication it passes genetic information from one cell to its daughters or from one generation to the next.

- (iii) Crossing over of DNA produces recombinants.
- (iv) Changes in sequence and number of nucleotides in DNA produce mutations which in turn causes variations and formation of new species.
- (v) DNA controls the metabolic reactions of cells through RNAs and RNA-directed synthesis of proteins, enzymes and other biochemicals.

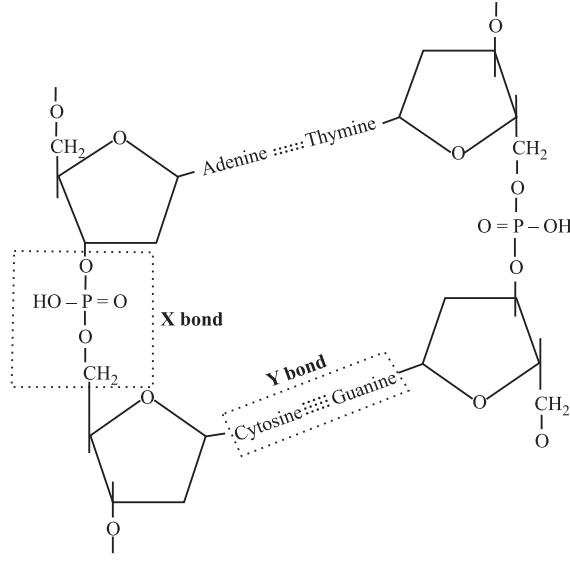
## RNA

- It is a polymer of **ribonucleotides**, held together by **3', 5'-phosphodiester bridges**. It is generally involved in protein synthesis and serves as genetic material in some viruses. RNA contains the pyrimidine **uracil** in place of thymine found in DNA.



# SPEED PRACTICE

1. Which of the following is not a characteristic of glycogen?
  - (a) Heteropolysaccharide
  - (b) Homopolysaccharide
  - (c) Branched chain molecule
  - (d) Stored in liver and muscle
2. Refer to the given statements and select the incorrect ones.
  - (i) General formula of saturated and unsaturated fatty acids are  $C_nH_{2n}O_2$  and  $C_nH_{2n-2x}O_2$  respectively.
  - (ii) Albumin is a storage protein whereas prolamine is a structural protein.
  - (iii) In eukaryotic DNA, AT content is generally more than GC content.
  - (iv) Right end of a polysaccharide chain is called non-reducing end while left end is called reducing end.
    - (a) (i) and (ii)
    - (b) (ii) and (iv)
    - (c) (i) and (iii)
    - (d) (ii) and (iii)
3. Identify bonds X and Y in the given diagram?



- |  |  |
|--|--|
| <b>X</b>   | <b>Y</b>   |
| <ol style="list-style-type: none"> <li>(a) Glycosidic bond</li> <li>(b) Phosphodiester bond</li> <li>(c) Glycosidic bond</li> <li>(d) Phosphodiester bond</li> </ol> | <ol style="list-style-type: none"> <li>Hydrogen bond</li> <li>Hydrogen bond</li> <li>Phosphodiester bond</li> <li>Glycosidic bond</li> </ol> |

- 4.** Which of the following biomolecule is correctly characterised?
- (a) Arachidonic acid - A saturated fatty acid with 19-carbon atoms
  - (b) Aspartic acid - Amino acid having an extra carboxylic group
  - (c) Palmitic acid - An unsaturated fatty acid with 18-carbon atoms.
  - (d) Adenylic acid - An adenine containing nucleoside
- 5.** Identify the given structure.
- (a) Proline COOH  
|  
H – C – NH<sub>2</sub>  
|  
CH<sub>2</sub> – SH
  - (b) Serine H<sub>2</sub>N – C – H  
|  
H
  - (c) Alanine H<sub>2</sub>N – C – H  
|  
CH<sub>3</sub>
  - (d) Lysine H<sub>2</sub>N – C – H  
|  
CH<sub>3</sub>
- 6.** Which of the following has correct arrangement of carbohydrates in the order of increasing complexity of chemical structure?
- (a) Glyceraldehyde < Fructose < Maltose < Raffinose
  - (b) Ribose < Threose < Sucrose < Starch
  - (c) Fructose < Glyceraldehyde < Raffinose < Maltose
  - (d) Ribose < Sucrose < Threose < Starch
- 7.** Match the column I with column II and select the correct option.
- | <b>Column I</b>                    | <b>Column II</b>        |
|------------------------------------|-------------------------|
| A. Steroid                         | (i) Protein synthesis   |
| B. RNA                             | (ii) Sex hormone        |
| C. Haemoglobin                     | (iii) Animal cellulose  |
| D. Tunicin                         | (iv) Transport of gases |
| (a) A-(ii), B-(i), C-(iv), D-(iii) |                         |
| (b) A-(i), B-(iii), C-(iv), D-(ii) |                         |
| (c) A-(iii), B-(i), C-(iv), D-(ii) |                         |
| (d) A-(iii), B-(ii), C-(i), D-(iv) |                         |
- 8.** Consider the following statements and select the option that correctly identifies the true (T) and false (F) ones.
- (i) Glucose is a dextrorotatory carbohydrate also known as grape sugar.
  - (ii) Wax D is a major pathogenic substance produced by *Mycobacterium laprae*.
  - (iii) RNA strand contains 70-12000 ribonucleotides.
  - (iv) Biliprotein contains Cu-Haem as prosthetic group.
- (i) (ii) (iii) (iv)
- (a) F F T F
  - (b) T T F T
  - (c) T T T F
  - (d) F T F T
- 9.** Identify the given amino acids and select the correct option.
- |   |   |  |
|---|---|--|
| COOH<br> <br>H – C – NH <sub>2</sub><br> <br>CH <sub>2</sub> – SH | COOH<br> <br>H <sub>2</sub> N – C – H<br> <br>H | COOH<br> <br>H <sub>2</sub> N – C – H<br> <br>CH <sub>2</sub> COOH |
| <b>A</b>  | <b>B</b>  | <b>C</b>   |
- (a) Lysine
  - (b) Cysteine
  - (c) Methionine
  - (d) Proline
- |         |               |
|---------|---------------|
| Alanine | Glutamate     |
| Glycine | Aspartic acid |
| Serine  | Valine        |
| Valine  | Phenylalanine |
- 10.** Distance between two adjacent nitrogen bases of B-DNA is
- (a) 3.8 Å
  - (b) 3.4 Å
  - (c) 2.0 Å
  - (d) 2.4 Å
- 11.** Keratin present in hair shows secondary structure known as
- (a) parallel β-sheet
  - (b) antiparallel β-sheet
  - (c) α-helix
  - (d) none of these.
- 12.** Which of the following can reduce Cu<sup>+2</sup> ions to Cu<sup>+</sup> state?
- (a) Sucrose
  - (b) Maltose
  - (c) Glucose
  - (d) Fructose
- 13.** Select the option that correctly fills the blanks of any two statement (I) → (IV).
- (I) Inulin is a (i) polysaccharide.
  - (II) Water soluble end of fatty acid (ii) surface tension and (iii) wetting power of water.
  - (III) Leucine and phenylalanine are (iv) amino acids.
  - (IV) Starch and glycogen are (v) molecules.
- (a) (i) fructan; (ii) increases; (iii) decreases
  - (b) (iv) essential; (v) branched
  - (c) (i) fructan; (ii) non-essential, (v) unbranched
  - (d) (i) decreases; (ii) increases; (iii) non-essential
- 14.** Natural silk fibre is
- (a) polyacid
  - (b) polyamide
  - (c) polyester
  - (d) polysaccharides.
- 15.** Which of the following is functional in calmodulin mediated chemical reaction?
- (a) cAMP
  - (b) cGMP
  - (c) UDP
  - (d) ADP
- 16.** Refer to the given table of difference between DNA and RNA and select the incorrect option.
- |       | <b>DNA</b>  | <b>RNA</b>                     |
|-------|---|--------------------------------|
| (i)   | Occurs inside the nucleus only.                                   | Only found in the cytoplasm.   |
| (ii)  | It is usually double stranded with the exception of some viruses. | It is usually single stranded. |
| (iii) | It is Feulgen negative.   | It is Feulgen positive.        |

(iv)	Purine and pyrimidine bases are in equal number.	There is no proportionality between number of purine and pyrimidine bases.
------	--	--

- (a) (i) and (iii) (b) (iii) only  
 (c) (ii) and (iii) (d) (ii), (iii) and (iv)

**17.** Read the following statements and fill the blanks with correct options.

  - The 20 different amino acids have different \_\_\_\_\_.
  - Human milk contains maximum amount of \_\_\_\_\_.
  - \_\_\_\_\_ is the father of ATP cycle.

(i)	(ii)	(iii)
(a) carboxylic groups	Maltose	Fritz Lipmann
(b) R-groups	Lactose	Fritz Lipmann
(c) peptide bonds	Lactose	Buchner
(d) amino groups	Protein	Fritz Lipmann

**18.** \_\_\_\_\_ is not an example of sweet proteins.

  - Monellin
  - Brazzein
  - Ferritin
  - Thaumatin

**19.** Select the incorrect match.

  - Triose - Ribose
  - Simple lipid - Wax
  - Neutral amino acid - Valine
  - Disaccharide - Maltose

**20.** Match the following columns and select the correct option.

Column I	Column II
A. Mucopolysaccharides	(i) Hyaluronic acid
B. Reserve proteins	(ii) Chondroitin sulphate
	(iii) Gluten
	(iv) Keratan sulphate
	(v) Globulin

A	B
(a) (i), (ii), (iv)	(iii), (v)
(b) (i), (ii), (iii)	(iv), (v)
(c) (ii), (iii), (iv)	(i), (v)
(d) (i), (iii), (v)	(ii), (iv)

**21.** Parallel and antiparallel  $\beta$ -pleated sheets occur respectively in

  - keratin and ribonuclease
  - ribonuclease and fibroin of silk
  - keratin and fibroin of silk
  - fibroin of silk and ribonuclease.

**22.** Saturated fatty acids possess \_\_\_\_\_ bonds between carbon atoms and are \_\_\_\_\_ at room temperature.

  - single, solids
  - double, solids
  - single, liquids
  - double, liquids



ANSWER KEY

- |            |     |            |     |            |     |            |     |            |     |
|------------|-----|------------|-----|------------|-----|------------|-----|------------|-----|
| <b>1.</b>  | (a) | <b>2.</b>  | (b) | <b>3.</b>  | (b) | <b>4.</b>  | (b) | <b>5.</b>  | (c) |
| <b>6.</b>  | (a) | <b>7.</b>  | (a) | <b>8.</b>  | (c) | <b>9.</b>  | (b) | <b>10.</b> | (b) |
| <b>11.</b> | (c) | <b>12.</b> | (b) | <b>13.</b> | (b) | <b>14.</b> | (b) | <b>15.</b> | (b) |
| <b>16.</b> | (a) | <b>17.</b> | (b) | <b>18.</b> | (c) | <b>19.</b> | (a) | <b>20.</b> | (a) |
| <b>21.</b> | (c) | <b>22.</b> | (a) | <b>23.</b> | (d) | <b>24.</b> | (c) | <b>25.</b> | (b) |
| <b>26.</b> | (a) | <b>27.</b> | (b) | <b>28.</b> | (b) | <b>29.</b> | (c) | <b>30.</b> | (b) |



# NEET

## FOUNDATION

Class-11

Maximise your chance of success in NEET by reading this article. This section is specially designed to optimise your preparation by practising more and more. It is a unitwise series having chapterwise question bank, allowing you to prepare systematically and become more competent.

- 👉 Recall question or single concept question – indicated by a single finger.
- 👉 Application question or question which requires 2 or 3 concepts - indicated by 2 fingers.
- 👉 Application question or question which requires 3 or more concepts - indicated by 3 fingers.

### UNIT-IV : PLANT PHYSIOLOGY

#### CHAPTER-11 : TRANSPORT IN PLANTS

##### Multiple Choice Questions

- 👉 1. Consider the following statements regarding hydrostatic pressure.  
(i) This pressure develops due to osmotic entry or exit of water in an osmotic system.  
(ii) Positive hydrostatic pressure is essential for cell enlargement during plant growth but it does not play any role in plant movements.  
(iii) Autochory of some fruits is dependent upon release of turgor pressure.  
(iv) When the cell becomes flaccid, wall pressure is equal and opposite to turgor pressure.  
Of these the incorrect pair of statements is  
(a) (i) and (iv)      (b) (i) and (ii)  
(c) (ii) and (iv)      (d) (ii) and (iii).
- 👉 2. Minerals present in soil cannot be passively absorbed because  
(a) they exist in the soil as ions which cannot directly cross the cell membranes  
(b) the concentration of mineral ions is 100 times more in soil than in the root interior  
(c) soil minerals are large in size, so cannot cross cell membrane  
(d) all of these.

- 👉 3. Which of the following groups of plants shows maximum and minimum transpiration ratio, respectively?  
(a) CAM and C<sub>3</sub>      (b) CAM and C<sub>4</sub>  
(c) C<sub>4</sub> and C<sub>3</sub>      (d) C<sub>3</sub> and CAM
- 👉 4. Select the incorrect statement regarding passive water absorption in plants.  
(a) Force for passive absorption originates in the aerial parts of the plant due to transpirational loss of water.  
(b) It can occur even in the absence of roots.  
(c) Metabolic poisons do not have any immediate effect on it.  
(d) It produces a positive pressure in xylem channels.
- 👉 5. Which of the following statements is true for symport?  
(a) Two molecules cross the membrane in the same direction at the same time.  
(b) Two molecules cross the membrane in the opposite directions.  
(c) Two molecules move across the membrane independent of each other.  
(d) None of these
- 👉 6. Which of the following does not pertain to facilitated transport?  
(a) High selectivity  
(b) Shows saturation  
(c) Uphill transport  
(d) Requirement of special carrier proteins

- 7.** Select the incorrectly matched pair.
- Diffusion pressure deficit – Meyer
  - Water potential – Slatyer and Taylor
  - Guttation-Bergerstein
  - Pressure flow hypothesis – Zimmermann
- 8.** Girdling experiment cannot be carried out in monocots and dicots with bicollateral bundles because of the
- presence of single strip of phloem
  - absence of single strip of phloem
  - presence of closed vascular bundles
  - bidirection movement of organic solutes by the phloem.
- 9.** Select the correct difference between osmosis and imbibition.
- Imbibition produces heat whereas heat is not produced in osmosis.
  - Imbibition requires presence of colloidal particles whereas osmosis requires presence of solute particles.
  - Osmotic pressure is always very high as compared to imbibition pressure.
  - Osmosis operates in the solutions separated by semi permeable membrane which is not required in case of imbibition.
- (i) and (ii)
  - (ii) and (iii)
  - (i), (ii) and (iv)
  - (iii) only
- 10.** Which of the following statements is incorrect?
- Water is absorbed by a system having higher DPD from another system with lower DPD.
  - Water potential of a solution is always negative or less than zero.
  - Osmotic pressure is numerically equal to osmotic potential but has a negative value.
  - Water is absorbed by a system with lower water potential from another system with higher water potential.

### Match The Columns

- 11.** Match Column I with Column II.
- | <b>Column I</b>  | <b>Column II</b>                        |
|------------------|---|
| A. Guttation     | (i) Heat of wetting                     |
| B. Transpiration | (ii) Selective permeability             |
| C. Osmosis       | (iii) Hydathodes                        |
| D. Imbibition    | (iv) Stomata                            |
| E. Diffusion     | (v) Spreading of smell of incense stick |
- 12.** Match Column I with Column II (There can be more than one match for items in Column I).
- | <b>Column I</b>      | <b>Column II</b>    |
|----------------------|---------------------|
| A. Cotransport       | (i) Ascent of sap   |
| B. Passive transport | (ii) Cooling effect |
| C. Water potential   | (iii) Exosmosis     |

- Plasmolysis
  - Transpiration pull
- Sum of solute potential and pressure potential
  - Symport
  - Simple diffusion
  - Zero for pure water
  - Antiport
  - Facilitated diffusion
  - Shrinkage of protoplast

### Passage Based Question

- 13.** Complete the given passage with appropriate words or phrases.

\_\_\_\_\_ are tiny pores found in epidermis of leaves. Stomata are mainly meant for the \_\_\_\_\_ but are also the main sites of \_\_\_\_\_. Each stoma is surrounded by green epidermal cells called \_\_\_\_\_. These cells are connected with the adjacent epidermal cells through \_\_\_\_\_. The guard cells possess small vacuoles and \_\_\_\_\_. Their walls are differentially \_\_\_\_\_ and \_\_\_\_\_. \_\_\_\_\_ of their walls are oriented specifically to help in opening and closing of stomata. The important factors which govern the stomatal opening are light as well as concentrations of K<sup>+</sup>, \_\_\_\_\_ ions.

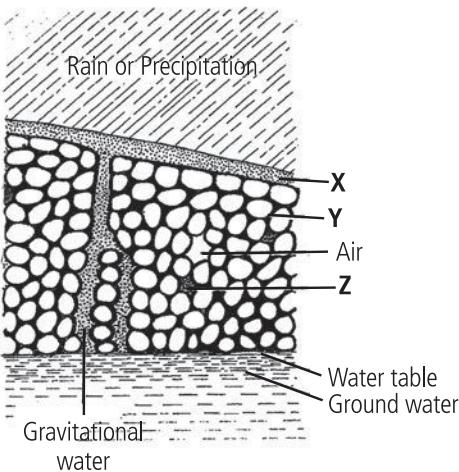
### Assertion & Reason

- In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :
- if both A and R are true and R is the correct explanation of A
  - if both A and R are true but R is not the correct explanation of A
  - if A is true but R is false
  - if both A and R are false.

- 14. Assertion :** Xylem transport is unidirectional and takes place upwards from root to shoot tips.  
**Reason :** The force for upward movement develops in the aerial part due to loss of water in transpiration.
- 15. Assertion :** Plasmolysis is the result of exosmosis.  
**Reason :** Deplasmolysis is the result of endosmosis.
- 16. Assertion :** Diffusion can operate in any medium.  
**Reason :** Diffusion requires a semi permeable membrane.
- 17. Assertion :** A very high wind velocity often decreases the rate of transpiration.  
**Reason :** A very high wind velocity results in closure of stomata due to mechanical effect, drying and cooling of transpiring organs.
- 18. Assertion :** Only hygroscopic water is available to plant root for absorption.  
**Reason :** Hygroscopic water is held loosely in soil pores by capillary forces.

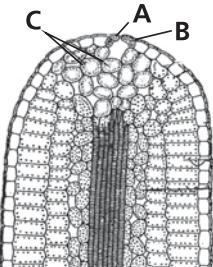
### Figure Based Questions

19. Refer to the given figure and answer the following questions.



- (a) Identify X, Y, and Z in the given figure.
- (b) Which out of X, Y and Z is available to plant roots for absorption? Give reason.

20. Refer to the given figure and answer the following questions.



- (a) Identify A, B and C in the given figure.
- (b) Briefly describe the phenomenon executed by the structure comprised of parts A, B and C.

### CHAPTER-12 : MINERAL NUTRITION

#### Multiple Choice Questions

1. Select the incorrect statement.
  - (a) Mg is a component of chlorophyll.
  - (b) *Rhizobium* is a symbiotic nitrogen fixing bacterium.
  - (c) *Frankia* is a rod-shaped bacterium.
  - (d) *Anabaena* is a common symbiont in lichens.
2. During nitrification, the microbe *Nitrosomonas* helps in conversion of
  - (a)  $\text{NH}_3 \rightarrow \text{Nitrite}$
  - (b)  $\text{N}_2 \rightarrow \text{NH}_3$
  - (c)  $\text{Nitrite} \rightarrow \text{Nitrate}$
  - (d)  $\text{NH}_3 \rightarrow \text{N}_2$
3. Hydroponics refers to growing plants in
  - (a) tissue culture medium
  - (b) water
  - (c) solution of mineral nutrients
  - (d) soil culture.

4. Which of the following statements is true?

- (a) Plants absorb nitrogen in free diatomic state.
- (b) Calcium and magnesium ions minimise the toxic effects of heavy elements in plants.
- (c) Boron and potassium are involved in translocation of organic substances in phloem.
- (d) Both (b) and (c)

5. In plants, potassium plays an important role in

- (a) RNA and protein synthesis
- (b) opening and closing of stomata
- (c) cell division and growth
- (d) all of these.

6. Which enzyme plays an important role in biological  $\text{N}_2$  fixation and is very sensitive to  $\text{O}_2$ ?

- (a) Dehydrogenase
- (b) Nitrogenase
- (c) Glutamase
- (d) Transaminase

7. The nodules of some plants export the fixed nitrogen as \_\_\_\_\_ which have high nitrogen to carbon ratio.

- (a) ureides
- (b) glutamine
- (c) asparagine
- (d) urea

8. During nodule formation which hormone is liberated by invading bacteria?

- (a) Auxin
- (b) Gibberellin
- (c) Cytokinin
- (d) Ethylene

9. Which of the following is a component of middle lamella?

- (a) Phosphorus
- (b) Calcium
- (c) Zinc
- (d) Chlorine

10. Which of the following is a non-mineral element?

- (a) Mg
- (b) Zn
- (c) N
- (d) Fe

#### Match The Columns

11. Match Column I with Column II.

Column I	Column II
A. Molybdenum	(i) Necrosis
B. Chlorine	(ii) Whiptail disease
C. Boron	(iii) Leaf rosette
D. Zinc	(iv) Loss of apical dominance
E. Sulphur	(v) Tea yellow

12. Match Column I with Column II (There can be more than one match for items in Column I).

Column I	Column II
A. Free living nitrogen fixing anaerobic bacteria	(i) <i>Xanthomonas</i>
B. Free living nitrogen fixing cyanobacteria	(ii) <i>Anabaena</i>
	(iii) <i>Cylindrospermum</i>
	(iv) <i>Clostridium</i>
	(v) <i>Lyngbia</i>

- C. Symbiotic nitrogen fixing bacteria
- (vi) *Frankia*
- D. Symbiotic nitrogen fixing cyanobacteria
- (vii) *Nostoc*
- (viii) *Chromatium*

### Passage Based Question

- 13.** Complete the given passage with appropriate words or phrases.

The roots of a legume secrete chemical attractants such as (i) that attract bacteria. Bacteria collect over root hairs and release (ii) causing curling of root hairs and formation of an (iii) enclosing bacteria. The infected cortical cells dedifferentiate and start dividing to form (iv). Nodule formation is stimulated by (v) formed by cortical cells and (vi) released by invading bacteria. Inside the enlarged infected cells, bacteria form irregular polyhedral structures called (vii) that occur in groups surrounded by host membrane. The host develops an oxygen scavenger pigment called (viii). It protects enzyme (ix) from oxygen. Besides *nod* genes such symbiotic nitrogen fixation requires (x) genes.

### Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

- (a) if both A and R are true and R is the correct explanation of A
- (b) if both A and R are true but R is not the correct explanation of A
- (c) if A is true but R is false
- (d) if both A and R are false.

- 14. Assertion :** The reduction of nitrite by enzyme nitrite reductase requires reducing power.

**Reason :** In higher plants, nitrite is translocated to leaf cells or electron donor operating in illuminated cells.

- 15. Assertion :** Deficiency of silicon results in stunted growth and leaf necrosis in rice.

**Reason :** Silicon is considered as a non-essential element and is so far not included under micronutrients.

- 16. Assertion :** Phosphorus plays an important role in energy transfer, membrane formation and phosphorylation reactions.

**Reason :** Phosphorus is component of nucleotides, phospholipids and other coenzymes.

- 17. Assertion :** The toxicity symptoms of Mn are actually combined deficiency symptoms of Fe, Mg and Ca.

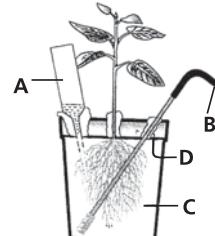
**Reason :** The excess of manganese causes deficiency of iron, magnesium and calcium.

- 18. Assertion :** Plants obtain minerals from the leaf.

**Reason :** The minerals are absorbed by plant in organic form.

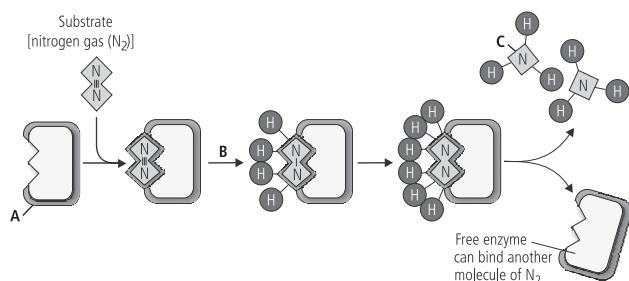
### Figure Based Questions

- 19.** Refer to the given figure and answer the following questions.



- (a) Identify A, B, C and D in given experimental set up.
- (b) State the aim of above given experimental set up.
- (c) Mention the role of A and B in the experiment.

- 20.** Consider the figure showing steps involved in nitrogen fixing reaction and answer the following questions.



- (a) State the function of 'A' in above reaction.
- (b) Identify the step 'B' and the site where this reaction is carried out.
- (c) What is the fate of product 'C'?

### CHAPTER-13 : PHOTOSYNTHESIS IN HIGHER PLANTS

#### Multiple Choice Questions

- 1.** Select the incorrectly matched pair.

- (a) Pelletier and Caventou – Discovered and named chlorophyll
- (b) Blackmann – Propounded the law of limiting factor
- (c) Hatch and Slack – Discovered C<sub>3</sub> pathway
- (d) Arnon – Discovered photophosphorylation

- 2.** Select the correct statement regarding photosynthetic pigments.

- (a) The curve representing the amount of absorption at different wavelengths of light by a photosynthetic pigment is called as absorption spectrum.
- (b) Chl a and chl b absorb maximum light in blue and red wavelengths of light.
- (c) Rate of photosynthesis is maximum in blue and red wavelengths of light.
- (d) All of these

- 3.** Which of the following statements are incorrect regarding Calvin-Benson cycle?
- Calvin cycle occurs in all photosynthetic plants including both C<sub>3</sub> and C<sub>4</sub> plants.
  - In this cycle, the primary acceptor molecule is 3-phosphoglyceric acid.
  - Ribulose 1, 5-diphosphate or RuBP is the first stable product of photosynthesis.
  - RuBP carboxylase oxygenase or RuBisCo is the most abundant protein of the biological world.
- (i) and (ii)
  - (ii) and (iv)
  - (i) and (iv)
  - (ii) and (iii)
- 4.** The enzyme responsible for the initial fixation of CO<sub>2</sub> in C<sub>4</sub> plants is
- PGA
  - PEP
  - RuBP
  - RuMP.
- 5.** The correct sequence of sites (organelles) in the process of photorespiration are
- chloroplast, Golgi bodies and mitochondria
  - chloroplast, peroxisome and mitochondria
  - mitochondria, nucleus and peroxisome
  - chloroplast, mitochondria and peroxisome.
- 6.** Refer to the given reaction.
- $$2\text{H}_2\text{O} \rightarrow 4\text{H}^+ + \text{O}_2 + 4\text{e}^-$$
- Where does this reaction take place in the chloroplasts of plants?
- Outer surface of thylakoid membrane
  - Inner surface of thylakoid membrane
  - In the matrix (stroma)
  - Intermembrane space
- 7.** Which of the following statements is true regarding RuBisCo in C<sub>4</sub> plants?
- RuBisCo functions purely as carboxylase in C<sub>4</sub>.
  - RuBisCo is located only in mesophyll cells.
  - RuBisCo is found both in bundle sheath cells and mesophyll cells.
  - RuBisCo helps in release of both oxygen and CO<sub>2</sub>.
- 8.** The factor which is not limiting in normal conditions for photosynthesis is
- water
  - chlorophyll
  - light
  - carbon dioxide.
- 9.** In cyclic photophosphorylation, the electron released by reaction centre P<sub>700</sub> is ultimately accepted by
- ferredoxin
  - reaction centre P<sub>700</sub>
  - NADPH<sup>+</sup>
  - reaction centre P<sub>680</sub>.
- 10.** To synthesise a molecule of glucose during dark reaction, the number of ATP and NADPH molecules required are respectively
- 12 and 18
  - 18 and 12
  - 6 and 18
  - 18 and 36.

### Match The Columns

- 11.** Match Column I with Column II.

Column I	Column II
A. PS I	(i) Photolysis of water
B. PS II	(ii) Absorption maximum at 680 nm
C. OEC	(iii) Absorption maximum at 700 nm
D. Carotenoids	(iv) Accessory photosynthetic pigment

- 12.** Match Column I with Column II (There can be more than one match for items in Column I).

Column I	Column II
A. CAM plant	(i) Photorespiration
B. C <sub>4</sub> plant	(ii) Monomorphic chloroplast
C. C <sub>3</sub> plant	(iii) Euphorbia
D. C <sub>2</sub> cycle	(iv) Kranz anatomy
	(v) Succulents
	(vi) Maize
	(vii) Wheat
	(viii) Glyoxylate

### Passage Based Question

- 13.** Complete the given passage with appropriate words or phrases.

Photorespiration is the (i) dependent process of oxygenation of (ii). The sites for photorespiration are chloroplast, (iii) and (iv). This process is also called (v). Photorespiration does not produce energy or reducing power rather consumes energy. There is approximately 25% loss of fixed CO<sub>2</sub> hence it is considered as a highly (vi) process. At high temperature in tropical areas, RuBP carboxylase functions as (vii) and instead of fixing CO<sub>2</sub>, it oxidises ribulose 1, 5 biphosphate (RuBP) to produce 3-carbon (viii) and 2-carbon (ix). As it involves the synthesis of a 2-carbon compound, it is called (x).

### Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

- if both A and R are true and R is the correct explanation of A
- if both A and R are true but R is not the correct explanation of A
- if A is true but R is false
- if both A and R are false.

- 14. Assertion :** C<sub>4</sub> plants are more efficient than C<sub>3</sub> plants.

**Reason :** Photorespiration is suppressed in C<sub>4</sub> plants.

- 15.** **Assertion :** C<sub>3</sub> plants respond to increased CO<sub>2</sub> concentration by increasing the rate of photosynthesis.  
**Reason :** The higher productivity of some greenhouse crops such as tomatoes and bell pepper is due to increased CO<sub>2</sub> concentration.

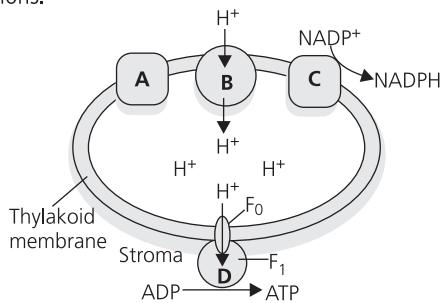
**16.** **Assertion :** The reaction centre of photosystem I is P<sub>700</sub>.  
**Reason :** PS I is concerned with photolysis of water.

**17.** **Assertion :** Chlorophyll a is found in all photosynthetic plants except bacteria.  
**Reason :** Chlorophyll a is accessory photosynthetic pigment.

**18.** **Assertion :** Action spectrum is a graphical representation of the amount of energy absorbed by various pigments at different wavelengths of light.  
**Reason :** Action spectrum shows the amount of light absorbed at same wavelength.

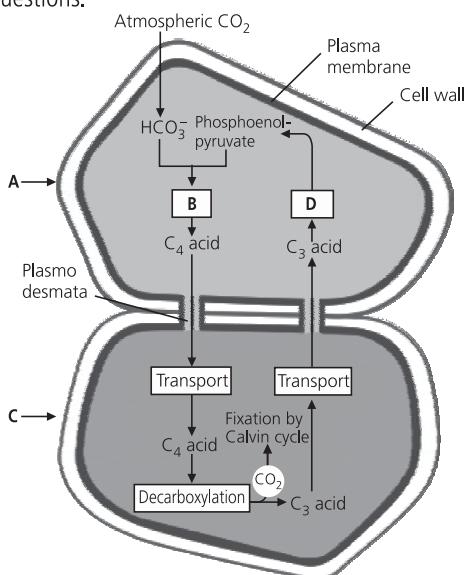
## **Figure Based Questions**

- 19.** Consider the given figure and answer the following questions.



- (a) Identify the parts labelled as A,B, C and D.  
(b) Name the process being depicted by above figure.  
(c) State the role of D in this process.

20. Refer to the given figure and answer the following questions.



- (a) Identify A, B, C and D in the above schematic description of a process.
  - (b) Name the process being represented by above figure.
  - (c) State a characteristic feature of plants undergoing this process. Give an example.

## **CHAPTER-14 : RESPIRATION IN PLANTS**

## Multiple Choice Questions

- (iii) synthesis of ATP by the oxidation of NADH and FADH<sub>2</sub>
- (iv) ATP synthase enzyme for the synthesis of ATP
- (a) both (i) and (ii)
- (b) both (i) and (iii)
- (c) both (ii) and (iii)
- (d) both (iii) and (iv).

**Q7.** How many ATPs are formed from the oxidation of NADH and FADH<sub>2</sub> molecule respectively?

- (a) 3 and 2
- (b) 2 and 3
- (c) 1 and 2
- (d) 3 and 4

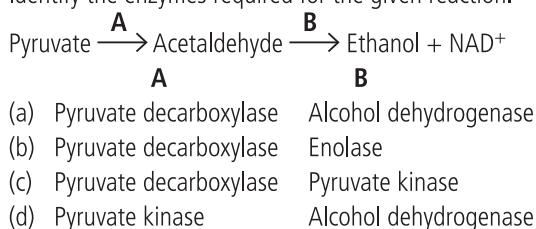
**Q8.** Which of the following reaction is not an example of oxidative decarboxylation?

- (a) Conversion of pyruvate to acetyl CoA
- (b) Conversion of oxaloacetate to citrate
- (c) Conversion of isocitrate to  $\alpha$ -ketoglutarate
- (d) Conversion of  $\alpha$ -ketoglutarate to succinyl CoA

**Q9.** Which of the following options does not hold true regarding anaerobic respiration or fermentation?

- (a) Occurs inside the mitochondria
- (b) Partial breakdown of glucose occurs
- (c) Net gain of only 2 ATP molecules
- (d) None of these

**Q10.** Identify the enzymes required for the given reaction.



### Match The Columns

**11.** Match Column I with Column II.

<b>Column I</b> <b>(Respiratory substrate)</b>	<b>Column II</b> <b>(Respiratory quotient)</b>
A. Oxalic acid	(i) 0.9
B. Glucose	(ii) 0.7
C. Tripalmitin	(iii) 1.3
D. Malic acid	(iv) 1.0
E. Protein	(v) 4.0

**12.** Match Column I with Column II (There can be more than one match for items in column I).

<b>Column I</b>	<b>Column II</b>
A. 2C compound	(i) Citric acid
B. 3C compound	(ii) Phosphoglyceric acid
C. 4C compound	(iii) OAA
D. 6C compound	(iv) Ethanol

- (v) Glyceraldehyde phosphate
- (vi) Acetyl CoA
- (vii) Succinic acid
- (viii) Fructose biphosphate

### Passage Based Question

**13.** Complete the given passage with appropriate words or phrases.

Krebs' cycle is a cyclic pathway comprising of (i) steps that occurs inside the (ii). It involves stepwise oxidation of activated acetate derived from (iii). (iv) is considered as the connecting link between glycolysis and Krebs' cycle. The acceptor molecule of Krebs' cycle is (v). It is followed by two successive steps of (vi), leading to the formation of  $\alpha$ -ketoglutaric acid and then (vii). (vii) is oxidised to oxaloacetate allowing the cycle to continue. Krebs' cycle produces (viii) ATPs, (ix) NADH and (x) FADH<sub>2</sub> for every two molecules of acetyl CoA.

### Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

- (a) if both A and R are true and R is the correct explanation of A
- (b) if both A and R are true but R is not the correct explanation of A
- (c) if A is true but R is false
- (d) if both A and R are false.

**14. Assertion :** The first step in TCA cycle is the condensation of pyruvate with oxaloacetic acid and water.

**Reason :** The first step of TCA cycle is catalysed by the enzyme pyruvate synthase.

**15. Assertion :** Glycolysis occurs during both aerobic and anaerobic respiration.

**Reason :** CO<sub>2</sub> is evolved during glycolysis.

**16. Assertion :** Fermentation generally utilises NADH produced during glycolysis.

**Reason :** Fermentation does not produce ATP.

**17. Assertion :** Metabolic water is formed at the end of ETC.

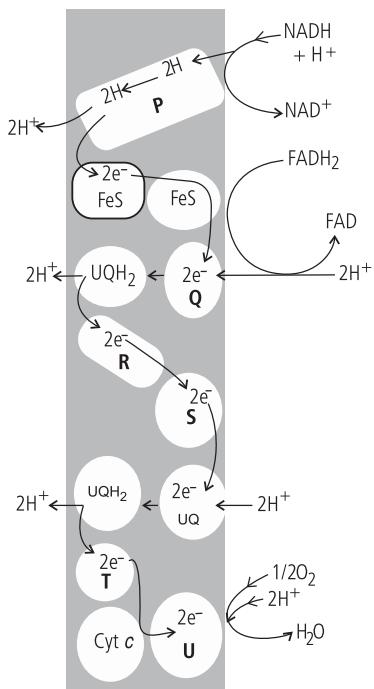
**Reason :** Oxygen is the ultimate acceptor of electrons in ETC.

**18. Assertion :** Two turns of Krebs' cycle occurs for the breakdown of a single glucose molecule.

**Reason :** Two pyruvic acid molecules are produced from a glucose molecule.

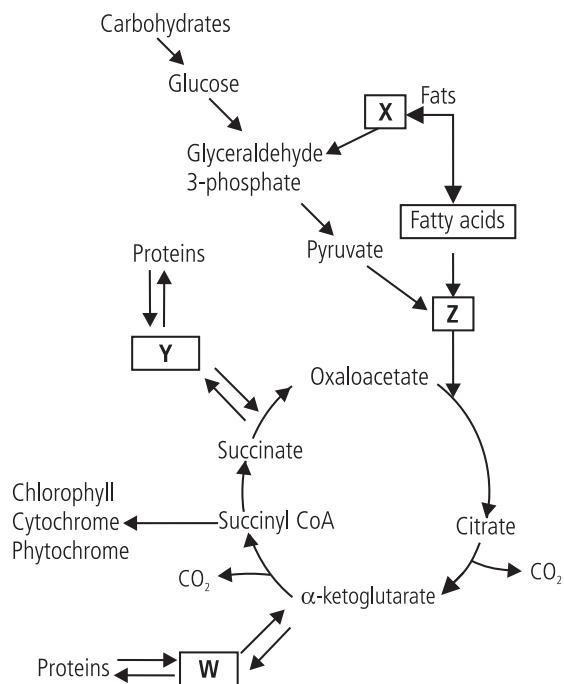
### Figure Based Questions

**19.** Refer to the given figure representing mitochondrial electron transport chain and answer the following questions.



- (a) Identify the components labelled as P, Q, R, S, T and U.  
 (b) What does R, S, T and U represent in ETC?  
 (c) State the role of P in ETC.

20. Refer to the given figure showing interrelationship among metabolic pathways and answer the following questions.



- (a) Identify the intermediate substrates W, X, Y and Z that enters the Krebs' cycle.

- (b) Name any two compounds synthesised each by Y and Z.  
 (c) What is the significance of cycle mentioned above?

## CHAPTER-15 : PLANT GROWTH AND DEVELOPMENT

### Multiple Choice Questions

1. The gibberellins have been commercially exploited for  
 (a) promoting femaleness in flowers  
 (b) increasing the shelf life of marketed vegetables  
 (c) production of parthenocarpic pomaceous fruits  
 (d) preventing lodging in crop plants.

2. Select the mismatched pair.

- |                   |                    |
|-------------------|--------------------|
| (a) Auxin         | - Kogl et. al.     |
| (b) Cytokinin     | - Miller et. al.   |
| (c) Ethylene      | - Skoog et. al.    |
| (d) Abscisic acid | - Addicott et. al. |

3. Identify the correct pair of synergistic hormones.

- |                                  |
|----------------------------------|
| (a) Ethylene and gibberellins    |
| (b) Abscisic acid and ethylene   |
| (c) Cytokinins and abscisic acid |
| (d) Cytokinins and ethylene      |

4. Which of the following statements are correct regarding vernalisation?

- (i) It increases yield of crop, imparts resistance to cold and many diseases.
  - (ii) It helps in removal of kernel wrinkles of *Triticale*.
  - (iii) It is believed to be mediated by a chemical named as florigen.
  - (iv) Its effect cannot be reversed even by high temperature treatment.
- |                         |                               |
|-------------------------|-------------------------------|
| (a) (i) and (ii)        | (b) (i) and (iii)             |
| (c) (i), (ii) and (iii) | (d) (i), (ii), (iii) and (iv) |

5. The example of redifferentiated cells are

- |                                      |
|--------------------------------------|
| (a) interfascicular vascular cambium |
| (b) wound cambium                    |
| (c) cork cambium                     |
| (d) cork cells.                      |

6. Read the given statements and select the option stating which ones are true (T) and which ones are false (F).

- I. Phytohormone GA<sub>3</sub> are derivatives of terpenes.
- II. Compounds such as salicylic acid and jasmonic acid also regulate the growth of plant.
- III. Abscisic acid, auxin and ethylene are the plant growth inhibitors while cytokinins and gibberellins are plant growth promoters.
- IV. Plant growth inhibitors are important for plant responses during wound, biotic and abiotic stress.

- V. Cytokinins promote cell growth while auxin is involved only in cell division.

I	II	III	IV	V
(a) T	T	F	F	T
(b) F	F	T	T	T
(c) T	T	F	T	F
(d) F	T	F	T	F

7. Select the incorrect option from the given table representing certain conditions of light period that induces (✓) or inhibits (✗) flowering in short day plant (SDP) and long day plant (LDP).

Conditions	SDP	LDP
(a) Complete dark	✓	✗
(b) Dark period interrupted by light	✓	✗
(c) Light period interrupted by dark	✓	✗
(d) Alternate short period of light and dark	✗	✓

8. Cytokinins are essential phytohormone for tissue culture because they  
 (a) promote cell division as well as morphogenesis  
 (b) delay senescence  
 (c) overcome seed dormancy  
 (d) causes bolting.
9. In sunflower, phototropic responses of shoot tips are due to  
 (a) production of auxins  
 (b) redistribution of auxins  
 (c) redistribution of gibberellins  
 (d) photoperiodism.
10. The example of day indeterminate plant is  
 (a) *Bryophyllum*      (b) *Spinacea oleracea*  
 (c) wild kidney bean    (d) cotton.

### Match The Columns

11. Match Column I with Column II.

Column I (Plant type)	Column II (Photoperiod)
A. Short day plants	(i) Any duration of light hours
B. Long day plants	(ii) Light period of 14-16 hours
C. Day neutral plants	(iii) Short photoperiods for blossoming
D. Long-short day plants	(iv) Dark period of 14-16 hours
E. Short-long day plants	(v) Short photoperiod for floral initiation

12. Match Column I with Column II (There can be more than one match for items in Column I).

Column I (Hormones)	Column II (Functions)
A. Auxins	(i) Replaces vernalisation
B. Cytokinins	(ii) Promote division in the cells of vascular cambium
C. Ethylene	(iii) Stimulates transverse growth
D. Abscisic acid	(iv) Development of seedless fruits
E. Gibberellins	(v) Stops cambium activity
	(vi) Phloem transport
	(vii) Increase storage of solutes inside the cells
	(viii) Antitranspirant
	(ix) Accumulation of salts inside the cells
	(x) Induces epinasty

### Passage Based Question

13. Complete the given passage with appropriate words or phrases.

Auxin is synthesised from amino acid (i), in shoot apices, (ii) and (iii). (iv) is an universal natural auxin. (v) is widely used as herbicide to kill dicot weeds. The first naturally obtained cytokinin was (vi). (vii) is produced in plants from the amino acid methionine. Abscisic acid is formed from (viii) and produced in many parts of the plants but more abundantly inside the (ix) of green cells.

### Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

- (a) if both A and R are true and R is the correct explanation of A  
 (b) if both A and R are true but R is not the correct explanation of A  
 (c) if A is true but R is false  
 (d) if both A and R are false.

14. **Assertion :** Ethylene causes climacteric ripening of fruits.  
**Reason :** Ethylene is a gaseous hormone.

15. **Assertion :** Abscisic acid is antagonistic to gibberellins.  
**Reason :** Abscisic acid induces dormancy whereas gibberellin helps to overcome natural dormancy of seeds, etc.

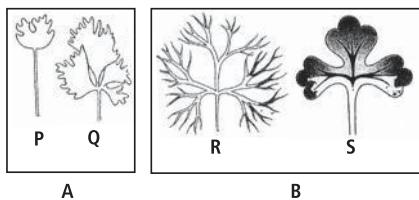
16. **Assertion :** Short day plants do not flower under long photoperiods.  
**Reason :** Short day plants usually flower between spring and summer.

- 17.** **Assertion :** Proper dehydration of protoplasm is must before vernalisation treatment.  
**Reason :** Vernalisation increases the vegetative phase of a plant.

**18.** **Assertion :** Sigmoid growth curve is typical of higher plants growing in their natural environment.  
**Reason :** Limited nutrient availability slows down the geometric growth and leads to stationary phase.

## Figure Based Questions

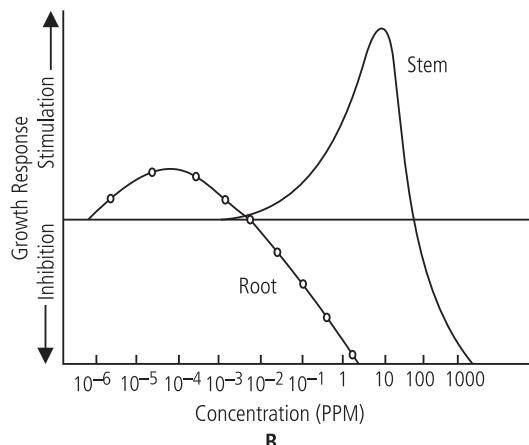
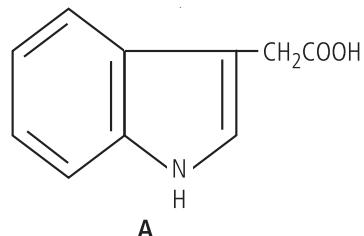
- 19.** Refer to the given figures showing leaves of plant A (P, Q) and plant B (R, S) and answer the following questions.



- (a)** Which phenomenon is represented by the differently shaped *i.e.*, P, Q and R, S leaves of above shown A and B plants?

**(b)** Give one difference in the phenomenon occurring in two given plants A and B.

**20.** Refer to the given structure of a hormone (A) whose various concentration effect is shown in the graph (B). Answer the following questions based on given



- (a) Identify the structure of hormone A.
  - (b) What can be concluded regarding action of A from the given graph B?
  - (c) Describe the movement of hormone A in both stem and root

# SOLUTIONS

## CHAPTER-11 : TRANSPORT IN PLANTS



tension and does not respond to the gravitational pull. Run-away water (X) is not absorbed by soil and quickly washes into nearby water bodies or other harvesting sites, etc. Most of it is re-evaporated. Hygroscopic water (Y) is very tightly held by soil particles and forms very thin films around them hence cannot be readily absorbed by plants.

- 20.** (a) The given figure shows the section of a leaf wherein A is water stoma, B is guard cell and C represents epithem cells.

(b) Parts A, B and C constitute the structure called hydathode. Epithem (C) is a group of loosely arranged achlorophyllous, parenchymatous cells lying over tip of vascular strand. They communicate to the outside through a permanent pore called water pore or stoma (A) guarded by guard cells (B). Hydathode takes part in exudation of liquid due to development of positive pressure in xylem present in vein ending.

## CHAPTER-12 : MINERAL NUTRITION

1. (c) 2. (a) 3. (c) 4. (d) 5. (b)  
 6. (b) 7. (a) 8. (c) 9. (b) 10. (c)
11. A-(ii), B-(i), C-(iv), D-(iii), E-(v)  
 12. A-(iv, viii), B-(iii, v), C-(i, vi), D-(ii, vii)  
 13. (i) flavonoids and betaines  
 (ii) nod factors  
 (iii) infection thread (iv) nodules  
 (v) auxin (vi) cytokinin  
 (vii) bacteriods (viii) leghaemoglobin  
 (ix) nitrogenase (x) nif and fix
14. (c) 15. (b) 16. (b) 17. (a) 18. (d)  
 19. (a) In the above described experimental set up, A is funnel, B is aerating tube, C is nutrient solution and D is cork.  
 (b) The experimental set up shows a nutrient solution culture in which the plants are raised to determine the essentiality of mineral nutrients and their deficiency symptoms, toxicity etc.  
 (c) The funnel (A) is required for adding nutrients and water to the culture solution. The aerating tube (B) provides regular aeration required for proper growth. Adequate aeration of nutrient solution is essential to supply oxygen to roots so as to obtain optimum root growth and mineral uptake.  
 20. (a) 'A' is identified as enzyme nitrogenase. It is responsible for the reduction of free nitrogen. The bonds between two atoms of nitrogen becomes weak by binding with the metallic components (Fe and Mo) of nitrogenase. This weakened molecule of nitrogen is reduced by a coenzyme.  
 (b) The step 'B' shows reduction of dinitrogen by hydrogen molecules from a reduced coenzyme. This reaction takes

place inside nodules of nitrogen fixing bacteria e.g., *Rhizobium* under anaerobic conditions.

- (c) The product 'C' formed is ammonia ( $\text{NH}_3$ ). It is not liberated, rather it is protonated to form ( $\text{NH}_4^+$ ) ammonium ions. Since ammonium is toxic to plants even in small quantities, it cannot be accumulated and is used to synthesise amino acids in plants.

## CHAPTER-13 : PHOTOSYNTHESIS IN HIGHER PLANTS

1. (c) 2. (d) 3. (d) 4. (b) 5. (b)  
 6. (b) 7. (a) 8. (b) 9. (b) 10. (b)
11. A-(iii), B-(ii), C-(i), D-(iv)  
 12. A-(iii, v); B-(iv, vi); C-(ii, vii); D-(i, viii)  
 13. (i) light (ii) ribulose biphosphate  
 (iii) peroxisome (iv) mitochondria  
 (v) photosynthetic carbon (vi) wasteful oxidative cycle  
 (vii) oxygenase (viii) phosphoglyceric acid  
 (ix) phosphoglycolate (x)  $\text{C}_2$  cycle
14. (a) 15. (b) 16. (c) 17. (c) 18. (d)  
 19. (a) In the given figure, A-represents PS II, B-Cyt b and f complex, C-PS I and D-ATP synthase.  
 (b) The figure shows the synthesis of ATP through chemiosmosis.  
 (c) ATP synthase helps in breaking down the proton gradient developed across the thylakoid, by allowing movement of protons through its transmembrane channels ( $\text{CF}_0$ ). This facilitated diffusion of protons to other side brings about conformational changes in  $\text{CF}_1$  particle of ATPase. Thus, ATP is formed from ADP and  $\text{P}_i$ . For every two protons that pass through ATPase one molecule of ATP is formed.

20. (a) In the diagram, A is mesophyll cell, B is fixation of  $\text{CO}_2$ , C is bundle sheath cell and D is regeneration of PEP.  
 (b) The figure shows the Hatch and Slack pathway of carbon fixation in plants. It is also called as  $\text{C}_4$  cycle since the first stable product of  $\text{CO}_2$  fixation is a 4C compound, i.e., oxaloacetate.  
 (c) The plants showing this pathway are called  $\text{C}_4$  plants. The  $\text{C}_4$  plants show kranz anatomy, peculiar to them wherein the vascular bundles are surrounded by large bundle sheath cells arranged in wreath like fashion. E.g., maize, sugarcane etc.

## CHAPTER-14 : RESPIRATION IN PLANTS

1. (c) 2. (b) 3. (c) 4. (c) 5. (b)  
 6. (d) 7. (a) 8. (b) 9. (a) 10. (a)
11. A-(v), B-(iv), C-(ii), D-(iii), E-(i)  
 12. A-(iv, vi), B-(ii, v), C-(iii, vii), D-(i, viii)

## Spellathon

1. Make as many biological terms as possible using the given letters. Each word should contain the letter given in circle.
2. Minimum 4 letter word should be made.
3. In making a word, a letter can be used as many times as it appears in the box.
4. Make at least 1 seven letter word.



Send your response at [editor@mtg.in](mailto:editor@mtg.in) or post to us with complete address by 25<sup>th</sup> of every month to win exciting prizes. Winners' name will be declared on 1<sup>st</sup> of every month on [www.mtg.in](http://www.mtg.in)

- 13.** (i) ten (ii) mitochondrial matrix  
(iii) pyruvate (iv) Acetyl CoA  
(v) oxaloacetic acid (vi) decarboxylation  
(vii) succinyl-CoA (viii) 2  
(ix) 6 (x) 2

**14.** (d)    **15.** (c)    **16.** (c)    **17.** (a)    **18.** (a)

- The labelled parts represent:

  - P - Flavin mononucleotide (FMN)
  - Q - Ubiquinone (UQ)
  - R - Cytochrome *b* (Cyt *b*)
  - S - FeS complex
  - T - Cytochrome *c*<sub>1</sub> (Cyt *c*<sub>1</sub>)
  - U - Cytochrome *a-a*<sub>3</sub> (Cyt *a-a*<sub>3</sub>)

**(b)** The electron transport chain comprises of four complexes (I to IV). Here in this chain, R (cytochrome  $b$ ), S (FeS complex) and T (cytochrome  $c_1$ ) represents complex III i.e., UQH<sub>2</sub>-cytochrome c reductase, while U (cytochrome a and cytochrome  $a_3$ ) represents complex IV i.e., cytochrome c oxidase.

(c) The electrons and protons pass from NADH to FMN. The FMN gets reduced to  $\text{FMNH}_2$  and breaks to release protons and electrons. These electrons moves to FeS complex and from there to O<sub>2</sub>.

**20. (a)** In the given figure the substrates are :

- W - Glutamate  
X - Glycerol  
Y - Aspartate  
Z - Acetyl CoA.

**(b)** The intermediate products of Krebs' cycle 'Y' i.e., aspartate forms pyrimidines and alkaloids. The product 'Z' acetyl CoA participates in synthesis of various compounds viz, fatty acids, steroids, terpenes, gibberellins, etc.

(c) The significance of Krebs' cycle are as follows:

- (i) It is a common metabolic pathway for the oxidative breakdown and energy production from carbohydrates, fats and proteins.
  - (ii) It is an amphibolic pathway (both catabolic and anabolic) involving oxidation of carbohydrates, fats and

proteins (catabolic) as well as synthesis (anabolism) of amino acids like aspartate and glutamate, synthesis of chlorophyll, cytochromes, etc.

CHAPTER-15 : PLANT GROWTH AND DEVELOPMENT

- 1.** (c)    **2.** (c)    **3.** (b)    **4.** (a)    **5.** (d)  
**6.** (c)    **7.** (b)    **8.** (a)    **9.** (c)    **10.** (d)

**11.** A-(iy), B-(ii), C-(i), D-(iji), E-(y)

**12.** A-(ii, viii); B-(vi, ix); C-(iii, x); D-(v, viii); E-(i, iv)

**13.** (i) tryptophan (ii) leaf primordia  
(iii) developing seed (iv) Indole 3-acetic acid  
(v) 2,4-D (vi) zeatin  
(vii) Ethylene (viii) xanthophyll  
(ix) chloroplasts

14. (b) 15. (a) 16. (c) 17. (d) 18. (a)

19. (a) In both cases, plants show the phenomenon of heterophylly. Heterophylly is the occurrence of different types of leaves on the same plant in different growth phases or under different environmental conditions. In A-larkspur, the juvenile leaves (P) are broadly lobed while mature leaves (Q) are divided pinnately, while in B-buttercup plant, the submerged leaves (R) are highly dissected while the emerged leaves (S) are lobed and broad.

(b) Though both the plants show heterophily but the leaves of larkspur (P and Q) show intrinsic plasticity and leaves of buttercup (R and S) show environmental plasticity.

**20. (a)** The given structure is of hormone auxin (Indole 3-acetic acid).

(b) From the graph, following points can be concluded about auxin –

- (i) It helps in the elongation of both root and shoot but the optimum concentration for the two is different. For stem growth, optimum concentration is 10 ppm while for root growth it is 0.0001 ppm.

(ii) At higher concentration, it acts as growth inhibitor.  
Auxin movement is polar. It is basipetal in stem but acropetal in the root.

1

ANSWERS	WHO AM I...	MPP CLASS XII	ANSWER	KEY
1. Fructose	Pg. 14	1. (a)    2. (c)    3. (b)    4. (a)	5. (d)	
2. ATP	Pg. 18	6. (b)    7. (b)    8. (d)    9. (b)	10. (a)	
3. Statin	Pg. 42	11. (c)    12. (b)    13. (a)    14. (d)	15. (d)	
4. Biogas	Pg. 48	16. (a)    17. (b)    18. (c)    19. (a)	20. (d)	
		21. (a)    22. (a)    23. (a)    24. (b)	25. (d)	
		26. (c)    27. (a)    28. (a)    29. (b)	30. (a)	
		31. (d)    32. (d)    33. (b)    34. (c)	35. (c)	
		36. (b)    37. (c)    38. (b)    39. (b)	40. (a)	

# MPP-3

## MONTHLY Practice Problems

Class XI

This specially designed column enables students to self analyse their extent of understanding of specified chapters. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

- Morphology of Flowering Plants
- Anatomy of Flowering Plants

**Total Marks : 160**

**Duration : 40 Min.**

1. Identify the correct match with respect to part of root and its function.
 

(a) Root cap – Anchors the plant firmly in soil	(b) Meristematic zone – Protects the root from friction of soil particles	(c) Root hair zone – Increases the surface area of root for water absorption	(d) Zone of mature cells – Ensures continued water supply to the plant even on maturation
---	---	--	---
2. In a unilocular ovary, ovules are borne around a central column which is not connected with the ovary wall by any septum. Identify the type of placentation found in this ovary.
 

(a) Axile	(b) Parietal
(c) Free central	(d) Basal
3. Identify the correctly matched pair given along with its description.
 

(a) Meristem	- Simple tissue which can divide and form new cells
(b) Parenchyma	- Simple permanent tissue which possesses pectocellulose thickenings
(c) Collenchyma	- Morphologically and physiologically unspecialised tissue
(d) Sclerenchyma	- Cutinised parenchyma modified to form a protective covering on plant parts
4. Match column I with column II and column III and select the correct option.
 

<b>Column I</b>	<b>Column II</b>	<b>Column III</b>
A. Trailer	(i) Fleshy underground stem that continues to grow indefinitely in the soil	p. <i>Euphorbia</i>
- B. Rhizome (ii) Spread horizontally along the ground with branches spreading in all directions
- C. Corm (iii) Underground oval or spherical structure with spirally arranged depressions called eyes
- D. Tuber (iv) Short, thick, spherical or subspherical underground stem that grows vertically in the soil
 

(a) A-(ii)-p; B-(i)-q; C-(iv)-s; D-(iii)-r
(b) A-(iii)-q; B-(i)-r; C-(ii)-p; D-(iv)-s
(c) A-(i)-p; B-(ii)-q; C-(iii)-r; D-(iv)-s
(d) A-(iv)-s; B-(i)-p; C-(ii)-q; D-(iii)-r
5. Read the given statements and select the correct option.
 

**Statement A :** In *Nymphaea*, the seed is called perispermic seed.

**Statement B :** In *Nymphaea*, the food is stored in nucellus.

(a) Both statements A and B are correct and B is the correct explanation of A.
(b) Both statements A and B are correct but B is not the correct explanation of A.
(c) Statement A is correct but statement B is incorrect.
(d) Both statements A and B are incorrect.
6. Select the correctly matched pair given in context of derivatives of vegetative shoot apex.
 

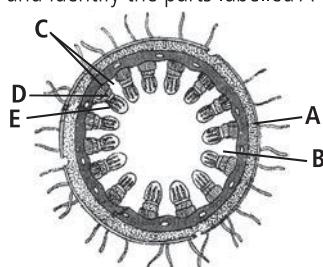
(a) Dermatogen	- Endodermis
(b) Periblem	- Cortex
(c) Plerome	- Epidermis
(d) Protoderm	- Pericycle

- 7.** Choose the incorrect statement out of the following.  
 (a) Trichomes are multicellular outgrowths of epidermis.  
 (b) Epidermis is the outermost protective layer of plant body.  
 (c) Periderm is the outermost boundary of vascular strand.  
 (d) Endodermis is the innermost layer of cortex.
- 8.** Select the correct option to fill up the blanks in the following statements regarding types of fruit.  
 I. (i) develops from single simple or compound ovary of a flower.  
 II. Simple succulent fruit that develops from an inferior compound ovary is (ii).  
 III. (iii) developed from hypanthodium inflorescence, has small pore protected by scaly leaves.  
 IV. In (iv) the endocarp is stony and usually encloses one seed only.  
 (i) (ii) (iii) (iv)  
 (a) Simple fruit pome Syconus drupe  
 (b) Capsular fruit pome Lomentum pepo  
 (c) Simple fruit pepo Balausta drupe  
 (d) Capsular fruit regma Syconus pome
- 9.** Match column I with column II and select the correct option.
- | <b>Column I</b> | <b>Column II</b>      |
|-----------------|-----------------------|
| A. Succulent    | (i) <i>Corypha</i>    |
| B. Epiphyte     | (ii) <i>Euphorbia</i> |
| C. Holoparasite | (iii) <i>Vanda</i>    |
| D. Monocarpic   | (iv) <i>Cuscuta</i>   |
- (a) A-(iii), B-(ii), C-(iv), D-(i)  
 (b) A-(ii), B-(iii), C-(iv), D-(i)  
 (c) A-(iv), B-(ii), C-(iii), D-(i)  
 (d) A-(i), B-(ii), C-(iii), D-(iv)
- 10.** Select the incorrect difference between the given types of parenchymatous tissue.

	<b>Chlorenchyma</b>	<b>Aerenchyma</b>
(i)	It is parenchyma containing chloroplasts.	It is parenchyma containing air cavities.
(ii)	The cells are small.	The cells are large.
(iii)	It performs photosynthesis.	It provides buoyancy.

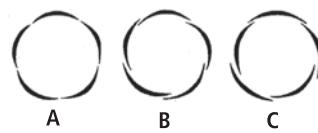
- (a) (i) and (ii) (b) (iii) only  
 (c) (ii) only (d) (ii) and (iii)

- 11.** Study the given figure of transverse section of stem of sunflower and identify the parts labelled A-E.



- | <b>A</b>          | <b>B</b>      | <b>C</b>      | <b>D</b> | <b>E</b> |
|-------------------|---------------|---------------|----------|----------|
| (a) Epidermis     | Medullary ray | Pericycle     | Phloem   | Xylem    |
| (b) Cuticle       | Medullary ray | Pericycle     | Xylem    | Phloem   |
| (c) Epidermis     | Pericycle     | Medullary ray | Xylem    | Cambium  |
| (d) Medullary ray | Epidermis     | Cortex        | Phloem   | Xylem    |

- 12.** The type of inflorescence found in Family Compositae is  
 (a) umbel (b) spike  
 (c) corymb (d) capitulum.
- 13.** In *Nepenthes* and *Sarracenia* the leaf pitchers are meant for  
 (a) catching and digesting insects  
 (b) storing rain water  
 (c) storing air for gaseous exchange  
 (d) floating as they act as balancers.
- 14.** Which of the following functions are irrelevant to xylem?  
 I. Provides mechanical strength  
 II. Conduction of water and mineral salts to the shoot  
 III. Helps in the storage of food  
 IV. Transportation of organic food to various parts of the plant  
 (a) I and III (b) II and IV  
 (c) I, II and III (d) IV only
- 15.** Which of the following tissues of primary dicot root function as a check post to allow entry of substances inside?  
 (a) Epiblema (b) Endodermis  
 (c) Pericycle (d) Cortex
- 16.** Select the option that correctly identifies the type of aestivation shown in the given figures.



- (a) A-Vexillary, B-Twisted, C-Valvate  
 (b) A-Twisted, B-Imbricate, C-Valvate  
 (c) A-Valvate, B-Twisted, C-Quincuncial  
 (d) A-Imbricate, B-Valvate, C-Twisted

- 17.** Identify the family to which the given floral diagram belongs.

- (a) Papilionaceae  
 (b) Solanaceae  
 (c) Liliaceae  
 (d) Poaceae



- 18.** Select the correct option to fill up the blanks.

In *Canna*, a special type of parenchyma tissue is found, known as (i). It consists of a network of cells which encloses very large (ii) that provide (iii) to the plant.

- | (i)             | (ii)                 | (iii)                  |
|-----------------|----------------------|------------------------|
| (a) prosenchyma | air cavities         | synthesised inclusions |
| (b) aerenchyma  | intercellular spaces | storage of food        |
| (c) prosenchyma | intercellular spaces | reserve food           |
| (d) aerenchyma  | air cavities         | buoyancy               |

**19.** Identify the incorrectly matched pair.

- |                 |                  |
|-----------------|------------------|
| (a) Hardwood    | - Porous wood    |
| (b) Spring wood | - Early wood     |
| (c) Late wood   | - Heart wood     |
| (d) Soft wood   | - Nonporous wood |

**20.** Identify the correct floral formula for *Withania somnifera*.

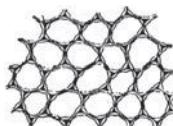
- |   |  |
|---|--|
| (a) ♂ K <sub>(5)</sub> C <sub>(5)</sub> A <sub>5</sub> G <sub>(2)</sub>       | (b) ♀ P <sub>(3+3)</sub> A <sub>3+3</sub> G <sub>(3)</sub> |
| (c) ♂ K <sub>(5)</sub> C <sub>1+2+(2)</sub> A <sub>1+(9)</sub> G <sub>1</sub> |  |
| (d) ♀ K <sub>(4)</sub> C <sub>4</sub> A <sub>4</sub> G <sub>1</sub>           |  |

**21.** Which of the following modification of aerial stem does not help in reduction of transpiration in plants?

- |             |                 |
|-------------|-----------------|
| (a) Cladode | (b) Phylloclade |
| (c) Prickle | (d) Offset      |

**22.** Refer to the given figure and identify its correct structural characteristics.

- (a) Thickenings are present at the angles.
- (b) Thickenings occur on the tangential walls.
- (c) Thickenings are found on the walls bordering intercellular spaces.
- (d) None of these



**23.** Select the incorrect statements regarding morphology of roots.

- I. The radicle grows directly into tap root system.
  - II. Respiratory roots come out of water and pick up carbon dioxide directly from atmosphere.
  - III. Roots that grow from any part of the plant other than radicle are called adventitious roots.
  - IV. Parasitic roots possess a covering of dead spongy tissue called velamen.
- |               |                  |
|---------------|------------------|
| (a) II and IV | (b) I, II and IV |
| (c) I and III | (d) I and II     |

**24.** Read the given statements and select the correct option.

**Statement A :** Phloem is made up of sieve tubes, companion cells and phloem parenchyma.

**Statement B :** Phloem parenchyma cells are found mostly in dicots and store food.

- (a) Both statements A and B are correct and B is the correct explanation of A.
- (b) Both statements A and B are correct but B is not the correct explanation of A.
- (c) Statement A is correct but statement B is incorrect.
- (d) Both statements A and B are incorrect.

**25.** Consider the following statements and select the incorrect ones.

- I. Protoxylem is first formed xylem, made up of smaller and narrower elements.
  - II. Protophloem is also the first formed phloem in which sieve areas are prominent.
  - III. Metaxylem comprises of larger and broader tracheids and vessels with different wall thickenings.
  - IV. Metaphloem is part of secondary phloem that differentiates after the plant parts or cells have stopped enlargement.
- |               |                    |
|---------------|--------------------|
| (a) I and IV  | (b) II and III     |
| (c) II and IV | (d) II, III and IV |

**26.** Identify the correctly matched pair.

- |             |                         |
|-------------|-------------------------|
| (a) Rhizome | - <i>Amorphophallus</i> |
| (b) Stolon  | - <i>Colocasia</i>      |
| (c) Runner  | - <i>Eichhornia</i>     |
| (d) Twiner  | - <i>Smilax</i>         |

**27.** Identify the family to which the following characteristics belong.

- I. Plants usually perennial herbs or shrubs.
  - II. Leaves are simple and have parallel venation.
  - III. Calyx and corolla undifferentiated.
  - IV. Gynoecium is tricarpellary and syncarpous.
- |               |                |
|---------------|----------------|
| (a) Gramineae | (b) Compositae |
| (c) Liliaceae | (d) Solanaceae |

**28.** Cork of *Quercus suber* is filled with air, hence employed commercially in the manufacture of

- |                     |                   |
|---------------------|-------------------|
| (a) bottle stoppers | (b) insulators    |
| (c) linoleum        | (d) all of these. |

**29.** Which of the following statements are correct with respect to functions of the epidermis in an isobilateral leaf?

- (i) Protection of internal tissues
  - (ii) Gaseous exchange through motor cells
  - (iii) Folding of leaves during drought with the help of bulliform cells
  - (iv) Protection from microbial attack due to silica
- |                         |                  |
|-------------------------|------------------|
| (a) (i) and (ii)        | (b) (i) and (iv) |
| (c) (i), (iii) and (iv) | (d) All of these |

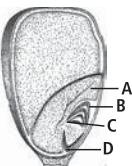
**30.** In monocot root, the vascular bundles are radial, wherein the phloem bundles are separated from xylem bundle by means of a narrow strip of

- |                      |                        |
|----------------------|------------------------|
| (a) Caspian strip    | (b) conjunctive tissue |
| (c) vascular cambium | (d) companion cell.    |

**31.** Complete the following table by correctly identifying X, Y and Z.

	Name	Type	Edible part
(i)	Litchi	Nut	X
(ii)	Apple	Y	Fleshy thalamus
(iii)	Date palm	Berry	Z

X	Y	Z
(a) Aril	Pome	Epicarp and mesocarp
(b) Endocarp	Drupe	Pome
(c) Aril	Pepo	Endocarp
(d) Mesocarp	Berry	Endocarp



32. Study the given diagram of longitudinal section of a maize grain and identify the option correctly describing function of its labelled parts (A-D).

- (a) A - Bears rudimentary leaves
- (b) B - Assists future shoot to pass through soil during germination
- (c) C - Forms future root
- (d) D - Rich in starch grains, fats and proteins

33. The heartwood is stronger and durable than sapwood because

- (a) it is formed of smaller and narrower elements
- (b) it possesses abundant vessels
- (c) tracheids get plugged by sclerenchymatous outgrowths called tyloses
- (d) vessels contain antiseptic extractives, resistant to microbial attack.

34. During secondary growth of dicot stem, the phellogen, phellem and phellogen together constitute

- (a) periderm
- (b) cork cambium
- (c) heartwood
- (d) interfascicular cambium.

35. Select the correct differences among the following types of inflorescence.

	Racemose	Cymose
(i)	Flowers arise laterally.	Flowers are actually terminal.
(ii)	The growing point seldom ends in a flower.	The growing point always forms a flower.
(iii)	Arrangement of flowers is basipetal.	Arrangement of flowers is acropetal.
(iv)	The floral axis is monopodial.	The floral axis is sympodial.

- (a) (i), (ii) and (iv) only
- (b) (i) and (iii) only
- (c) (ii) and (iv) only
- (d) All of these

36. Read the given statements and select the option correctly stating which ones are true (T) and which ones are false (F).

- (i) In root, the primary function of cortex is storage of food.
- (ii) Parenchyma provides turgidity to the softer parts of the plant.

(iii) In *Trapa*, leaves are modified to store air either in lamina or petiole for gaseous exchange and floating.

(iv) Cremocarp are capsular fruits developed from an inferior bilocular ovary of apocarpous pistil with persistent stylodod.

(i) (ii) (iii) (iv)

- |       |   |   |   |
|-------|---|---|---|
| (a) T | T | T | F |
| (b) T | T | F | F |
| (c) T | F | T | T |
| (d) T | F | T | F |

37. Consider the following statements and select the incorrect one.

- (a) Tuberous roots do not have a definite shape.
- (b) In *Nepenthes*, the leaf is modified to form a large pitcher having nectariferous glands.
- (c) The nuclei of sieve tubes control the activities of companion cells through plasmodesmata.
- (d) Phloem parenchyma are living cells of phloem having abundant plasmodesmata.

38. Read the following statements and select the option that correctly fill the blanks.

- I. In *Nerium*, the lower surface of leaf bears deep depressions called (i) having a number of cutinised hair and stomata.
- II. In coconut, the fibrous mesocarp yields (ii).
- III. In the Family Brassicaceae, a false septum that develops between the two parietal placenta is called (iii).

- |               |                |                |
|---------------|----------------|----------------|
| (i)           | (ii)           | (iii)          |
| (a) crypts    | coir           | replum         |
| (b) hydathode | coir           | neutral suture |
| (c) crypts    | coconut milk   | replum         |
| (d) hydathode | placental hair | ventral suture |

39. Select the mismatched pair.

- (a) Mustard - Dicot seed
- (b) Oxalis - Runner
- (c) Hemp - Phloem fibres
- (d) Tamarix - Living phloem fibres

40. Which of the following statements are correct?

- I. Sclerenchyma is the chief mechanical tissue of the mature plant organs.
- II. Pith stores food as well as waste materials.
- III. Phylloclades are green photosynthetic stems of limited growth found in *Ruscus*.
- IV. The flowers having inferior ovary with all the floral organs borne at its top are called hypogynous.

- (a) I, II and IV
- (b) I and II
- (c) II and IV
- (d) I and III

Key is published in this issue. Search now! ☺

## SELF CHECK

Check your score! If your score is

> 90% EXCELLENT WORK ! You are well prepared to take the challenge of final exam.

90-75% GOOD WORK ! You can score good in the final exam.

74-60% SATISFACTORY ! You need to score more next time.

< 60% NOT SATISFACTORY! Revise thoroughly and strengthen your concepts.

# HIGH YIELD FACTS



Class XII

## Microbes in Human Welfare

- Microorganisms are very small organisms that cannot be seen by naked eyes. An individual microbe can be seen only under the microscope however, their colonies are visible with naked eyes also.
- Microbes are **omnipresent** i.e., in soil, water, air, inside the body of plants and animals. They are even found at those sites which are unfavourable to other life forms such as deep inside the thermal vents, hot springs, deep in soil, under the several meters thick layer of snow and highly acidic environment, etc.
- A diverse group of organisms like protozoa, bacteria, fungi, microscopic plants, viruses, viroids and prions are considered as microorganisms.
- Viruses (nucleoprotein entities), viroids (nucleic acids entities), prions (proteinaceous entities) can only be grown inside cells while microbes like bacteria and fungi can be grown in colonies on nutrient media.
- Microbes are infectious agents and are known to cause various diseases and are also responsible for food spoilage but several microbes are very useful in transforming raw food into gastronomic delights, in beverage production, sewage treatment, agriculture and making several industrial products.

### MICROBES IN HOUSEHOLD PRODUCTS

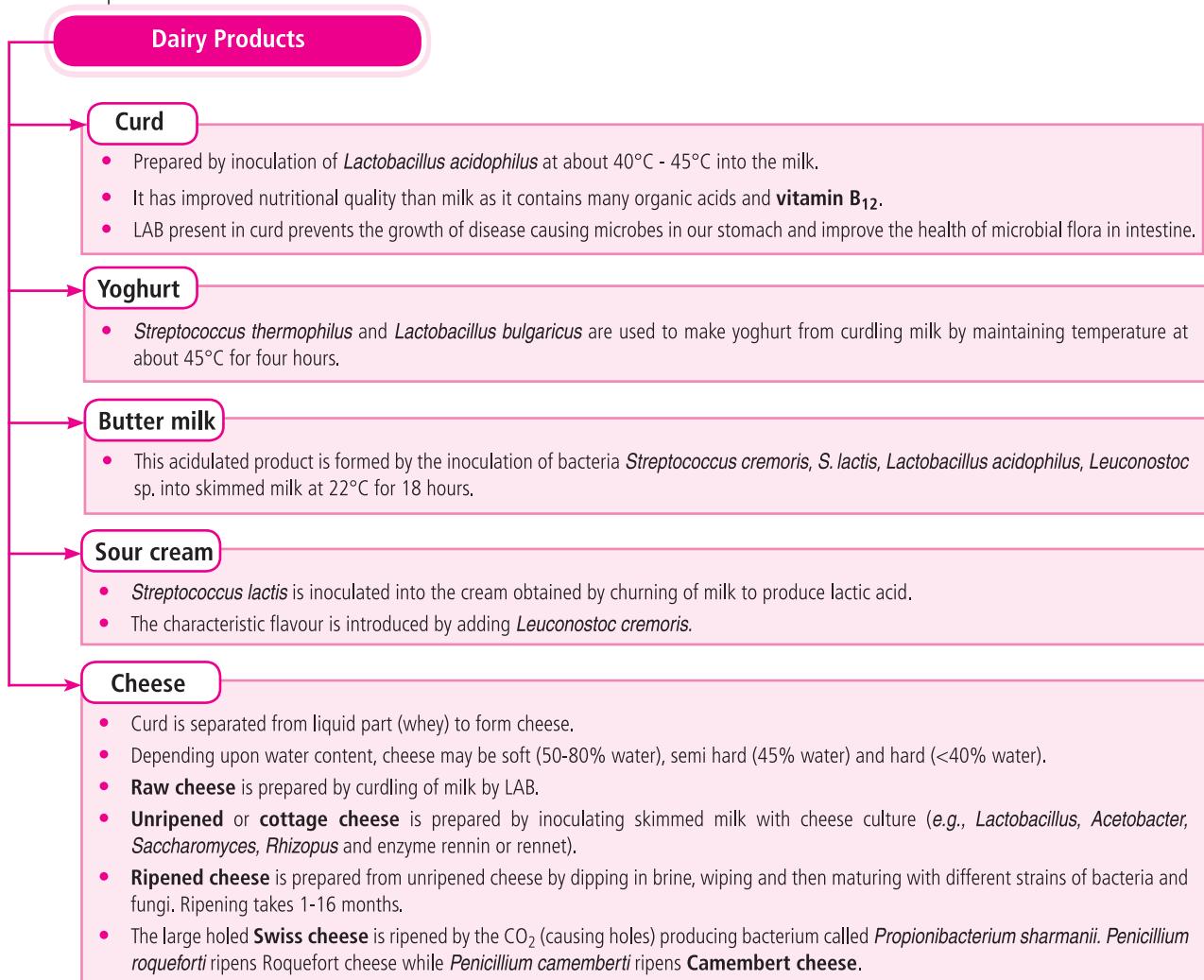
- **Bread** : Dough used for making bread is fermented by using *Saccharomyces cerevisiae* (**Baker's yeast**). Yeast secretes three enzymes; **amylase** (causes breakdown of starch into maltose sugar), **maltase** (converts maltose into glucose) and **zymase** (for fermentation of glucose). Release of carbon dioxide and ethyl alcohol makes bread porous and soft.
- **Dosa, Upma and Idli** : The dough of rice and black gram is fermented by air borne species of bacteria *Leuconostoc* and *Streptococcus* and released carbon dioxide causes puffing of dough.

	Analysis of various PMTs from 2013-2017				
	2013	2014	2015	2016	2017
AIPMT/NEET	1	-	-	3	3
AIMS	1	3	-	3	-
AMU	-	4	1	-	-
Kerala	-	2	1	-	-
K-CET	-	2	1	-	-
J & K	-	1	2	-	-

- **Toddy:** It is a traditional, sweet and refreshing drink of South India made by fermentation of sap of palms. It is a mild intoxicating aromatic wine with 4% alcohol. Toddy left for few hours undergoes fermentation to form alcoholic beverage. Longer fermentation (upto a day) yields stronger, more sour and acidic drink. In some parts of India, toddy is used to produce jaggery and vinegar.
- Microbes are also used to ferment fish and meat, bamboo shoots, soybean and wheat to produce soy sauce, tofu, etc.
- **Microorganisms can be used directly as a food source or supplement to other foods for humans and animals called single cell protein (SCP).** The common SCP are *Spirulina*, yeast and *Fusarium graminearum*. SCP is rich in high quality proteins, vitamins and minerals but poor in fat.

## Dairy Products

- A majority of dairy products are produced by **lactic acid bacteria (LAB)**.
- The starter or inoculum containing millions of LAB is added to milk at suitable temperature. These bacteria multiply and convert lactose sugar of milk into lactic acid. Lactic acid causes coagulation and partial digestion of milk protein casein and that is how curd is produced from milk.



Probiotics are the living microorganisms that are taken orally to promote health and growth by competing with pathogens, inactivating bacterial toxins, producing inhibitors for bacterial growth and by stimulating non-specific immunity. A large variety of probiotics have been prepared for cattle, goats, poultry and humans etc. Most of these contain *Lactobacilli* and/or *Streptococci*. Certain probiotic microorganisms provide additional benefits to humans like anticarcinogenic activity, improvement in lactose intolerance and reduction in the serum cholesterol level.

## MICROBES IN INDUSTRIAL PRODUCTS

- Microbes are used to synthesise a number of industrial products for human use.
- Industrial scale production requires very large vessels called **fermentors** or **bioreactors** to grow microbes.
- Alcoholic beverages and antibiotics are two common industrial products obtained by microbes.

### Fermented Beverages / Alcohol

- *Saccharomyces cerevisiae* (Brewer's yeast) is used for the production of beverages like wine, beer, whisky, brandy or rum, by fermenting malted cereals and fruit juices, to produce ethanol. Production of different types of alcoholic drinks depend on type of raw material for fermentation and type of processing. Wine (9-12% alcohol) and beer (3-6% alcohol) are filtered, pasteurised and bottled without further distillation while distillation of fermented broth is carried out for producing hard liquors like whisky, brandy and rum.

### Antibiotics

- **Antibiotics** are chemicals produced by microbes which can kill or retard the growth of harmful microbes without adversely affecting the host. For example, penicillin (first antibiotic discovered by Alexander Fleming) inhibits the growth of bacterium *Staphylococcus aureus*.
- Antibiotics function either as **bactericides** (kill bacteria) or **bacteriostatic** (inhibit growth of bacteria) by any of these methods: (i) Disruption of cell wall synthesis. (ii) Inhibition of 30S and 50S ribosome functioning. (iii) Disruption of synthesis and repair of plasmalemma. (iv) Inhibition of aa-tRNA binding to ribosome. (v) Inhibition of translation.

**Table:** Some antibiotics obtained from microbes

Microbe	Source	Antibiotic
Eubacteria	<i>Bacillus licheniformis</i>	Bacitracin
	<i>Bacillus polymyxa</i>	Polymyxin
Actinomycetes	<i>Streptomyces griseus</i>	Streptomycin
	<i>Streptomyces venezuelae</i>	Chloramphenicol
	<i>Streptomyces aureofaciens</i>	Tetracycline
	<i>Streptomyces rimosus</i>	Terramycin
	<i>Streptomyces erythreus</i>	Erythromycin
Fungi	<i>Penicillium notatum</i> , <i>P. chrysogenum</i>	Penicillin
	<i>Aspergillus fumigatus</i>	Fumagillin
	<i>Cephalosporium acremonium</i>	Cephalosporin



### Chemicals, Enzymes and Other Bioactive Molecules

- Certain organic acids, enzymes and bioactive molecules are commercially synthesised at industrial scale using microbes.

#### Organic acids

- A number of organic acids which are manufactured with the help of microbes are discussed below.

	Organic acid	Source	Uses
(i)	Acetic acid	Bacteria: <i>Acetobacter aceti</i>	Vinegar production
(ii)	Citric acid	Bacteria: <i>Aspergillus niger</i> , <i>Mucor</i> Yeast: <i>Candida lipolytica</i>	Dyeing, inks, flavouring and preservation of food, etc.
(iii)	Lactic acid	Bacteria: <i>Streptococcus lactis</i> , <i>Lactobacillus</i> Fungi: <i>Rhizopus</i>	Used in confectionery, fruit juices, pickles, canned food, etc.
(iv)	Butyric acid	Bacteria: <i>Clostridium acetobutylicum</i>	Food and perfume additives

## Alcohols

- Yeast, *Mucor*, *Rhizopus* and bacteria are also helpful in the commercial production of ethanol, methanol, propanol and butanol. These alcohols are used as industrial solvents.

## Enzymes

- Enzymes are proteinaceous substances of biological origin, capable of catalysing biochemical reactions without undergoing any change.

**Table: Some enzymes obtained by microbes**

	Enzyme	Sources	Functions
(i)	Proteases	<i>Aspergillus</i> and <i>Bacillus</i> species	(i) Clearing beer and whisky (ii) Softening of bread and meat (iii) Manufacturing liquid glue
(ii)	Amylases	<i>Aspergillus</i> , <i>Rhizopus</i> and <i>Bacillus</i> species	(i) Production of alcoholic beverages from starchy materials (ii) Clearing turbidity in juices caused by starch
(iii)	Streptokinase (Tissue Plasminogen Activator)	<i>Streptococcus</i>	Helps in clearing blood clots inside blood vessels through dissolution of intravascular fibrin
(iv)	Pectinases	<i>Byssochlamys fulvo</i>	(i) Clearing of fruit juices (ii) Retting of fibres (iii) Preparation of green coffee
(v)	Lipases	<i>Candida lipolytica</i> and <i>Geotrichum candidum</i>	(i) Added in detergents for removing oily stains from laundry (ii) Used in flavouring cheese

## Bioactive molecules

- Bioactive molecules affect living systems by interacting with their components.

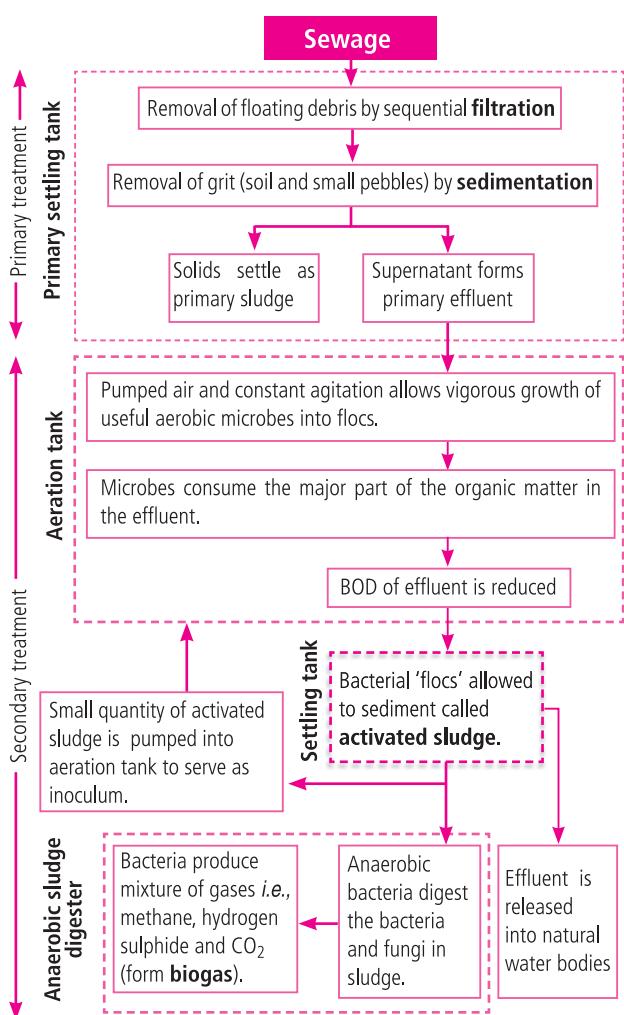
	Bioactive molecule	Source	Functions
(i)	Cyclosporin A	<i>Trichoderma polysporum</i>	(i) Anti-fungal, anti-inflammatory and immunosuppressive properties (ii) Prevent organ transplant rejection by inhibiting T-cell activation
(ii)	Statins	<i>Monascus purpureus</i>	Inhibit cholesterol synthesis

## MICROBES IN SEWAGE TREATMENT

- The sewage or wastewater is generated everyday from domestic and industrial waste in towns and cities. It contains high levels of organic matter, human excreta and many pathogenic bacteria, therefore, it is necessary to treat sewage in sewage treatment plant (STPs) before discharging it into the water bodies.
- Treatment of wastewater is performed at municipal level using heterotrophic microbes naturally present in the sewage.
- It involves a number of steps that are spatially segregated but the first three common steps are primary, secondary and tertiary.

## Primary and Secondary Treatment

- Primary treatment is physical treatment where small and large, floating and suspended solids from sewage are removed by two processes : filtration and sedimentation.
- In secondary or biological treatment several methods like oxidation tanks, trickling filter system and activated sludge systems are used.
- Both the primary and secondary treatments are summarised in the given flow chart:



- **Flocs** are the masses of bacteria associated with fungal filaments to form a mesh-like structure.
- **Biological oxygen demand (BOD)** is the amount of oxygen that would be consumed by the bacteria to oxidise all organic matter present in one litre of water.
- The BOD test measures the rate of uptake of oxygen by microbes in a water sample and thus the amount of organic matter present in water is indirectly calculated.
- More polluted water has greater BOD.

### Tertiary Treatment

- Tertiary treatment is usually not employed except where necessary. It further purifies the effluent of secondary treatment before discharging it into water bodies.
- Chlorination is performed inside chlorine contact tank to eliminate pathogens like bacteria and viruses. Concerns about harmful disinfection by-products led to replace chlorination by UV radiation treatment or ozonation.
- Tertiary treatment is particularly important for the removal of nitrogen and phosphorus compounds from water. It is an expensive step of treatment.

The Ministry of Environment and Forests has initiated Ganga Action Plan and Yamuna Action Plan to prevent the discharge of untreated sewage into these rivers. The number of STPs are not enough to manage the increasing quantity of sewage due to urbanisation. These plans proposed to build a large number of new STPs so that rivers receive only treated sewage.

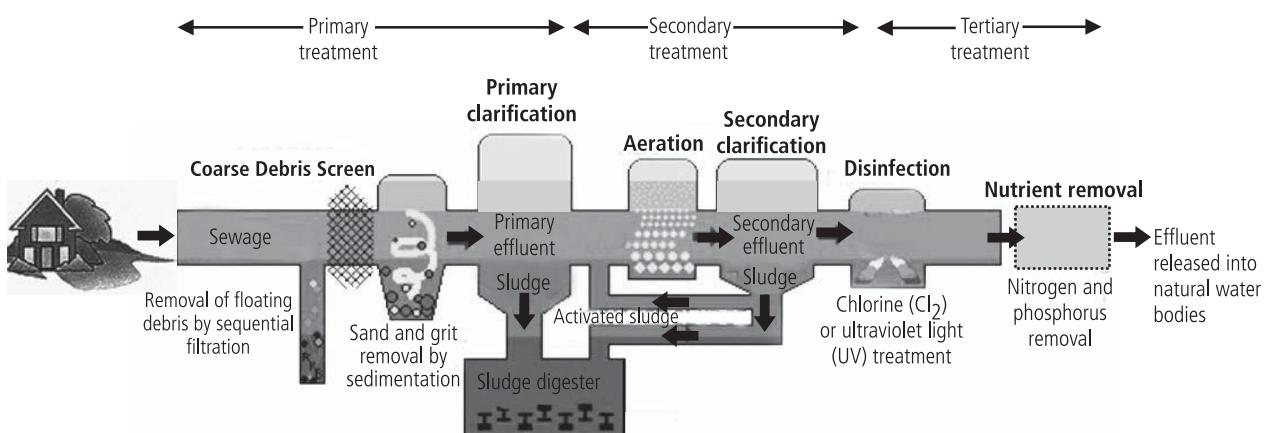


Fig. : Sewage Treatment Plant

## MICROBES IN PRODUCTION OF BIOGAS

- Biogas is a mixture of gases which can be used as fuel for cooking and lighting.
- The composition of biogas is methane ( $\text{CH}_4$ ): 50 - 70%, carbon dioxide ( $\text{CO}_2$ ): 30 - 40%, traces of nitrogen, hydrogen sulphide and hydrogen. Methane is the major component of biogas.
- It is produced when **methanogens** (bacteria) anaerobically digest the cellulosic material.
- One common methanogenic bacteria is *Methanobacterium*. Methanogens are also present in the rumen of cattle hence, the excreta (dung) can also be used for biogas (**gobar gas**) production.
- Biogas generation is a three-stage anaerobic digestion of animal and other organic wastes. These stages involved in biogas generation are described below:

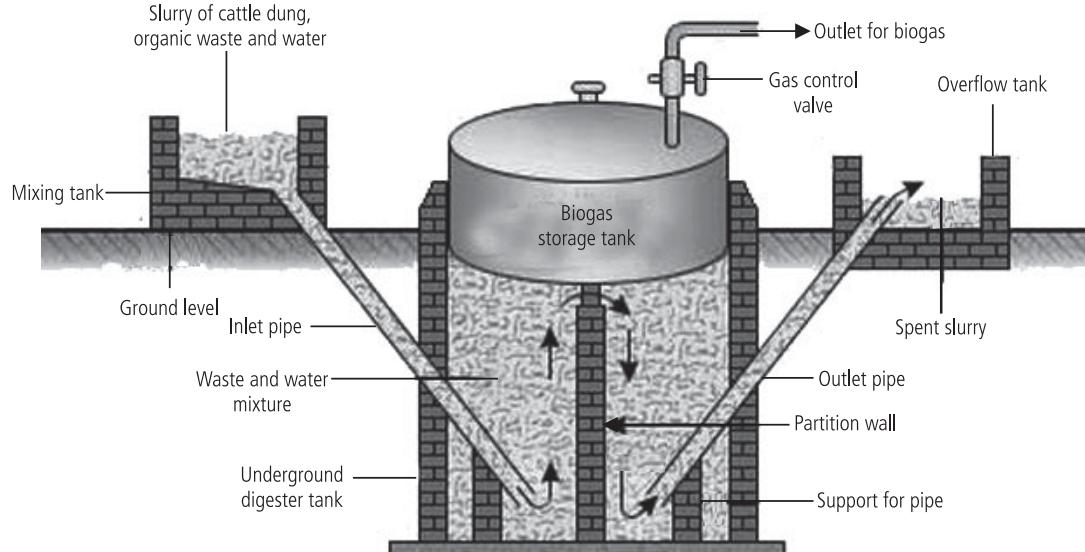
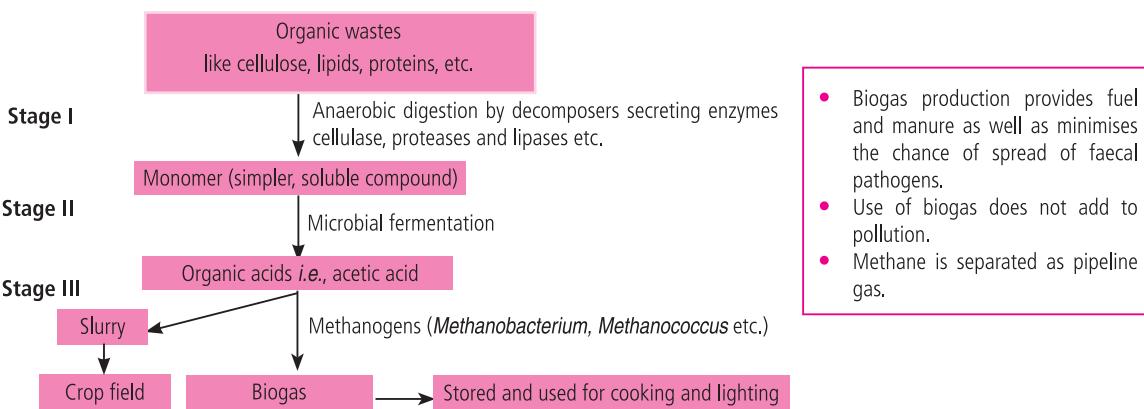


Fig.: A biogas plant

## MICROBES AS BIOCONTROL AGENTS

- Biocontrol** or **biological control** is the natural method of pest and pathogen control using biological agents i.e., microbes and insects.
- Biocontrol agents are preferred over chemical methods of pest and disease control because:
  - They do not eradicate pests and pathogens, but keep their levels manageable. Eradication of pest is undesirable because some beneficial predators and parasitic organisms which depend upon eradicated species for food would also be annihilated.
  - They are non-toxic and non-biocidal.
  - They do not kill useful organisms and do not pollute soil, fruits and vegetables.
  - They avoid the threat of development of resistant pest and pathogen varieties on continuous use of pesticides.

# CONCEPT MAP

# HUMAN HEART : STRUCTURE AND FUNCTION

Human heart is a hollow, four chambered, fibro-muscular organ of somewhat conical or pyramidal shape having upper broad base and lower narrow apex. Apex is slightly directed towards the left.

## Structure of Heart

- Entire heart is enclosed by a double layered sac called **pericardium**. In between the two layers, **pericardial cavity** is present. It normally contains 5-30 mL of **pericardial fluid** which lubricates the heart, permits it to contract with minimal friction and protects the heart from external injury.
- Internally, heart contains four chambers i.e., two thin walled **atria** separated from each other by interatrial septum and two thick walled **ventricles** separated from each other by interventricular septum. Of the two ventricles, left ventricle is thicker.

**Superior vena cava** : Carries blood from body's upper region to right atrium.

**SA node**: Pacemaker of the heart, which spreads waves of contraction across walls of atria.

**Right atrium** : It receives deoxygenated blood from systemic circulation via superior and inferior venae cavae and coronary sinus.

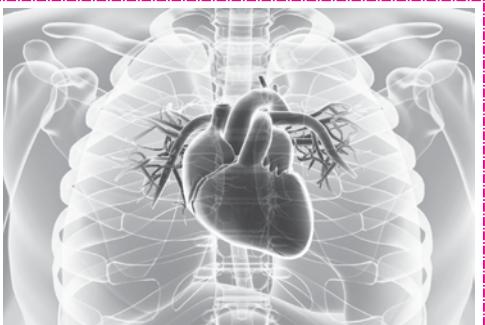
**AV node** : Pacesetter of the heart.

**Pulmonary valve** : Allows unidirectional flow of deoxygenated blood from right ventricle to pulmonary artery.

**Tricuspid valve** : Guards the right atrio-ventricular opening.

**Inferior vena cava** : Carries blood from body's lower region to the heart.

- Heart is located between the lungs in the thoracic cavity. An average adult heart is about 12 cm.
- It weighs around 280-340 gms (in an average male) and 230-280 gms (in an average female).



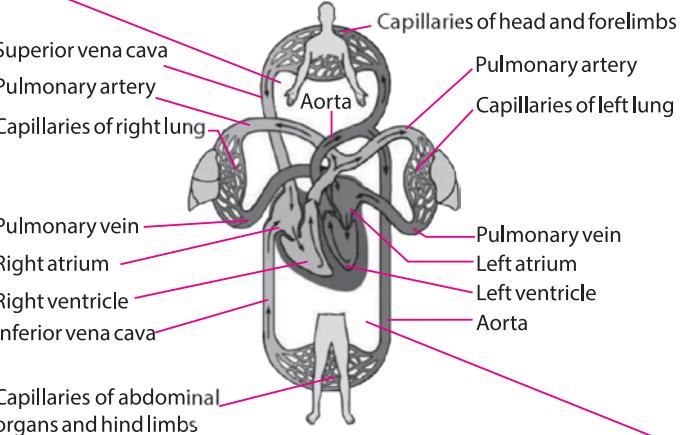
## Location and Size

## Cardiac Cycle

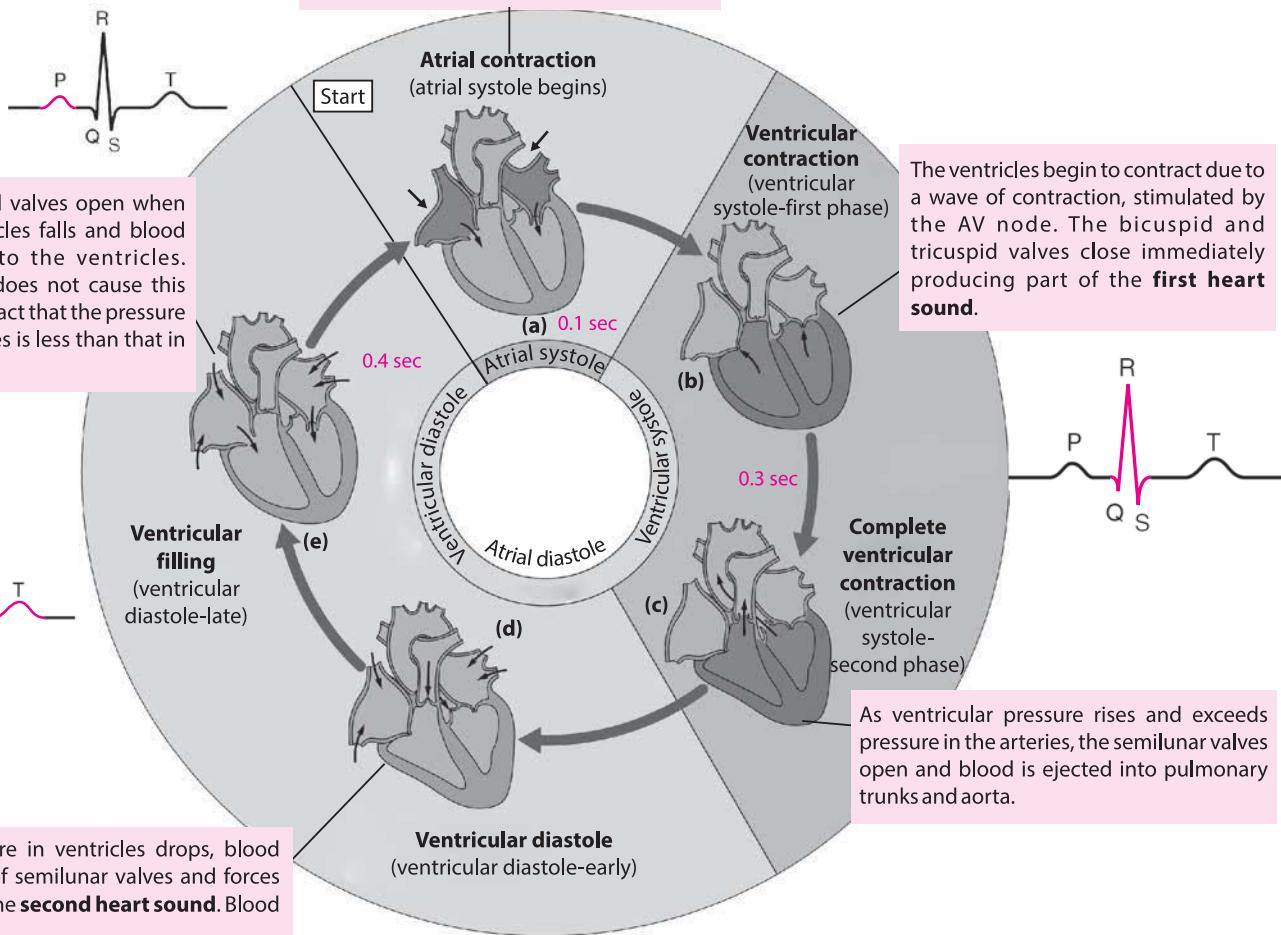
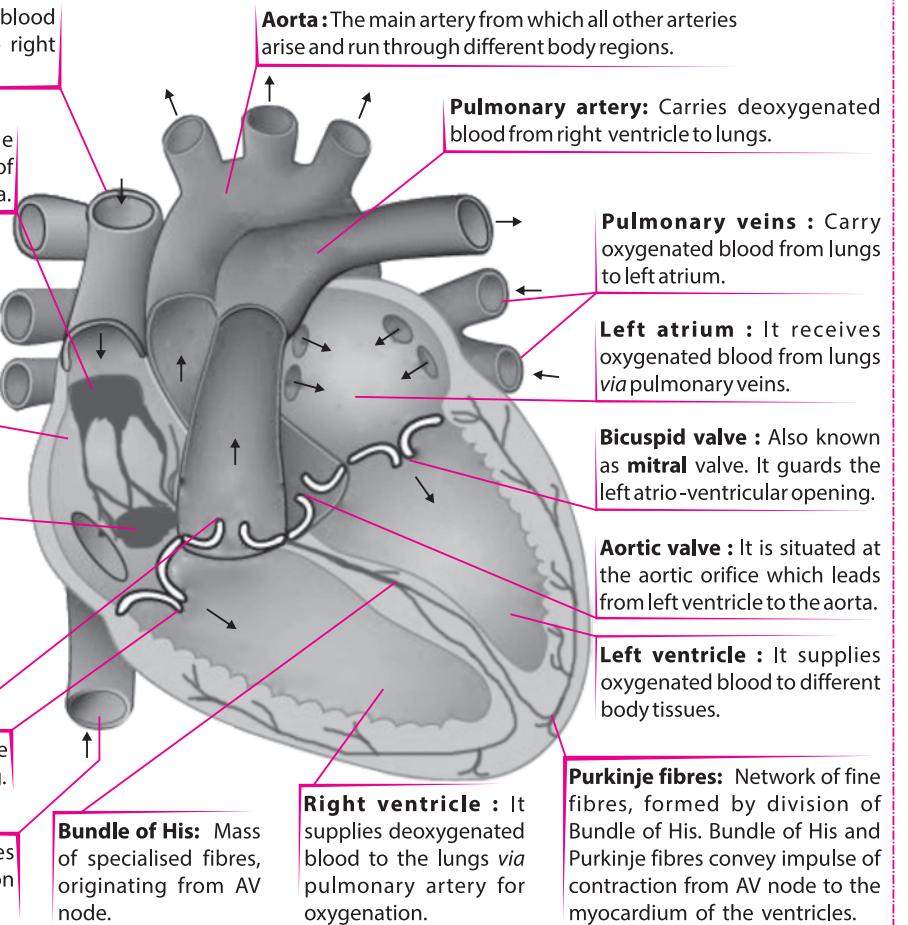
Cardiac cycle consist of one cycle of contraction and relaxation of cardiac muscles.

Function of heart is to pump blood throughout the body via the circulatory system supplying oxygen and nutrients to the tissues and removing carbon dioxide and other wastes from the same. The heart circulates the blood through two pathways (**double circulation**) i.e., pulmonary and systemic circuits. It checks mixing of blood.

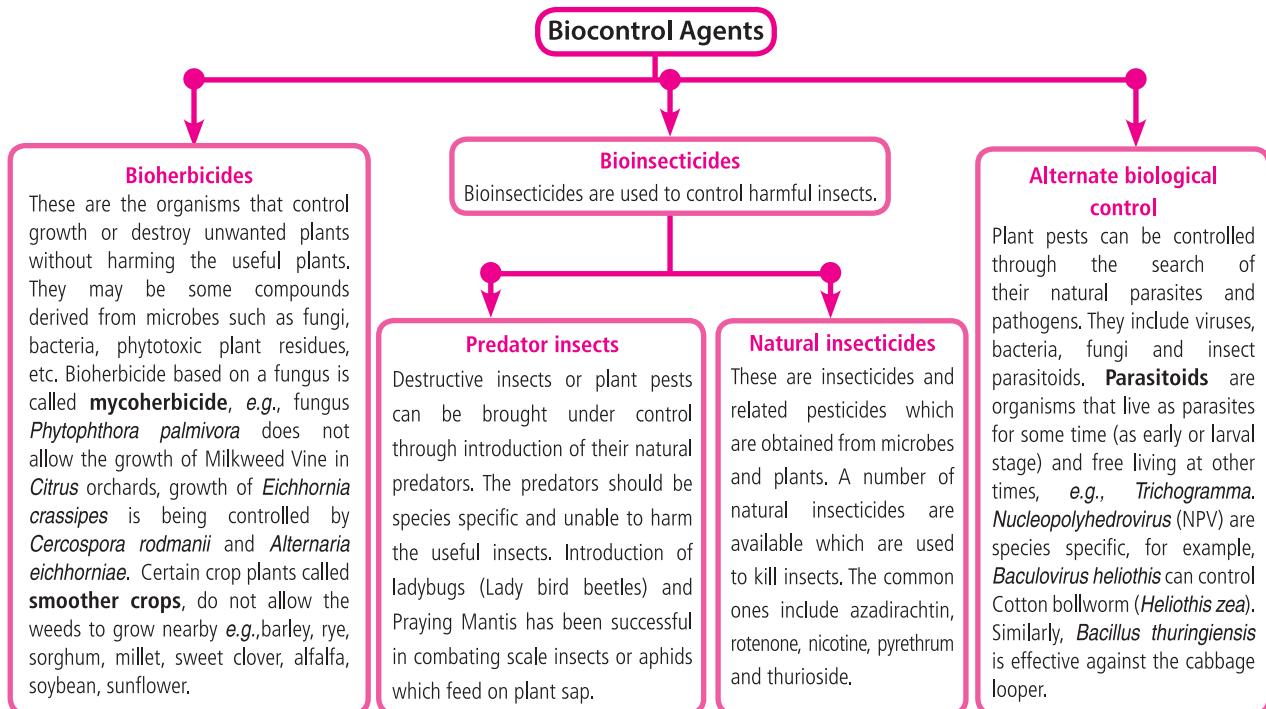
In **pulmonary circuit**, deoxygenated blood flows from right ventricle to the lungs and oxygenated blood returns from lungs to the left atrium.



In **systemic circuit**, oxygenated blood leaves the body from the left ventricle via aorta and from there it enters arteries and capillaries which supply the body's tissue with oxygen. Deoxygenated blood returns via veins to the venae cavae, re-entering the heart's right atrium.

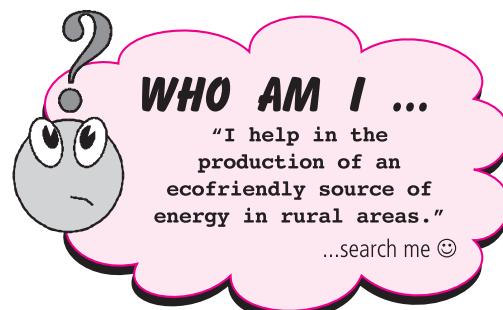


## BIOPESTICIDES



## MICROBES AS BIOFERTILISERS

- Farmers are encouraged to adopt organic farming and use biofertilisers to help in controlling environmental pollution.
- Biofertilisers are the organisms that enrich the soil and increase the availability of nutrients to plants, increase plant yield, improve soil texture, produce vitamins and growth promoting biochemicals.
- Bacteria, cyanobacteria (blue green algae) and mycorrhizal fungi are the good examples of biofertilisers.
- Bacteria and cyanobacteria have the property of nitrogen fixation while mycorrhizal fungi preferentially withdraw minerals from organic matter for the plant with which they are associated.
- Nitrogen fixation is the process of conversion of molecular nitrogen into nitrogen compounds.
- Insoluble forms of soil phosphorus are converted into soluble forms by certain microorganisms. This makes the phosphorus available to the plants. The various biofertilisers are listed in the given table.



**Table: Biofertilisers**

	Biofertiliser	Examples
(i)	Free living nitrogen fixing bacteria (saprotrophic or photoautotrophic)	<i>Bacillus polymyxa</i> , <i>Azotobacter</i> , <i>Clostridium</i> , <i>Beijerinckia</i> , <i>Rhodospirillum</i> , <i>Chromatium</i>
(ii)	Free living nitrogen fixing cyanobacteria (photosynthetic)	<i>Anabaena</i> , <i>Nostoc</i> , <i>Aulosira</i>
(iii)	Symbiotic nitrogen fixing bacteria (mutual association between bacteria and plants)	<i>Rhizobium</i> (legume plants), <i>Frankia</i> (non legume plants)
(iv)	Symbiotic nitrogen fixing cyanobacteria (mutual association between cyanobacteria and plants)	<i>Anabaena</i>
(v)	Mycorrhiza (symbiotic association of fungus with roots of higher plants)	<i>Glomus</i>

- Depending on residence of fungus, mycorrhiza are of two types: **ectomycorrhiza** and **endomycorrhiza**. Ectomycorrhiza lies in intercellular spaces of cortex and increases the surface of the root by exposing the fungal hyphae. It helps in absorption of water, absorption of minerals from soil and protects young roots from the attack of pathogens. Endomycorrhiza also called **VAM (vesicular arbuscular mycorrhiza)**, lives in cortex of root, mostly in intercellular spaces with some hyphal tips passing inside cortical cells. It supplies inorganic nutrients to plants, enhance water absorption and makes phosphate abundantly available to plant.

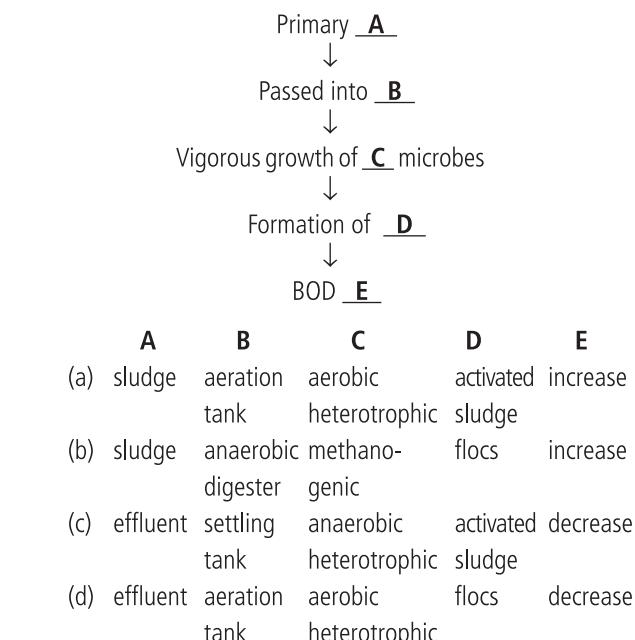
# SPEED PRACTICE

- Curd is considered more nutritious than milk as it contains
  - Lactobacillus*
  - more proteins
  - organic acids and vitamin B<sub>12</sub>
  - lactic acid.

- Match column I with column II and select the correct option from the given codes.

Column I (Product)	Column II (Microorganism)
A. Butyric acid	(i) <i>Rhizopus</i>
B. Acetic acid	(ii) <i>Clostridium acetobutylicum</i>
C. Citric acid	(iii) <i>Aspergillus niger</i>
D. Lactic acid	(iv) <i>Acetobacter aceti</i>
(a) A-(i), B-(iv), C-(ii), D-(iii)	
(b) A-(ii), B-(iv), C-(iii), D-(i)	
(c) A-(iii), B-(i), C-(iv), D-(ii)	
(d) A-(i), B-(iv), C-(iii), D-(ii)	

- Which one among the following statements is correct regarding biogas?
  - Biogas production involves aerobic digestion of organic wastes.
  - Methanogens convert complex organic compounds into simpler monomers.
  - Anaerobic decomposers convert organic acids and CO<sub>2</sub> into methane.
  - In biogas, proportion of methane is greater than CO<sub>2</sub>, N<sub>2</sub>, H<sub>2</sub>S and H<sub>2</sub>.
- Viruses belonging to genus *Nucleopolyhedrovirus* are the important component of integrated pest management programme because
  - they are narrow spectrum bioinsecticides
  - they conserve beneficial insects being a species specific insecticide
  - they do not pose any side effects on plants, mammals and birds
  - all of these.
- The given flow chart is representing the steps of secondary or biological treatment of sewage. Identify A, B, C, D and E in these steps.



- Select the mismatched pair of given pest specific bioinsecticides.
 

(a) <i>Baculovirus heliothis</i>	- Cotton bollworm
(b) <i>Beauveria bassiana</i>	- Potato beetle
(c) <i>Bacillus thuringiensis</i>	- Cabbage looper
(d) <i>Entomophthora ignobilis</i>	- Codling moth
- Study the given table and correctly identify P, Q, R and S.

Enzyme	Source	Function
Pectinase	P	Retting of fibres
Q	<i>Streptococcus</i>	Fibrinolytic effect
Protease	<i>Mortierella renispora</i>	R
Lactase	S	Prevents sandiness in ice-cream

P	Q	R	S
(a) <i>Byssochlamys fulvo</i>	Strepto- kinase	Chill proofing	<i>Saccharomyces fragilis</i>
(b) <i>Geotrichum candidum</i>	Lipase	Softening of bread	<i>Rhizopus</i>
(c) <i>Aspergillus</i> sp.	Amylase	Remove oil stains	<i>Mucor</i>
(d) <i>Torula cremoris</i>	Lipase	Clot buster	<i>Bacillus</i> sp.



	(i)	(ii)	(iii)
(a)	T	T	F
(b)	T	T	F
(c)	F	T	T
(d)	T	F	T

- 14.** Consider the following statements.

  - (i) *Saccharomyces cerevisiae* is used to ferment barley malt for obtaining beer.
  - (ii) Whisky and brandy are produced without distillation of the fermented broth.
  - (iii) Alcoholic content in rectified spirit is 80%.

Which of the statements given above is/are correct?

  - (a) (i) and (ii) only
  - (b) (ii) and (iii) only
  - (c) (i) only
  - (d) (i), (ii) and (iii)

**15.** Photoautotrophic bacteria having nitrogen fixation property is

  - (a) *Rhodospirillum*
  - (b) *Clostridium*
  - (c) *Azotobacter*
  - (d) *Beijerinckia*.

**16.** Read the following statements and select the correct option.

**Statement A :** An organ transplant patient if not provided with cyclosporin A may reject the transplanted organ.

**Statement B :** Cyclosporin A inhibits activation of T-cells and interferes with destruction of non-self cells.

  - (a) Both statements A and B are correct.
  - (b) Statement A is correct but statement B is incorrect.
  - (c) Statement A is incorrect but statement B is correct.
  - (d) Both statements A and B are incorrect.

**17.** Select an option that correctly fills the given blanks.

Gluconic acid is produced by the fermentation activity of \_\_\_\_\_ and \_\_\_\_\_. It is used in preparation of \_\_\_\_\_.

  - (a) *Aspergillus niger*, *Penicillium* sp., dye
  - (b) *Aspergillus niger*, *Penicillium* sp., pharmaceuticals
  - (c) *Streptococcus*, *Lactobacillus* sp., plastics
  - (d) *Streptococcus*, *Lactobacillus* sp., ink

**18.** Which of the following fermentation product of yeast *Monascus purpureus* is used in lowering blood cholesterol level in the body?

  - (a) Statin
  - (b) Cyclosporin A
  - (c) Streptokinase
  - (d) Citric acid

**19.** Match column I with column II and select the correct option from the given codes.

<b>Column I</b>	<b>Column II</b>
A. Penicillin	(i) <i>Penicillium griseofulvum</i>
B. Bacitracin	(ii) <i>Penicillium chrysogenum</i>
C. Griseofulvin	(iii) <i>Bacillus licheniformis</i>
D. Streptomycin	(iv) <i>Streptomyces griseus</i>

  - (a) A-(ii), B-(iii), C-(i), D-(iv)
  - (b) A-(ii), B-(i), C-(iv), D-(iii)
  - (c) A-(iii), B-(iv), C-(ii), D-(i)
  - (d) A-(iv), B-(i), C-(ii), D-(iii)

- 20.** Select the correct symbiotic association which is of great importance in agriculture.

  - (a) *Frankia* - *Azotobacter*
  - (b) *Azolla* - *Anabaena*
  - (c) *Anabaena* - *Nostoc*
  - (d) *Aulosira* - *Nostoc*

**21.** Natural insecticide obtained from the inflorescence of *Chrysanthemum* is

  - (a) rotenone
  - (b) pyrethrum
  - (c) thuriside
  - (d) nicotine.

**22.** \_\_\_\_\_ is a natural herbivore introduced in India to check extensive growth of *Opuntia* as a weed.

  - (a) *Chrysolina*
  - (b) *Puccinia chondrilla*
  - (c) *Cercospora rodmanii*
  - (d) *Cactoblastis cactorum*

**23.** Yoghurt is obtained by curdling of milk using

  - (a) *Streptococcus cremoris* and *Lactobacillus bulgaricus*
  - (b) *Streptococcus lactis* and *Lactobacillus acidophilus*
  - (c) *Streptococcus lactis* and *Leuconostoc cremoris*
  - (d) *Streptococcus thermophilus* and *Lactobacillus bulgaricus*.

**24.** Select the incorrect difference between primary and activated sludge from the table given below.

	<b>Primary sludge</b>	<b>Activated sludge</b>
(a)	It is formed during primary sewage treatment.	It is formed during secondary sewage treatment.
(b)	Its formation requires aeration.	Its formation does not require aeration.
(c)	Flocs of decomposer microbes are absent.	Flocs of decomposer microbes are present.
(d)	Limited decomposition occurs in the formation of primary sludge.	Decomposition occurs to a very large extent in activated sludge formation.

- 25.** The chemical substances produced by some microbes which can kill or retard the growth of other microbes are called



ANSWER KEY

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (c)  | 2. (b)  | 3. (d)  | 4. (d)  | 5. (d)  |
| 6. (d)  | 7. (a)  | 8. (b)  | 9. (b)  | 10. (c) |
| 11. (a) | 12. (a) | 13. (a) | 14. (c) | 15. (a) |
| 16. (a) | 17. (b) | 18. (a) | 19. (a) | 20. (b) |
| 21. (b) | 22. (d) | 23. (d) | 24. (b) | 25. (c) |
| 26. (b) | 27. (a) | 28. (d) | 29. (b) | 30. (d) |



# UNSCRAMBLED WORDS

MAY 2017

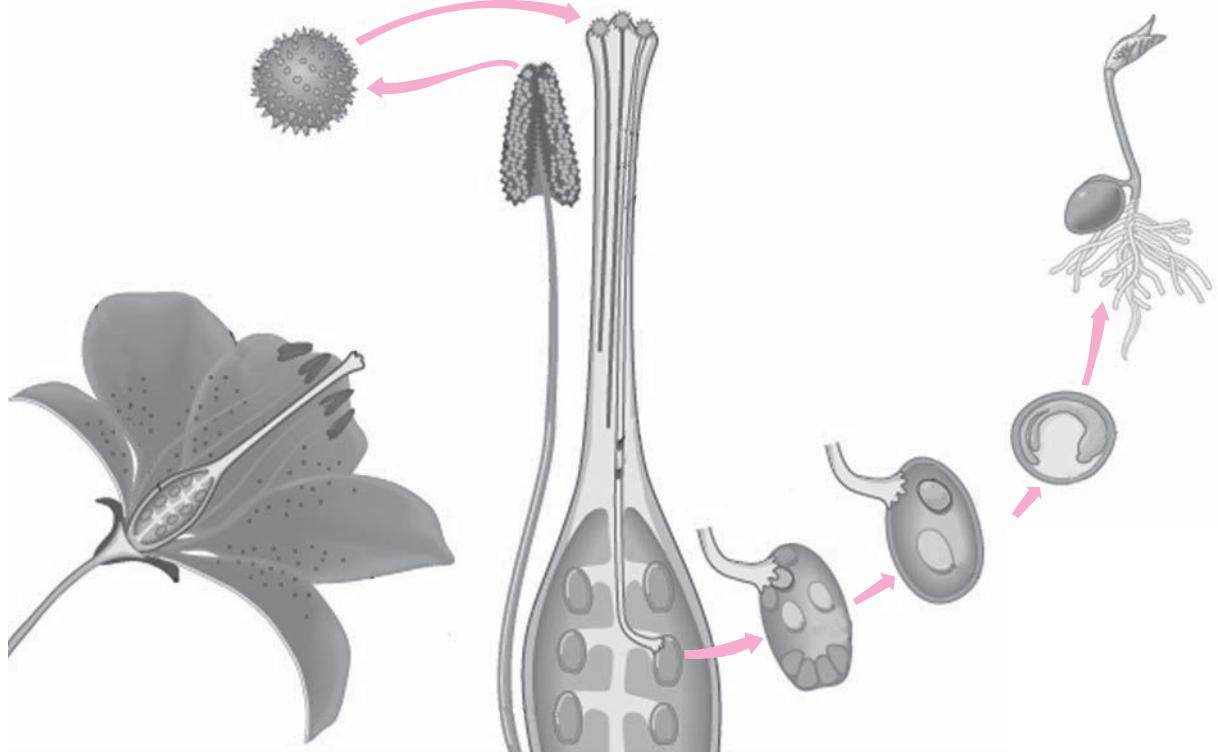
- |                  |                  |
|------------------|------------------|
| 1-h- PLIOCENE    | 2-g-PARAMYLON    |
| 3-f- CARRAGEENIN | 4-a-HERPETOLOGY  |
| 5-b- VELAMEN     | 6-c-REPLUM       |
| 7-d- CHONDRIN    | 8-e- OSTEOCLASTS |
| 9-i- LANQUIN     | 10-j- RAMETS     |

**Winners:** Meenakshi Sood, Nitesh Sahoo (Odisha), Agniva Das (West Bengal), Rohit Sharma (Gurugram), Abhishek Chowdhury (Jharkhand)

# Spelling Bee Winners

May-2017

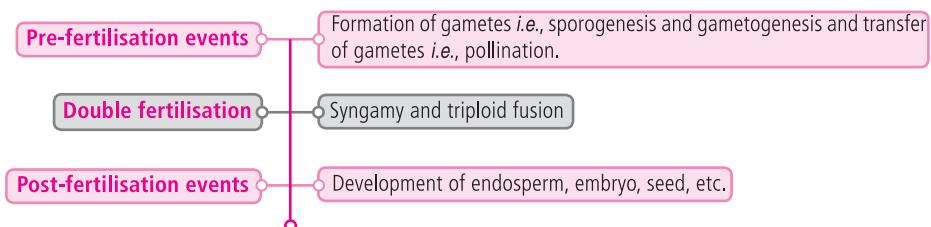
1. Ayush Dhiman (Himachal Pradesh)
  2. Nikhil Sai Chandra (Telangana)



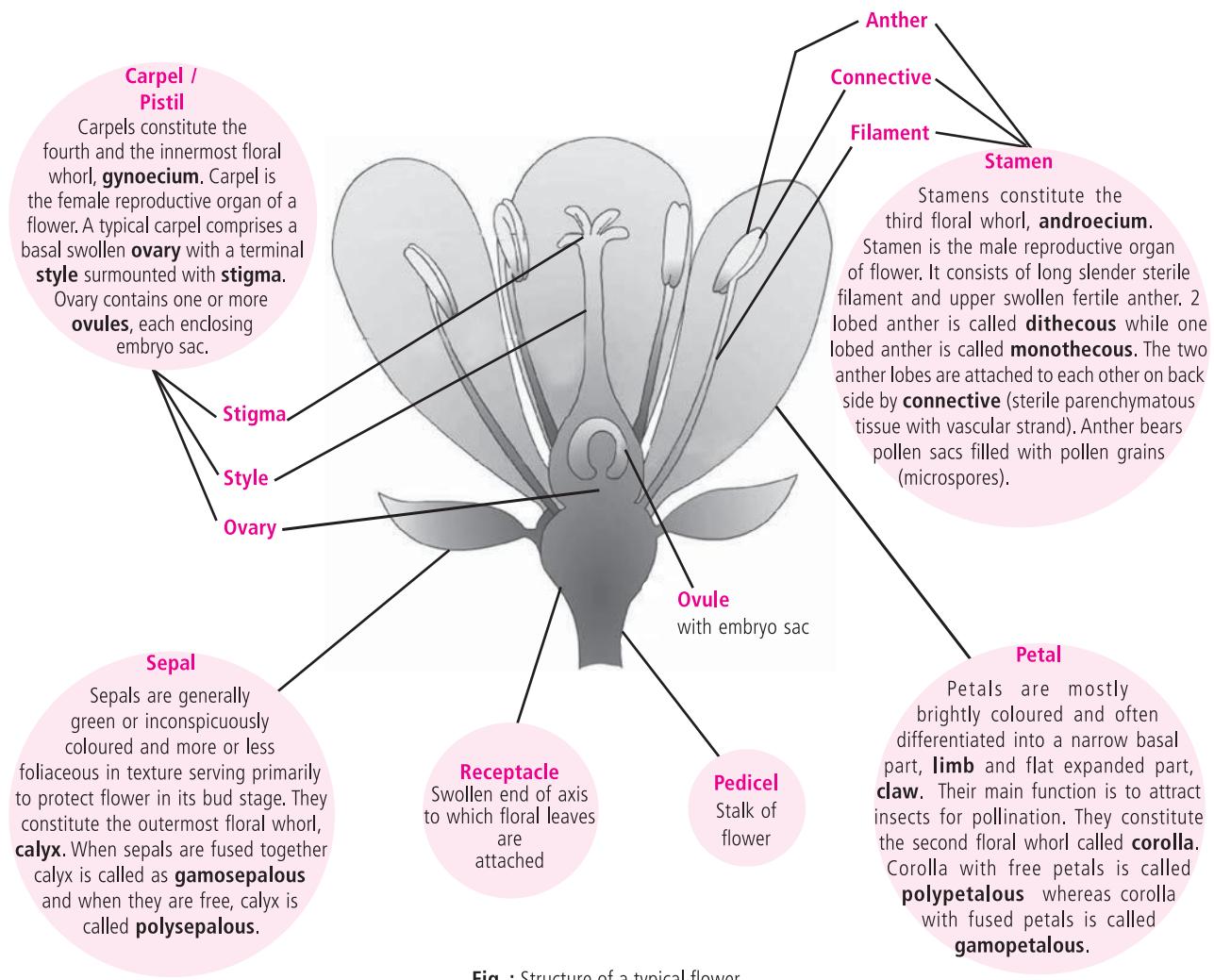
# NEET ESSENTIAL

## DOUBLE FERTILISATION IN ANGIOSPERMS

Sexual reproduction involves the process of development of new organisms by the formation and fusion of gametes of parent organisms. In angiospermic or flowering plants, the process of sexual reproduction is divided into three main events :

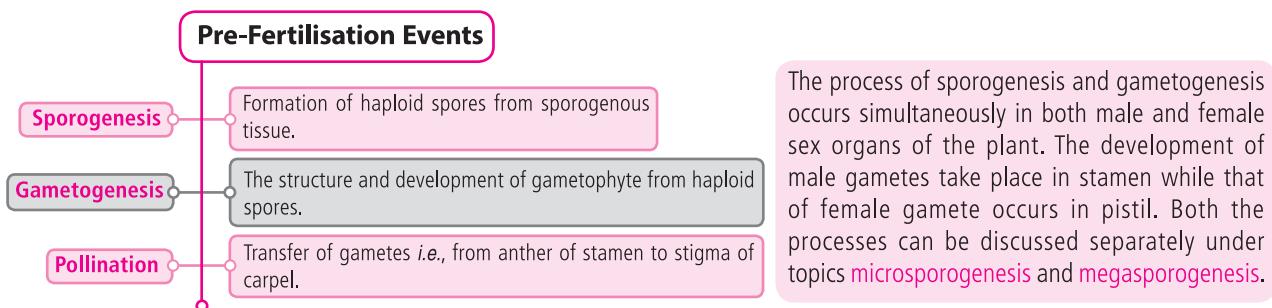


In sexual reproduction, the male and female gametes develop from the sporophytic structures of male and female sex organs respectively. In higher plants, the reproductive organ is represented by a flower, which is a modified condensed shoot, specialised to perform sexual reproduction.



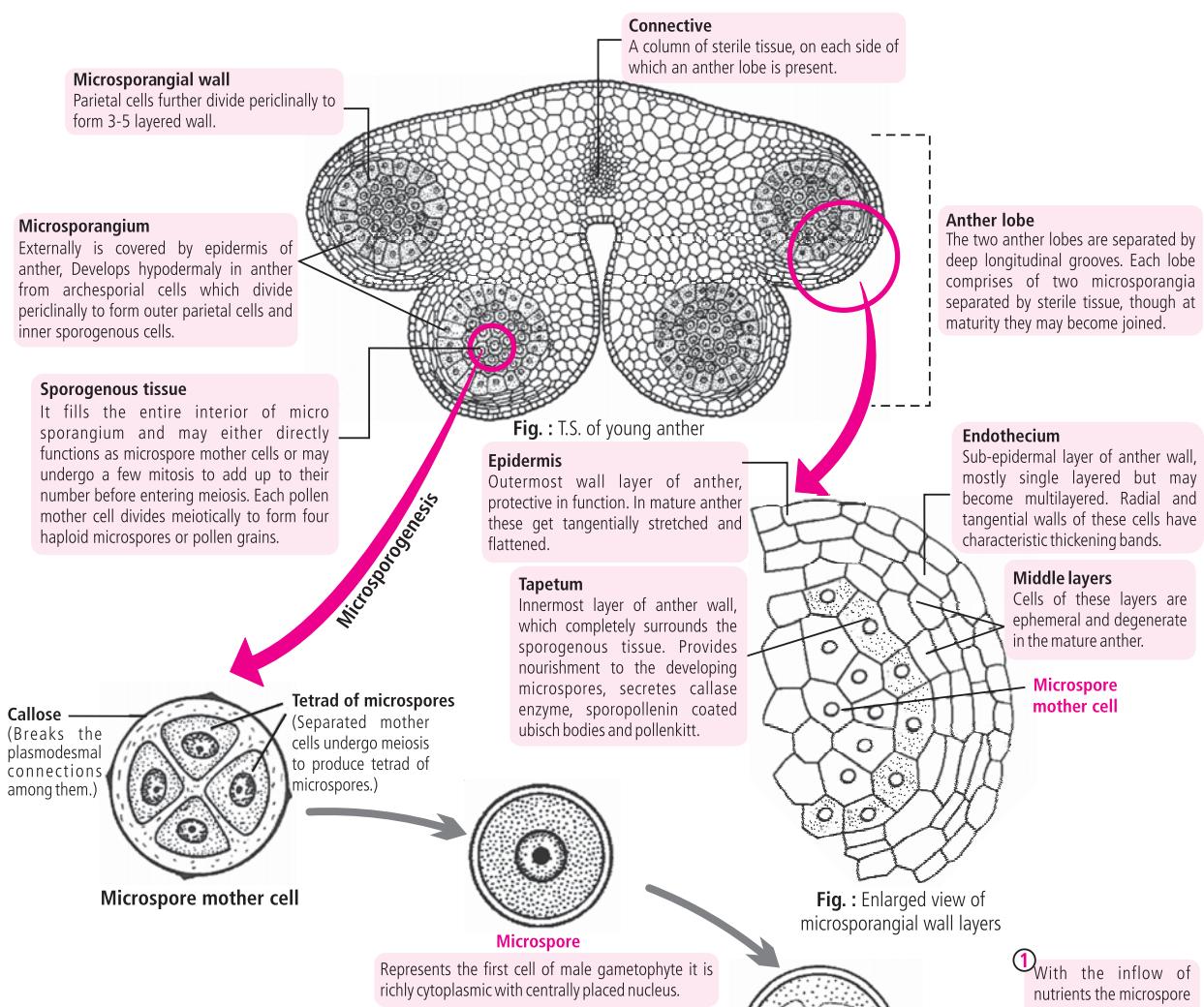
## PRE-FERTILISATION EVENTS

These events occur inside a flower in its respective male and female reproductive organs.

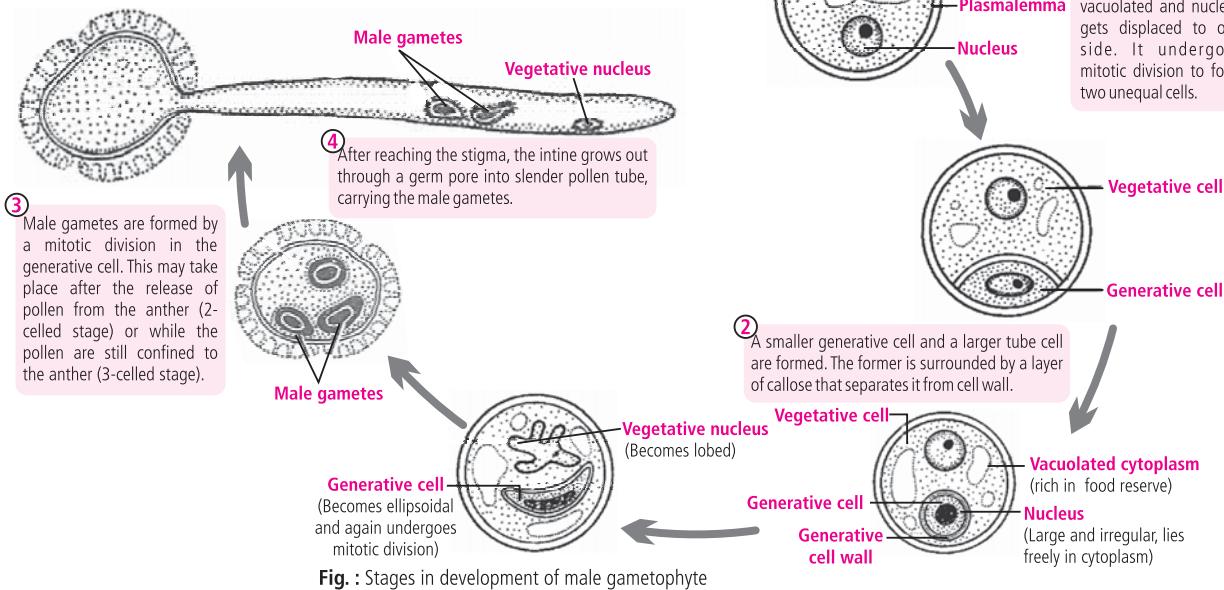


### Microsporogenesis

- It refers to the formation of microspores from sporogenous tissue of microsporangia (anther).
- It occurs inside the **anther**, part of male reproductive organ, the stamen.
- A typical anther is **tetrasporangiate** with four pollen sacs in a dithecosus anther lying in its four corners.

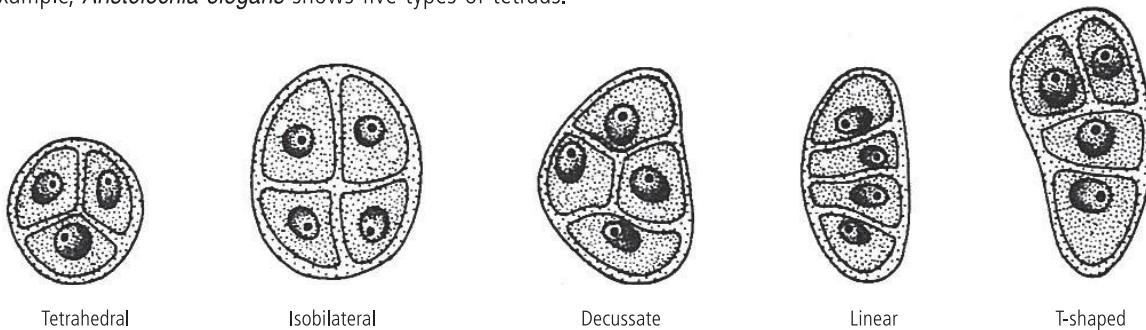


## Development of Male Gametophyte



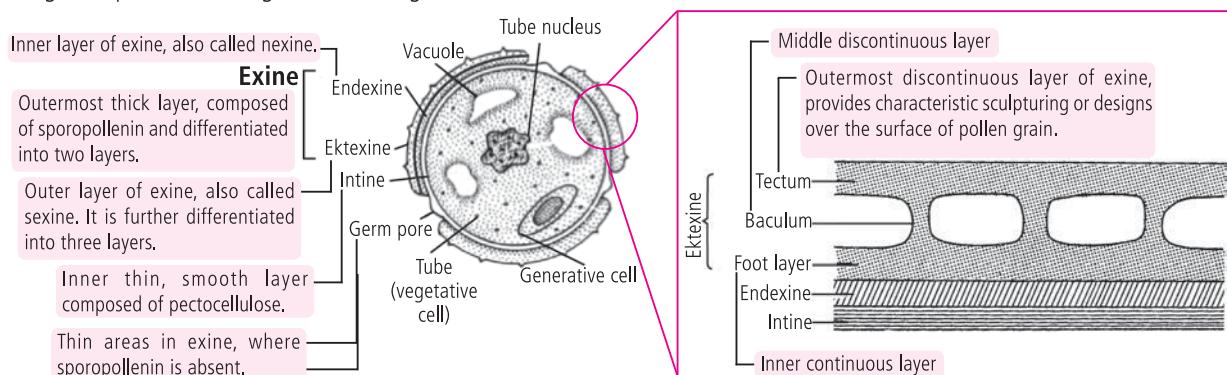
## Microspore Tetrads

Usually the microspores are arranged in a tetrahedral or isobilateral tetrad. However other types of tetrads are also observed. For example, *Aristolochia elegans* shows five types of tetrads.



### Pollen Grain

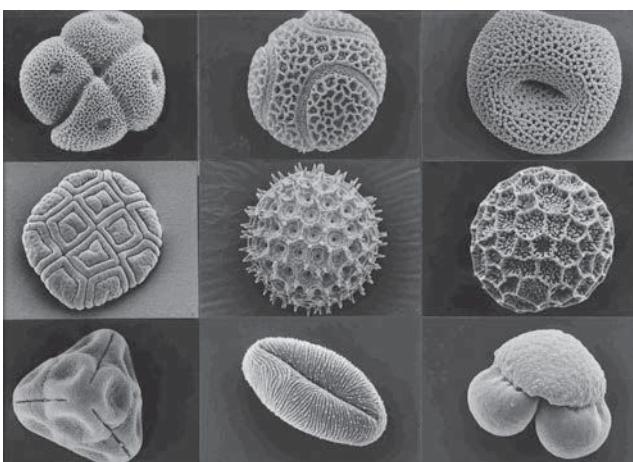
- Represents the beginning of male gametophyte.
- It is a haploid, oval or rounded structure having a highly resistant wall on the outside and cellular contents inside.
- The wall or covering of pollen grain is called **sporoderm**. Outer layer is made up of highly resistant fatty substance called **sporopollenin**. Presence of sporopollenin allows pollen grains to be preserved as microfossils, as it remains unaffected by high temperature, strong acid or strong alkali.



In insect pollinated pollen grains, the exine is spiny and covered by a yellowish, viscous sticky and oily layer called pollenkit. It is made up of lipids and carotenoids.

### Significance of Pollens

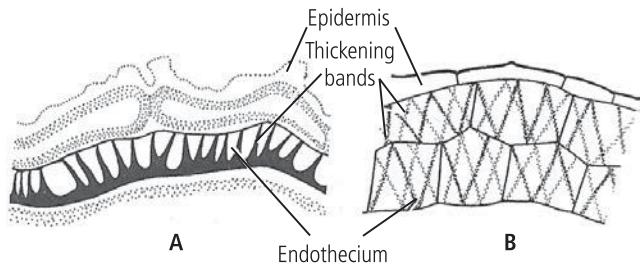
- Pollens are rich in nutrients i.e., proteins (7-26%), carbohydrates (24-48%) and fats (0.9-14.5%), therefore are used in the form of tablets or syrups to improve health, enhance performance of athletes etc.
- Pollen grains collected by bees are used for various purposes like nature cure, cosmetics and as food supplements.
- Pollens being produced in large number, float in air and enter respiratory tracts. This causes allergy in some people developing respiratory disorders like rhinitis, asthma and bronchitis.
- Parthenium*, the carrot grass is a major cause of pollen allergy.



**Fig. :** Common sculpturing in pollen grains

## Dehiscence of Anther

- Maturation and dessication of anther tissues are essential for anther dehiscence and thus release of pollens.
- Ripe anthers dehisce over a considerable range of temperature and humidity.
- Dehiscence takes place due to certain changes in the wall layers of anther at maturity. These changes are affected by environmental conditions.
- The endothelial layer of anther wall has fibrous bands on its inner tangential walls except along the line of dehiscence called stomium, marked by presence of thin walled cells.
- The presence of fibrous bands, differential expansion of inner and outer tangential walls and hygroscopic nature of endothelial cells all play an important role in the dehiscence of anther.

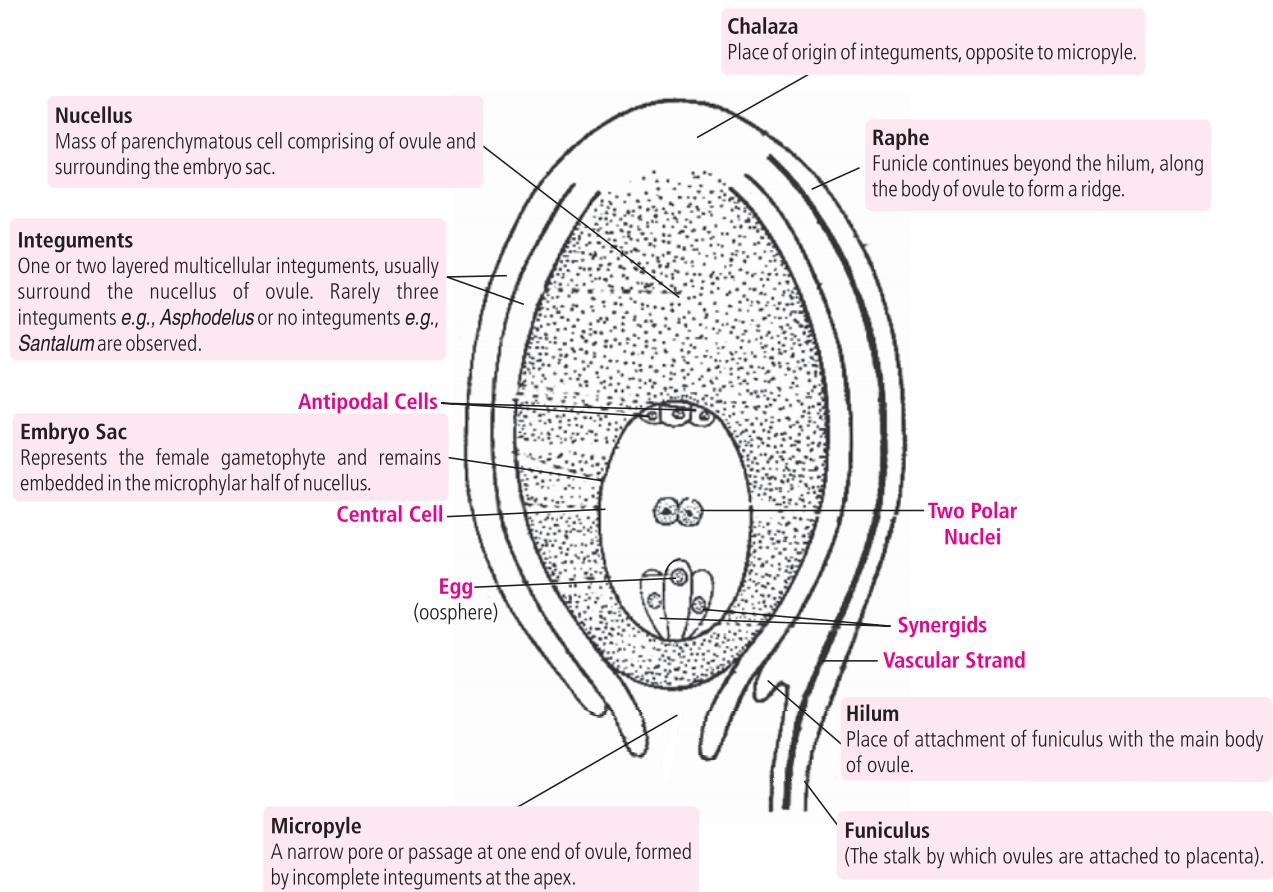


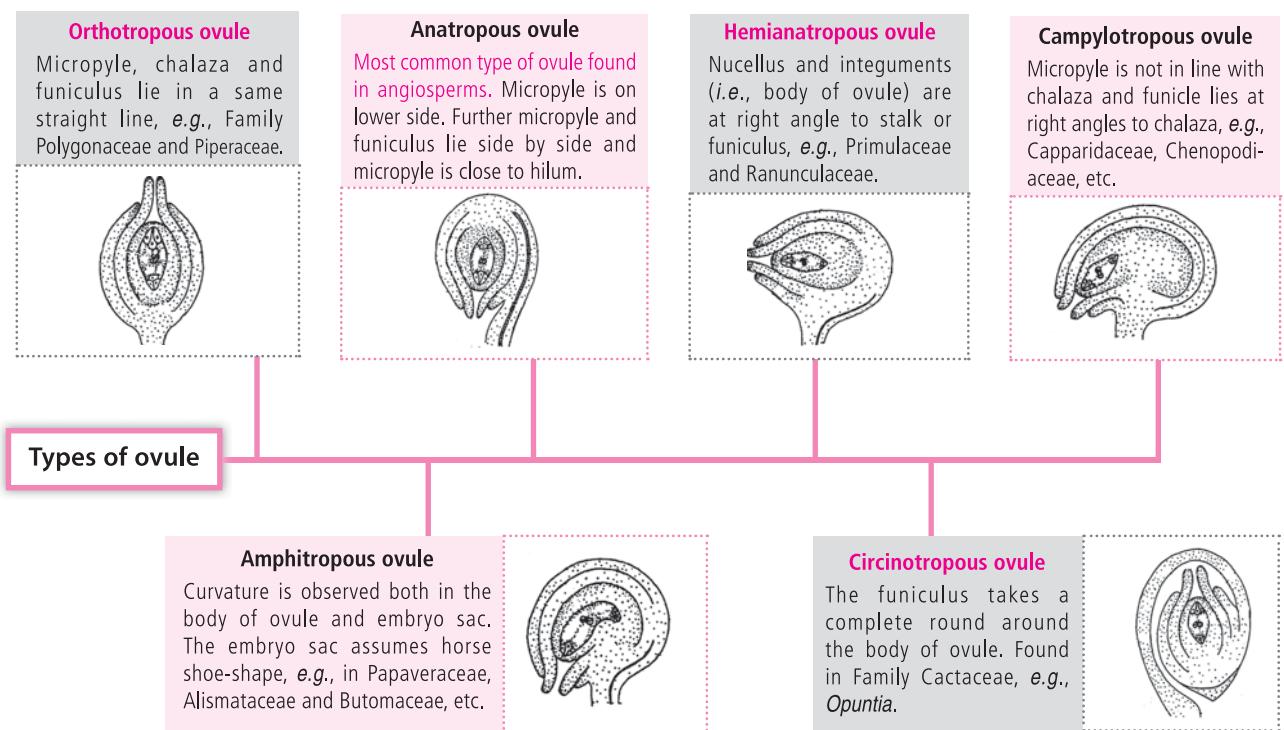
**Fig.:** Thickening bands in endothecium  
A : U-shaped,  
B- Overlapped spirals

## Megasporogenesis

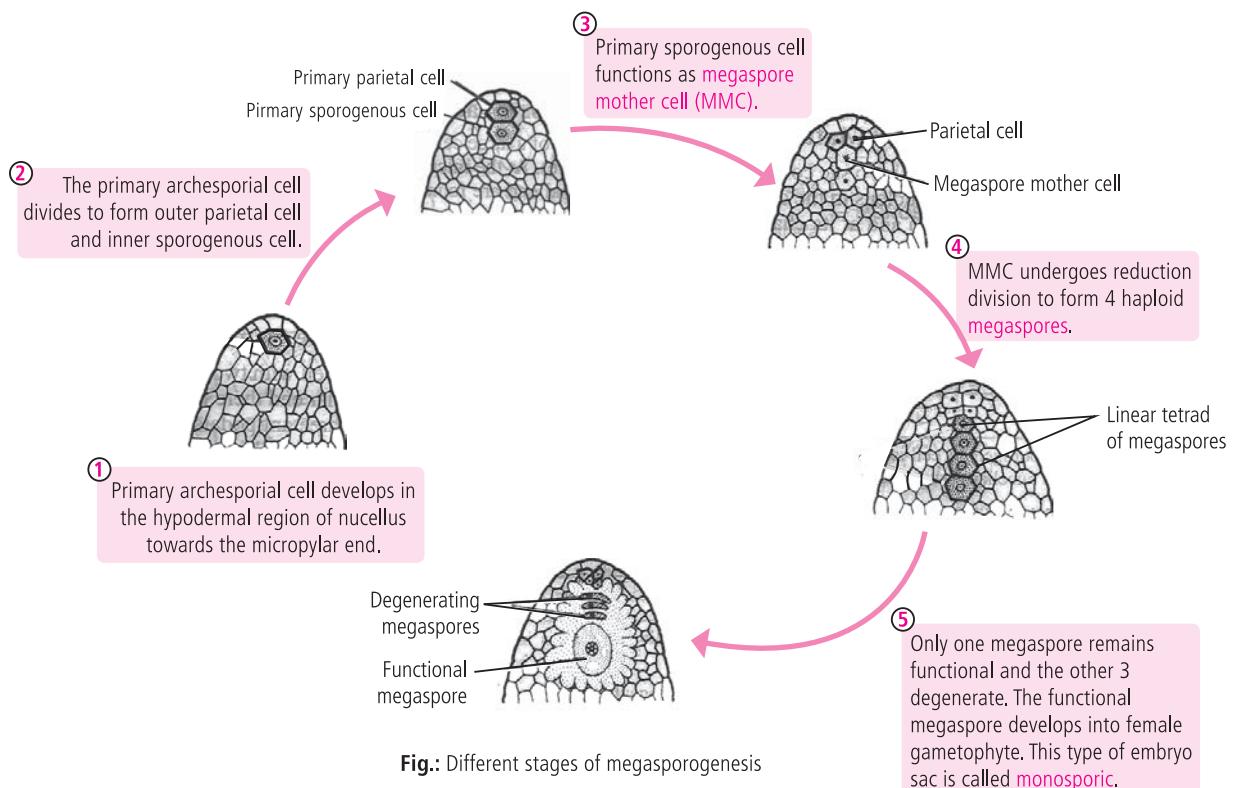
- It is the formation of megaspor from megasporocyte inside the ovule, also known as integumented megasporangium.
- It occurs inside **ovary**, a part of female reproductive organ, the carpel.
- Inside each ovary are borne one or more oval bodies from its inner surface or base. Ovules are attached to the placenta by a stalk called **funiculus**. Some may lack it and are called sessile.

## Structure of Typical Ovule





## Stages in Megasporogenesis



## Development of Female Gametophyte

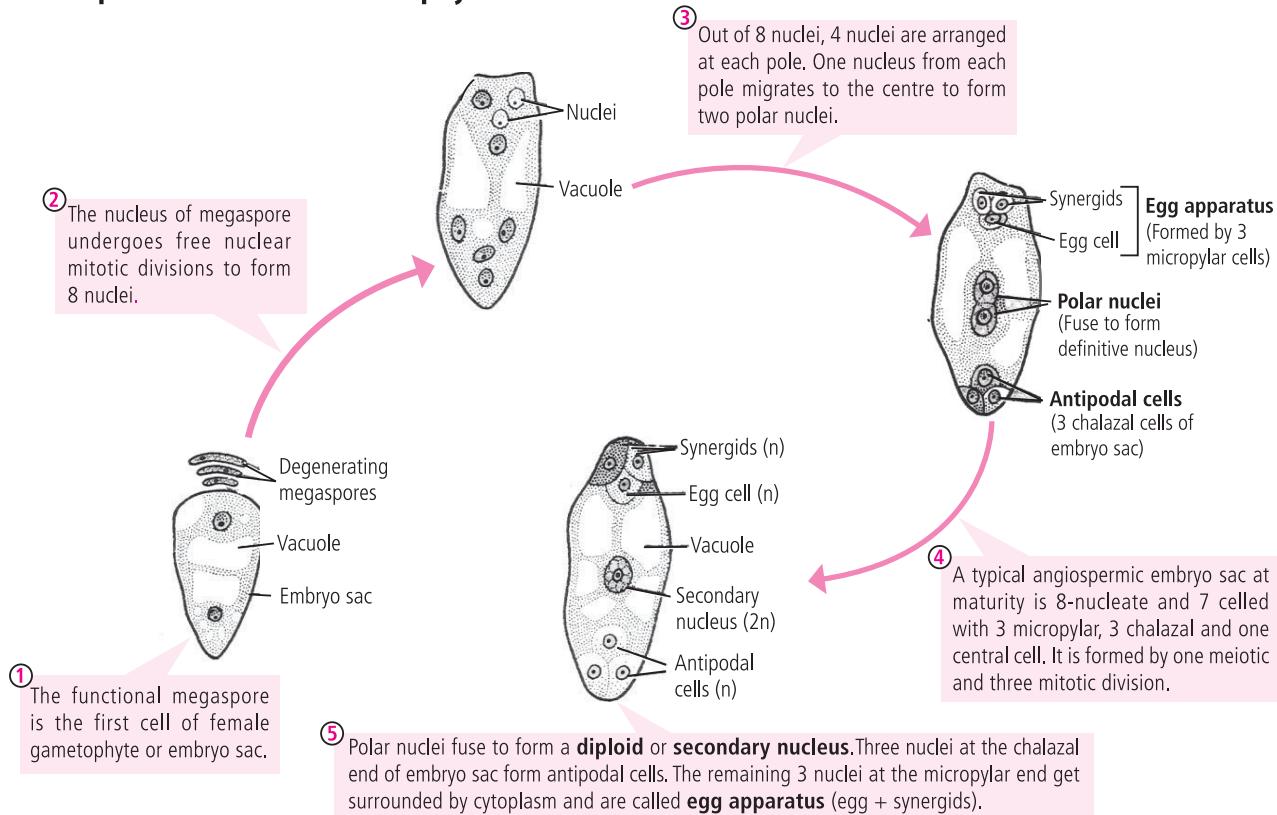


Fig.: Development of embryo sac (female gametophyte)

### Embryo Sac

Angiosperms exhibit tremendous diversity in the development of female gametophyte. Based on the number of megasporangium taking part in the development of embryo sac, it may be of following types.

- Monosporic** • Embryo sac is derived from only one megasporangium of tetrad, therefore all nuclei are genetically similar. The most common is polygonum type.
- Bisporic** • Embryo sac is derived from two megasporangium nuclei, therefore nuclei are genetically different.
- Tetrasporic** • All the four nuclei of megasporangium take part in formation of embryo sac. It is the most heterogenous type as all the nuclei are genetically different. It may be of various types as peperomia, penaca, fruit fritillaria, plumbagella etc.

## Girl from Surat tops AIIMS entrance examination

Nishita Purohit, a resident of Surat topped the country in the AIIMS MBBS entrance exam. Over two lakh students had appeared in the exam conducted on May 28 at 171 centres across India in two divisions for admissions in AIIMS-Delhi, Jodhpur, Raipur, Patna, Bhubaneswar, Bhopal and Rishikesh.

Nishita studied in CBSE-affiliated Essar School till Class X, in which she had scored over 95 percent. On her

brother's advice, she was enrolled in Pragati Public Senior Secondary School in Kota from where she completed her Class XII with 91.04 percent marks.

Nishita said, "My favourite subject is Physics and I want to become a cardiac surgeon. My hard work and proper guidance from the teachers of my coaching institute helped me a lot. Earlier my wish was to become an IAS officer."

Courtesy : The Indian Express

## Structure of Typical embryo sac

### Synergid

Also known as **helpers**. Completely embrace the egg cell on lateral sides. Synergids are marked by prominent systems of filiform apparatus. One synergid degenerates at the time of entry of pollen tube into embryo sac whereas other degenerates shortly after embryo sac has received contents of pollen tube.

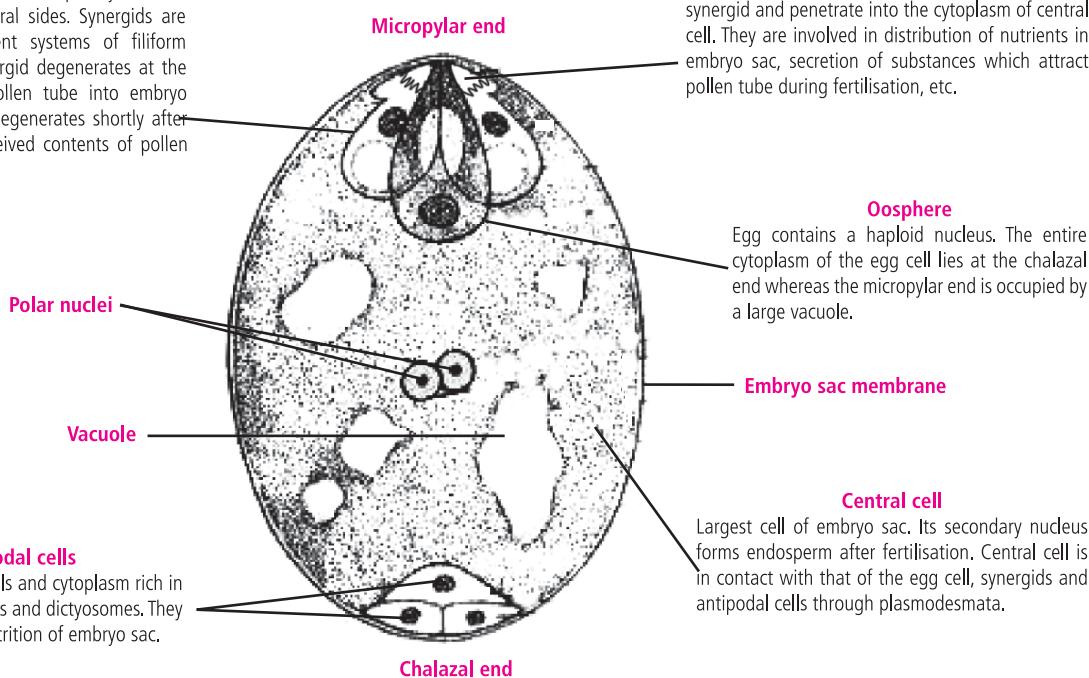


Fig.: *Polygonum* type of embryo sac

## POLLINATION

- The term 'pollination' refers to the process of transfer of pollen grains from anther to stigma.
- It takes place usually after dispersal of pollens at 2-celled stage i.e., vegetative and generative cell.

## Types of Pollination

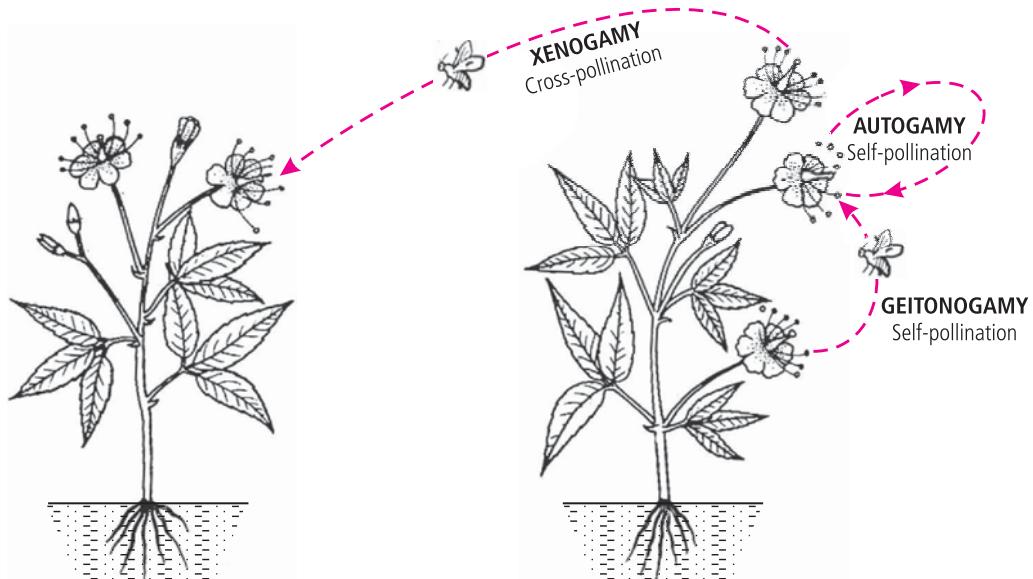


Fig.: Types of pollination

## Types of Pollination

### Self Pollination

Transfer of pollen grains from anther to stigma of same flower or genetically same flower.

#### Types of Self Pollination

##### Autogamy

Transfer of pollens from anther to stigma of same flower.

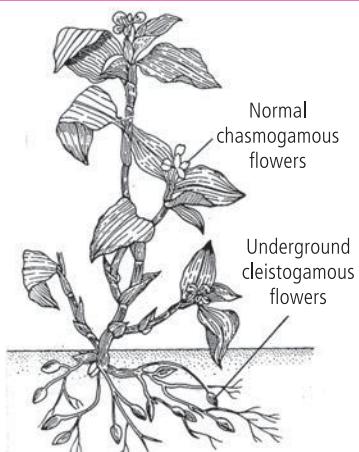
##### Geitonogamy

Transfer of pollens from anther of one flower to stigma of another flower present on same plant.  
May occur between bisexual and unisexual flowers of some plant.  
**Ecologically considered as cross pollination.**

#### Contrivances to Ensure self pollination

##### Homogamy

Flowers are bisexual and both male and female organs mature at same time i.e., chasmogamous flowers where anther and stigma are brought together by bending or folding e.g., *Catharanthus Commelina*.



**Fig.:** *Commelina* with both chasmogamous and cleistogamous flowers.

##### Cleistogamy

The flowers are bisexual and remain closed ensuring pollination and seed formation e.g., *Oxalis, Commelina*.

##### Bud Pollination

Anthers and stigmas of bisexual flowers mature even before opening of bud, ensuring self pollination e.g., wheat, rice.

### Cross Pollination

- Transfer of pollen grains from anther of one flower to stigma of flower of genetically different plant.
- Also known as **allogamy** or **xenogamy**.
- Requires various biotic or abiotic agents to bring about pollination.

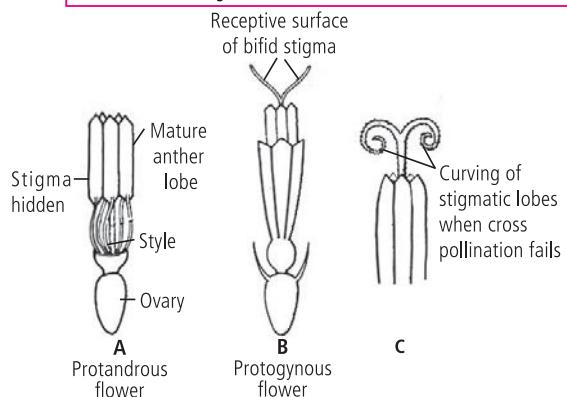
#### Contrivances to ensure cross pollination

##### Dicliny

Plants are either dioecious e.g., papaya or monoecious with male and female flowers on same plant e.g., maize. Unisexuality of flowers prevents self pollination.

##### Dichogamy

Anthers and stigmas mature at different times i.e., **protandry** (anthers mature earlier e.g., *Salvia*) and **protogyny** (stigmas mature earlier e.g., *Gloriosa*).

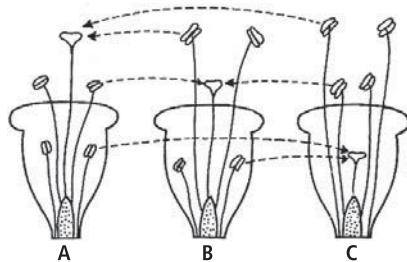


##### Self Sterility

Pollen grains of one flower do not germinate on stigma of same flower due to presence of similar sterile gene e.g., Crucifers.

##### Heterostyly

Two or three types of flower with different heights of styles and stamens occur. Pollination occurs between anthers and stigmas of same height present in different flowers.

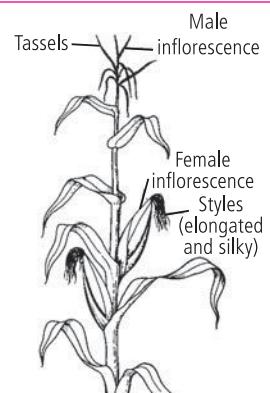
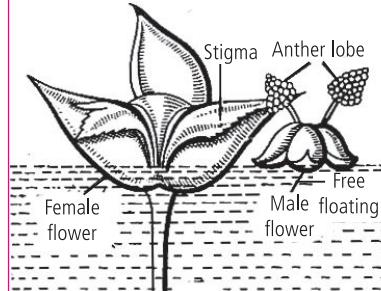
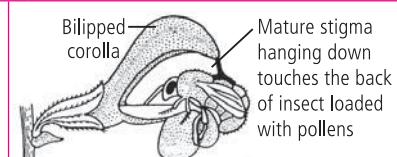


**Fig.:** Tristylous, A, Flower with long style, medium and short stamens. B, Flower with medium style and long and short stamens. C, Flower with short style, medium and long stamens.

##### Herkogamy

Presence of natural barrier or mechanical device to prevent self pollination. e.g., extrose dehiscence of anthers or stigmas lie on the route of insect entry and anthers occur near the exit as in *Cypripedium*.

**TABLE:** Agents of cross pollination

<b>Abiotic agents</b>	<h3>Anemophily</h3> <p>The pollination taking place by means of wind is known as <b>anemophily</b>. E.g., <i>Zea mays</i> (maize), grasses, mulberry, date palm, <i>Salix</i>, <i>Cannabis</i> etc.</p> <p>Wind pollinated flowers, called <b>anemophilous flowers</b> have following features:</p> <ul style="list-style-type: none"> <li>– Non-essential whorls such as calyx, corolla, bracts and bracteoles are not showy.</li> <li>– Flowers are devoid of scent and nectar.</li> <li>– Both the <b>stigmas and anthers are exerted</b>.</li> <li>– Pollen grains are dry, very small sized, non-sticky and unwettable, so that they can be carried by wind to long distances.</li> <li>– <b>Stigma is hairy, feathery</b> (grasses) or branched to catch the wind borne pollens.</li> </ul>	 <p><b>Fig.:</b> Anemophily in Maize</p>
	<h3>Hydrophily</h3> <p>Pollination which occurs with the help of water is called <b>hydrophily</b>. Water pollinated flowers have following features:</p> <ul style="list-style-type: none"> <li>– Flowers are <b>inconspicuous</b> and small.</li> <li>– Odour, nectar and colour is absent in flowers.</li> <li>– Floral whorls, if present are coated with wax.</li> <li>– Pollen grains are small, light weighted, non-sticky and coated with wax.</li> <li>– <b>Stigma is unwettable but sticky</b>.</li> </ul> <p><b>Types of Hydrophily</b>  <b>Hypohydrophily</b> occurs below the surface of water, e.g., <i>Ceratophyllum</i>, <i>Najas</i>, <i>Zostera</i>.  <b>Epihydrophily</b> takes place over the surface of water, e.g., <i>Potamogeton</i>, <i>Vallisneria</i>, etc.</p>	 <p><b>Fig.:</b> Epihydrophily in <i>Vallisneria</i></p>
<b>Biotic agents</b>	<h3>Entomophily</h3> <p>Pollination by insects is called <b>entomophily</b>. Insect-pollinated or entomophilous flowers produce <b>nectar</b> which attracts the pollinators for feeding. Some flowers produce <b>edible pollen grains</b>. Flowers are <b>fragrant</b> and emit scent and <b>odour</b>. Flowers are <b>bright coloured</b>. The pollen grains are heavy and sticky. E.g., <i>Salvia</i>, <i>Viola</i>, <i>Yucca</i>, <i>Clematis</i>.</p>	 <p><b>Fig.:</b> Pollination in <i>Salvia</i></p>
<h3>Ornithophily</h3> <p>Pollination by birds is called <b>ornithophily</b>. <b>Ornithophilous</b> flowers have <b>tubular</b> (<i>Nicotiana glauca</i>), <b>cup-shaped</b> (<i>Callistemon</i>) or <b>urn-shaped</b> (some members of Ericaceae) corollas. There are very few ornithophilous plants. Ornithophilous flowers are large sized, brightly coloured, usually <b>odourless</b> and they produce a large amount of mucilaginous nectar for birds to drink. E.g., <i>Bombax</i>, <i>Callistemon</i>, <i>Bignonia</i>.</p>		
<h3>Chiropterophily</h3> <p>Pollination of flowers performed by bats is called <b>chiropterophily</b>. Bat pollinated flowers are dull-coloured with strong fermenting or fruity smell, abundant nectar and pollen grains. Examples of chiropterophilous plants are <i>Kigelia</i>, <i>Adansonia</i>, etc.</p>		
<h3>Malacophily</h3> <p>Pollination by snails is called <b>malacophily</b>. This type of pollination is seen in some plants such as <i>Arisaema</i>, etc.</p>		
<h3>Myrmecophily</h3> <p>It is the pollination of flowers by ants, e.g., some members of Family Rubiaceae.</p>		

Self pollination	Cross pollination
<p style="background-color: #e6f2ff; padding: 5px;"><b>Advantages</b></p> <ul style="list-style-type: none"> <li>• It maintains the parental characters or purity of the race indefinitely.</li> <li>• It is used to <b>maintain pure lines</b> for hybridisation experiments.</li> <li>• Flowers need not develop devices for attracting insect pollinators.</li> <li>• It ensures seed production.</li> </ul>	<p style="background-color: #e6f2ff; padding: 5px;"><b>Advantages</b></p> <ul style="list-style-type: none"> <li>• It introduces <b>genetic recombinations</b> and hence variations in the progeny.</li> <li>• It increases the adaptability of the offspring towards changes in the environment.</li> <li>• The offspring have characters better than the parents due to the phenomenon of <b>hybrid vigour</b>.</li> <li>• The plants produced are more resistant to diseases.</li> <li>• New and more useful varieties can be produced through cross pollination.</li> <li>• The defective characters of the race are eliminated and replaced by better characters.</li> </ul>
<p style="background-color: #e6f2ff; padding: 5px;"><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• New useful characters are seldom introduced.</li> <li>• Vigour and vitality of the race decreases with prolonged self pollination.</li> <li>• Immunity to diseases decreases.</li> <li>• Variability and hence adaptability to changed environment is reduced.</li> </ul>	<p style="background-color: #e6f2ff; padding: 5px;"><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• It is <b>highly wasteful</b> because plants have to produce a large number of pollen grains and other accessory structures in order to suit the various pollinating agencies.</li> <li>• Some undesirable characters may creep in the race.</li> </ul>

## POST-POLLINATION EVENTS

- Pollination *i.e.*, deposition of pollen grains on stigma initiates a complex set of reactions that lead to germination of pollen grain and subsequently fertilisation.
- The events leading to fertilisation are initiated at stigma but whether the pollen landing on stigma will initiate the fertilisation or not depends on the outcome of pollen pistil interaction.

## Pollen-Pistil Interaction

### Landing of pollens on stigmatic surface

- As soon as pollen grain lands on stigma, it is hydrated. Due to hydration, the exine and intine proteins are released on the stigmatic surface. The pollen wall proteins bind to the pellicle within few minutes of contact.
- The stigma surface pellicle thus forms a receptor site for the pollen wall proteins. When pollen is compatible, erosion of the cuticle of the stigma papilla begins beneath the emerging pollen tube. It is pre-requisite for the penetration of pollen tube.
- Besides, pollination initiates many physiological and biochemical changes in the pistil such as increase in respiration, increase in activity of enzymes etc.

### Self Incompatibility

- If a pistil carrying functional female gametes fails to set seeds following pollination with viable and fertile pollen, capable of bringing about fertilisation in another pistil, the two are said to be incompatible, and the phenomenon is known as **sexual incompatibility**. Sexual incompatibility between individuals of same species is self-incompatibility. It is gene determined process and incompatibility reactions are controlled by single gene which has several alleles.
- In incompatible pollinations a range of abnormal behaviours of the male gametophyte has been recorded : (a) the pollen may fail to germinate, (b) if germination occurs, the tube is very short, (c) the inhibition of one tube leads to the emergence of another tube, (d) appressoria-like swellings develop at the tip of pollen tubes, etc.
- The most distinct response of the stigma to an incompatible pollen is the development of callosic plug between the plasma membrane and pectocellulosic layer of the stigmatic papillae, just below the point of contact with the pollen.

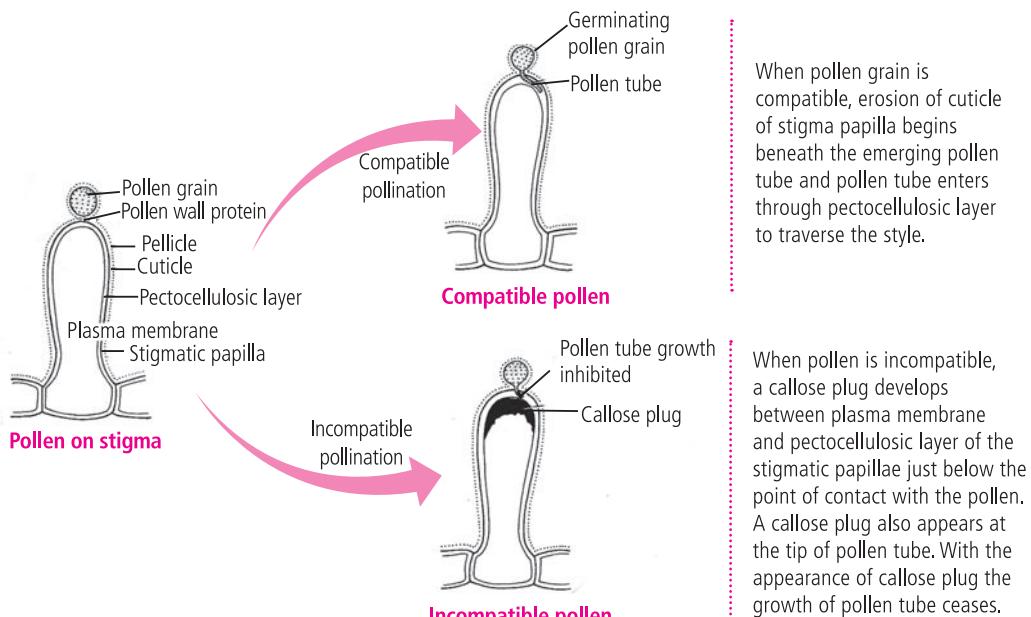


Fig.: Pollen-stigma interaction

### Gametophytic

### Self incompatibility

### Sporophytic

Incompatibility process is determined by the genotype of pollen grain. Pollen grains that possess S allele common to any one of the two alleles present in the cells of the pistil will not be functional on that particular pistil. e.g., Liliaceae, Salvaceae.

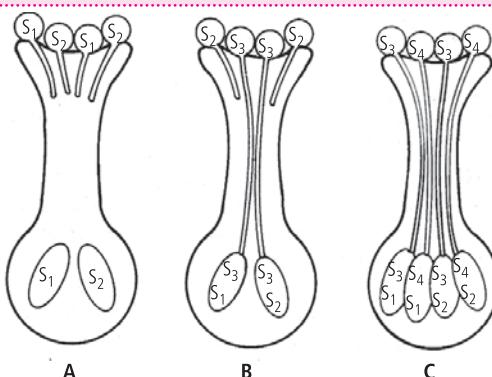


Fig.: Response of pollen on a pistil of  $S_1S_2$  plant, showing gametophytic self-incompatibility. A. None of the pollens from a  $S_1S_2$  plant is able to affect fertilisation. B. From a  $S_2S_3$  plant only  $S_3$  pollens succeed in fertilising the ovules. C. All the pollens from  $S_3S_4$  plants bring about fertilisation.

Incompatibility process is determined by the genotype of the sporophytic tissue of plant from which pollen is derived. The presence of even one of the alleles of the stylar tissue in the sporophytic tissue of the male parent would render all the pollens of that plant non-functional with respect to that particular style. e.g., Asteraceae, Brassicaceae.

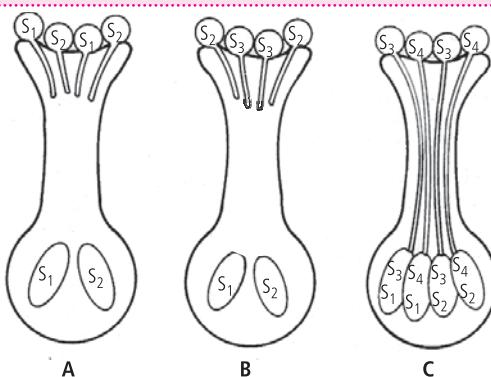


Fig.: Response of pollen on a pistil of  $S_1S_2$  plant, showing sporophytic self-incompatibility. A. None of the pollens from a  $S_1S_2$  plant is able to affect fertilisation. B. None of the pollens from  $S_2S_3$  plant succeed in fertilising the ovules. C. All the pollens from  $S_3S_4$  plants bring about fertilisation.

- Compatibility and incompatibility of the pollen-pistil is determined by special proteins coded by these genes. The compatible pollens are able to absorb water and nutrients from the surface of the stigma. They germinate and produce pollen tubes. Pollen tubes grow into the style. Their growth and path through the style are also determined by specific chemicals.

## FERTILISATION

We know that fertilisation involves the fusion of male gamete with female gamete, but in angiosperms the female gametophyte is located deep in the ovary away from the stigma, where the pollen grains (with male gametes) are held. So, the journey of pollen grains from the stigma to the embryo sac or egg can be discussed under following steps.

### A. Growth of Pollen Tube

- The fertilisation involving formation of pollen tube is called **siphonogamy**. Normally, pollen grains are **monosiphonous** i.e., each pollen grain produces only a single pollen tube. However, they may also be **polysiphonous** i.e., more than one tube emerge from a single pollen grain e.g., as many as 10 pollen tubes from a single pollen grain have been observed in *Althaea rosea* and in *Malva neglecta* the number goes upto 14. Pollen tube is generally unbranched but branched ones are common in some members of Family Amentiferae.
- For its growth, pollen tube absorbs nutrition from stylar tissue i.e., in the form of pectic substances that are dissolved by enzymes of pollen tube. Thus, the developing male gametophyte is parasitic over sporophytic tissue of style.

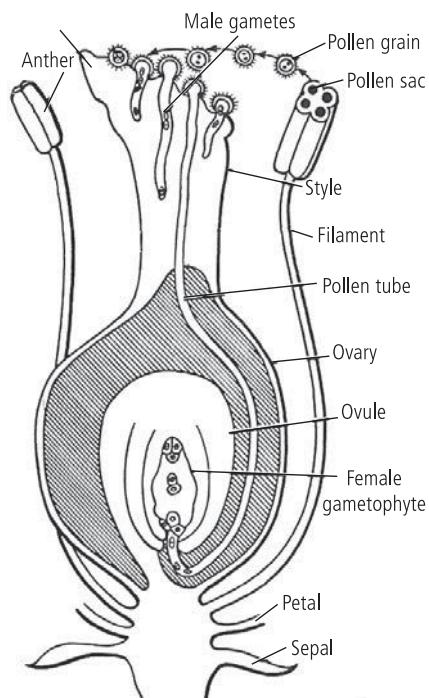
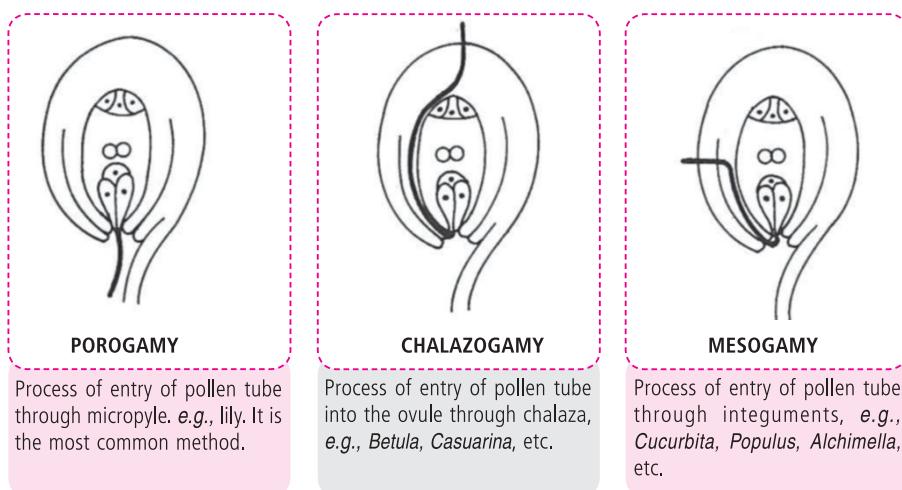


Fig.: L.S. of flower at the time of fertilisation

### B. Entry of Pollen Tube into Ovule

- On reaching the ovary, the pollen tube grows towards one of the ovules. The pollen tube enters the ovule in either of three ways:



### C. Entry of Pollen tube into Embryo Sac

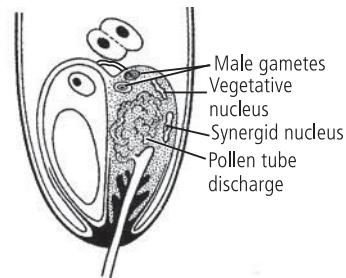
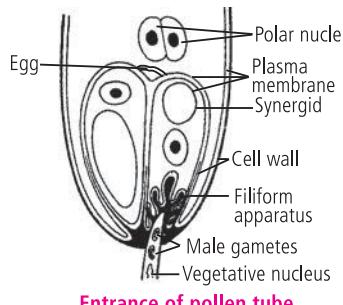
- The pollen tube enters at the apex of filliform apparatus and after growing through it, arrives in the cytoplasm of one of the synergids.
- This synergid is mostly pre-determined as it starts degenerating after pollination and before arrival of pollen tube. Hence, is easily recognised by growing pollen tube.
- The contents of the pollen tube are discharged in the synergid and the tube does not grow beyond it in embryo sac.

**FIND  
MORE  
FREE  
MAGAZINES**

**FREEMAGS.CC**

## D. Discharge of Male Gametes into Embryo Sac

- Male gametes are discharged into the embryo sac by either of the following methods :
  - The apex of the pollen tube bursts at the tip releasing male gametes.
  - The tip of pollen tube divides into two short branches, of which one enters egg and other towards secondary nucleus and both release male gametes into them by bursting tips.
- The pollen tube discharge comprises of two sperms or male gametes, the vegetative nucleus and fair amount of cytoplasm. The latter two undergo immediate degeneration.



## E. Fusion of Gametes

- Inside the embryo sac, one male gamete fuses with the egg to form the zygote ( $2n$ ), the process is known as **syngamy** or **generative fertilisation**.
- The second male gamete fuses with 2 polar nuclei or secondary nucleus to form triploid primary endosperm nucleus, the process is known as **triple fusion** or **vegetative fertilisation**.
- The zygote develops into **embryo** and primary endosperm nucleus develops into **endosperm**.
- Thus, these two acts of fertilisation occurring in the same embryo sac in angiospermic plants is called **double fertilisation**.
- Double fertilisation** is a feature peculiar to angiosperms only. It was discovered by **Nawaschin** in 1898 in *Fritillaria* and *Lilium*.

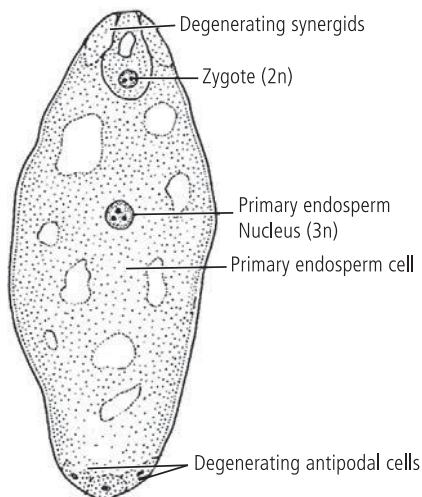


Fig. : Embryo sac soon after double fertilisation

# POWER EXERCISE

### New MCQs

- In angiospermic plants, the male gametophyte is formed from a pollen mother cell by
  - two meiotic divisions
  - three mitotic divisions
  - one meiotic and two mitotic divisions
  - one mitotic followed by two meiotic divisions.
- An ovule in which the funiculus takes a complete round around the body of ovule is called
  - orthotropous
  - amphitropous
  - campylotropous
  - circinotropous.
- Select the option which correctly fills the given blanks.
  - The hypodermal development of microsporangia from strips of archesporial cells is \_\_\_\_\_ type of development.

- Hypodermal region of nucellus towards the micropilar end of ovule develops a \_\_\_\_\_ that divides to form outer wall cell and inner sporogenous cell.
- Due to the development of fibrous thickenings, the \_\_\_\_\_ layer of anther is also called fibrous layer.
- Of the four haploid megasporangia formed from megasporangium, the \_\_\_\_\_ megasporangium remains functional, while rest degenerate.
 

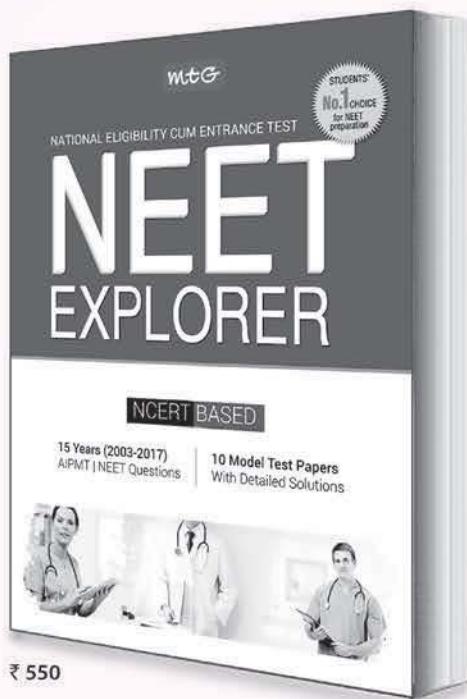
(i)	(ii)	(iii)	(iv)
(a) eusporangiate	primary archesporial cell	endothecium	chalazal
(b) leptosporangiate	primary parietal cell	middle layers	micropilar
(c) eusporangiate	primary parietal cell	endothecium	nucellar
(d) precocious	primary archesporial cell	tapetum	chalazal

- 4.** Select the incorrectly matched pair.
- |                       |   |
|-----------------------|---|
| (a) Anemophilous      | — Light and winged pollens                            |
| (b) Hydrophilous      | — Hairy and feathery stigma                           |
| (c) Entomophilous     | — Stamens are inserted and stigmas are sticky         |
| (d) Chiropterophilous | — Large flowers with most abundant nectar and pollens |
- 5.** Which of the following is the best contrivances to ensure self pollination?
- |              |               |
|--------------|---------------|
| (a) Dicliny  | (b) Dichogamy |
| (c) Homogamy | (d) Herkogamy |
- 6.** Inner thin and smooth layer of pollen grain is made up of
- |                    |                             |
|--------------------|-----------------------------|
| (a) sporopollenin  | (b) proteins                |
| (c) pectocellulose | (d) lipids and carotenoids. |
- 7.** The entry of pollen tube into the ovule through funiculus or integument is called
- |                 |                       |
|-----------------|-----------------------|
| (a) porogamy    | (b) mesogamy          |
| (c) chalazogamy | (d) both (a) and (b). |
- 8.** Select the correct statement related to angiospermic plants.
- |   |
|---|
| (a) Microspore mother cell is the first cell of male gametophyte.       |
| (b) An embryo sac represents megasporangium.                            |
| (c) Central cell of an embryo sac is diploid.                           |
| (d) The vegetative cell of pollen grain gives rise to two male gametes. |
- 9.** Double fertilisation is best defined as
- |  |
|--|
| (a) the fertilisation of two different eggs by two male gametes                                      |
| (b) fertilisation of one egg by two male gametes brought by different pollen tubes                   |
| (c) fertilisation of egg and central cell by two male gametes brought by same pollen tube            |
| (d) fertilisation of egg and polar nuclei by two male gametes brought by two different pollen tubes. |
- 10.** Match column I with column II and select the correct option.
- | <b>Column I</b>                                     | <b>Column II</b>                                   |
|---|--|
| A. Funicle  | (i) Small opening in ovule                         |
| B. Integuments                                      | (ii) Stalk of ovule                                |
| C. Chalaza  | (iii) Protective envelopes of ovule                |
| D. Hilum  | (iv) Place of junction of body of ovule with stalk |
| E. Micropyle  | (v) Basal part of ovule                            |
| (a) A - (ii), B - (iii), C - (v), D - (iv), E - (i) |  |
| (b) A - (ii), B - (iv), C - (v), D - (i), E - (iii) |  |
| (c) A - (iii), B - (v), C - (i), D - (ii), E - (iv) |  |
| (d) A - (i), B - (iii), C - (ii), D - (v), E - (iv) |  |
- 11.** The entry of pollen tube into the embryo sac upto egg is guided by
- |                        |                   |
|------------------------|-------------------|
| (a) antipodal cells    | (b) obturator     |
| (c) filiform apparatus | (d) central cell. |
- 12.** The correct sequence of development of male gametes is
- |  |
|--|
| (a) Pollen mother cell → megasporangium → microspore → vegetative cell → male gametes              |
| (b) Microsporangium → microspore mother cell → pollen → generative cell → male gametes             |
| (c) Megasporangium → pollen mother cell → megasporangium → pollen → generative cell → male gametes |
| (d) Microspore mother cell → generative cell → archesporial cell → microspore → male gametes.      |
- 13.** Self incompatibility refers to
- |   |
|---|
| (a) inhibition of pollen germination on the stigma of flower of another species |
| (b) maturation of anther and stigma at different times                          |
| (c) germination of pollen within the anther                                     |
| (d) inhibition of pollen germination on the stigma of same flower.              |
- 14.** Study the following statements and select the correct option accordingly.
- Tapetum secretes callase enzyme responsible for degradation of callose walls in pollen tetrads.
  - The flowers of Family Labiatae are usually anemophilous.
  - Raphe is the point of attachment of body of ovule with the funiculus.
  - The pollen grains in dicots are usually tricolporate.
- Of the above statements
- |   |
|---|
| (a) I and III are correct and II and IV are incorrect |
| (b) II and IV are correct and I and III are incorrect |
| (c) I and IV are correct and II and III are incorrect |
| (d) II, III and IV are correct and I is incorrect.    |
- 15.** Refer to the given figure and identify the labels A-D.
- 
- | <b>A</b>            | <b>B</b>        | <b>C</b>          | <b>D</b>        |
|---------------------|-----------------|-------------------|-----------------|
| (a) Egg cell        | Antipodal cells | Polar nuclei      | Synergids       |
| (b) Antipodal cells | Synergids       | Central cell      | Egg cell        |
| (c) Central cell    | Antipodal cells | Polar nuclei      | Synergids       |
| (d) Synergids       | Egg cell        | Secondary nucleus | Antipodal cells |

### Exam Section

- 1.** Functional megasporangium in an angiosperm develops into an
- |               |                |
|---------------|----------------|
| (a) endosperm | (b) embryo sac |
| (c) embryo    | (d) ovule.     |
- (NEET 2017)

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(NEET 2017)

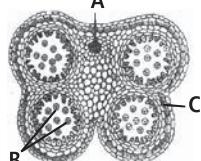
3. A dioecious flowering plant prevents both

  - (a) autogamy and geitonogamy
  - (b) geitonogamy and xenogamy
  - (c) cleistogamy and xenogamy
  - (d) autogamy and xenogamy.

4. Following is the diagram of T.S. of anther. Identify the parts labelled as A, B and C.

  - (a) A-Connective tissue, B-Pollen grains, C-Endothecium
  - (b) A-Endothecium, B-Connective tissue, C- Pollen grains
  - (c) A-Pollen grains, B-Connective tis
  - (d) A-Endothecium, B-Pollen grains

(NEET 2017)



5. Filiform apparatus is the characteristic feature of  
(a) aleurone cell              (b) synergids  
(c) generative cell            (d) nucellar embryo.

(AIPMT 2015)



(AIIMS 2015)



8. An ovule where chalaza, micropyle and embryo sac lie along vertical line is called

  - (a) campylotropous ovule
  - (b) hemianatropous ovule
  - (c) orthotropous ovule
  - (d) circinotropous ovule.

(UP CPMT 2015)

9. Gametogenesis refers to the process of  
(a) fusion of two gametes  
(b) fusion of two gametangia  
(c) formation of two types of gametes  
(d) formation of male gamete only.

(AMU 2014)

10. The germ pores in the pollen grain are the regions

  - (a) which are made up of lignin and suberin
  - (b) that can withstand high temperature and strong acids and alkalies
  - (c) which lack sporopollenin
  - (d) through which sperms are released into the female gametophyte.

*(Karnataka CET 2014)*

(Karnataka CET 2014)

11. The embryo sac of angiosperms contains

  - (a) 3 celled egg apparatus, 3 antipodal cells and 2 polar nuclei
  - (b) 2 celled egg apparatus, 3 antipodal cells and 2 polar nuclei
  - (c) 3 celled egg apparatus, 2 antipodal cells and 1 polar nuclei
  - (d) 3 celled egg apparatus, 1 antipodal cell and 2 polar nuclei.

(J & K 2014)

- 12.** Which of the following statements is correct?

  - (a) Sporopollenin can be degraded by enzymes.
  - (b) Sporopollenin is made up of inorganic materials.
  - (c) Sporopollenin can withstand high temperatures as well as strong acids and alkalies.
  - (d) Sporopollenin can withstand high temperatures but not strong acids.

*(NEET Karnataka 2013)*

(NEET Karnataka 2013)

- 13.** The innermost wall layer of microsporangium nourishing the developing pollen grains is known as  
(a) endodermis                    (b) endothecium  
(c) tapetum                        (d) sporogenous tissue.

(AMU 2012)

- 14.** Entry of the pollen tube with two male gametes and tube nucleus through micropyle is called  
(a) mesogamy                    (b) porogamy  
(c) chalazogamy                (d) auto gamy. (*Odisha 2011*)

The diagram illustrates a cross-section of a ciliophore. It features a large, central, oval-shaped body containing several small, circular organelles. Four specific structures are labeled: 'A' points to a cluster of organelles at the bottom; 'B' points to a pair of organelles located in the middle section; 'C' points to a single, larger organelle situated near the top; and 'D' points to a group of organelles positioned at the very top edge of the cell.

In the diagram given above, parts labelled as 'A', 'B', 'C', 'D', 'E' and 'F' are respectively identified as:

- (a) synergids, polar nuclei, central cell, antipodals, filiform apparatus and egg  
(b) polar nuclei, egg, antipodals, central cell, filiform apparatus and synergids  
(c) egg, synergids, central cell, filiform apparatus, antipodals and polar nuclei  
(d) central cell, polar nuclei, filiform apparatus, antipodals, synergids and egg  
(e) filiform apparatus, polar nuclei, egg, antipodals, synergids and central cell.

y, antipodalis,  
(Kerala 2010)

## Assertion & Reason

The following questions consist of two statements each : assertion (A) and reason (R). To answer these questions, mark the correct alternative as directed below:

- (a) If both A and R are true and R is the correct explanation of A.
- (b) If both A and R are true but R is not the correct explanation of A.
- (c) If A is true but R is false.
- (d) If both A and R are false.

**1. Assertion :** Gametophytic self-incompatibility is determined by the genotype of male gametophyte.

**Reason :** Pollen grains possessing S allele common to any one of the two alleles present in cells of carpel is not functional on that particular carpel.

**2. Assertion :** Cross pollination is a highly wasteful and less economical process.

**Reason :** It introduces genetic recombinations and variations in the progeny.

**3. Assertion :** Outer layers of microsporangium help in dehiscence of mature anther.

**Reason :** Tapetal cells develop fibrous thickenings in their wall and helps in dispersal along the line of dehiscence.

**4. Assertion :** The megasporangium is formed from the primary parietal cell in hypodermal region of nucellus towards the chalazal end.

**Reason :** Megasporangium undergoes reduction division to form haploid embryo sac or female gametophyte.

**5. Assertion :** In *Ceratophyllum*, the mature anthers dehisce on the surface of water and after germination sinks down.

**Reason :** The anthers come into contact with long and sticky swaying stigmas while sinking.

## Short Answer Type Questions

**1.** Fill in the blanks.

- (i) Seed set is assured in \_\_\_\_\_, even in absence of pollinators.
- (ii) A typical embryo sac is \_\_\_\_\_ nucleated.
- (iii) Sporopollenin is not degraded by enzyme, high temperature or strong acids and alkalies as it is composed of \_\_\_\_\_.

**2.** Differentiate between microsporogenesis and megasporogenesis.

**3.** A bilobed dithecosous anther has 100 microspore mother cells per microsporangium. How many pollen grains can this anther produce?

**4.** Describe the structure of an anatropous ovule with the help of a labelled diagram.

## ANSWER KEY

### New MCQ

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (c)  | 2. (d)  | 3. (a)  | 4. (b)  | 5. (c)  |
| 6. (c)  | 7. (b)  | 8. (c)  | 9. (c)  | 10. (a) |
| 11. (c) | 12. (b) | 13. (d) | 14. (c) | 15. (d) |

### Exam Section

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (b)  | 2. (b)  | 3. (a)  | 4. (a)  | 5. (b)  |
| 6. (c)  | 7. (c)  | 8. (c)  | 9. (c)  | 10. (c) |
| 11. (a) | 12. (c) | 13. (c) | 14. (b) | 15. (a) |

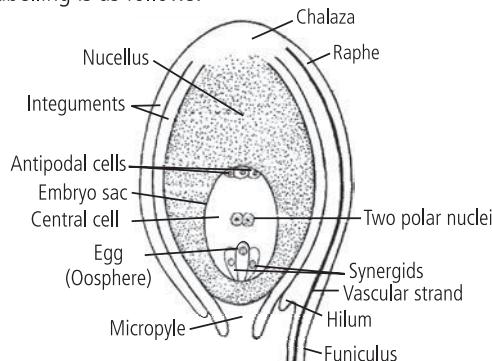
## Assertion & Reason

- |        |        |        |        |        |
|--------|--------|--------|--------|--------|
| 1. (a) | 2. (b) | 3. (c) | 4. (d) | 5. (b) |
|--------|--------|--------|--------|--------|

## Short Answer Type Questions

- 1.** (i) *Commelina* (ii) 8  
(iii) highly resistant fatty substance
- 2.** Differences between microsporogenesis and megasporogenesis are -
  - (i) Microsporogenesis occurs inside microsporangia of anther, while megasporogenesis takes place inside ovule.
  - (ii) Many microspore mother cells are differentiated in a microsporangium while only one megasporangium differentiates in a megasporangium.
  - (iii) All the four cells in microspore tetrad develops into pollen grains whereas only one of the four cells in megasporangium develops into an embryo sac.
- 3.** 100 microspore mother cells in a microsporangium will undergo meiosis to produce microspores.  
 $100 \times 4 = 400$  microspores per microsporangium  
Since anther has 4 lobes  $= 400 \times 4 = 1600$   
Thus, the anther can produce 1600 pollen grains.

- 4.** Diagrammatic structure of an anatropous ovule with labelling is as follows:



*New*

# NCERT Xtract

## Questions for NEET

### Strategies For Enhancement in Food Production

1. The term 'inbreeding depression' refers to the condition of
  - (a) reduced fertility
  - (b) reduced productivity
  - (c) expression of harmful recessive genes
  - (d) all of these.
2. The optimum production of eggs by poultry requires
  - (a) 14 – 16 hours of light
  - (b) 8 – 10 hours of light
  - (c) 10 hours of light followed by 5 hours of darkness
  - (d) 12 hours of light and temperature below 5°C.
3. The improved high yielding semi-dwarf varieties of rice developed in India are
  - (a) Safed Lerma and Sharbati Sonora
  - (b) Safed Lerma and Chhoti Lerma
  - (c) Jaya and Ratna
  - (d) Jaya and Lerma Roja 64-A.
4. Identify the incorrect statement regarding autopolyploidy.
  - (a) It is observed in some garden plants.
  - (b) It induces gigas effect.
  - (c) It occurs due to doubling of chromosomes.
  - (d) *Raphanobrassica* is an example of autopolyploid.
5. The essential strategy adopted for livestock improvement is
  - (a) breeding
  - (b) feeding
  - (c) weeding
  - (d) all of these.
6. Which of the following breeds of livestock are not indigenous?
  - (i) Murrah
  - (ii) Bakharwal
  - (iii) Nellore
  - (iv) Chegu
  - (v) Ongole
  - (vi) Jersey
  - (vii) Angora
  - (viii) Merino
  - (a) (i), (ii) and (iii)
  - (b) (iv), (vi) and (viii)
  - (c) (vi), (vii) and (viii)
  - (d) (v), (vii) and (viii)
7. Consider the following statements regarding single cell protein and select the incorrect one.
  - I. This provides an alternate source of proteins for humans.
  - II. It is obtained from unicellular microorganisms only, so called SCP.
  - III. Wide range of substrates such as industry effluents, saw dust and paddy straw are used in production of SCP.
  - IV. It is rich in fat and has average quantity of proteins, hence serves as good human food alternative.
    - (a) I and IV
    - (b) II and IV
    - (c) II and III
    - (d) I, II and III
8. Choose the incorrect statement regarding artificial insemination for carrying out controlled breeding in animals.
  - (a) Semen should be used immediately and cannot be stored for further usage.
  - (b) Fewer sperms are required to achieve conception through this technique.
  - (c) It controls spread of some diseases among animals.
  - (d) It is an economical method.
9. Some plants naturally exhibit resistance to insect and pests due to their morphological or physiological characteristics. Select the option showing the correct cause of pest resistance in plants.
  - (a) Solid stem in wheat prevents cereal leaf beetle.
  - (b) Hairy leaves of cotton are resistant to stem borer.
  - (c) Low aspartic acid content in maize imparts resistance to maize stem borers.
  - (d) All of these
10. Select the incorrect statements regarding inbreeding in animals.
  - I. Inbreeding is breeding between individuals (animals) of same breed but having no common ancestors between them.
  - II. Inbreeding increases homozygosity and hence purelines are produced.
  - III. Inbreeding exposes harmful recessive genes that are eliminated by selection.

- IV. Inbreeding depression helps in restoring fertility and yield.
- I and IV
  - II and IV
  - I, II and III
  - All of these
- 11.** Which of the following poultry diseases is caused by fungal pathogen?
- Marek's disease
  - Infectious coryza
  - Mycosis
  - Coccidiosis
- 12.** Recently many food crops have been improved nutritionally through biofortification. Identify the correct match of crop with its improved nutrient.
- |                  |                    |
|------------------|--------------------|
| (a) Carrot       | — Vitamin B        |
| (b) Bitter gourd | — Vitamin A        |
| (c) French beans | — Iron             |
| (d) Spinach      | — Calcium and iron |
- 13.** Somaclonal variations refer to the genetic variations present in plants obtained from tissue culture. These are used to develop useful varieties of plants, specific for particular traits. Identify the characteristic in plants obtained from somaclonal variations.
- Tolerance to rust in wheat
  - Resistance to rice tungro virus
  - Increased shelf life of tomato
  - All of these
- 14.** Match the column I showing diseases in animals with column II having their causative agents.
- | <b>Column I</b>      | <b>Column II</b>                    |
|----------------------|-------------------------------------|
| A. Marek's disease   | (i) H5N1 virus                      |
| B. Infectious coryza | (ii) <i>Argas persicus</i>          |
| C. Aspergillosis     | (iii) <i>Haemophilus gallinarum</i> |
| D. Tick fever        | (iv) DNA virus                      |
| E. Bird flu          | (v) <i>Aspergillus fumigatus</i>    |
- A - (v), B - (iii), C - (iv), D - (i), E - (ii)
  - A - (iv), B - (iii), C - (v), D - (ii), E - (i)
  - A - (iv), B - (i), C - (v), D - (iii), E - (ii)
  - A - (i), B - (iv), C - (v), D - (iii), E - (ii)
- 15.** During composite fish farming in a pond which of the following fish species will show least competition among themselves for food and space.
- Catla, Hilsa* and Tuna
  - Catla, Labeo rohita* and *Cirrhinus mrigala*
  - Sardinella, Stromateus* and *L.calbasu*
  - Eel, Mrigal and Tuna
- 16.** The conditions prerequisite for successful beekeeping is
- selection of suitable location as gardens and orchards
  - proper handling and collection of products, i.e., honey and beewax
  - catching and hiving of swarms
  - all of these.
- 17.** During the conventional plant breeding programme, the various steps are involved to develop a new variety. Select the correct sequence of steps during plant breeding.
- Evaluation and selection of parents → Collection of variability → Cross hybridisation → Release and commercialisation of new varieties → Selection and testing of superior recombinants
  - Collection of germplasm → Evaluation and selection of parents → Cross hybridisation → Selection and testing of superior recombinants → Release and commercialisation of new varieties
  - Selection of parents → Cross hybridisation → Collection of germplasm → Release and commercialisation of new cultivars → Testing of superior recombinants
  - Selection and evaluation of parents → Collection of germplasm → Cross hybridisation → Testing of superior recombinants → Release and commercialisation of cultures
- 18.** The byproduct of fisheries used in clarification of wine and beer is
- fish manure
  - fish glue
  - isinglass
  - shagreen.
- 19.** Quarantine refers to
- development of new crops
  - examination of introduced crops to prevent entry of weeds, diseases, etc.
  - examination of cultured crops (by micropropagation) for disease, nutrient deficiency, etc.
  - none of these.
- 20.** A farmer observes that all the sugarcanes in his field show mosaic disease caused by a virus. What techniques would you suggest him to adopt so as to eliminate this disease from the sugarcane field?
- Plant breeding
  - Mutation breeding
  - Meristem culture
  - Haploid culture
- 21.** Consider the following statements and select the incorrect ones.
- Animal husbandry refers to farm or domesticated animals.
  - The term poultry refers to birds raised under domestication for economic purpose.
  - Improved breeds of domesticated animals and their products are produced through selective mating.
  - MOET is the most common method of natural breeding in animals, resulting in improved breeds.
- I and IV
  - II and III
  - II, III and IV
  - None of these
- 22.** Identify the correct pair of edible marine fish.
- Mrigal, *Hilsa*, Eel
  - Labeo rohita*, *L.calbasu*, *Catla*
  - Sardinella, Stromateus, Rastrelliger*
  - Bombay duck, *Hilsa*, *Cirrhinus*
- 23.** *Hisardale* is a breed developed by crossing
- Bikaneri rams and Marino ewes
  - Bikaneri ewes and Marino rams
  - Tharparkar and Holstein Friesian
  - Sahiwal and Brown Swiss bull.

- 25.** Categorise the given breeds of Indian cattle, as milch, draught or general utility breeds and select the option with correct match of breeds.



Milch	Draught	Dual purpose
(a) (iv), (vi)	(i), (v)	(ii), (iii)
(b) (i), (vi)	(ii), (v)	(iii), (iv)
(c) (ii), (iv)	(i), (v)	(iii), (vi)
(d) (i), (iii)	(ii), (iv)	(v), (vi)

- 26.** Refer to the given table and select the correct option for blanks A, B, C.

Crop	Variety	Resistance to diseases
<i>Brassica</i>	A	Aphids
B	Pusa Sem 2	Jassids, fruit borer
Okra	C	Shoot and fruit borer

- | <b>A</b>        | <b>B</b>    | <b>C</b>    |
|-----------------|-------------|-------------|
| (a) Pusa Sawani | Cauliflower | Pusa Gaurav |
| (b) Pusa A-4    | Pea         | Pusa Sem 3  |
| (c) Pusa Gaurav | Flat bean   | Pusa Sawani |
| (d) Pusa Sem 2  | Cowpea      | Pusa Gaurav |

- 27.** The superior males of one breed are mated with superior females of another breed to produce better breeds. Such a cross is called as



- 28.** Some seeds do not have any form of stored food. Which of the following can be adopted to obtain maximum seedling formation?

  - (a) Meristem culture
  - (b) Embryo culture
  - (c) Protoplast culture
  - (d) Polyploidy

- 29.** The chromosome number of haploid plants can be doubled to obtain homozygous plants by  
(a) hybridisation      (b) colchicine treatment  
(c) rDNA technology      (d) ionising radiations.

- 30.** Identify the correct sequence of steps involved in the process of hybridisation.

- (a) Selection → Emasculation → Selfing → Bagging → Artificial pollination
  - (b) Emasculation → Selection → Bagging → Tagging → Selfing
  - (c) Selection → Selfing → Emasculation → Bagging → Artificial pollination
  - (d) Selection → Artificial pollination → Bagging → Emasculation → Selfing

- 31.** The protozoan disease in honeybee is



- 32.** Select the incorrect pair regarding production of SCP.

- (a) Bacteria – *Methylophilus methylotrophus*
  - (b) Yeast – *Saccharomyces cerevisiae*
  - (c) Cyanobacteria – *Spirulina*
  - (d) Filamentous fungi – *Aspergillus niger*

- 33.** Read the given statements and select the correct option.

**Statement 1 :** *Saccharum officinarum* having higher sugar content and thicker stems grows well only in South India.

**Statement 2 :** *Saccharum barberi* obtained as a result of cross between two varieties of sugarcane has above desirable qualities of sugarcane and is able to grow in North India as well.

- (a) Both statements 1 and 2 are correct and 2 is the correct explanation of 1.
  - (b) Both statements 1 and 2 are correct but 2 is not the correct explanation of 1.
  - (c) Statement 1 is correct but statement 2 is incorrect.
  - (d) Both statements 1 and 2 are incorrect.

- 34.** Match the column I (nutrient) with column II (source) required in plant tissue culture medium and select the correct option.

<b>Column I</b>	<b>Column II</b>
A. Carbon	(i) Nicotinic acid
B. Inorganic salts	(ii) Ammonium sulphate
C. Vitamins	(iii) 2, 4-D
D. Growth regulators	(iv) Thiamine
E. Amino acids	(v) Sucrose
	(vi) BAP
	(vii) L-arginine
(a)	A - (v), B - (ii), C - (i), D - (vi), E - (vii)
(b)	A - (v), B - (iv), C - (vi), D - (iii), E - (ii)
(c)	A - (iv), B - (i), C - (vii), D - (iii), E - (vi)
(d)	A - (iv), B - (ii), C - (i), D - (vi), E - (viii)

- 35.** The spread of certain diseases in animals can be prevented by adopting the method of

- (a) cross breeding      (b) artificial insemination  
(c) inbreeding          (d) interspecific hybridisation.

- 36.** Refer to the given table and select the correct pair of differences.

	Pureline Selection	Mass Selection
(i)	Used in self pollinated species.	Used in both self and cross pollinated species.
(ii)	Genetic variations are present .	Genetic variations are absent.
(iii)	Highly uniform variety is produced.	Less uniform variety is produced.
(iv)	Varieties produced show wide adaptation.	Varieties produced show narrow adaptation.

The correct set of differences are



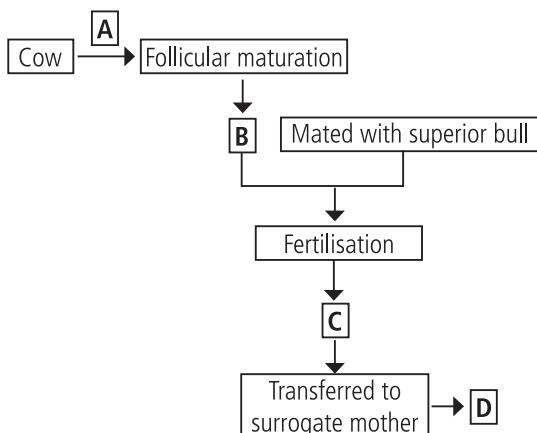
**37.** Select the incorrect statement regarding SCP.

- (a) These are microbial biomass produced using low cost substrates.



# **HIGHER ORDER THINKING SKILLS QUESTIONS (HOTS)**

**41.** Refer to the given flow chart representing the steps in MOFT



Identify the correct statements for A, B, C and D and select the correct option.



- (b) Production of SCP reduces pressure on agricultural production systems.
  - (c) Its production also helps to minimise environmental pollution.
  - (d) In most cases, SCP need not to be processed and can be used as such.

**38.** Biofortification refers to plant breeding aimed mainly to improve

- (a) protein content                          (b) fat content  
(c) vitamin content                            (d) all of these.

**39.** Androgenic haploids in anther culture can be produced by

- (a) young pollen grains (b) connective tissue  
(c) tapetum (d) anther wall.

**40.** Endosperm culture is a significant technique since it

- (a) produces seedless fruits
  - (b) produces virus free plants
  - (c) provides nutrition to developing embryo
  - (d) both (a) and (c).

**42.** Consider the given statements regarding types of culturing and choose the correct ones

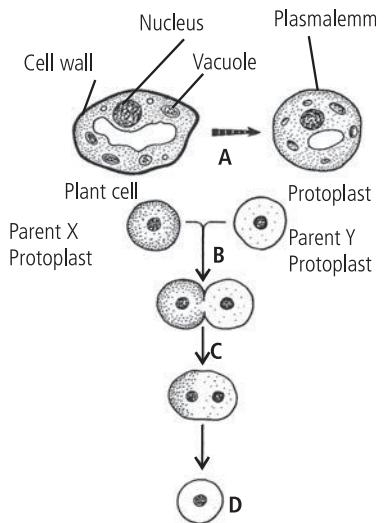
- I. Callus culture is maintained on agar medium containing auxin and cytokinin as growth regulators.
  - II. Suspension culture is maintained in liquid medium containing both auxins and cytokinins as growth regulators.
  - III. Callus culture grows much faster than suspension culture.
  - IV. Callus culture needs to be continuously agitated at 100-250 rpm.

(a) II, III and IV only      (b) I and II only  
(c) I only                        (d) III only

**43.** Match the column I (livestock) with column II (indigenous breed) and column III (exotic breeds) and select the correct option.

	<b>Column I</b>	<b>Column II</b>	<b>Column III</b>
A.	Honeybee	(p) Red Sindhi	(i) Angora
B.	<i>Capra capra</i>	(q) Rampur Bushair	(ii) Dorset
C.	<i>Ovis aries</i>	(r) <i>Apis indica</i>	(iii) Ayrshire
D.	<i>Bos indicus</i>	(s) Changthangi	(iv) <i>Apis mellifera</i>
(a)	A - (p) - (iv), B - (s) - (ii), C - (r) - (iii), D - (q) - (i)		
(b)	A - (r) - (iv), B - (s) - (i), C - (q) - (ii), D - (p) - (iii)		
(c)	A - (p) - (iii), B - (q) - (ii), C - (r) - (i), D - (s) - (iv)		
(d)	A - (p) - (iii), B - (s) - (ii), C - (q) - (iv), D - (r) - (i)		

44. Refer to the given figure and identify A,B,C and D.



	A	B	C	D
(a)	Cellulase + Chitinase	Pectinase	Nuclear fusion	Recombinant cell
(b)	Lysozyme	Cellulase	Cell fusion	Hybrid cell
(c)	Cellulase + Pectinase	Calcium chloride	Propoplast fusion	Transformed cell
(d)	Cellulase + Pectinase	PEG	Protoplast fusion	Somatic hybrid cell

45. Select the incorrect statement regarding micropropagation.

- (a) Since this method rapidly propagates plants with the use of minute sized propagules, it is called micropropagation.
- (b) It produces genetically superior plants as compared to its parents and are called somaclones.
- (c) It is an easy, safe and economical method for plant propagation.
- (d) It is mainly employed for production of ornamental plants, e.g., lily, orchids, etc., and fruit trees like tomato, grapes, etc.

46. Consider the given statements regarding a method of animal breeding, aimed to improve breeds of domesticated animals.

- I. It is the reverse of inbreeding depression.
- II. In this method, male and female animals with desirable characters of two different species are mated.
- III. The resulting offspring shows phenotypic superiority over either of its parents in one or more traits.
- IV. Mules obtained from such breeding method have greater strength and resistance to diseases than their parents.

From the above mentioned statements, it can be inferred that the method of breeding is

# mcq's

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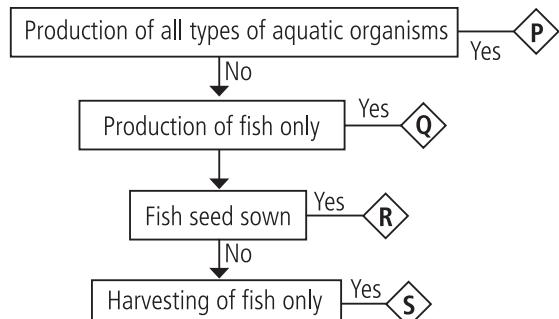
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- (a) cross breeding      (b) interspecific hybridisation  
 (c) outcrossing      (d) controlled breeding.

47. Refer to the given flow chart and identify the incorrect statement regarding P, Q, R and S.



- (a) P provides both food as well as economically important substances.  
 (b) In Q, feed is provided from outside.  
 (c) R is carried out in water bodies like rivers, estuaries, reservoirs, etc.  
 (d) In S, harvesting is done without sowing any seed or rearing them.

48. Refer to the given statements regarding autopolyploidy and select the incorrect one.

- (a) In autotriploids there is 3 times numerical increase of same genome i.e., AAA.  
 (b) Autotriploids are sexually sterile and propagate vegetatively.  
 (c) Autotriploids can also freely cross breed with diploids.

- (d) Maize and rice are some of the common autopolyploids.

49. The plantlets obtained from tissue culture are transferred to field under controlled conditions as reduced light intensity and high humidity. This process is referred to as

- (a) subculturing      (b) regeneration  
 (c) hardening      (d) plantlet transfer.

50. Select the incorrect pair of improved crops, their traits and the method by which they are developed.

- (a) Mung bean – Resistance to yellow mosaic virus – Mutation breeding  
 (b) Maize – Twice the amount of lysine and tryptophan – Biofortification  
 (c) Millets – Resistance to water stress – Mutation breeding  
 (d) Flat bean – Resistance to aphids – Plant breeding

### ANSWER KEY

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (d)  | 2. (a)  | 3. (c)  | 4. (c)  | 5. (d)  |
| 6. (c)  | 7. (b)  | 8. (a)  | 9. (c)  | 10. (a) |
| 11. (c) | 12. (d) | 13. (d) | 14. (b) | 15. (b) |
| 16. (d) | 17. (b) | 18. (c) | 19. (b) | 20. (c) |
| 21. (a) | 22. (c) | 23. (b) | 24. (a) | 25. (a) |
| 26. (c) | 27. (b) | 28. (b) | 29. (b) | 30. (c) |
| 31. (c) | 32. (d) | 33. (c) | 34. (a) | 35. (b) |
| 36. (c) | 37. (d) | 38. (d) | 39. (a) | 40. (d) |
| 41. (c) | 42. (c) | 43. (b) | 44. (d) | 45. (b) |
| 46. (b) | 47. (c) | 48. (c) | 49. (c) | 50. (c) |



## UNSCRAMBLE ME

Unscramble the words given in column I and match them with their explanations in column II.

### Column I

- NCIODLBSAT
- TEMHCAORISS
- IHCORTPREPOIHYL
- ERUTOLECI
- ELPOIRTPOY
- YHTORLACICOTINN
- NAHTCOAYINN
- OIBOTEP
- AMIRUJNAA
- ASCNUTRAY

### Column II

- |     |  |
|-----|--|
| (a) | Cross pollination of flower performed by nocturnal flying mammals.           |
| (b) | A condition in which a single gene influences more than one trait.           |
| (c) | A water soluble vacuolar pigment that imparts various colours to the flower. |
| (d) | Area of an ecosystem having uniform environmental conditions.                |
| (e) | Ability of frog to change its body colour with the changing environment.     |
| (f) | Animals whose nitrogenous excreta mainly contains urea.                      |
| (g) | Natural hallucinogenic product obtained from Cannabis.                       |
| (h) | A protected area where fauna can take shelter without being hunted.          |
| (i) | Hormone secreted by 'C' cells that regulates the blood calcium level.        |
| (j) | Type of cells found in coelenterates having stinging organ for defence.      |

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Winners' names will be published in next issue.

# MPP-3 | MONTHLY Practice Problems

Class XII

This specially designed column enables students to self analyse their extent of understanding of specified chapters. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

- Principles of Inheritance and Variation
- Molecular Basis of Inheritance

Total Marks : 160

Duration : 40 Min.



1. Read the following statements and select the incorrect one.
  - (a) Prokaryotic DNA is usually linear and double stranded.
  - (b) DNA is the largest biomolecule in a cell.
  - (c) Thomas Hunt Morgan is considered as "Father of experimental genetics".
  - (d) Allelic abnormalities develop due to mutations.
2. Estimated number of genes in human beings are
 

(a) 3,000	(b) 80,000
(c) 20,500	(d) $3 \times 10^9$ .
3. Which of the following helps in bringing a specific amino acid at its proper position during translation?
  - (a) Codon
  - (b) Anticodon
  - (c) rRNA
  - (d) Both (a) and (c)
4. Identify P, Q, R and S in the given table and select the correct option.

	<b>Types of DNA</b>	<b>Diameter of helix</b>	<b>Repeating unit</b>
1.	<b>P</b>	18 Å	Dinucleotide
2.	A	26 Å	<b>Q</b>
3.	C	<b>R</b>	Mononucleotide
4.	<b>S</b>	20 Å	Mononucleotide

	<b>P</b>	<b>Q</b>	<b>R</b>	<b>S</b>
(a)	Z	Mononucleotide	19 Å	B
(b)	B	Dinucleotide	33 Å	Z
(c)	B	Mononucleotide	30 Å	Z
(d)	Z	Dinucleotide	19 Å	B

5. Select the correct option to fill up the blanks in the following statements.
  - (i) \_\_\_\_\_ works on the principle of polymorphism in DNA sequences.
  - (ii) \_\_\_\_\_ genes do not show independent assortment at the time of gamete formation.
  - (iii) Straight inheritance from both the parents to all the offspring is seen in \_\_\_\_\_.

<b>(i)</b>	<b>(ii)</b>	<b>(iii)</b>
(a) Human genome project	Linked	sickle cell anaemia
(b) DNA fingerprinting	Linked	haemophilia
(c) DNA fingerprinting	Unlinked	haemophilia
(d) DNA fingerprinting	Linked	sickle cell anaemia
6. Match column I with column II and select the correct option.
 

<b>Column I</b>	<b>Column II</b>
A. Sutton and Boveri	(i) One-gene-one enzyme hypothesis
B. T.H. Morgan	(ii) Genetic code
C. Beadle and Tatum	(iii) Fly man of genetics
D. Hargobind Khorana	(iv) Chromosomal theory of inheritance

  - (a) A-(ii); B-(i); C-(iii); D-(iv)
  - (b) A-(iv); B-(iii); C-(i); D-(ii)
  - (c) A-(iii); B-(ii); C-(iv); D-(i)
  - (d) A-(iv); B-(i); C-(ii); D-(iii)
7. Select the correctly matched pair.
  - (a) Streptomycin – inhibits RNA synthesis
  - (b) Neomycin – inhibits interaction of tRNA with mRNA
  - (c) Puromycin – inhibits initiation of translation
  - (d) Erythromycin – inhibits peptidyl transferase

- 8.** Mohan is suffering from a disorder. It is caused due to an extra chromosome number 13. He has a small head, cleft lip and palate, low set deformed ears and a small chin. He keeps the finger tightly clenched against the palm of the hand. Identify the disorder.  
 (a) Cri-du-chat syndrome (b) Edward's syndrome  
 (c) Down syndrome (d) Patau's syndrome
- 9.** The  $F_2$  ratio in supplementary and complementary genes respectively are  
 (a) 9 : 7 and 9 : 3 : 4 (b) 9 : 3 : 4 and 9 : 7  
 (c) 1 : 2 : 1 and 9 : 7 (d) 9 : 7 and 3 : 1.
- 10.** Which of the following is best known example of lethal genes?  
 (a) Thalassaemia major (b) Phenylketonuria  
 (c) Sickle cell anaemia (d) Haemophilia
- 11.** Which chromosomal complement and X/A ratio respectively are responsible for the expression of metamale in *Drosophila*?  
 (a) 3X + 2A and 1.5 (b) 3X + 3A and 1.0  
 (c) XY + 3A and 0.33 (d) XO + 2A and 0.5
- 12.** In short horned cattle, the heterozygous condition of alleles for white (W) and red (R) hair colour produces roan hair colour. When a roan cattle is breed to red cattle, the proportion of offsprings will be  
 (a) 25% white : 50% roan : 25% red  
 (b) 50% roan : 50% red  
 (c) 50% roan : 50% white  
 (d) 50% red : 50% white.
- 13.** Select an option that shows the correct sequence of the steps involved in DNA fingerprinting.  
 (i) Separation of DNA fragments by electrophoresis  
 (ii) Isolation of DNA  
 (iii) Hybridisation using VNTR probe  
 (iv) Transferring of separated DNA fragments to nylon membrane  
 (v) Detection of hybridised DNA fragments by autoradiography  
 (vi) Digestion of DNA by restriction endonucleases  
 (a) (ii) → (vi) → (i) → (iv) → (iii) → (v)  
 (b) (i) → (ii) → (iii) → (iv) → (v) → (vi)  
 (c) (ii) → (v) → (vi) → (i) → (iii) → (iv)  
 (d) (iii) → (ii) → (iv) → (vi) → (v) → (i)
- 14.** The following features occur during protein synthesis.  
 (i) Movement of mRNA from the nucleus into the cytoplasm, where it binds to small subunit of the ribosome.  
 (ii) Aminoacylation of tRNA.  
 (iii) Transcription of specific segments of DNA into mRNA molecules in the nucleus.  
 (iv) Binding of N-terminal amino acid, methionine tRNA to the P-site of the ribosome. The tRNA anticodon pairs with AUG on mRNA.
- (v)** Formation of peptide bond between first and second amino acid at the A-site.  
 (vi) Release of the complete polypeptide chain from mRNA and the ribosomes.  
 (vii) Formation of polypeptide.  
 Select the correct order of events.  
 (a) (iii) → (ii) → (i) → (iv) → (v) → (vi) → (vii)  
 (b) (i) → (ii) → (iii) → (iv) → (v) → (vi) → (vii)  
 (c) (iii) → (i) → (ii) → (v) → (iv) → (vi) → (vii)  
 (d) (iii) → (i) → (ii) → (iv) → (v) → (vii) → (vi)
- 15.** Consider the following statements and select the correct option stating which ones are true (T) and which ones are false (F).  
 (i) Introns appear in a mature RNA.  
 (ii) The untranslated regions are present before start codon and after stop codon and are required for efficient translation process.  
 (iii) Monogenic inheritance controls quantitative trait.  
 (iv) Non-sense mutation stops polypeptide synthesis due to formation of a termination codon.  
 (i) (ii) (iii) (iv)  
 (a) F F F T  
 (b) T T F F  
 (c) T F T F  
 (d) F T F T
- 16.** Haemophilia is a sex linked trait.  $F_1$  generation consists of all carrier girls and all normal boys. What would be the possible genotype of parental generation?  
 (a) XX,  $X^hY$  (b)  $XX^h$ , XY  
 (c)  $XX^h$ ,  $X^hY$  (d)  $X^hX^h$ , XY
- 17.** Identify the type of gene from the characters.  
 (i) It is a small gene.  
 (ii) It is the site for binding of RNA polymerase.  
 (iii) It is an AT rich region of the transcription unit.  
 (a) Structural gene (b) Promoter gene  
 (c) Regulator gene (d) Operator gene
- 18.** Identify the correct pair of differences between prokaryotic and eukaryotic transcription.
- |     | Prokaryotic transcription                      | Eukaryotic transcription            |
|-----|--|-------------------------------------|
| (a) | There are three types of RNA polymerase.       | There is only one RNA polymerase.   |
| (b) | An enhancer may be present alongwith promoter. | An enhancer is usually absent.      |
| (c) | mRNA is generally polycistronic.               | mRNA is generally monocistronic.    |
| (d) | Splicing is required.                          | Splicing is generally not required. |

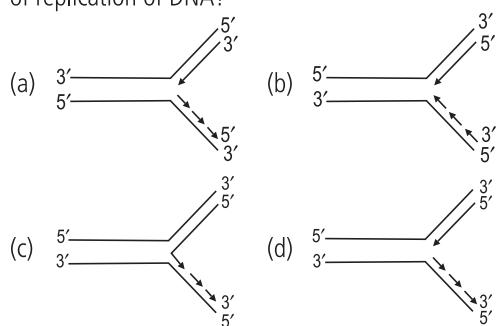
**19.** Read the given statements and select the correct option.

**Statement A :** Linkage is the biggest obstacle for breeders.

**Statement B :** Linkage does not allow breeders to bring all the desirable traits in one variety.

- (a) Both statements A and B are correct and B is the correct explanation of A.
- (b) Both statements A and B are correct but B is not the correct explanation of A.
- (c) Statement A is correct but statement B is incorrect.
- (d) Both statements A and B are incorrect.

**20.** Which one of the following correctly represents the manner of replication of DNA?



**21.** Match the following columns and select the correct option.

<b>Column I</b>	<b>Column II</b>	<b>Column III</b>
1. Initiation codon	P. UGG	A. Arginine
2. Termination codon	Q. AUG	B. Tryptophan
3. Related codon	R. CGU	C. Selenocysteine
4. Redundant codon	S. UGA	D. Methionine
(a) 1 - Q - D; 2 - S - C; 3 - P - B; 4 - R - A		
(b) 1 - P - D; 2 - R - A; 3 - Q - C; 4 - S - B		
(c) 1 - P - B; 2 - S - C; 3 - Q - D; 4 - R - A		
(d) 1 - R - B; 2 - S - C; 3 - P - A; 4 - Q - D		

**22.** An analysis of DNA (double-stranded) sample yielded 18% cytosine. What would be the percentage of other bases in this sample?

- (a) T-32%, A-32%, G-18%
- (b) T-32%, A-18%, G-32%
- (c) T-18%, A-32%, G-32%
- (d) T-40%, A-22%, G-20%

**23.** Read the following statements and select the option which correctly fill the blanks.

- (i) The aggregate of all the genes and their alleles in an interbreeding population is known as \_\_\_\_\_.
- (ii) Both genes and chromosomes show \_\_\_\_\_.
- (iii) \_\_\_\_\_ codon specifies only one amino acid which is same in all cases.
- (iv) \_\_\_\_\_ is removal of introns and fusion of exons to form functional hnRNAs.

	<b>(i)</b>	<b>(ii)</b>	<b>(iii)</b>	<b>(iv)</b>
(a)	gene pool	Law of independent assortment	Unambiguous	Splicing
(b)	genome	Law of segregation	Unambiguous	Cleavage
(c)	gene pool	Law of segregation	Unambiguous	Cleavage
(d)	genome	Law of independent assortment	Universal	Splicing

**24.** Select the incorrect statement regarding complete linkage.

- (a) Linked genes are located on the same chromosome.
- (b) Crossing over occurs to bring recombinants along with parental types.
- (c) Its occurrence is rare.
- (d) It produces parental types and no recombinants in the progeny.

**25.** The ZO – ZZ type of sex determination occurs in

- (a) birds
- (b) butterflies
- (c) moths
- (d) both (b) and (c).

**26.** Select the mismatched pair.

- (a) Genomic RNA – Tobacco Mosaic Virus
- (b) Catalytic RNA – Ribonuclease P
- (c) Small nuclear RNA – Reovirus
- (d) Small cytoplasmic RNA – 7S

**27.** A woman is married for the second time. Her first husband was ABO blood type (B) and her child by that marriage was type AB. Her new husband is blood type A and their child is type O. What is the woman's ABO genotype and blood type?

- (a)  $I^A/I^0$ ; Blood type A
- (b)  $I^A/I^B$ ; Blood type AB
- (c)  $I^B/I^0$ ; Blood type B
- (d)  $I^0/I^0$ ; Blood type O

**28.** The process of formation of number of copies of the same polypeptide simultaneously from an mRNA with the help of polysome is referred to as

- (a) translational amplification
- (b) polyribosome
- (c) aminoacylation
- (d) none of these.

**29.** Which one of the following is the most abundant protein found in *E.coli*?

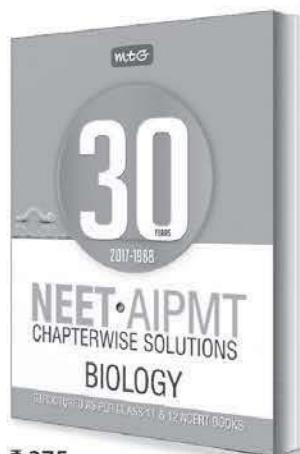
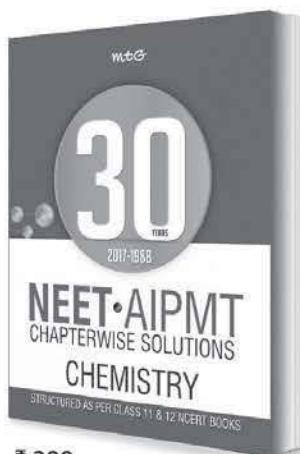
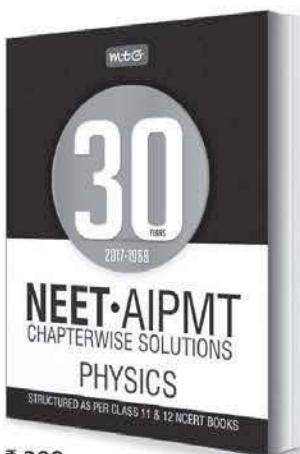
- (a) eEF1
- (b) EF-Tu
- (c) EFTs
- (d) eIF3

**30.** Select the correct sequence of tRNA attachment site on ribosome during polypeptide chain formation.

- (a) A-site → P-site → E-site
- (b) E-site → P-site → A-site
- (c) E-site → A-site → P-site
- (d) P-site → E-site → A-site

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- 31.** Which of the following is a recessive trait studied by Mendel?
- Violet flower colour
  - Green pod colour
  - Yellow cotyledon colour
  - Yellow pod colour
- 32.** Read the following statements regarding DNA polymerase and select the incorrect one.
- In eukaryotes, five types of DNA polymerase are found.
  - Polymerase delta is involved in replication of leading strand.
  - Polymerase alpha is largest and main enzyme of DNA replication.
  - Polymerase epsilon helps in the synthesis of leading strand.
- 33.** Given below are the symbols for common human pedigree analysis.
-  — Consanguineous mating
  -  — Affected individual
  -  — Still death
  -  — Identical twins
  -  — Death
- Identify the correct ones and select the correct option.
- (i), (ii) and (v) only
  - (i), (iii), (iv) and (v) only
  - (iii) and (v) only
  - (i), (ii) and (iv) only
- 34.** Identify the number of sex chromosomal gene disorders from the given list: (i) Down syndrome, (ii) Sickle cell anaemia, (iii) Superfemale, (iv) Turner's syndrome, (v) Haemophilia.
- 2
  - 4
  - 3
  - 5
- 35.** Read the following statements and select the correct option.
- Statement A :** All the boys are colourblind when the parental genotypes is  $X^cX^c$  and XY.
- Statement B :** Colourblindness is a recessive sex linked trait in which eye fails to distinguish blue and green colours.
- Both statements A and B are correct and B is the correct explanation of A.
  - Both statements A and B are correct but B is not the correct explanation of A.
  - Statement A is correct but statement B is incorrect.
  - Both statements A and B are incorrect.
- 36.** Consider the following statements and select the correct option stating which ones are true (T) and which ones are false (F).
- Genes change their expression due to position effect and transposons.
- (ii) Eukaryotic translation requires set of nine initiation factors.
- (iii) In ribosome, a groove is present for passage of newly synthesised polypeptide.
- (iv) In eukaryotes, major part of transcription occur in  $G_1$  and  $G_2$  phases.
- | (i)   | (ii) | (iii) | (iv) |
|-------|------|-------|------|
| (a) F | F    | F     | T    |
| (b) T | T    | T     | T    |
| (c) F | T    | F     | T    |
| (d) T | T    | F     | T    |
- 37.** Match the column I with column II and select the correct option.
- | <b>Column I</b>         | <b>Column II</b>  |
|-------------------------|---|
| I. Supplementary genes  | A. The gene which suppresses the expression of a non-allelic gene   |
| II. Complementary genes | B. Gene controlling the expression of two or more characters in dominant state                            |
| III. Epistatic gene     | C. Pair of non-allelic genes where only one is able to express its effect independently in dominant state |
| IV. Pleiotropic gene    | D. Pair of non-allelic genes, both of which independently express similar phenotypes                      |
- I-B, II-D, III-A, IV-C
  - I-D, II-C, III-A, IV-B
  - I-C, II-D, III-A, IV-B
  - I-D, II-B, III-C, IV-A
- 38.** Which DNA molecule among the following will melt at the lowest temperature?
- 5'-A-A-T-G-C-T-G-C-3'      3'-T-T-A-C-G-A-C-G-5'
  - 5'-A-A-T-A-A-A-G-C-T-3'      3'-T-T-A-T-T-T-C-G-A-5'
  - 5'-G-C-A-T-A-G-C-T-3'      3'-C-G-T-A-T-C-G-A-5'
  - 5'-A-T-G-C-T-G-A-T-3'      3'-T-A-C-G-A-C-T-A-5'
- 39.** Which one of the following is an example of codominance?
- Flower colour in snapdragon
  - Coat colour in cattle
  - Flower colour in Four O'Clock
  - Andalusian fowl
- 40.** Select the correct match.
- Turner's syndrome – XO
  - Supermale – XXYY
  - Superfemale – XXXXY
  - Klinefelter's syndrome – XYY

Key is published in this issue. Search now! ☺

## SELF CHECK

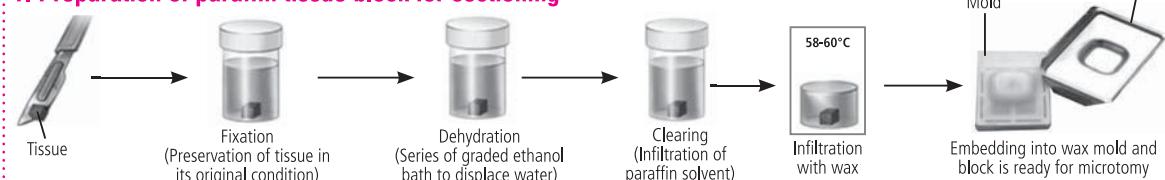
### Check your score! If your score is

<b>&gt; 90%</b>	<b>EXCELLENT WORK !</b>	You are well prepared to take the challenge of final exam.
<b>90-75%</b>	<b>GOOD WORK !</b>	You can score good in the final exam.
<b>74-60%</b>	<b>SATISFACTORY !</b>	You need to score more next time.
<b>&lt; 60%</b>	<b>NOT SATISFACTORY!</b>	Revise thoroughly and strengthen your concepts.

## Microtomy

Microtomy is a technique used for the precise cutting of biological specimen/tissues in very thin sections to examine them under the microscope. This technique is used for the histopathological studies. There are various types of microtome such as rotary microtome, sledge microtome, cryomicrotome, sliding microtome, laser microtome and ultramicrotome. Most commonly used microtome is rotary microtome which is being discussed here. It is preferred for getting serial sections. The typical cut thickness for a rotary microtome is approximately 1-60  $\mu\text{m}$ . It is found in most laboratories where routine paraffin and frozen sections are the only requirements.

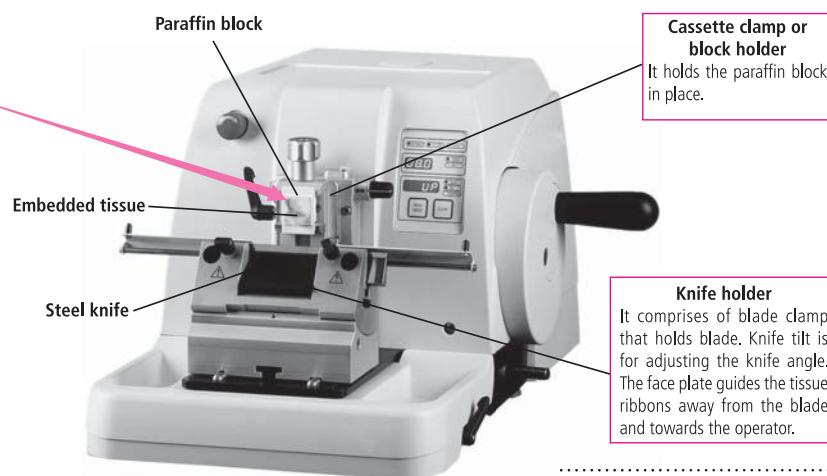
### 1. Preparation of paraffin tissue block for sectioning



The tissue is extracted, fixed, dehydrated, cleared and infiltrated with wax before embedding. For embedding, mold that best corresponds to the size of the tissue is chosen. A margin of at least 2 mm of paraffin surrounding all sides of the tissue is preferred. Small amount of molten paraffin is put in mold. Using warm forceps, tissue is transferred into mold with wax and tissue is oriented. Now, mold is transferred to the cold plate and flattened as required. Cassette is put on top of the mold as a backing. Paraffin will solidify which holds the tissue in position. The tissue paraffin attached to the cassette will form a block. Block is trimmed to remove excess paraffin which takes trapezoid shape ready for sectioning. Embedded tissue into paraffin block supports the tissue structure and enables very thin sections to be cut and mounted onto microscope slides for analysis.

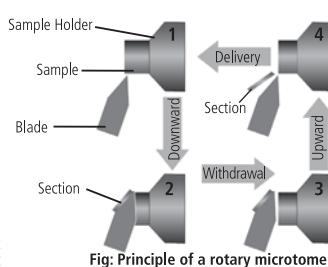
### 2. Mounting the block

Block to be sectioned is inserted into the microtome's chuck and is set to cut sections of desired thickness.

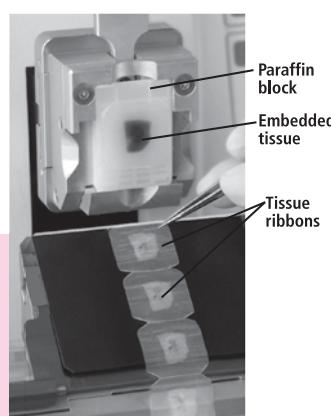


### 3. Section cutting

Rotary microtome operates with a feed screw. The block moves up and down. The block advances a preset number of micrometers. With each revolution of the wheel, one section is cut. The top and bottom edges of the block should be paralleled otherwise the section would curve.

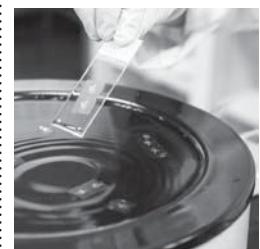


Each time the block hits the knife, it leaves behind a cut section which slides onto the knife, pushing the previous one ahead to produce a ribbon-like structure. The angle between knife and block set is 5-10 degrees.



### 4. Section mounting

Paraffin ribbon is picked with forceps or fine paint brush and is floated on the flotation bath. Microscope slide is used to pick the section out of the water bath. A device with warm shallow water is maintained at about 46°C (10°C below the melting point of paraffin wax). This will float and flatten the ribbon. The slide may be treated with adhesive so that sections remain fix on the slide during staining. The most common adhesive is Mayer's egg albumin. Now, slide is placed overnight on warming block in a 45°C oven to bond the tissue to the glass. After bringing the slide at room temperature, the sample can be stained and examined under microscope.

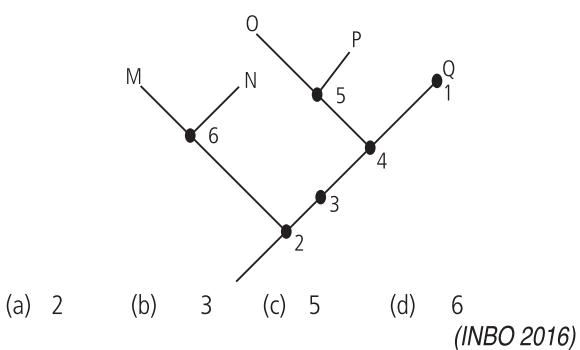


# BIOLOGY

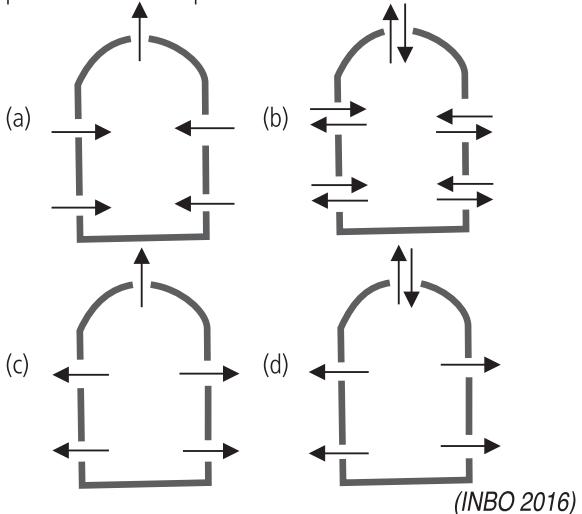
## OLYMPIAD PROBLEMS

1. A cladogram that classifies five species (M, N, O, P and Q) is shown below.

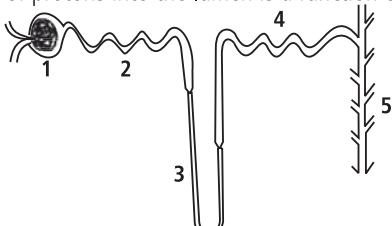
Which of the six dots in the cladogram corresponds to the most recent common ancestor of N and P?



2. Which of the following is the correct depiction of circulatory pattern of water in poriferans?



3. In the accompanying diagram of a human nephron the functional parts are labelled with numbers 1-5. Active secretion of protons into the lumen is a function of

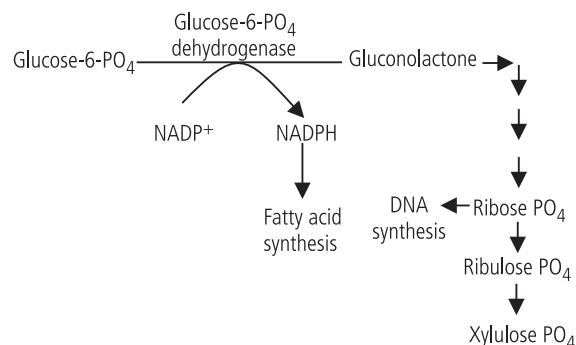


- (a) 3, 4 and 5      (b) only 2 and 4  
(c) only 4      (d) only 5. (NSEB 2015-16)

4. Which of the following is referred to as "chemosynthesis-powered" ecosystem?

- (a) Grassland ecosystem (b) Deep sea ecosystem  
(c) Intertidal ecosystem (d) Forest ecosystem  
(INBO 2015)

5. In addition to glycolysis, there also exists another "glucose direct oxidation" pathway in the cell cytoplasm. This pathway is depicted below.



Enzymes of this pathway will be found abundantly in

- (i) Bone marrow cells      (ii) Liver cells  
(iii) Adipose tissue      (iv) Skeletal muscles  
(a) (i) and (iii) only      (b) (iii) and (iv) only  
(c) (i), (ii) and (iii) only      (d) (ii) and (iv) only  
(INBO 2015)

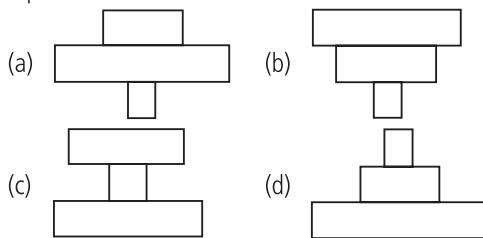
6. Red blood cells also possess the same pathway that is shown in above figure. What is the role of this pathway in these cells?

- (i) To provide pentose sugars required for nucleic acid synthesis.  
(ii) To provide reducing equivalents required for fat synthesis.  
(iii) To provide extra energy by direct glucose oxidation.  
(iv) To generate NADPH that can provide protection against reactive oxygen species.  
(a) (i) and (iv) only      (b) (iii) and (iv) only  
(c) (i), (ii) and (iii) only      (d) (iv) only (INBO 2015)

7. Data collected after survey in an evergreen forest patch was:

- 425 -Trees
- 2,80,000 - Primary consumers
- 2,05,000 - Secondary consumers

Which of the following pyramid of biomass correctly represents the data?



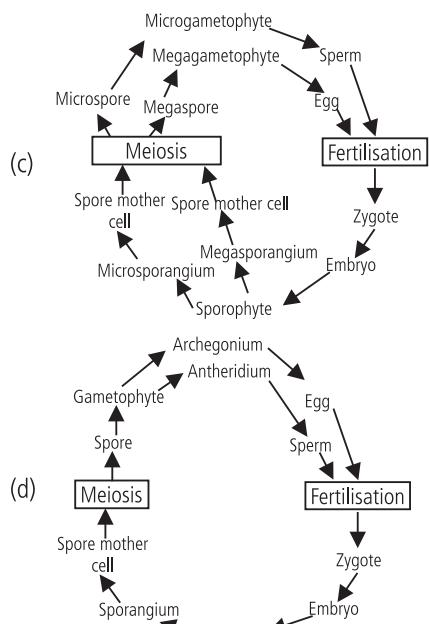
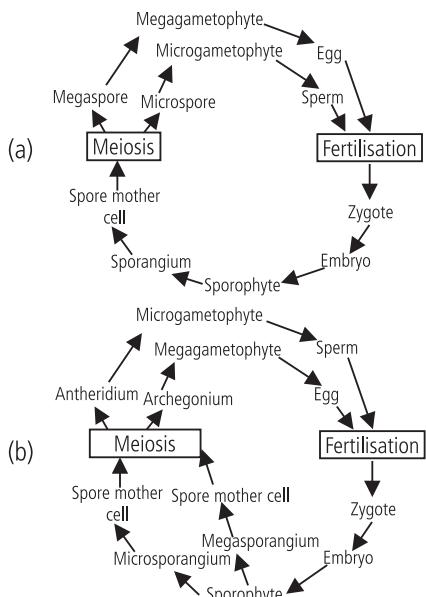
(NSEB 2014-15)

8. An antibiotic was found to be very effective in a mammal. A veterinary student used the same dose for a reptile with a similar body weight and injected it into its hind limb. Even after repeated trials, it was found to be totally ineffective. What could be the most probable reason?

- (a) The absorptive surfaces of the two animals vary greatly. As a result the minimum effective concentration of the drug could not be reached in the blood of the reptile.
- (b) The body temperature of the reptile is quite low as compared to the mammal. As a result, minimum effective concentration of the drug could not be reached in the blood.
- (c) The low metabolic rate of the reptile hindered the rate of diffusion of the drug in the body. Hence, minimum effective concentration of the drug could not be reached in the blood.
- (d) The drug must have got excreted from the body of the reptile before it could reach the minimum effective concentration in the blood.

(INBO 2014)

9. Heterospory is evolutionarily advanced feature over homosporous condition which first appeared in pteridophytes. Which of the following cycles correctly describes this feature in ferns?



(INBO 2014)

10. In a women suspecting pregnancy, blood analysis showed low levels of human chorionic gonadotropin (hCG), considerably high progesterone and very high levels of estrogen. This is indicative of

- (a) no pregnancy (b) early pregnancy
- (c) advanced pregnancy (d) pseudo-pregnancy.

(INBO 2014)

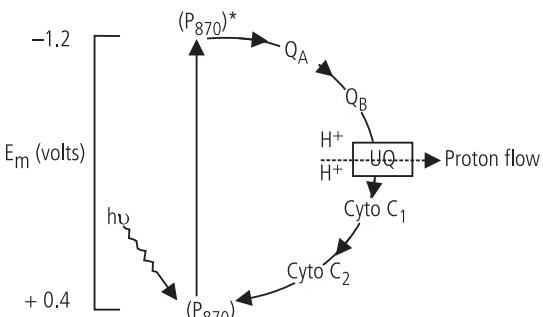
11. Lignin is a secondary metabolite found in plants. Which of the following statement(s) about this biomolecule is/are true?

- I. It is the most abundant organic compound on the earth.
- II. In many plants, lignin is sequestered in vacuoles in order to protect other compounds of the cell.
- III. It waterproofs the cell wall and helps in transportation of water in terrestrial plants.
- IV. Lignin is structurally very similar to tannins and like tannins, it is also an important deterrent to herbivores.

- (a) I, II and III (b) II and IV
- (c) Only III (d) I, III and IV

(INBO 2014)

12. Study the photosynthetic pathway given. A few statements are made about this pathway. Choose the appropriate one.



- (a) The pathway represents the cyclic photosynthesis that occurs in plants and algae.
- (b) The pathway represents the anoxygenic photosynthesis that is found in bacteria.
- (c) The pathway indicates photosynthesis of cyanobacteria but is erroneous as it does not show synthesis of NADPH.
- (d) The pathway indicates cyclic photosynthesis involving photosystem I that is found in plants as well as bacteria.

(INBO 2014)

### SOLUTIONS

- 1. (a) :** As we can see from the cladogram, the most recent common ancestor of N and P is at point 2. It is because, there is no common ancestor for N and P, after dot 2.
- 2. (a) :** In poriferans, body contains many pores called ostia, that serve only for inflow of water. There may be one or more water exits called osculum.
- 3. (b) :** In the given diagram of nephron :
  1. Malpighian corpuscle
  2. Proximal convoluted tubule (PCT)
  3. Descending limb of loop of Henle
  4. Distal convoluted tubule (DCT)
  5. Collecting duct
 In PCT (2), DCT (4) as well as collecting duct (5) parts of nephron there is active secretion of protons ( $H^+$ ) into the lumen.
- 4. (b) :** Chemosynthesis refers to the synthesis of organic compounds by bacteria or other organisms using energy derived from reactions involving inorganic chemicals. It occurs in absence of sunlight and therefore is prominent in deep sea ecosystem. The deep sea or hydrothermal vents are home to chemosynthetic bacteria e.g., Archaeabacteria.
- 5. (c) :** In some animal tissues, the oxidation of glucose-6-phosphate to pentose phosphate occurs by the pentose-phosphate pathway. It is also called the phosphogluconate pathway or hexose monophosphate pathway. Enzymes of this pathway occur abundantly in bone marrow cells, adipose tissue, liver etc. Skeletal muscles contain less enzymes of this pathway.
- 6. (d) :** Erythrocytes are directly exposed to oxygen and thus to the damaging free radicals generated by oxygen. By maintaining a reducing atmosphere (a high ratio of NADPH to NADP+ and a high ratio of reduced to oxidised glutathione), these cells prevent or undo oxidative damage to proteins, lipids and other sensitive molecules. NADPH

produced by the pentose phosphate pathway is so important in preventing oxidative damage that even a genetic defect in glucose-6-dehydrogenase, the first enzyme of the pathway may result in serious medical consequences.

- 7. (d) :** As we know that maximum biomass occurs in producers. There is a progressive reduction of biomass at successive trophic levels, i.e., primary consumers, secondary and tertiary consumers, e.g., herbivores, primary carnivores, secondary carnivores, etc. Therefore, pyramid of biomass is upright for terrestrial habitats (evergreen forest).
- 8. (d)**
- 9. (c) :** In pteridophytes, two types of spore are formed which differ significantly in their size and function. This condition is called heterospory. Megaspores are larger and small in number. Microspores are smaller and large in number.
- 10. (c) :** A woman's hormone levels change dramatically during pregnancy. Important hormones of pregnancy include progesterone, estrogen, hCG and HPL (human placental lactogen). Levels of estrogen and progesterone rise steadily from early pregnancy until close to term, when they level off and then may slowly decline. A similar pattern is true of HPL, except that it is produced until close to the beginning of second trimester. It then rises steadily, until close to the beginning of second trimester. HCG is the primary hormone of early pregnancy, its level drops significantly during the second trimester.
- 11. (c) :** Lignin is the second most abundant organic compound on earth after cellulose. Tannins and lignins are structurally and biosynthetically related polymers whose monomer units are phenols. Tannins are sequestered in vacuoles within the plant cell in order to prevent damage to other cellular components. Lignins are deposited in the cell wall rather than in vacuoles to waterproof the cell wall. So, therefore facilitates the upward transport of water in the conducting cells of the xylem by limiting the outward movement of water from these cells.
- 12. (b):** The given pathway shows the anoxygenic photosynthesis found in bacteria. This pathway has only one type of photosystem with reaction center  $P_{870}$ . To provide electrons for the reduction of  $CO_2$ , anoxygenic photosynthetic bacteria oxidise inorganic or organic molecules available in their environment. The electron carriers in this pathway include quinone (e.g., ubiquinone, menaquinone) and cytochrome, which is similar to the cytochrome *bf* complex of oxygenic photosynthetic apparatus. The process is cyclic.



# CROSS WORD

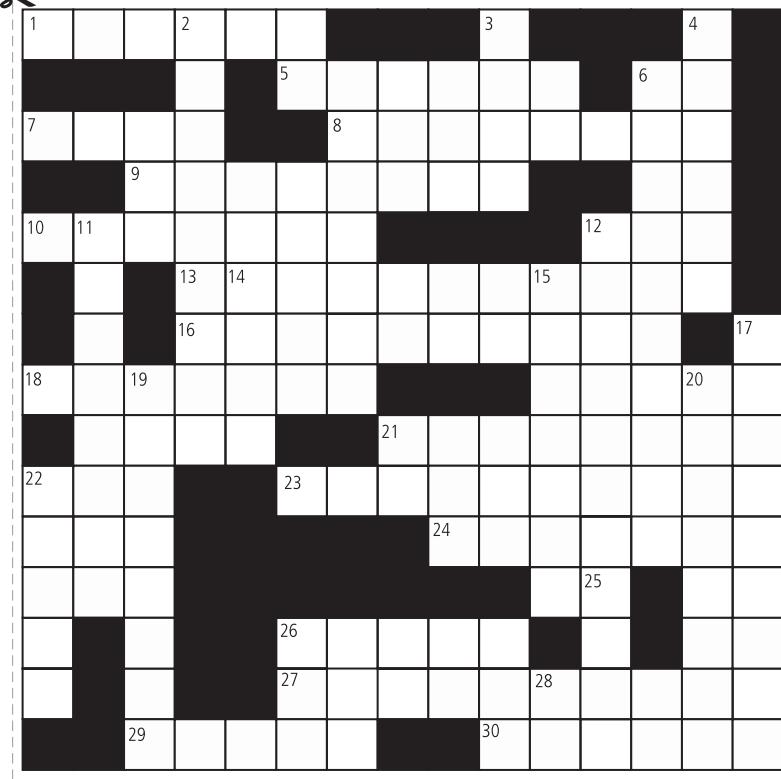


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## ACROSS

1. A phycocolloid extracted from *Gloiopelets* used as an adhesive. (6)
  5. The unit in which the thickness of ozone is measured. (6)
  7. A type of arthritis caused due to accumulation of uric acid crystals in synovial joints. (4)
  8. A porous ring present in stirred tank bioreactor providing aeration to the medium. (7)
  9. Most abundant natural protein in the biosphere. (7)
  10. Central histogen of promeristem that contributes in formation of stele. (7)
  13. The copulatory embrace of frogs. (8)
  16. The first drug approved by the US for treatment of Alzheimer's disease. (7)
  18. Type of composite fruit found in mulberry. (7)
  21. The first natural cytokinin obtained from unripe maize grains. (6)
  23. The shoot with superior characters that is grafted into another plant for vegetative propagation. (5)
  24. The last abdominal segment in *Palaemon* having conical shape. (6)
  26. A group of species belonging to the same trophic level and utilising the common resources. (5)
  27. The intermediate skin colour produced in human for genotype AaBbCc. (7)
  28. A fermented drink made from the sap of palm tree. (5)
  29. The scientist who discovered amitosis. (5)
  30. A gland located on the dorsal surface of the diencephalon of the brain. (6)
- DOWN**
2. The tissue that directs the growth of pollen tube into the ovary. (9)
  3. The sweet liquid obtained from crushed food mixed with hot water before alcoholic fermentation. (4)
  4. An animal that has become extinct in South Africa due to anthropogenic reasons. (6)

## Cut Here



6. The plants in which pollen grains of another flower germinate more rapidly than the same flower. (9)
11. Carotene that imparts red colour to chillies and tomatoes. (8)
12. STD that spreads through mites. (7)
14. The cells of connective tissue which release heparin, serotonin and histamine during allergic responses. (4)
15. Collapsing of a swollen contractile vacuole observed in some protistan and algal cells, in order to throw their vacuolar contents outside. (7)
17. Germination of seeds while still attached to plant. (8)
19. Hormone responsible for softening the connective tissues of pubis symphysis for facilitating child birth. (7)
20. Woody twiners or climbers. (6)
22. Hybrid between female ass and stallion. (5)
25. Coding part of DNA that is responsible for producing gene product. (4)



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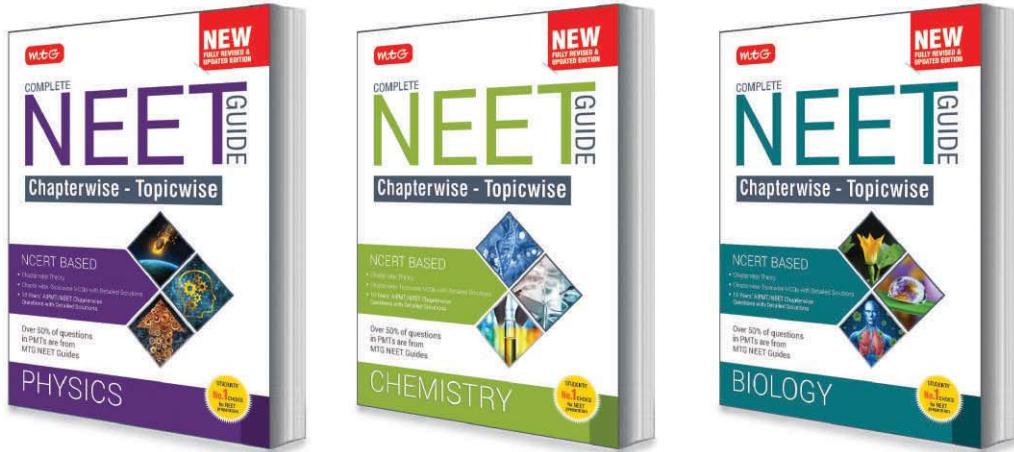
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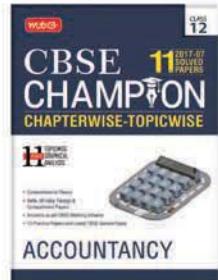
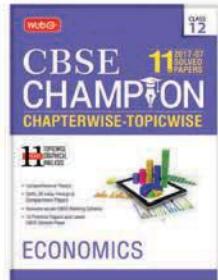
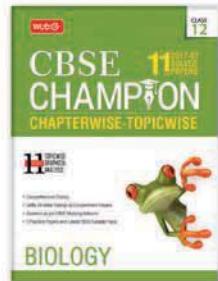
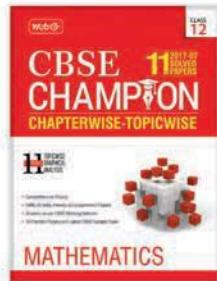
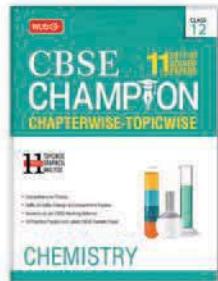
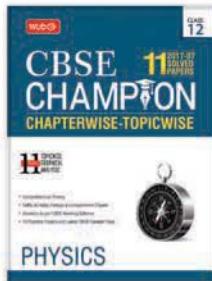
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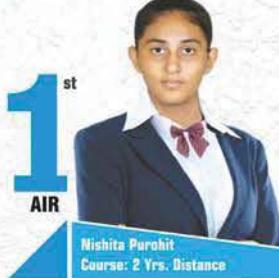
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