9

NEET/IIT/JEE

FOUNDATION

COURSE

PREFACE

This book is specially for the students to get ready for competitive exams. The objective of this book is to make the students get ready for future.

At the same time it guides the students to face the challenges in maths and science in various fields.

It places emphasis on developing, thinking and reasoning skills among students, by connecting mathematics and science curriculum with real life situations.

This book is compiled with six chapters in mathematics and five chapters in science.

Each chapter is divided under different heads.

KEY FEATURES

UNDERSTANDING

Students will be able to

- **Understand the concept of different topics with related formulas, equations and concepts.**

APPLICATION

- **Apply effectively with the help of the guidelines given.**

ANALYSIS

- **Analyze the concepts using the given formula and equations.**

OUTCOME

- **Get ready for competitive exams in future.**

"Education is the kindling of a flame,

Not the Filling of a vessel"

9

IIT/JEE–MATHS

Mathematics Is Not About Numbers, Equation, Computations, Or Algorithms: It Is About Understanding

CONTENT

UNIT-1

SETS

Sets in mathematics are an organized collection of objects and can be represented in descriptive form set-builder form and roster form.

Usually, sets are represented in curly braces {}.

A set is represented by a capital letter. The number of elements in the finite set is known as the cardinal number of a set.

example:

A={1,2,3,4,5}

Since a set is usually represented by the capital letter. Thus, A is the set and 1, 2, 3, 4, 5 are the elements of the set or members of the set.

The elements that are written in the set can be in any order but cannot be repeated.

The cardinal number of the set is 5.

Some commonly used sets are as follows:

N: Set of all natural numbers ={1,2,3,… ..... }

Z: Set of all integers ={……..-3,-2,-1,0,1,2,3,… ..... }

Q: Set of all rational numbers={$\frac{p}{q}$,q≠0}

R: Set of all real numbers

Order of Sets

The order of a set defines the number of elements a set is having. It describes the size of a set. The order of set is also known as the cardinality.

The size of set when there it is a finite set or an infinite set ,said to be set of finite order or infinite order, respectively.

Representation of Sets

The sets are represented in curly braces, {}. For example, {2,3,4} or{a,b,c}or{Bat, Ball, Wickets}.The elements in the sets are depicted in either the Statement form, Roster Form or Set Builder Form.

Descriptive form

Instatement form, It can be written as {evennumberslessthan15}.

Roster Form

In Roster form, all the elements of a set are listed. Natural

Number less than 5 = 1, 2, 3, 4

Therefore, the set is N={1,2,3,4}

Example: Write the following sets in set builder from: A={ 2,4,6,8}

Solution:

2=2x1

4=2x2

6=2x3

8=2x4

So, the set builder form is A={x:x=2n, n ∈ N and 1≤n≤ 4}

Roster Form :

Listing the elements of a set inside a pair of braces {} is called the roster form.

(i) Let A be the set of even natural numbers less than11.

In roster form we write A = {2, 4, 6, 8, 10}

(ii) A={x:x is an integer and -1≤x <5}

In roster form we write A = {-1, 0, 1, 2, 3, 4}

Set Builder Form:

Set-builder notation is a notation for describing a set by indicating the properties that its members must satisfy.

Reading Notation :

„|"or„:"such that

A={x:x is a letter in the word dictionary}

"A is the set of all **x** such that **x** is a letter in the word dictionary"

For example,

(i) N={x : x is a natural number},

(ii) P={x : x is a prime number less than100},

(iii) A={x : x is a letter in the English alphabet},

Difference between Union and Inter section of Set

The difference of universal set (U) and the subset of the universal set (A) is the complement of the subset, that is A' = U - A.

Example of Complement of a Set

If the universal set is all **prime numbers** up to 25 and set A= {2, 3,5}then the complement of set A is other than the elements of A.

- **Step1**: Check for the universal set and the set for which you need to find the complement. U = {2, 3, 5, 7, 11, 13, 17, 19, 23}, A = {2, 3, 5}.
- **Step2**: Subtract, that is(U-A).
  Here, U – A = A'.
  = {2,3,5,7,11,13,17,19,23} -{2,3,5}
  = {7,11,13,17,19, 23}

Union of Set

Example: If X={1,2,3} and
Y={2,3,4},then X∪Y={1,2,3,4}

Inter section of Set
Example: If X={1,2,3}and
Y = { 2, 3, 4},
Then X∩Y={2,3}

Power set

A set that contains all the subsets of a given set along with the empty set is called a power set.

For example, **if set A={a, b},then the power set of A is{{},{a}, {b}, {a, b}}.**

The Empty set

A set which does not contain any element is called the empty set or the null set or the void set.

Example: D={x:x^2=9, x is even}
Here D is the empty set, because the equation x^2=9 is not satisfied by any even value of x.

Note: The empty set is denoted by the symbol φ or{}.

Singleton Set :

A set which contains only one element is called a singleton set.

Example: A={x : x is neither prime n or composite}
It is a singleton set containing one element, i.e., 1.

Example: B={x : x is a whole number, x<1}
This set contains only one element 0 and is a singleton set.

Example: Let A={x : x ∈ N and x^2=4}
Here A is a singleton set because there is only one element 2 whose square is 4.

Finite Set

A set which contains a definite number of elements is called a finite set. Empty set is also called a finite set.
Example: The set of all colours in the rainbow.
Example: N = {x : x ∈ N, x < 7}
Example: P={2,3,5,7,11,13,17,.....97}

Infinite set

The set whose elements cannot be listed, i.e., set containing never- ending elements is called an infinite set.
Example: Set of all points in a plane
Example: A = {x : x ∈ N, x > 1}
Example: Set of all prime numbers
Example: B = {x : x ∈ W, x = 2n}
Note: All in finite sets cannot be expressed in roster form.
Example: The set of real numbers since the elements of this set do not follow any particular pattern.

Equal Sets

Two sets A and B are said to be equal if they contain the same elements. Every element of A is an element of B and every element of B is an element of A.

Example:
A= {p, q, r, s}
B = {p, s, r, q}
Therefore, A=B

Equivalent Set

Two sets A and B are said to be equivalent if their cardinal number is same, i.e., n(A) = n(B). The symbol for denoting an equivalent set is "↔".

Example:
A= {1, 2, 3}Here n(A)=3
B= {p, q, r}Here n(B)=3 Therefore,
A↔ B

Universal Set

A set which contains all the elements of other given sets is called a universal set. The symbol for denoting a universal set is ∪ or ξ.

Example: If A={1,2, 3} B ={2,3,4} C={3,5,7}
Then U={1, 2, 3, 4, 5, 7}
[Here A ⊆ U, B ⊆ U, C ⊆ U and U ⊇ A, U ⊇ B, U ⊇ C]

Example: If P is a set of all whole numbers and Q is a set of all negative numbers then the universal set is a set of all integers.

Example: If A = {a, b, c} B = {d, e} C = {f, g, h, i}
then U={a, b, c, d, e, f, g, h, i} can be taken as universal set.

Subsets

If A and B are two sets, and every element of set A is also an element of set B, then A is called a subset of B and we write it as $A \subseteq B$ or $B \supseteq A$

The symbol $\subset$ stands for is a subset of "or" is contained in"
- Every set is a subset of itself, i.e., $A \subset A$, $B \subset B$.
- Empty set is a subset of every set.
- Symbol "$\subseteq$" is used to denote is a subset of "or" is contained in.
- $A \subseteq B$ means A is a subset of B or A is contained in B.
- $B \subseteq A$ means B contains A.

Example: Let A={2, 4, 6} B={6, 4, 8, 2}
Solution: Here A is a subset of B
Since, all the elements of set A are contained in set B.
But B is not the subset of A
Since, all the elements of set B are not contained in set A.
NOTES:
1. If $A \subset B$ and $B \subset A$, then A=B, i.e., they are equal sets.
2. Every set is a subset of itself.
3. Null set S or $\emptyset$ is a subset of every set.

Example: The set N of natural numbers is a subset of the set Z of integers and we write $N \subset Z$.
Example: Let A= {2, 4, 6}
B={x:x is an even natural number less than8}
Here $A \subset B$ and $B \subset A$.
Hence, we can say A = B
Example: Let A = {1, 2, 3, 4}
B= {4, 5, 6, 7}
Here $A \not\subset B$ and also $B \not\subset C$
[$\not\subset$ denotes, not a subset of]

Proper Subsets

If A and B are two sets, then A is called the proper subset of B if $A \subseteq B$ but $B \supseteq A$ i.e., $A \neq B$. The symbol „$\subset$" is used to denote proper subset.

Symbolically, we write A⊂ B.

Example: A={1, 2, 3, 4} B ={1, 2, 3, 4, 5}

Solution: Here n(A) = 4, n(B) = 5
We observe that, all the elements of A are present in B but the element "5"of B is not present in A.
So, we say that A is a proper subset of B.
Symbolically, we write it as A ⊂ B

NOTES
No set is a proper subset of itself.
Null set or ∅ is a proper subset of every set.

Example: A={p, q, r} B={p, q, r, s, t}

Solution : Here A is a proper subset of B as all the elements of set A are in set B and also A ≠ B.

NOTES
No set is a proper subset of itself.
Empty set is a proper subset of every set.

Superset

Whenever a set A is a subset of set B, we say the B is a super set of A and we write, B ⊇ A.
Symbol ⊇ is used to denote is "a super set of "

Example:
A={a, e, i, o, u}B ={a, b, c, ... ,z}

Here A ⊆ B i.e., A is a subset of B but B ⊇A i.e., B is a super set of A

Proper Superset

A proper super set of a set A is a super set of A that is not equal to A. In other words, if B is a proper superset of A, then all elements of A are in B but B contains at least one element that is not in A.

Example: if A={1, 3, 5} then B={1, 3, 4, 5} is a proper superset of A. The set C={1, 3, 5} is a superset of A, but it is not a proper superset of A since C=A. The set D={1, 3, 7} is not even a superset of A, since D does not contain the element 5.

Power Set

The collection of all subsets of set A is called the power set of A. It is denoted by P(A).
In P(A), every element is a set.

Example:
If A= {p, q} then all the subsets of A will be
P(A) = {∅, {p}, {q}, {p, q}}

Number of elements of P(A)=n[P(A)]=4=2^2
In general, n[P(A)]=$2^m$where m is the number of elements in set A.

EXERCISE

1. A well defined collection of objects is known as

   a) population b) fraction c) equation d)set

   Ans : d) set

2. If U={1, 2, 3, 4, 5}and A={2, 4}then A' should be

   a) {2, 4, 5} b){2, 4} c){1, 2, 3, 4, 5} d){1, 3, 5}

   Ans: d) {1, 3, 5}

3. If 2 sets A and B are given, then the set consisting of all the elements which are either in A or in B or in both is called.

   a) Inter section of A and B b) union of A and B

   c) Complement of A d)Complement of B

   Ans : b) union of A and B

4. A set with no element in it is known as.

   a) subset b) singleton set c) power set d)empty set

   Ans : d) empty set

5. A set containing only one element is said to be.

   a) subset b) singleton set c) power set d)empty set

   Ans :b) singleton set

6. X={1, 2, 3, 4, 5} and Y={2, 4, 5, 6, 8} then X-Y equals to.

   a) {6, 8} b){1, 3} c){4, 5} d){1, 6}

   Ans: b){1,3}

7. If A={1, 2, 3, 4} and B ={4, 5, 6, 7} then A∪B should be.

   a) {2,3,4,5,6,7} b){1,2,3,4,5,6,7} c){4} d){1,2,3,5,6,7}

   Ans: b){1,2,3,4,5,6,7}

8. The range of R={(0,2),(2,4),(3,4),(4,5)}is

   a) {0,2,4,5} b){0,2,3, 4} c){2,4,5} d){3,4,5}

   Ans: c){2,4, 5}

9. If A={2,3,4,5,6} and B={4,5,6,7} then A∩B should be.

a) {2,3,4,5,6,7} b){4,5,6, 7} c){4,5,6} d) {0}

Ans: c){4,5,6}

10. The number of elements in power set{1,2,3}are.

a)5 b)6 c)7 d)8

Ans : d)8

11. Write the set A={x:x is a natural number ≤ 8}in roster form.

a) A={1,2,3, 4,5,6,7, 8} b)A={1,2,3,4,5,7,8}

c)A={1,2,3, 4,5,6,7} d)A={1,3,4,5,6,7,8}

Ans: a) A={1,2,3,4,5,6,7,8}

12. Represent the following sets in set-builder form.

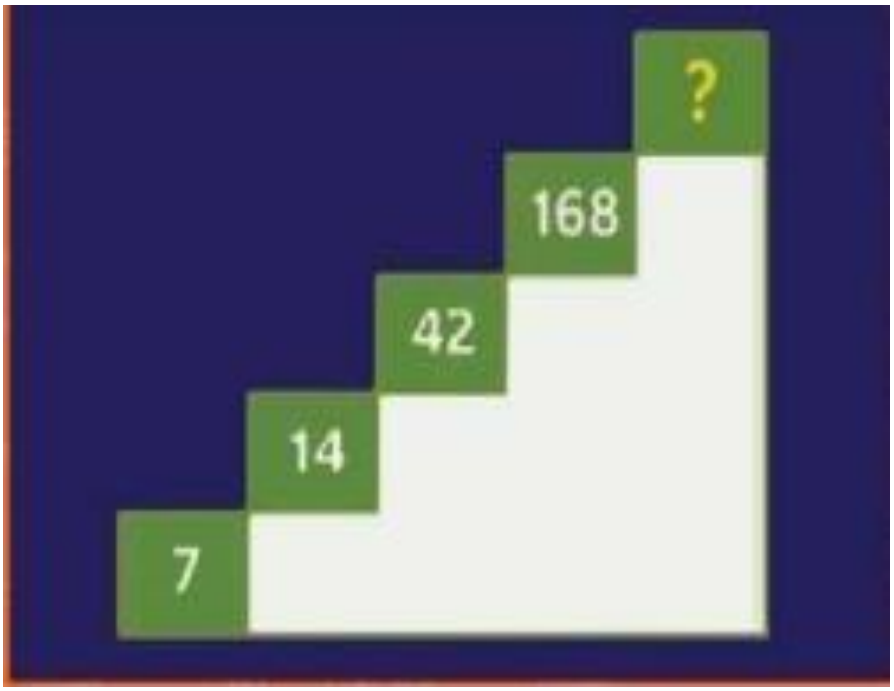
X={Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday}

a) X={x:x is a day in a month} b)X={x:x is a day in a year}

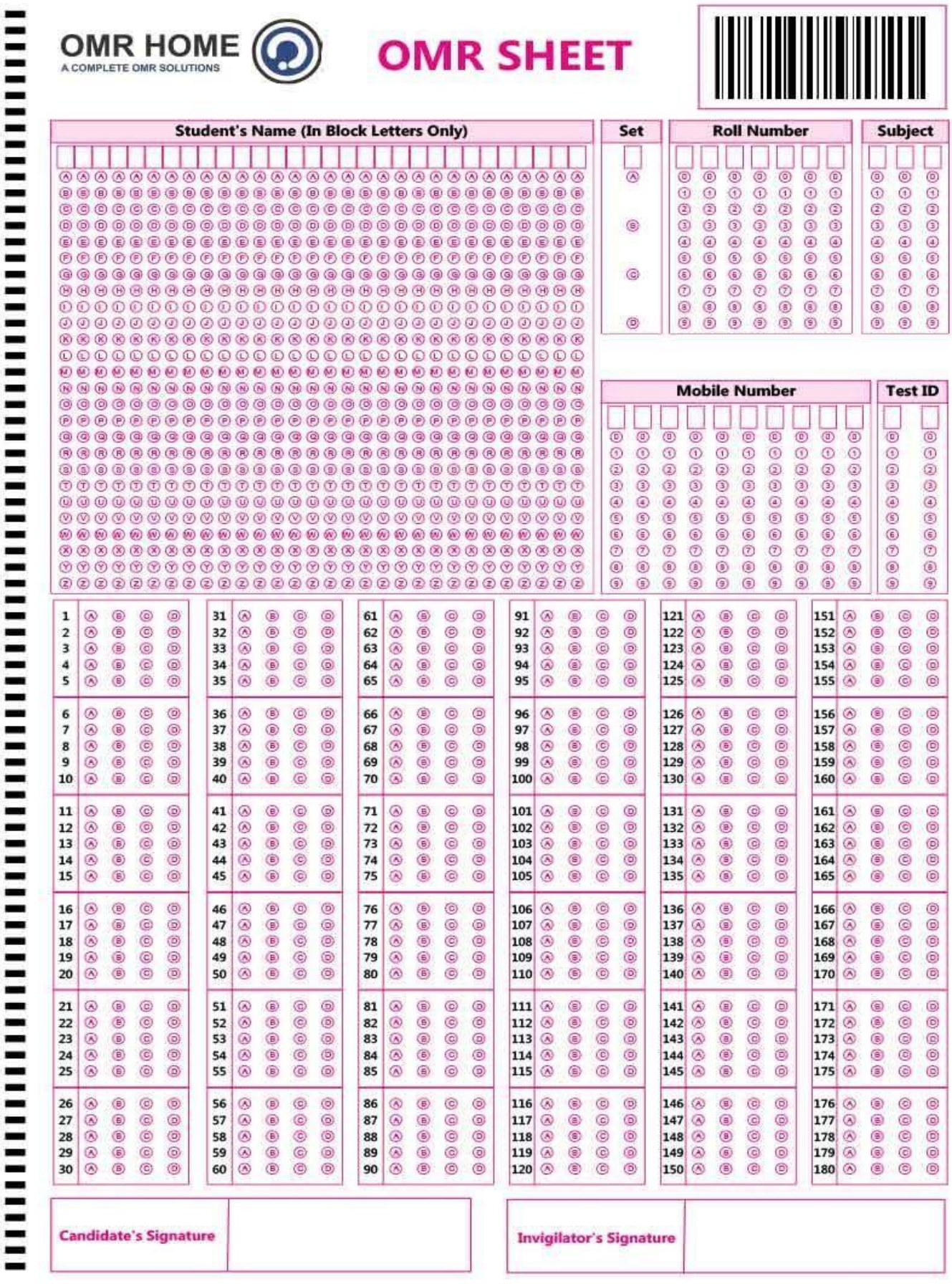
c)X ={x :x is a day} d)X= {x:x is a day in a week }

Ans: d) X={x :x is a day in a week}

Can you solve this puzzle:



WORKSHEET


OMR HOME
A COMPLETE OMR SOLUTIONS
OMR SHEET
Student's Name (In Block Letters Only)
Set
Roll Number
Subject
Mobile Number
Test ID
Candidate's Signature
Invigilator's Signature

UNIT-2

ALGEBRA

Algebra is just like as signing values to variables and also understanding relationships between values in a given statement.

Algebra employs four mathematical operations, such as addition, subtraction, multiplication, and division.

It is very useful in many mathematical and scientific computations involving either a very large number or a very small number.

Algebraic identities

$(a+b)^2 = a^2+b^2+2ab$

$(a-b)^2 = (a-b)(a-b) = a^2-ab-ba+b^2 = a^2+b^2-2ab$

Identity: 1

The product of sum and difference of 2 numbers "a" and "b" is given as

$(a + b)(a - b) = a^2 - b^2$.

Proof:

$(a+b)(a-b) = a^2 - ab + ab - b^2 = a^2 - b^2$

Identity: 2

$(x+a)(x+b) = x^2 + x(a+b) + ab$

Proof:

$(x+a)(x+b) = x^2 + xb + ax + ab = x^2 + x(a+b) + ab$

Identity: 3

$(x-a)(x+b)=x^2+x(b-a)-ab$

Proof:

$(x-a)(x+b)=x^2+xb-ax-ab=x^2+x(b-a)-ab$

Identity: 4

$(x-a)(x-b)=x^2-x(a+b)+ab$

Proof:

$(x-a)(x-b)=x^2-xb-ax+ab=x^2-x(a+b)+ab$

Identity: 5

The cube of sum of any two numbers is given by $(a+b)^3=a^3+b^3+3ab(a+b)$

Proof:

$(a+b)^3=(a+b)(a+b)^2$

$=(a+b)(a^2+b^2+2ab)$

$=a^3+ab^2+2a^2b+ba^2+b^3+2ab^2$

$=a^3+b^3+3a^2b+3ab^2$

$=a^3+b^3+3ab(a+b)$

Identity: 6

The cube of difference of any two numbers is given by

$(a - b)^3 = a^3 - b^3 - 3ab\,(a - b)$

Proof:

$(a-b)^3=(a-b)(a-b)^2$

$=(a-b)(a^2+b^2-2ab)$

$=a^3+ab^2-2a^2b-ba^2-b^3+2ab^2$

$=a^3-b^3-3a^2b+3ab^2$

$=a^3-b^3-3ab(a-b)$

Identity: 7

The square of sum of three numbers “a”, “b” and “c” is given by $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

Proof:

$(a+b+c)^2=(a+b+c)(a+b+c)$

$=a^2+ab+ac+ba+b^2+bc+ca+cb+c^2$

$=a^2+b^2+c^2+2ab+2bc+2ca$

1. Evaluate the square of 99 and 101 using appropriate algebraic identity.

Solution:

$99^2=(100-1)^2$ and $(101)^2=(100+1)^2$

99^2 can be solved using the algebraic identity $(a-b)^2=a^2+b^2-2ab$.

a = 100 and b = 1

$(a-b)^2= a^2+b^2-2ab$

$(100-1)^2=(100)^2-2x100x1+1^2$

$=10000+1-200$

$=9801$

101^2 can be solved using the algebraic identity $(a+b)^2=a^2+b^2+2ab$.

a = 100 and b = 1

$(a+b)^2=a^2+2ab+b^2$

$(100+1)^2=(100)^2+2x100x1+1^2$

$=10000+200+1$

$=10201$

2. If the sum of two numbers is 12 and the sum of their cubes is 468, find the product of these numbers using algebraic identities.

Solution:

Let us consider the two numbers as “a” and

“b” Sum of the numbers = a + b = 12

Sum of their cubes=$a^3+b^3=468$

Product of these two numbers = ab =?

The product of two numbers can be found using the algebraic identity:

$(a+b)^3 = a^3 + b^3 + 3ab(a+b)$

$(12)^3 = 468 + 3ab\ (12)$

$1728 = 468 + 3ab\ (12)$

$36ab = 1728 - 468$

$36ab = 1260$

$ab = 1260 / 36$

$ab = 35$

Factorisation

Expressing any number as the product of two or more numbers is called as factorisation. The number 12 can be expressed as the product of prime factors like $12 = 2 \times 2 \times 3$. This is called prime factorisation.

How will you factorise an algebraic expression? Yes. Expressing an algebraic expression as the product of two or more expressions is called the Factorisation.

For example e,(i)$a^2 - b^2 = (a+b)(a-b)$ Here, (a +b) and (a -b)are the two factors of $a^2 - b^2$

(ii)$5y + 30 = 5(y+6)$,Here 5 and (y+6)are the factors of $5y + 30$

Any expression can be Factorised as (1)×(expression)

For example,

$a^2 - b^2$ can also be factorised as $1 \times (a^2 - b^2)$ or $(b^2 - a^2)$

Because “1” is a factor for all numbers and expressions.

Polynomial

Definition of a polynomial in one variable, with examples and counter examples. Coefficients of apolynomial, terms of apolynomial and zero polynomial.

Degree of apolynomial. Constant, linear, quadratic and cubic polynomials. Monomials, binomials, trinomials.

Factors and multiples. Zeros of apolynomial. Factorization of a x^2+bx+c, $a\neq0$ where a,b and care real numbers, and of cubic polynomials using the Factor Theorem.

Recall of algebraic expressions and identities.Verification of identities

$$\mathbf{(x+y+z)^2=x^2+y^2+z^2+2xy+2yz+2zx}$$

$$\mathbf{(x+y)^3=x^3+y^3+3xy(x+y),\ (x-y)^3=x^3-y^3-3xy(x-y),}$$

And their use in factorization of polynomials.

Important Formulas

Dividend = (Divisor × Quotient) + Remainder

Remainder theorem

Let p(x) be any polynomial of degree greater than or equal to one and let a be any real number.

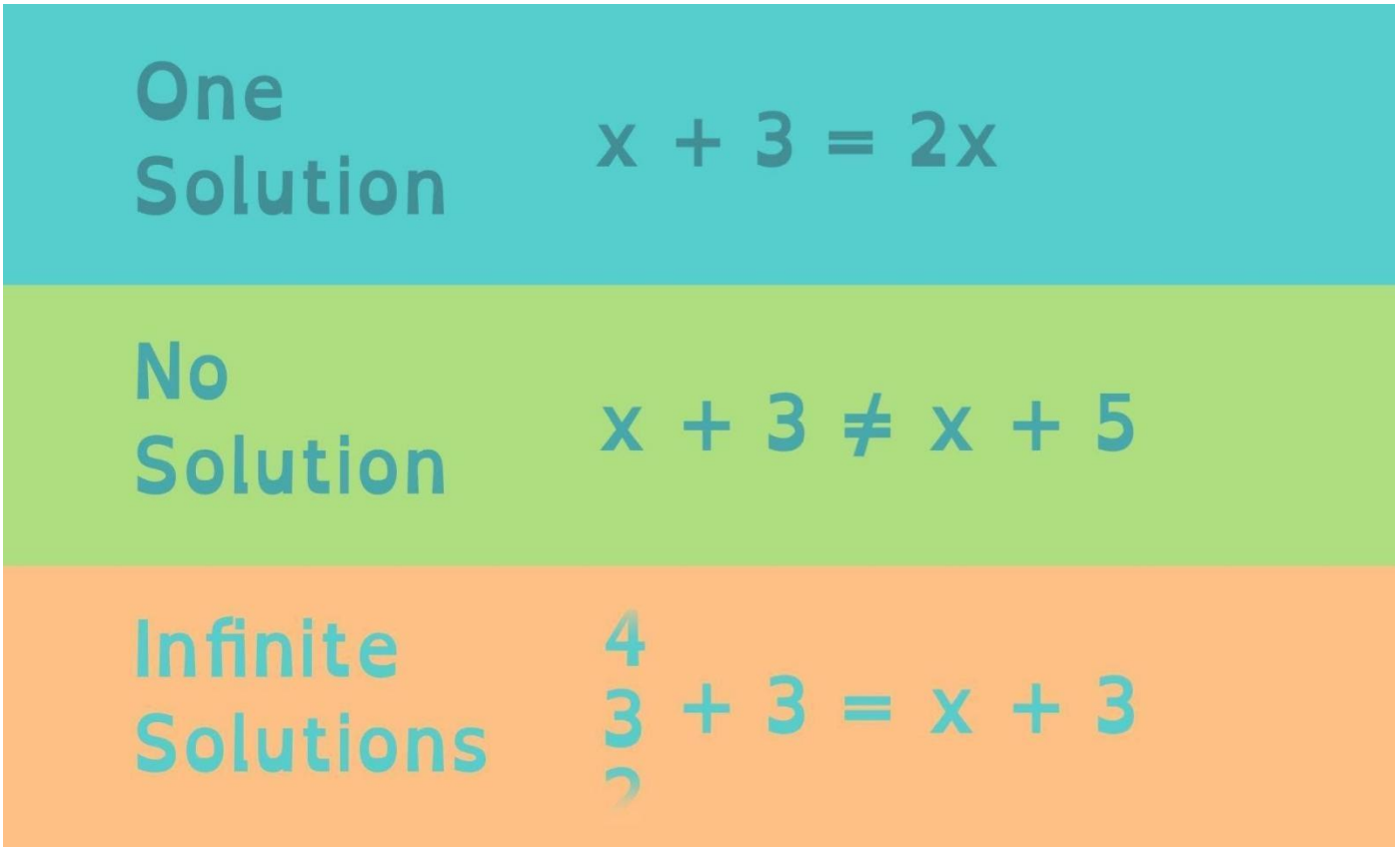
If p(x) is divided by the linear polynomial x–a, then the remainder is p(a).

Factor theorem

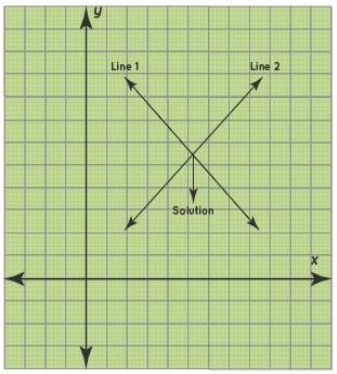
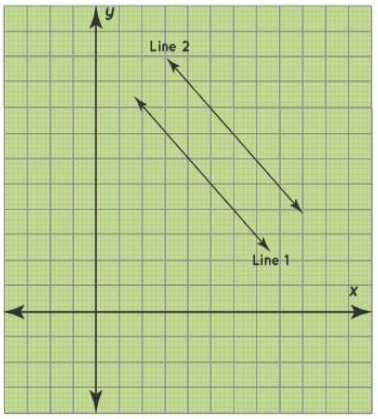
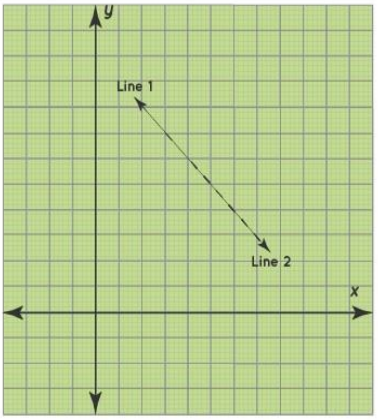
If p(x) is a polynomial of degree n>1 and “a” is any real number,

then (i) x – a is a factor of p(x), if p(a) = 0, and

(ii) p(a)=0,ifx–a is a factor of p(x).



Types of solution

Type of solution	Conditions	Graphical Representation
Unique Solution (Consistent and Independent)	$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	 Unique Solution (Consistent and independent)
No Solution (Inconsistent and Independent)	$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	 No Solution (Inconsistent and independent)
Infinite Number of Solutions (Consistent and Dependent)	$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	 Infinite number of solutions (consistent and dependent)

Exercise

1. The value of $f(x)=5x-4x^2+3$ when x=-1, is:

   a) 3 b)-12 c)-6 d)6

   Ans: c)-6

2. The value of $p(t)=2+t+2t^2-t^3$ when t=0 is

   a) 2 b) 1 c) 4 d) 0

   Ans : a) 2

3. The zero of the polynomial f(x)=2x+7is

   a) 2/7 b) -2/7 c) 7/2 d)-7/2

   Ans : d) -7/2

4. What is the degree of the polynomial √3?

   a) 0 b) 1 c) ½ d)2

   Ans : c) ½

5. The degree of the constant polynomial is

   a) 0 b) 1 c) 2 d)3

   Ans : a) 0

6. One of the linear factors of $3x^2+8x+5$ is

   a) (x+1) b)(x-2) c)(x+2) d)(x-4)

   Ans:a)(x+1)

7. The coefficient of x in $7x^2+6x-2$ is

a)2 b)6 c) -2 d)7

Ans : b)6

8. Which of the following is an example of the quadratic polynomial?

a)7x+3 b) $2x^2+x-1$ c)$x+3x^3-9$ d)None of the above

Ans : b) $2x^2+x-1$

9. Find the value of 7^2-5^2.

a)22 b) 23 c) 24 d) 25

Ans: c) 24

Explanation: $7^2-5^2 = 49–25 = 24$.

10. If$x^2+kx+6=(x+2)(x+3)$ for all k, find the value of k.

a) -1 b) 1 c) 3 d)5

Ans : d) 5

11. Which of the following is a constant polynomial?

a) 4x+1 b) 3 c) $2x^2$ d)6x+3

Ans : b) 3

12. The linear equation 3x-11y = 10 has:

a) Unique solution b)Two solutions

c) Infinitely many solutions d)No solutions

Ans : c) Infinitely many solutions

Explanation: 3x-11y =10 y =(3x-10)/11

Now for infinite values of x, y will also have infinite solutions.

13. **3x+10=0**will have:

a) Unique solution b)Two solutions

c) Infinitely many solutions d)No solutions

Ans : a) Unique solution

Explanation: 3x+10=0

x =-10/3.

Hence, only one solution is possible.

14. The solution of equation x-2y = 4 is:

a) (0,2) b) (2,0) c) (4,0) d)(1,1)

Ans : c) (4,0)

Explanation: Putting x=4 and y=0, on the L.H.S. of the given equation, we get; 4-2(0) = 4 – 0 = 4 Which is equal to R.H.S.

15. Point (3,4) lies on the graph of the equation 3y=kx+7. The value of k is:

a) 4/3 b) 5/3 c) 3 d)7/3

Ans : b) 5/3

Explanation: 3y=kx+7 Here,

x = 3 and y = 4

Hence,

(3×4) = (kx3)+7

12= 3k+7

3k=12–7=5

k =5/3

16. Factors of $9m^2 + 6mn$ are

a) 3n, (m+2) b) 3m, (3m+3n) c) 6m, (3m+2n) d)3m,(3m+2n)

Ans: d) 3m, (3m+2n)

17. Factors of $4–x^2$ are

a) (2+x)(2+x) b) (2–x)(2–x) c)(2+x)(2–x) d) (4+x)(4–x)

Ans: c)(2+x)(2–x)

18. (y+4) and (y–5) are the factors of _____

a) y^2 –y+20 b)y^2–9y–20 c) y^2+y–20 d)y^2–y–20

Ans: d)y^2–y–20

19. The factors of z^2–5z+6 are (z–2)(z–p) then the value of p is_____

a) –3 b)3 c)2 d)–2

Ans: b)3

20. One factor of p^3+q^3 is

a) (p – q) b) (p + q) c) $(p + q)^3$ d)$(p–q)^3$

Ans: b) (p + q)

21. The factors of $1–x^3$

a) $(1+x),(1+x+x^2)$ b)$(1–x),(1–x–x^2)$

c) $(1–x), (1+x+x^2)$ d)$(1+x),(1–x+x^2)$

Ans: c) $(1–x), (1+x+x^2)$

22. Factorise: $x^2+8x+16$

a) (x+4)(x+4) b)(x-4)(x-4) c)(x+4)(x-4) d)(x+2)(x+2)

Ans: a) (x+4)(x+4)

23. Factorise: $49x^2–64y^2$

a) (7x-8y)(7x-8y) b)(7x+8y)(7x-8y)

c) (7x+7y)(7x-7y) d)(8x+8y)(8x-8y)

Ans: b) (7x+8y)(7x-8y)

24. Factorise: $2x^2$-15x-27

a) (x+9)(2x+3) b)(x-9)(2x-3)

c) (x-9)(2x+3) d)(3x-9)(2x-3)

Ans: c) (x-9)(2x+3)

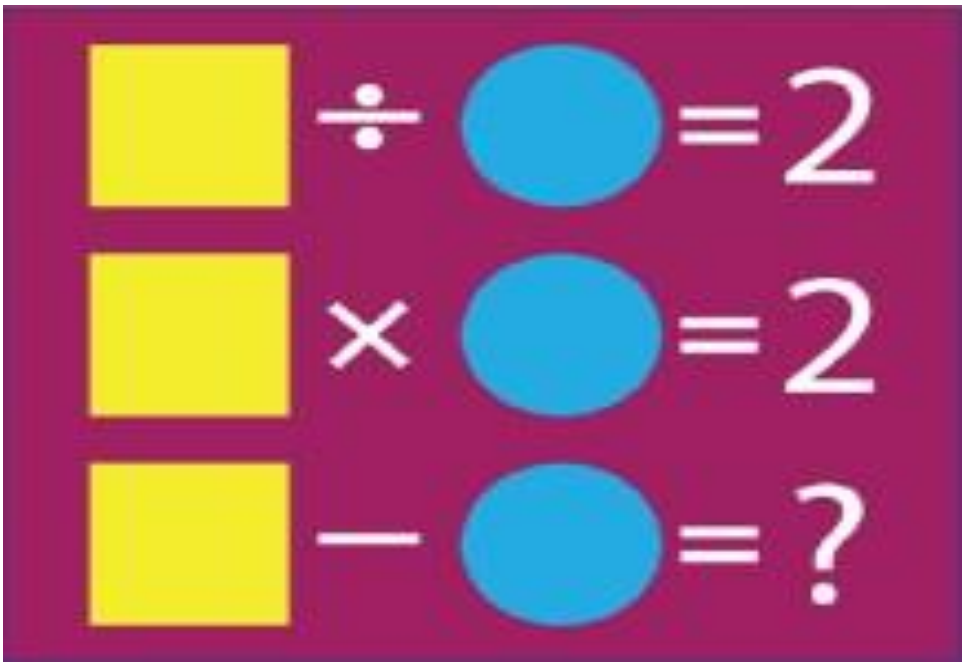
25. Factorise: y^4-16 (Hint: $a^4-b^4=(a^2+b^2)(a+b)(a-b)$)

a) $(x^2+4)(x+2)$ b) $(x^2+4)(x+4)$

c) $(x+2)(x-2)$ d)$(x^2+4)(x+2)(x-2)$

Ans: d) $(x^2+4)(x+2)(x-2)$

Can you solve this puzzle:



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UNIT-3

TRIGONOMETRY

BASIC TRIGONOMETRIC RATIOS:

$\sin\theta=\frac{opposite side}{Hypotenuse}$, $\text{cosec}\ \theta = \frac{Hypotenuse}{opposite\ side}$

$\cos\theta=\frac{Adjacent side}{Hypotenuse}$, $\sec\theta = \frac{Hypotenuse}{adjacent side}$

$\tan\theta=\frac{Opposite side}{Adjacent side}$, $\cot\theta= \frac{Adjacent side}{opposite side}$

θ / Trig Ratio	0^0	30^0	45^0	60^0	90^0
$\sin\theta$	0	1/2	$1/\sqrt{2}$	$\sqrt{3}/2$	1
$\cos\theta$	1	$\sqrt{3}/2$	$1/\sqrt{2}$	1/2	0
$\tan\theta$	0	$1/\sqrt{3}$	1	$\sqrt{3}$	Not defined

Trigonometric rations for complementary angles:-

$\sin\theta = \cos(90^0-\theta)$ $\quad$ $\text{cosec}\theta=\sec(90^0-\theta)$

$\cos\theta=\sin(90^0-\theta)$ $\quad$ $\sec\theta=\text{cosec}(90^0-\theta)$

$\tan\theta= \cot(90^0-\theta)$ $\quad$ $\cot\theta = \tan(90^0-\theta)$

Reciprocal Trigonometric ratios:

$\sin\theta = \frac{1}{cosec\theta}$, $\cos\theta = \frac{1}{sec\theta}$

$cosec\theta = \frac{1}{\sin\theta}$, $\sec\theta = \frac{1}{cos\theta}$

$\tan\theta = \frac{1}{cot\theta}$, $cot\theta = \frac{1}{tan\theta}$

1.Find the value of $cosec45^0$

Solution:

$Sin45^0 = 1/\sqrt{2}$

$Sin\theta = 1/cosec\theta$, $cosec\theta = 1/sin\theta$

$\therefore cosec45^0 = 1/sin45^0 = \frac{1}{1/\sqrt{2}}$

$Cosec45^0 = \sqrt{2}$

2.Find the value of $cos74^0$

Solution:

$Cos74^0 = cos(90^0 - 16) = sin16^0$

3.If $sin60^0$ = x and $cos60^0$=y then find x^2+y^2is_____.

Solution:

$Sin60^0 = \sqrt{3/2} = x$

$Cos60^0 = 1/2 = y$

$X^2+y^2 = (\sqrt{3}/2)^2 + (1/2)^2$

$= 3/4 + 1/4$

$= 4/4$

$X^2+y^2 = 1$

EXERCISE:3.1

1. If tan A = 7/24 then find the value of cos A

   a) 7/25 b)24/25 c)24/7 d)25/7

   Ans : b)24/25

2. If $\sin 90^0 = x$ and $\cos 90^0 = y$ then x^2+y^2 is.

   a) 0 b) $\cos 30^0$ c)1 d) $\sin 30^0$

   Ans : c)1

3. Value of $\sin 45^0$ is_____.

   a) $\frac{1}{\sqrt{2}}$ b)0 c)none d)1

   Ans : a) $\frac{1}{\sqrt{2}}$

4. Find the value of $\frac{1+tan45^0}{1-tan45^0}$

   a) not defined b)2 c)0 d)1/√3

   Ans : a)not defined

5. If tan B = $\cot 47^0$ then find B.

   a) 33 b)43 c)53 d)63

   Ans: b)43

6. Find the value of $\frac{cos35^0}{sin55^0} + \frac{sin12^0}{cos78^0} - \frac{cos18^0}{sin72^0}$

   a) 0 b)√3 c)1 d)√2

   Ans : c)1

7. Find the value of $\sin 74^0$.

a) $\operatorname{cosec} 16^0$ b) $\tan 16^0$ c) $\sin 16^0$ d) $\cos 16^0$

Ans : d) $\cos 16^0$

8. Find the value of $\sec 45^0$

a) $1/\sqrt{2}$ b) $\sqrt{3}/2$ c) $\sqrt{2}$ d) 1

Ans :c) $\sqrt{2}$

9. Find the value of $\sin 49^0/\cos 41^0$

a) 0 b) 1 c) 2 d) not defined

Ans : b) 1

10. Find the value of $\sin 60^0+\cos 30^0$

a) $2\sqrt{3}/3$ b) $\sqrt{3}$ c) $\sqrt{3}/2$ d) 2

Ans :b) $\sqrt{3}$

11. What is the complementary angle of $\sec\theta$?

a) $\sin(90^0-\theta)$ b) $\operatorname{cosec}(90^0-\theta)$ **c) $\cot(90^0-\theta)$** d) $\cos(90^0-\theta)$

Ans : b) $\operatorname{cosec}(90^0-\theta)$

12. Identify the reciprocal trigonometric ratio of $\cot\theta$.

a) $1/\tan\theta$ b) $1/\cot\theta$ c) $1/\sec\theta$ d) $1/\operatorname{cosec}\theta$

Ans : a) $1/\tan\theta$

13.Find the value of $\sin(90^0-\theta)$

a)$\sin\theta$ b)$\cos\theta$ c)$\tan\theta$ d)$\operatorname{cosec}\theta$

Ans : b)$\cos\theta$

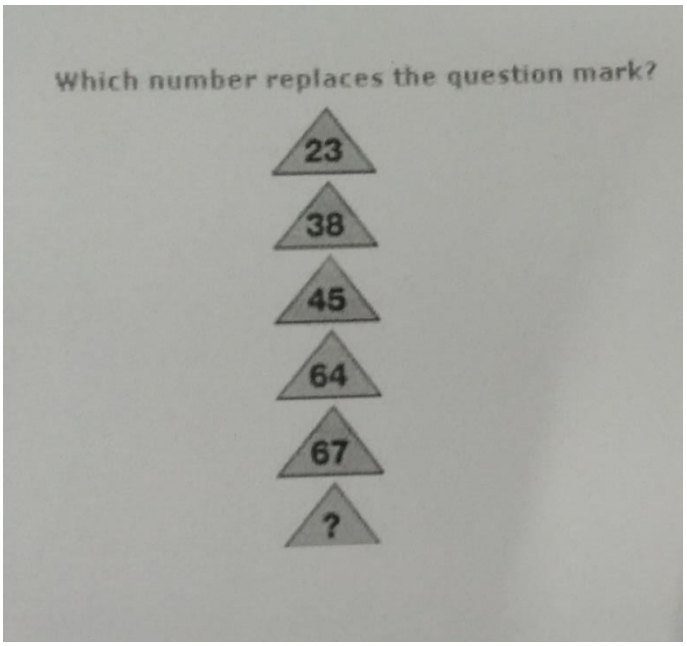
14.Which is the correct answer for trigonometric ratio?

a)$\tan\theta=\frac{oppositeside}{Hypotenuse}$ b)$\sin\theta\ \frac{Hypotenuse}{oppositeside}$

c)$\sec\theta=\frac{Hypotenuse}{Adjacentside}$ d)$\cot\theta=\frac{oppositeside}{Adjacentside}$

Ans:c)$\sec\theta=\frac{Hypotenuse}{Adjacentside}$

Can you solve this puzzle:



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2	A	B	C	D	32	A	B	C	D	62	A	B	C	D	92	A	B	C	D	122	A	B	C	D	152	A	B	C	D
3	A	B	C	D	33	A	B	C	D	63	A	B	C	D	93	A	B	C	D	123	A	B	C	D	153	A	B	C	D
4	A	B	C	D	34	A	B	C	D	64	A	B	C	D	94	A	B	C	D	124	A	B	C	D	154	A	B	C	D
5	A	B	C	D	35	A	B	C	D	65	A	B	C	D	95	A	B	C	D	125	A	B	C	D	155	A	B	C	D
6	A	B	C	D	36	A	B	C	D	66	A	B	C	D	96	A	B	C	D	126	A	B	C	D	156	A	B	C	D
7	A	B	C	D	37	A	B	C	D	67	A	B	C	D	97	A	B	C	D	127	A	B	C	D	157	A	B	C	D
8	A	B	C	D	38	A	B	C	D	68	A	B	C	D	98	A	B	C	D	128	A	B	C	D	158	A	B	C	D
9	A	B	C	D	39	A	B	C	D	69	A	B	C	D	99	A	B	C	D	129	A	B	C	D	159	A	B	C	D
10	A	B	C	D	40	A	B	C	D	70	A	B	C	D	100	A	B	C	D	130	A	B	C	D	160	A	B	C	D
11	A	B	C	D	41	A	B	C	D	71	A	B	C	D	101	A	B	C	D	131	A	B	C	D	161	A	B	C	D
12	A	B	C	D	42	A	B	C	D	72	A	B	C	D	102	A	B	C	D	132	A	B	C	D	162	A	B	C	D
13	A	B	C	D	43	A	B	C	D	73	A	B	C	D	103	A	B	C	D	133	A	B	C	D	163	A	B	C	D
14	A	B	C	D	44	A	B	C	D	74	A	B	C	D	104	A	B	C	D	134	A	B	C	D	164	A	B	C	D
15	A	B	C	D	45	A	B	C	D	75	A	B	C	D	105	A	B	C	D	135	A	B	C	D	165	A	B	C	D
16	A	B	C	D	46	A	B	C	D	76	A	B	C	D	106	A	B	C	D	136	A	B	C	D	166	A	B	C	D
17	A	B	C	D	47	A	B	C	D	77	A	B	C	D	107	A	B	C	D	137	A	B	C	D	167	A	B	C	D
18	A	B	C	D	48	A	B	C	D	78	A	B	C	D	108	A	B	C	D	138	A	B	C	D	168	A	B	C	D
19	A	B	C	D	49	A	B	C	D	79	A	B	C	D	109	A	B	C	D	139	A	B	C	D	169	A	B	C	D
20	A	B	C	D	50	A	B	C	D	80	A	B	C	D	110	A	B	C	D	140	A	B	C	D	170	A	B	C	D
21	A	B	C	D	51	A	B	C	D	81	A	B	C	D	111	A	B	C	D	141	A	B	C	D	171	A	B	C	D
22	A	B	C	D	52	A	B	C	D	82	A	B	C	D	112	A	B	C	D	142	A	B	C	D	172	A	B	C	D
23	A	B	C	D	53	A	B	C	D	83	A	B	C	D	113	A	B	C	D	143	A	B	C	D	173	A	B	C	D
24	A	B	C	D	54	A	B	C	D	84	A	B	C	D	114	A	B	C	D	144	A	B	C	D	174	A	B	C	D
25	A	B	C	D	55	A	B	C	D	85	A	B	C	D	115	A	B	C	D	145	A	B	C	D	175	A	B	C	D
26	A	B	C	D	56	A	B	C	D	86	A	B	C	D	116	A	B	C	D	146	A	B	C	D	176	A	B	C	D
27	A	B	C	D	57	A	B	C	D	87	A	B	C	D	117	A	B	C	D	147	A	B	C	D	177	A	B	C	D
28	A	B	C	D	58	A	B	C	D	88	A	B	C	D	118	A	B	C	D	148	A	B	C	D	178	A	B	C	D
29	A	B	C	D	59	A	B	C	D	89	A	B	C	D	119	A	B	C	D	149	A	B	C	D	179	A	B	C	D
30	A	B	C	D	60	A	B	C	D	90	A	B	C	D	120	A	B	C	D	150	A	B	C	D	180	A	B	C	D

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UNIT-4

MENSURATION

HERON'S FORMULA:

Area of triangle $=\sqrt{s(s-a)(s-b)(s-c)}$ sq.units

Where S = $\frac{a+b+c}{2}$

Area of equilateral triangle $=\frac{\sqrt{3}}{4}a^2$ sq. units

Perimeter of equilateral triangle = 3a units

Total surface area(TSA) of a cuboid=2(lb +bh+lh) sq. units

Lateral surface area (LSA) of a cuboid= 2 (l + b) h sq. units

TSA of cube = $6a^2$ sq. units

LSA of cube=$4a^2$sq.units

Volume of cuboid =lbh cubic units

Volume of cube = a^3 cubic units

1. The perimeter of an equilateral triangle is 36cm find the area?

Solution:

Perimeter of the equilateral triangle=3a

36=3a

36/3=a,

12=a

$$a=12$$

Area of the equilateral triangle=$\frac{\sqrt{3}}{4}a^2$

$$\sqrt{3}/4a^2=\sqrt{3}/4\times12\times12$$

$$=36\sqrt{3}$$

2. If the ratio of the sides of two cubes are 3:5 then ratio of their surface area will be.

Solution:

Surface area of cube=$6a^2$

$S.A_1/S.A_2=\frac{6a_1}{6a_2}^2=(3x)^2/(5x)^2$

$$=9x^2/25x^2$$

$$=9/25$$

The ratios are=9:25

EXERCISE

1. If the total surface area of a cube is 2400cm^2 then find it's lateral surface area.

a) 1500 cm^2 b)1400 cm^2 c)1600cm^2 d)1700cm^2

Ans : c)1600cm^2

2. Find the area of an equilateral triangle whose perimeter is 180cm.

a) 1568.8cm^2 b)5168.7cm^2 c)1685.8cm^2 d)1558.8cm^2

Ans: d)1558.8cm^2

3. A cubical tank can hold 1728000 liters of water find the length of its side in meters.

a) 11 m b)12m c)4m d)13m

Ans : b)12m

4. What is the formula for LSA of a cube.

a) $6a^2$ b)$4a^2$ c)a^3 d)lbh

Ans : b)$4a^2$

5. The formula to find the surface area of a cuboid of length, breadth and heightis.

a) lb+bh+hl b) 2(lb+bh+hl) c) 2(lbh) d)lbh/h

Ans : b) 2(lb+bh+hl)

6. The LSA of a cube is $256m^3$.The volume of the cube is.

a) $512m^3$ b)$64m^3$ c)216 m^3 d)256 m^3

Ans: a)$512m^3$

7. The perimeter of a triangular plot is 600 m If the sides are in the ratio5:12:13,then find the area of the PLOT.

a) 12000 m^2 b)$13000m^2$ c)$14000m^2$ d)$16000m^2$

Ans:a)12000 m^2

8. The dimensions of a fish tank are3.8m×1.2m×8.6m. How many liters of water it can be hold?

a) 15200 liters b)3921600 liters c)4123600 liters d)24512litres

Ans : b)3921600 liters

9. Find the volume of the cuboid whose dimensions are l=14cm,b=10cm,h=8cm.

a) 576 cm^3 b)1041 cm^3 c)1206 cm^3 d)1120cm^3

Ans : d)1120 cm^3

10. Find the volume of cube each of whose side is 3.5 meters.

a) 78.245 m^3 b)38.743 m^3 c)42.875m^3 d)57.843m^3

Ans : c)42.875m^3

11. Using Heron's formula, find the area of a triangle whose sides are 1.8m,8m,8.2m.

a) 8.m^2 b)7.2m^2 c)6.1m^2 d)5.3m^2

Ans: b)7.2m^2

12. The perimeter of an equilateral triangle is 12cm. Find the area?

a) $4\sqrt{3}cm^2$ b)$12\sqrt{3}cm^2$ c)$25\sqrt{3}cm^2$ d)$10\sqrt{3}cm^2$

Ans : a)$4\sqrt{3}cm^2$

13. The volume of cuboid is 208cm^3 and the area of the base is 26cm^2 and its height is__ .

a) 9cm b)8cm c)7cm d)6cm

Ans : b)8cm

14. If a=8cm and find the area of equilateral triangle.

a)$25\sqrt{3}$ m^2 b)$81\sqrt{3}m^2$ c)$25\sqrt{3}cm^2$ d)$16\sqrt{3}m^2$

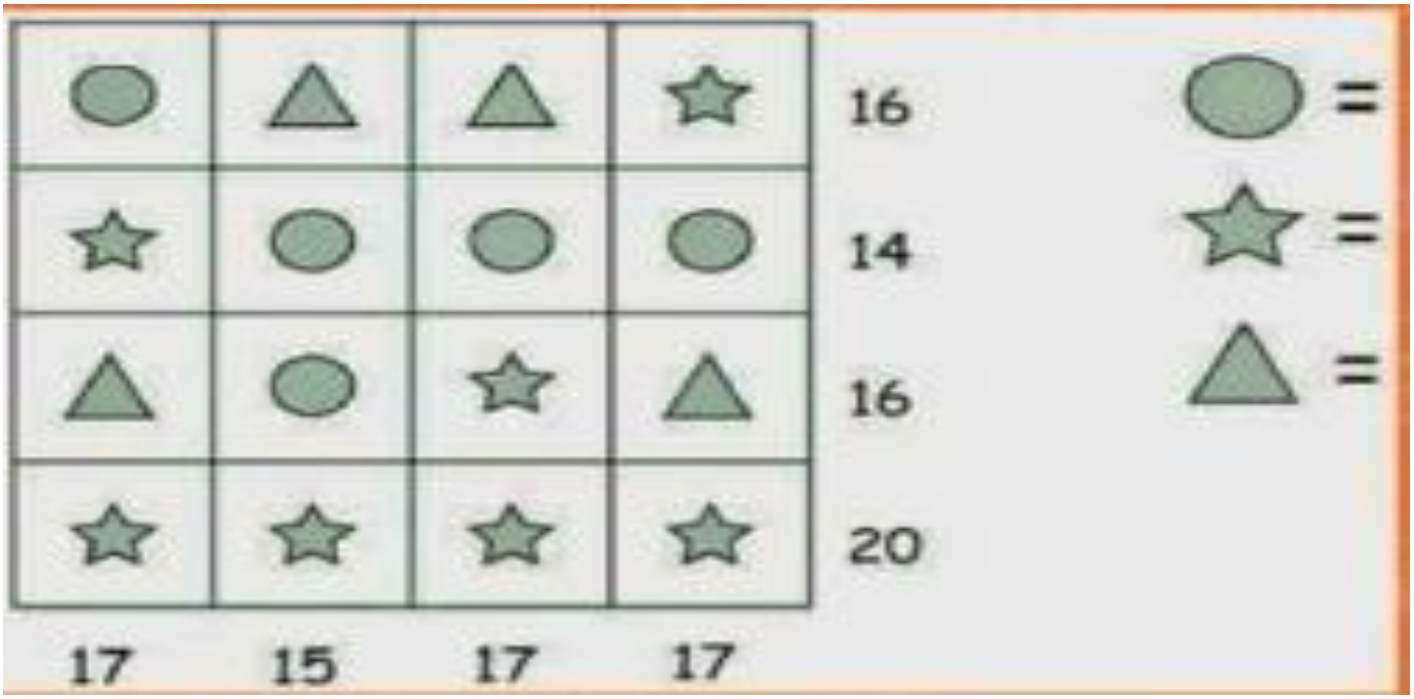
Ans : d)$16\sqrt{3}m^2$

15. The ratio of the sides of two cubes are 4:5, then the ratios of their surface area will be_____.

a)16:25 b)8:10 c)12:15 d)20:25

Ans :a)16:25

Can you solve this puzzle:



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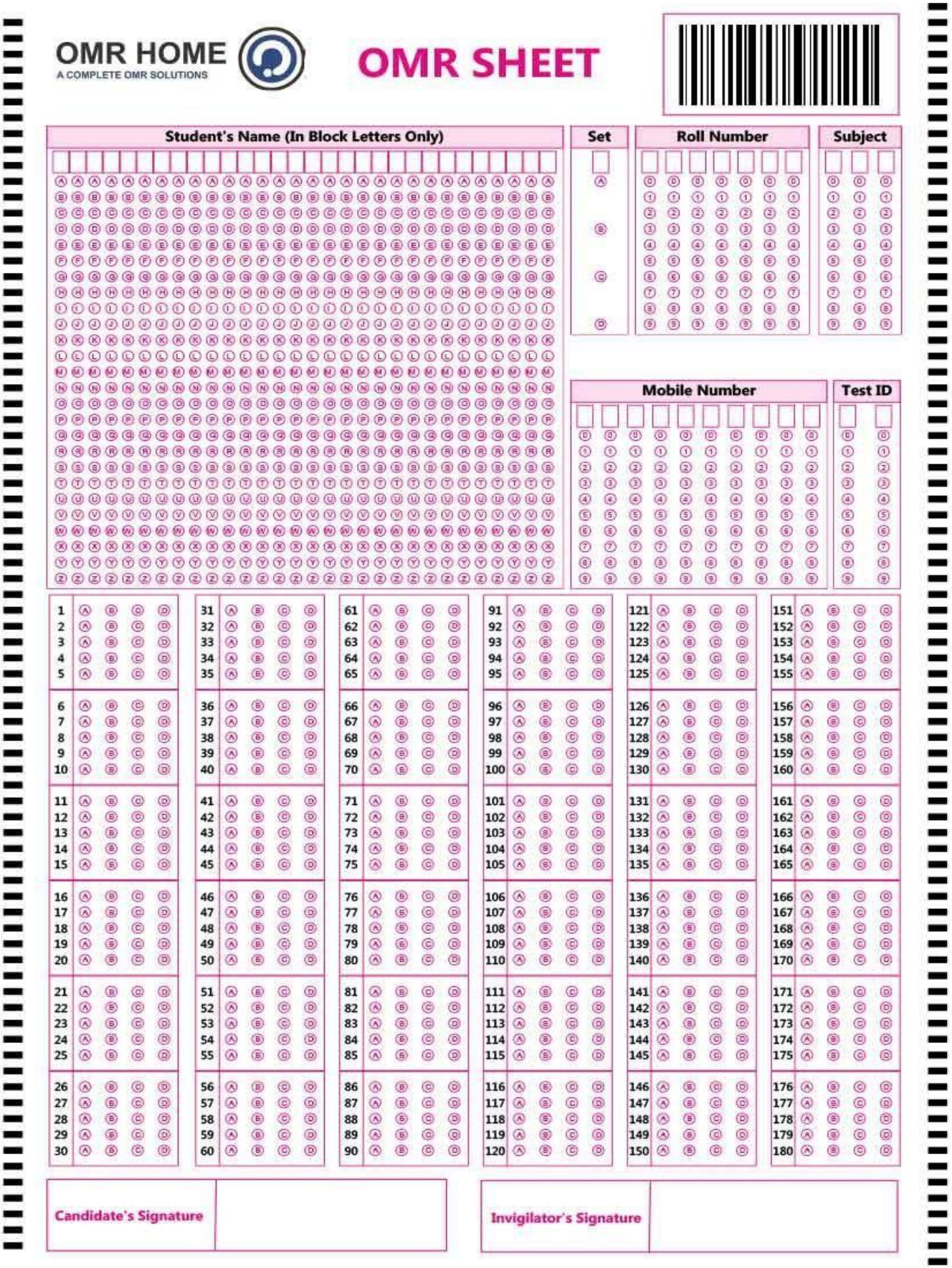
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UNIT-5

STATISTICS

Size of the class interval=UCL-LCL Mid

value $=\frac{UCL+LCL}{2}$

Mean=$\sum x/n$

For ungrouped data:

Median = $[(n+1)/2]^{th}$ observation, if n is odd.

Median=mean of $(n/2)^{th}$ observation and $[(n/2)+1]^{th}$

Observation, if n is even.

Mode for ungrouped data:

Mode means a value or a number that appears most frequently in a data set.

Measures of Central Tendency

The mean, median and mode are all valid measures of central tendency.

EXERCISE

1. The median of the data:155,160,145,149,150,147,152,144,148 is

   a) 149 b)150 c)147 d)144

   Ans: a) 149

2. The value which appears very frequently in a data is called:

   a) Mean b)Median c)Mode d)frequency

   Ans :c) Mode

3. Find the mode of the given data: 4,6,5,9,3,2,7,7,6,5,4,9,10,10,3,4,7,6,9,9,

a) 7 b)9 c)10 d)6

Ans : b)9

4. Find the mean of the data:11,5,7, 9,13,3,1,17,15,19 is

a) 49.5 b)10 c)50 d)99

Ans: b)10

5. Which of the following is not a measure of central tendency?

a) Mean b)Median c)Mode d)Range

Ans :d)Range

6. The sum of the deviations of the entries from the arithmetic mean is always_____.

a) 0 b)1 c)1.5 d)0.5

Ans: a)0

7. The median of observation11, 12,14,18,x+2,x+4,30,32,35,41arranged in ascending order is 24. Find the value of x.

a) 28 b)25 c)21 d)52

Ans: c)21

8. A set of numbers consists of five 4's, four 5's, nine 6's and six 9's what is the mode?

a) 4 b)5 c)6 d)9

Ans : c)6

9. Find the median of the first ten prime numbers.

a) 24 b)14 c)12 d)22

Ans: c)12

10. Which one of the following is the correct examples of secondary data.

a) Diaries b)Interview c)photographs d)Census data

Ans : c)photographs

11. The mean of five numbers is 30, If one number is excluded their mean be comes 28, the excluded number is.

a) 28 b)30 c)35 d)38

Ans: d)38

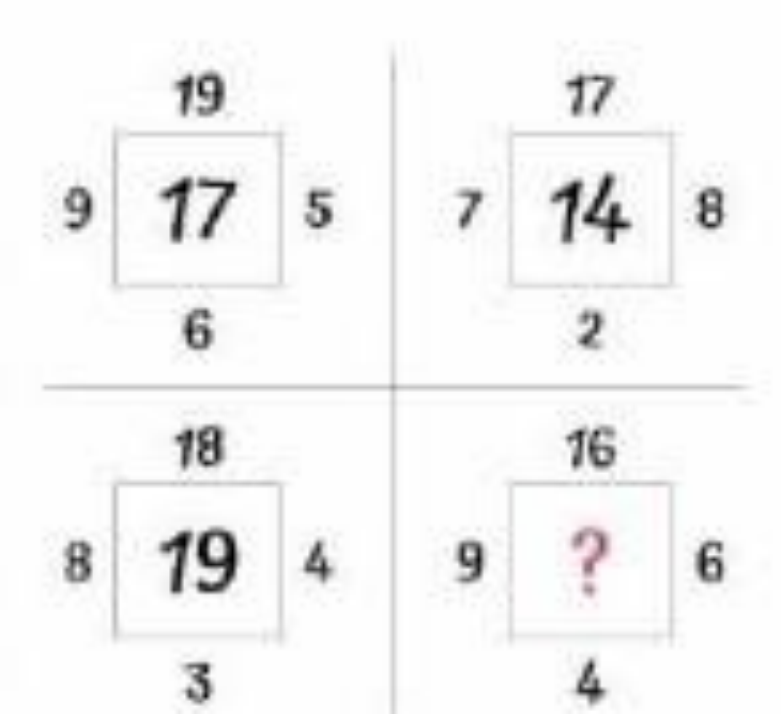
12. If each observation of the data is increased by 5 then their mean_____.

b)Remains the same b)becomes 5 times the original

c) is decreased by 5 d)is increased by 5

Ans : d) is increased by 5

Can you solve this puzzle:



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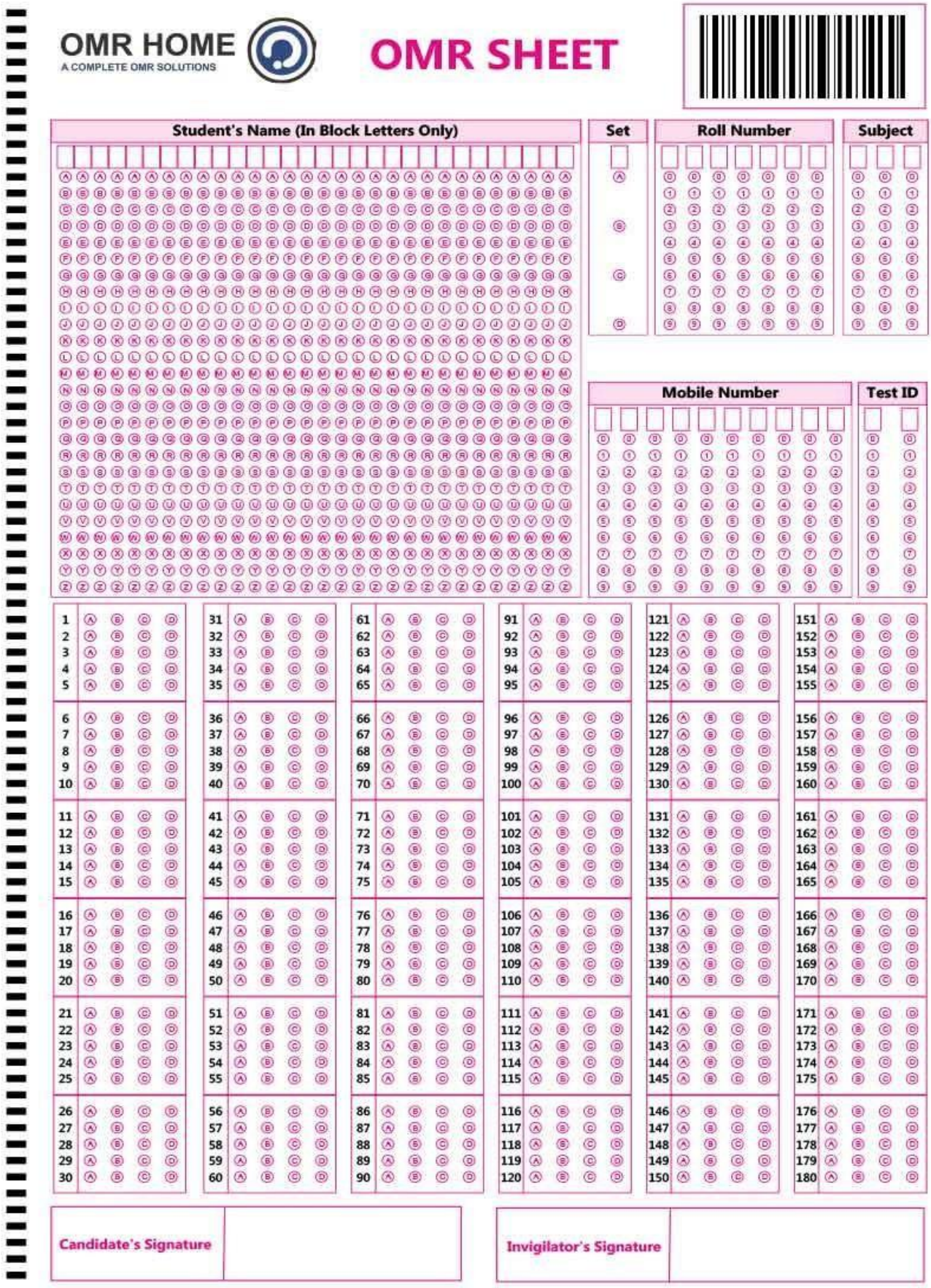
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UNIT – 6

PROBABILITY

Probability is a measure of the likelihood of an event to occur. Many events cannot be predicted with total certainty. We can predict only the chance of an event to occur i.e. how likely they are to happen, using it. Probability can range in from 0 to 1,

The probability of an event E is denoted as P(E)

$$\mathbf{P(E)=}\frac{no\ of\ favourable\ outcomes}{total\ no\ of\ outcomes}= \quad \frac{n(E)}{n(S)}$$

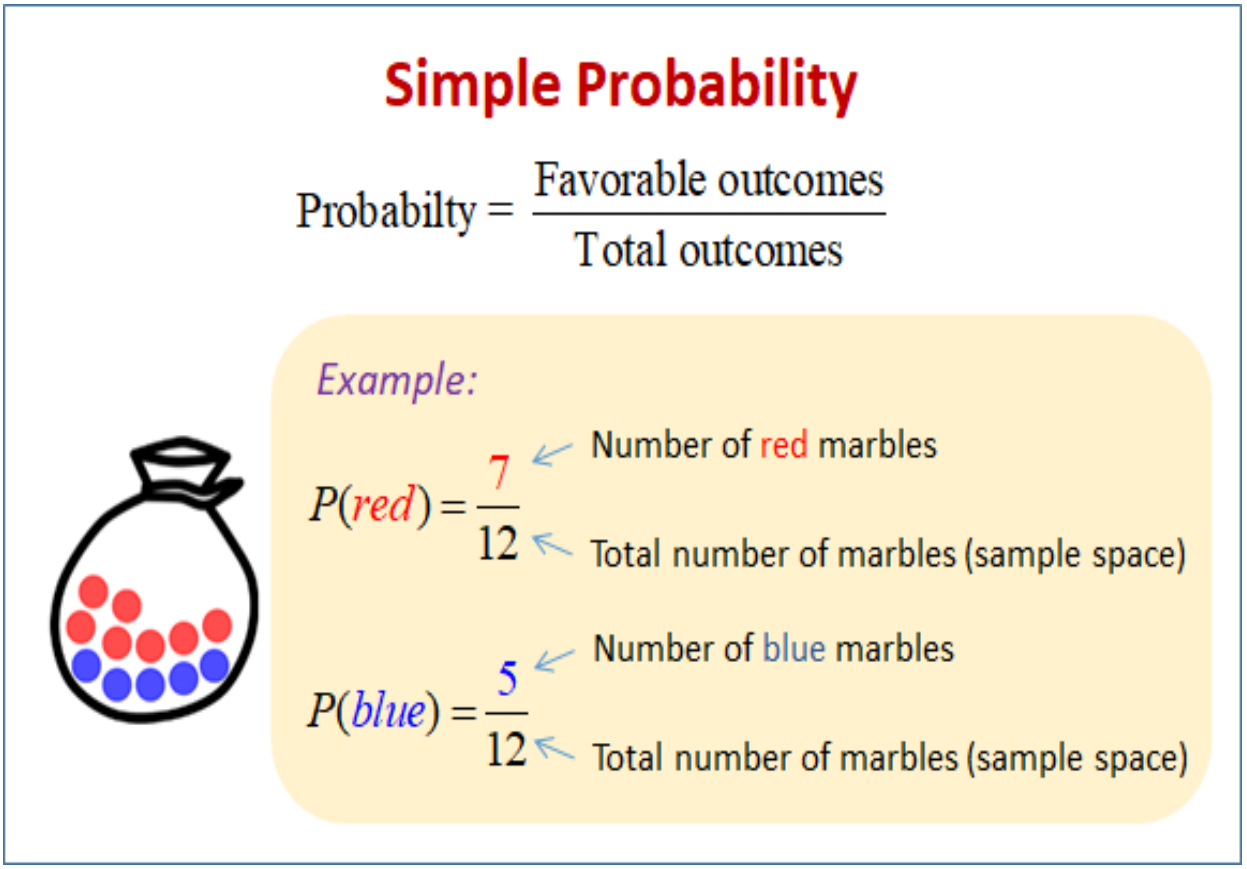
Two events E and E^1 are said to be complementary events. If

$$\mathbf{P(E)+P(E^1)=1}$$

The probability of an impossible event is always zero.

The probability of a sure event is always one.

The sum of the two probability event is 1.



EXERCISE

1. If P(E)=0.38, then probability of event E not occurring is.

   a) 1 b)0.38 c)0.48 d)0.62

   Ans : d)0.62

2. When the dice is rolled, find the probability to get the number which is greater than 4?

   a) 1/6 b)5/6 c)2/6 d)3/6

   Ans : c)2/6

3. What is the probability of drawing a king or a queen or jack from a deck of cards?

   a) 3/13 b)5/24 c)1/2 d)2/3

   Ans : a)3/13

4. If a probability of a player winning a particular tennis match is 0.72 what is the probability of the player losing the match.

   a) 0.45 b)0.28 c)0.54 d)0.82

   Ans : b)0.28

5. The probability that it will rain tomorrow is 91/100 what is the probability that it will not rain tomorrow?

   a) 0.09 b)0.91 c)0.89 d)0.99

   Ans :a)0.09

6. If P(E)=0 then E is known as_____.

   a) Possible event b)Impossible event

   c)Sure event d)Complementary events

   Ans : b)Impossible event

7. If P(E)=1 then E is called_____.

   a) Possible event b)Impossible event

   c)Sure event d)Simple event

   Ans: c)Sure event

8. A particular result of an experiment is called_____.

   a) Compound event b)Trial

   c)Outcome d)Complementary events

   Ans: c)Outcome

9. Outcome of 35 students participating in a debate 10 are girls. The probability that winner is a boy is.

   a) 1 b)2/7 c)3/7 d)5/7

   Ans: d)5/7

10. A bats man hits boundaries for 6 times out of 30 balls. Find the probability that he did not hit the boundaries.

    a) 3/5 b)2/5 c)4/5 d)1/5

    Ans :c)4/5

11. Which of the following cannot be the empirical probability of an event.

    a) 2/3 b)3/2 c)0 d)1

    Ans: b)3/2

12. When two coins are tossed, what is the probability that two heads are obtained?

    a) 1/4 b)2/4 c)4/2 d)1/5

    Ans :a)1/4

13. The probability of drawing an ace card from a deck of cards is.

a) 1/52 b)1/26 c)4/13 d)1/13

Ans :d)1/13

14. Probability of a leap year having 53 Sundays is.

a) 1/7 b)3/7 c)2/7 d)none of these

Ans : c)2/7

15. There are 5 red and 3 black balls in a bag probability of drawing a black ball is.

a) 5/8 b)1/2 c)3/8 d)1/8

Ans :c)3/8

Can you solve this puzzle:

Solve the first three rows to understand the logic:

7+3+4+1
5+6+3+3
6+3+9+1
4+8+2+ ?

WORKSHEET

OMR HOME
A COMPLETE OMR SOLUTIONS

OMR SHEET

Student's Name (In Block Letters Only)	Set	Roll Number	Subject
	A B C D	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9

Mobile Number	Test ID
0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9

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2	A B C D	32	A B C D	62	A B C D	92	A B C D	122	A B C D	152	A B C D
3	A B C D	33	A B C D	63	A B C D	93	A B C D	123	A B C D	153	A B C D
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5	A B C D	35	A B C D	65	A B C D	95	A B C D	125	A B C D	155	A B C D
6	A B C D	36	A B C D	66	A B C D	96	A B C D	126	A B C D	156	A B C D
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8	A B C D	38	A B C D	68	A B C D	98	A B C D	128	A B C D	158	A B C D
9	A B C D	39	A B C D	69	A B C D	99	A B C D	129	A B C D	159	A B C D
10	A B C D	40	A B C D	70	A B C D	100	A B C D	130	A B C D	160	A B C D
11	A B C D	41	A B C D	71	A B C D	101	A B C D	131	A B C D	161	A B C D
12	A B C D	42	A B C D	72	A B C D	102	A B C D	132	A B C D	162	A B C D
13	A B C D	43	A B C D	73	A B C D	103	A B C D	133	A B C D	163	A B C D
14	A B C D	44	A B C D	74	A B C D	104	A B C D	134	A B C D	164	A B C D
15	A B C D	45	A B C D	75	A B C D	105	A B C D	135	A B C D	165	A B C D
16	A B C D	46	A B C D	76	A B C D	106	A B C D	136	A B C D	166	A B C D
17	A B C D	47	A B C D	77	A B C D	107	A B C D	137	A B C D	167	A B C D
18	A B C D	48	A B C D	78	A B C D	108	A B C D	138	A B C D	168	A B C D
19	A B C D	49	A B C D	79	A B C D	109	A B C D	139	A B C D	169	A B C D
20	A B C D	50	A B C D	80	A B C D	110	A B C D	140	A B C D	170	A B C D
21	A B C D	51	A B C D	81	A B C D	111	A B C D	141	A B C D	171	A B C D
22	A B C D	52	A B C D	82	A B C D	112	A B C D	142	A B C D	172	A B C D
23	A B C D	53	A B C D	83	A B C D	113	A B C D	143	A B C D	173	A B C D
24	A B C D	54	A B C D	84	A B C D	114	A B C D	144	A B C D	174	A B C D
25	A B C D	55	A B C D	85	A B C D	115	A B C D	145	A B C D	175	A B C D
26	A B C D	56	A B C D	86	A B C D	116	A B C D	146	A B C D	176	A B C D
27	A B C D	57	A B C D	87	A B C D	117	A B C D	147	A B C D	177	A B C D
28	A B C D	58	A B C D	88	A B C D	118	A B C D	148	A B C D	178	A B C D
29	A B C D	59	A B C D	89	A B C D	119	A B C D	149	A B C D	179	A B C D
30	A B C D	60	A B C D	90	A B C D	120	A B C D	150	A B C D	180	A B C D

Candidate's Signature		Invigilator's Signature	

CONTENT

SCIENCE

UNIT-1

FUNDAMENTAL LAWS OF GASES

The three fundamental laws which connect the relation between pressure, volume and temperature are as follows:

1) Boyle's Law

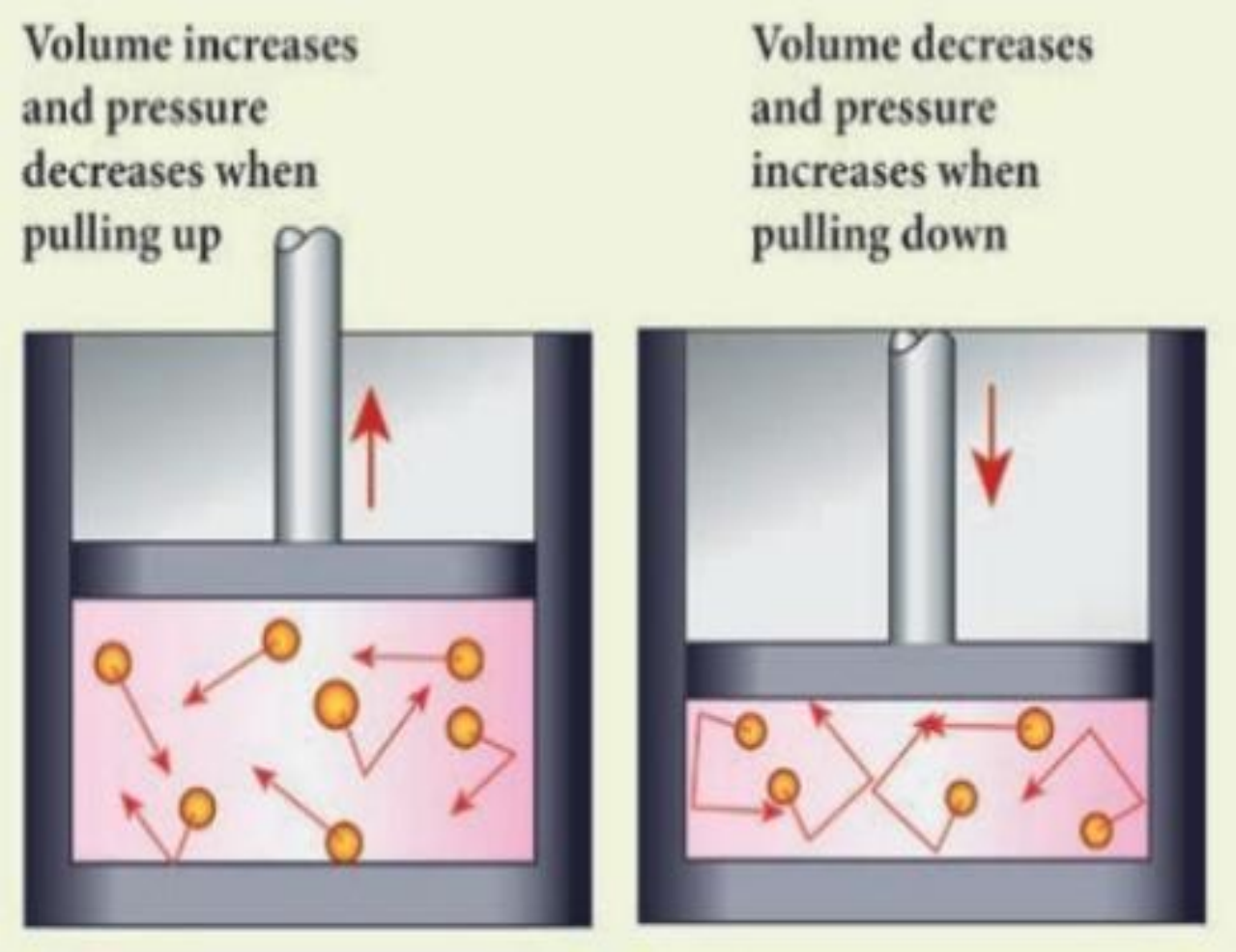
2) Charles's law

3) Avogadro's law

Boyle's law:

When the temperature of a gas is kept constant, the volume of a fixed mass of gas is inversely proportional to its pressure.

$P\alpha 1/V$



Variation of volume with pressure

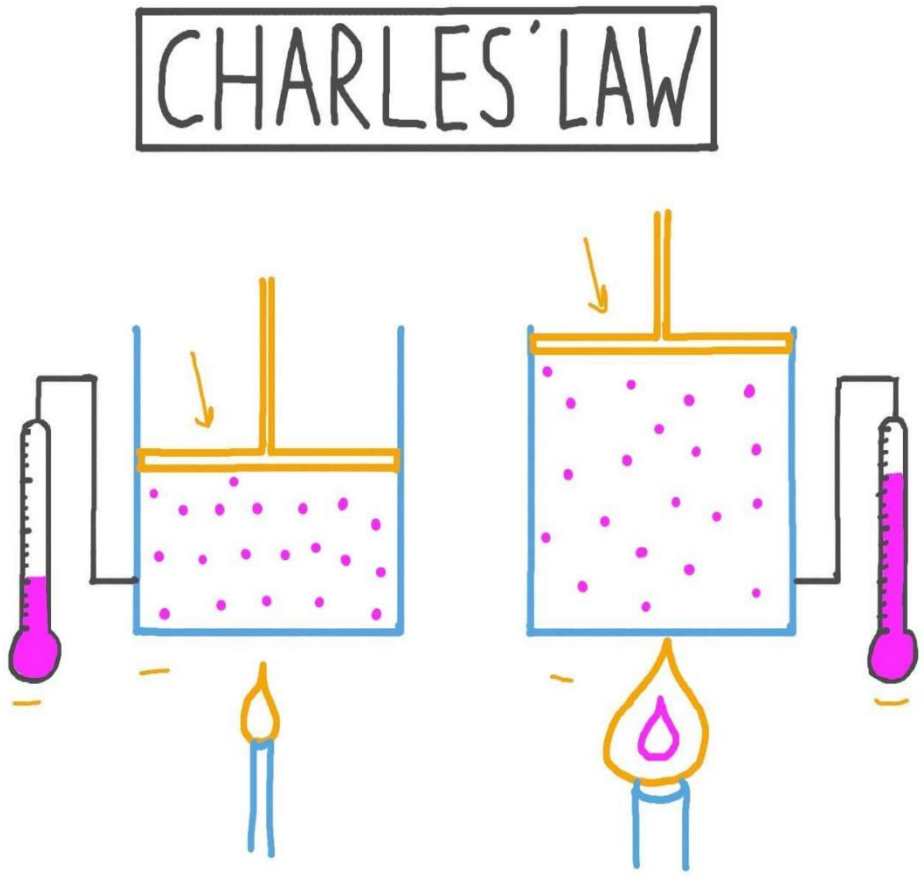
In other words, for an invariable mass of a perfect gas, at constant temperature, the product of its pressure and volume is a constant.

PV=constant

Charles's law: (The law of volume)

Charles's law was formulated by a French scientist **Jacques Charles**. According to this law, When the pressure of gas is kept constant, the volume of a gas is directly proportional to the temperature of the gas.

V α T or V/T = constant

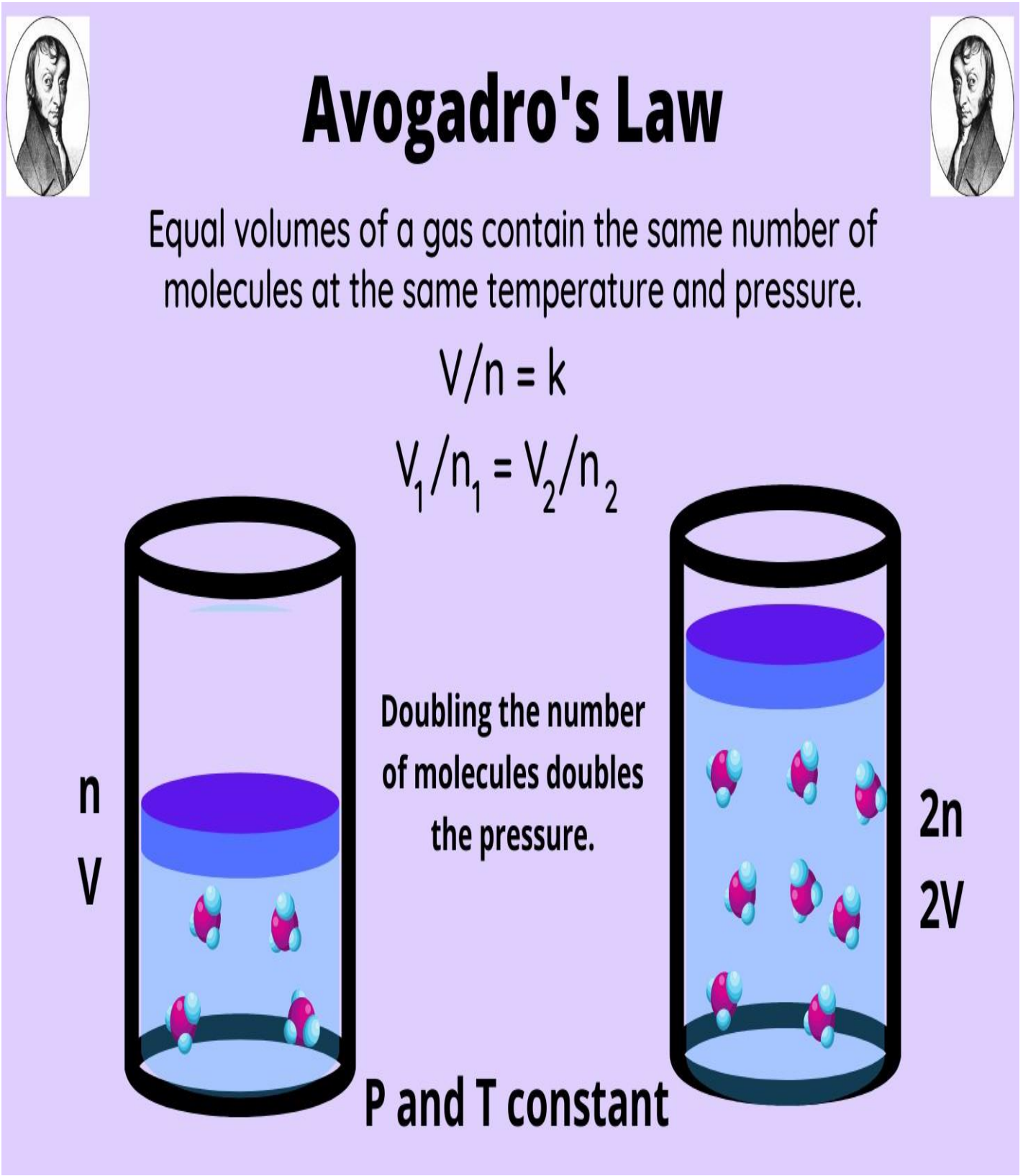


Avogadro's law:

Avogadro's law states that at constant pressure and temperature, the volume of a gas is directly proportional to number of atoms or molecules present in it.

V α n (or) V/n = constant

Avogadro's number (N_A) is the total number of atoms per mole of the substance. It is equal to **6.023×10^{23} /mol**.



GASES

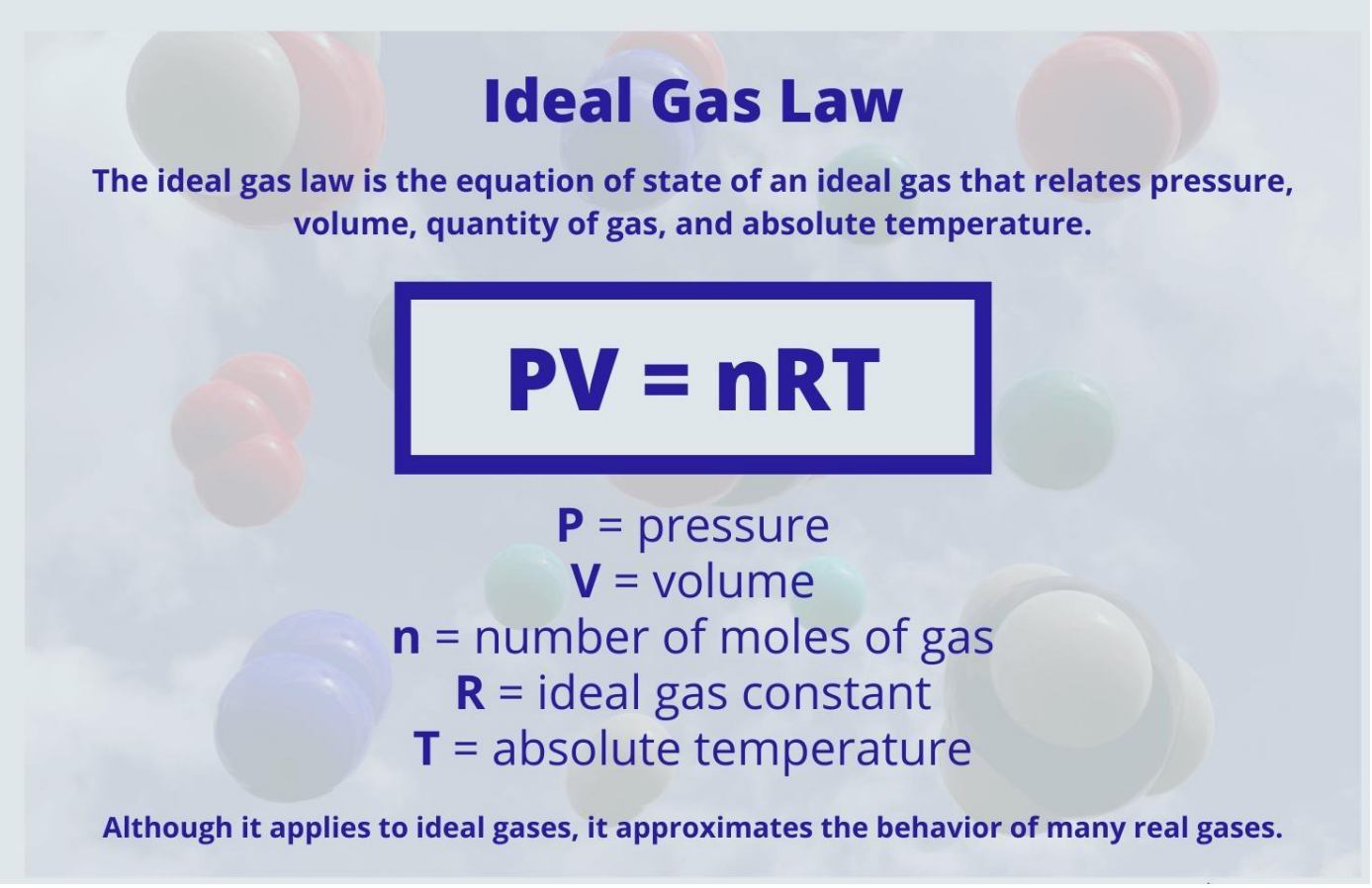
Gases are classified as real gases and ideal gases.

Real Gases

If the molecules or atoms of a gases interact with each other with a definite amount of intermolecular or inter atomic force of attraction, then the gases are said to be real gases. At very high temperature or low pressure, a real gases behaves as an ideal gases because in this condition there is no inter atomic or intermolecular force of attraction.

Ideal Gases

If the atoms or molecules of a gas do not interact with each other**,** then the gas is said to be an ideal gas or a perfect gas.



Actually, in practice, no gas is ideal. The molecules of any gas will have a certain amount of interaction among them**.**

But, these interactions are weaker when the pressure is low or the temperature is high because the inter atomic or intermolecular forces of attraction are weak in ideal gas. Hence, a real gas at low pressure or high temperature can be termed as a perfect gas.

Ideal Gas Equation

The ideal gas equation is an equation, which relates all the properties of an ideal gas. An ideal gas obeys Boyle's law and Charles's law and Avogadro's law. According to Boyle's law,

PV=constant

According to Charles's law,

V/T = constant (3.2)

According to Avogadro's law,

V/n = constant

After combining equations

PV/nT = constant

The above relation is called the combined law of gases.

If you consider a gas, which contains μ moles of the gas, the number of atoms contained will be equal to μ times the Avogadro number, N_A.

$$n=\mu N_A.$$

$$PV/\mu N_{AT}=constant$$

The value of the constant in the above equation is taken to be k_B, which is called as Boltzmann constant (1.38×10^{-23} JK^{-1}).

Hence, we have the following equation:

$$PV/ \mu N_{AT} = k_B$$

$$PV=\mu N_A k_B T$$

Here, $\mu N_A k_B = R$, which is termed as universal gas constant whose value is $8.31 Jmol^{-1}K^{-1}$.

$$PV = RT$$

Ideal gas equation is also called as equation of state.

MCQ :

1. Boyle's law equation is_____.

a) P/V=constant **b)PV=constant** **c)V/T=constant** **d)v/n=constant**

2. Charle's law formula is_____.

a) P/V=constant **b)PV=constant** **c)V/T=constant** **d)V/N=constant**

3. Avogadro's law is_____.

a) p/v=constant **b)pv=constant** **c)c/t=constant** **d)v/n=constant**

4. Avogadro's number (N_A) is_____.

a) 6.023×10^{23}/mole **b) $6.023\times^{-23}$/mole**

c) 6.026×10^{23}/mole **d) 6.026×10^{23}/mole**

5. Fundamental law of gases is relation between_____.

a) PWT **b)PVW** **c)PVT** **d)PTW**

6. If the atoms or molecules of a gas do not interact with each other, then the gas is said to be

a) Ideal gas **b)perfect gas** **c)gas b** **d)both a and b**

7. A real gas at low pressure or high temperature can be termed as a_____.

a) Weak in ideal gas **b)in ideal gas** **c)perfect gas** **d)none of these**

8. Ideal gas equation is_____.

a)PV=constant **b)V/T=constant**

c) PV=RT **d)V/N=constant**

9.universal gas constant is_____.

a)8.31Jmol^{-1}k^{-1} **b)2.5Jmol^{-1}k^{-1}**

c)20.7Jmol^{-1}k^{-1} **d)18.2Jmol^{-1}k^{-1}**

10. Boltzman constant is_____.

a) 8.31×10^{-23}J **b)1.38×10^{-23}JK^{-1}** **c)1.38×10^{23}JK^{-1}** **d)8.31×10^{-23}JK^{-1}**

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24 A B C D	49 A B C D	74 A B C D	99 A B C D
25 A B C D	50 A B C D	75 A B C D	100 A B C D

Candidate's Signature

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UNIT-2

MODERN PERIODIC LAW

Henry Moseley, a British scientist in 1912, discovered a new property of elements called atomic number, which provided a better basis for the periodic arrangement of the elements.

It is a well-known fact that atomic number of an element is equal to the number of protons or the number of electrons present in the neutral atom of an element. The periodic law was, therefore, modified to frame a modern periodic law, which states that

"The physical and chemical properties of the elements are the periodic functions of their atomic numbers".

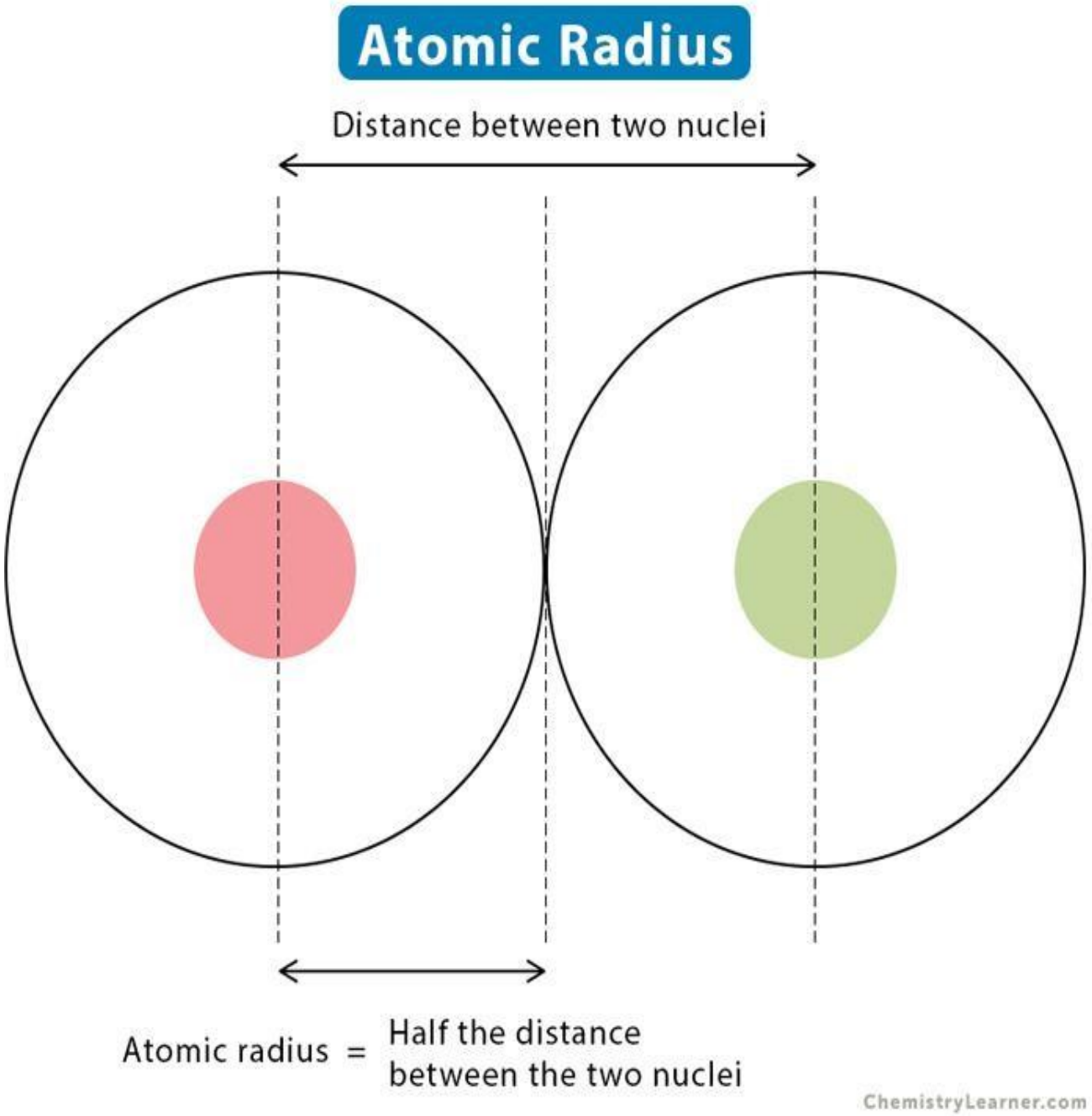
Features of Periods

periods	Types of periods	Atomic no	Elements
I	Shortest period	1and2	Hydrogen &Helium(2 elements)
II	Short period	3to10	Lithium to Neon(8 elements)
III	Short period	11to 18	Sodium to argon(8 elements)
IV	Long period	19to 36	Potassium to Krypton(18 elements)
V	Long period	37to 54	Rubidium to Xenon(18elements)
VI	Longest period	55to 86	Caesium to Radon(32elements)
VII	Incomplete period	87to 118	Francium to Oganesson(32 elements)

Features of Groups

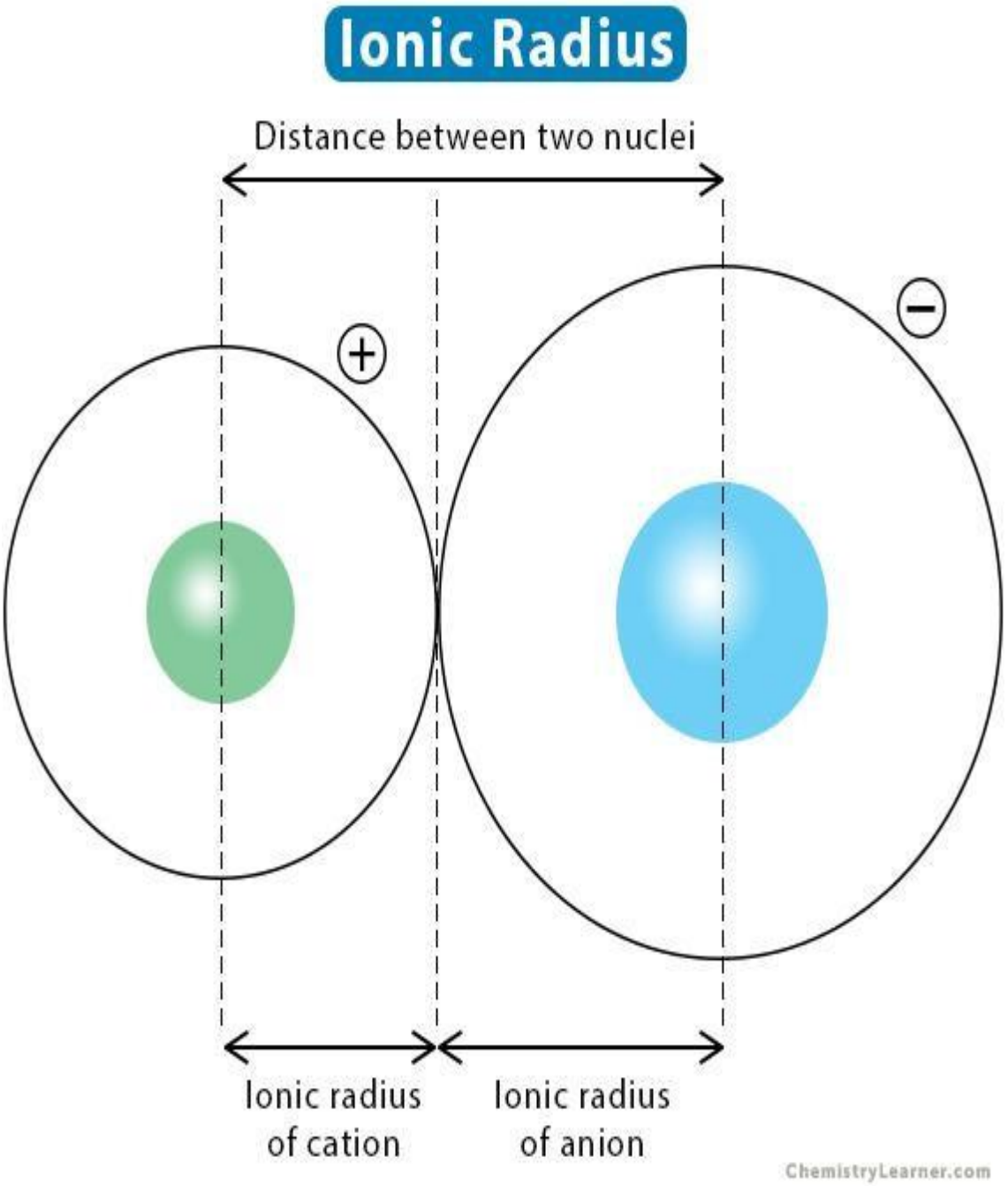
GroupNumber	Family
1	Alkali Metals
2	Alkaline earth metals
3to12	Transition metals
13	Boron Family
14	Carbon Family
15	Nitrogen Family
16	Oxygen Family (or) Chalcogen family
17	Halogens
18	Noble gases

Atomic radius of an atom is defined as the distance between the center of its nucleus and the outermost shell containing the valence electron.
Direct measurement of the radius of an isolated atom is not possible.



Ionic Radii

- **Positively charged ion called cation.**
- **Negatively charged ion called anion.**

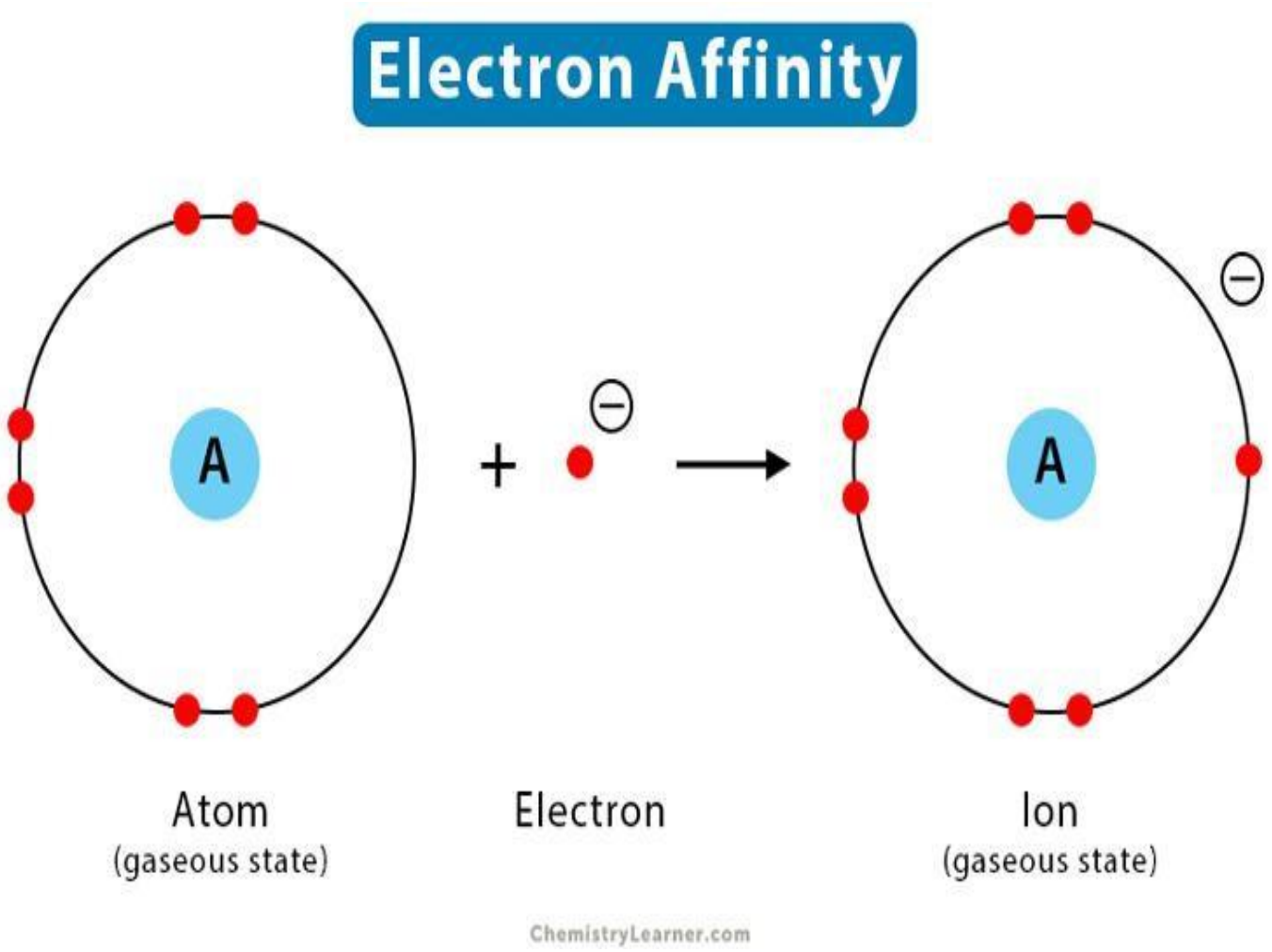


Note: As the positive charge increases the size of the cation decreases.

As the negative charge increases the size of the anion increases.

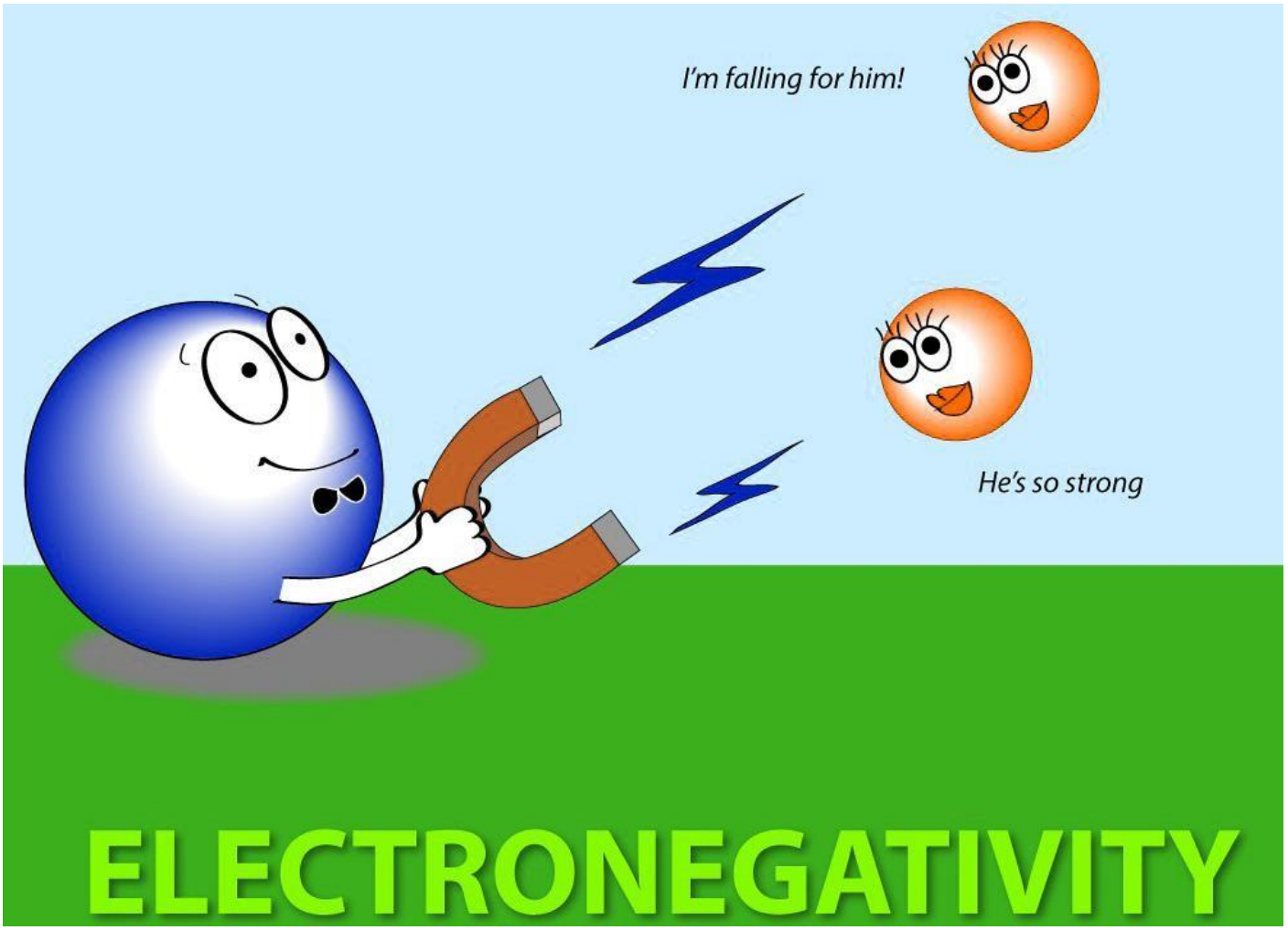
Electron Affinity

- ✓ Electron affinity is the amount of energy released when an isolated gaseous atom.
- ✓ Gains an electron to form its anion.
- ✓ It is also measured in kJ/mol.



Electrone gativity

- Electro negativity of an element is the measure of the tendency of its atom to attract the shared pair of electrons towards itself in a covalent bond.
- Electro negativity is based on various experimental data such as bond energy, Ionization potential, electron affinity, etc.
- Along the period, from left to right in the periodic table, the electro negativity increases because of the increase in the nuclear charge which in turn attracts the electrons more strongly.
- On moving down a group, the electro negativity of the elements decreases because of the increased number of valence shells.



MCQ:

1. Modern periodic law states that, the physical and chemical properties of the elements are the periodic functions of their_____".

a) Mass number **b)Atomic number** **c)Atomic mass** **d)Atomic radii**

2. Modern periodic table was discovered by_____.

a) Mendeleev **b)Moseley** **c)Dalton** **d)Chadwick**

3. Fourth period contains_____elements.

a) 16 **b)17** **c)18** **d)19**

4. Sixth period is_____.

a) Short period **b)Long period** **c)Longest period** **d) shortest period**

5. Group 16 is called_____family.

a) **Oxygen** **b)Chalcogen** **c)Halogens** **d)Oxygen (or) Chalcogen**

6. Noble gases are_____group elements.

a) **16^{th}** **b)17^{th}** **c)18^{th}** **d)19^{th}**

7._____Of an atom is defined as the distance between the center of its nucleus and the outermost shell containing the valence electron.

a) **Atomic radius** **b)Ionic radii** **c)Ionization** **d)electron**

8. Negatively changed Ion is called_____.

a) **Cation** **b)anion** **c)photon** **d)proton**

9. As the positive charge increases the size of the cation_____.

a)Increases **b)Decreases** **c)Infinity** **d)Zero**

10. Electron affinity is measured in_____.

a) **K/mol** **b)KJ/mol** **c)Kg/mol** **d)g/mol**

11._____Of an element is the measure of the tendency of its atom to attract the shared pair of electrons towards itself in a covalent bond.

a) **Ionization energy** **b)Ionic radii**

c)Electro negativity **d)Electron affinity**

12. Electro negativity is based on various experimental data such as_____.

a) **Ionic radii** **b)bond energy**

c)electron affinity **d)bond energy and electron affinity**

13. Along the period, from left to right in the periodic table, the electro negativity_____.

a)Decreases **b)Increases** **c)same** **d)zero**

14. Positively charged ion called _____.

a) **anion** **b)nutrial** **c) cation** **d)positron**

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OMR SHEET

Student's Name (In Block Letters Only)

Set

Roll Number

Subject

Mobile Number

Test ID

1	26	51	76
2	27	52	77
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17	42	67	92
18	43	68	93
19	44	69	94
20	45	70	95
21	46	71	96
22	47	72	97
23	48	73	98
24	49	74	99
25	50	75	100

Candidate's Signature

Invigilator's Signature

UNIT-3

BIOTECHNOLOGY

What is Biotechnology ?

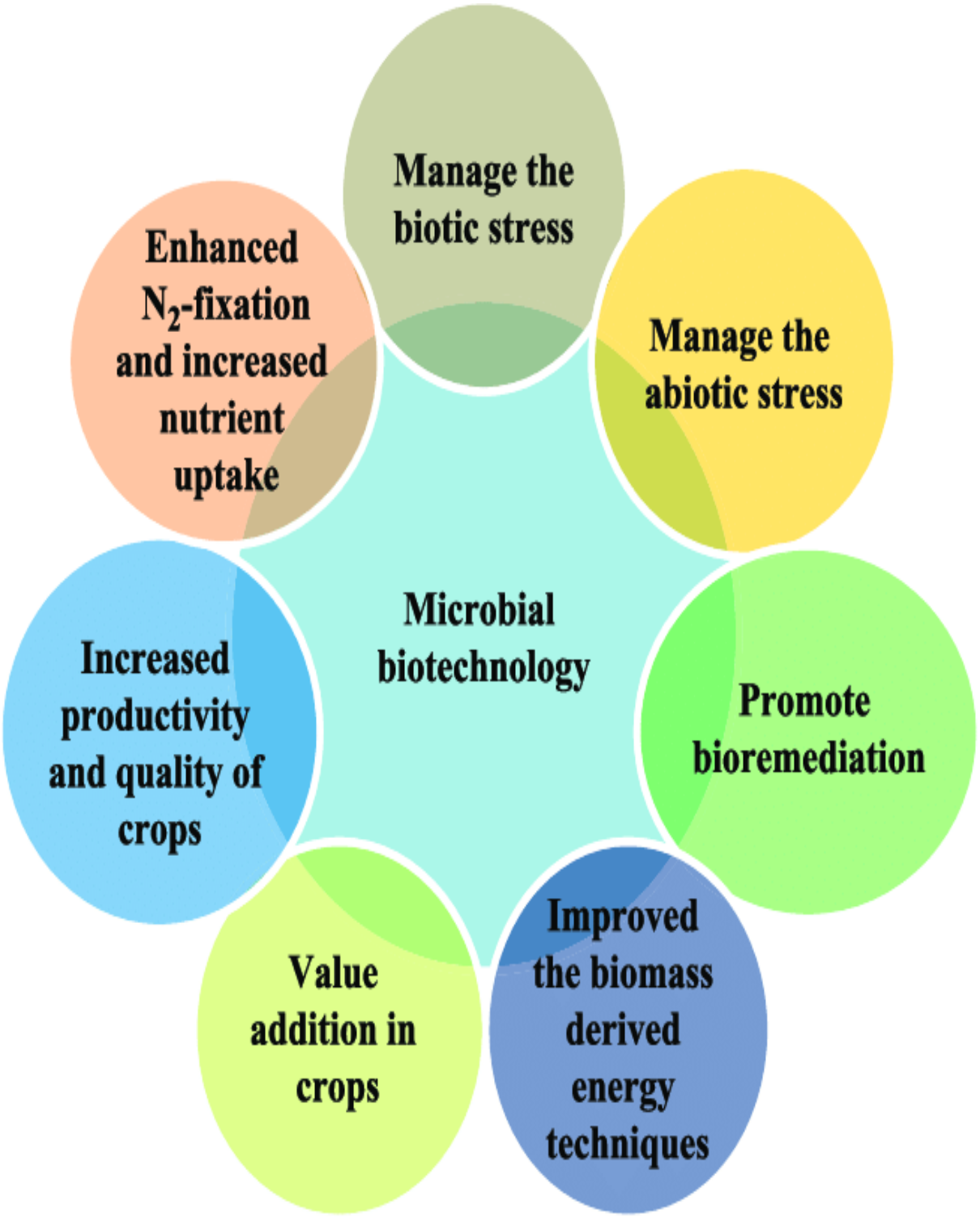
Biotechnology is the use of living organisms and their internal systems for the benefit of the human being.

With the advancement of various molecular techniques, scientists have used biotechnology in various fields, **e.g.** for the production of genetically modified (GM) crop, new drugs, vaccines, enzymes, chemicals for industrial use, diagnosis, to increase the yield of the crop, waste management, etc.

Applications of Biotechnology

Earlier the use of biotechnology was limited to making bread, alcoholic beverages and cross breed animals and crops.

Modern biotechnology makes use of the advancement in science such as genetic engineering and recombinant DNA technology with great effect and has expanded the application of biotechnology for the benefit and well being of humans.


Manage the biotic stress
Manage the abiotic stress
Promote bioremediation
Improved the biomass derived energy techniques
Value addition in crops
Increased productivity and quality of crops
Enhanced N_2-fixation and increased nutrient uptake
Microbial biotechnology

1. Application of Biotechnology in Agriculture

The “Green revolution” used the application of pesticides and fertilizers to increase the production of crops.

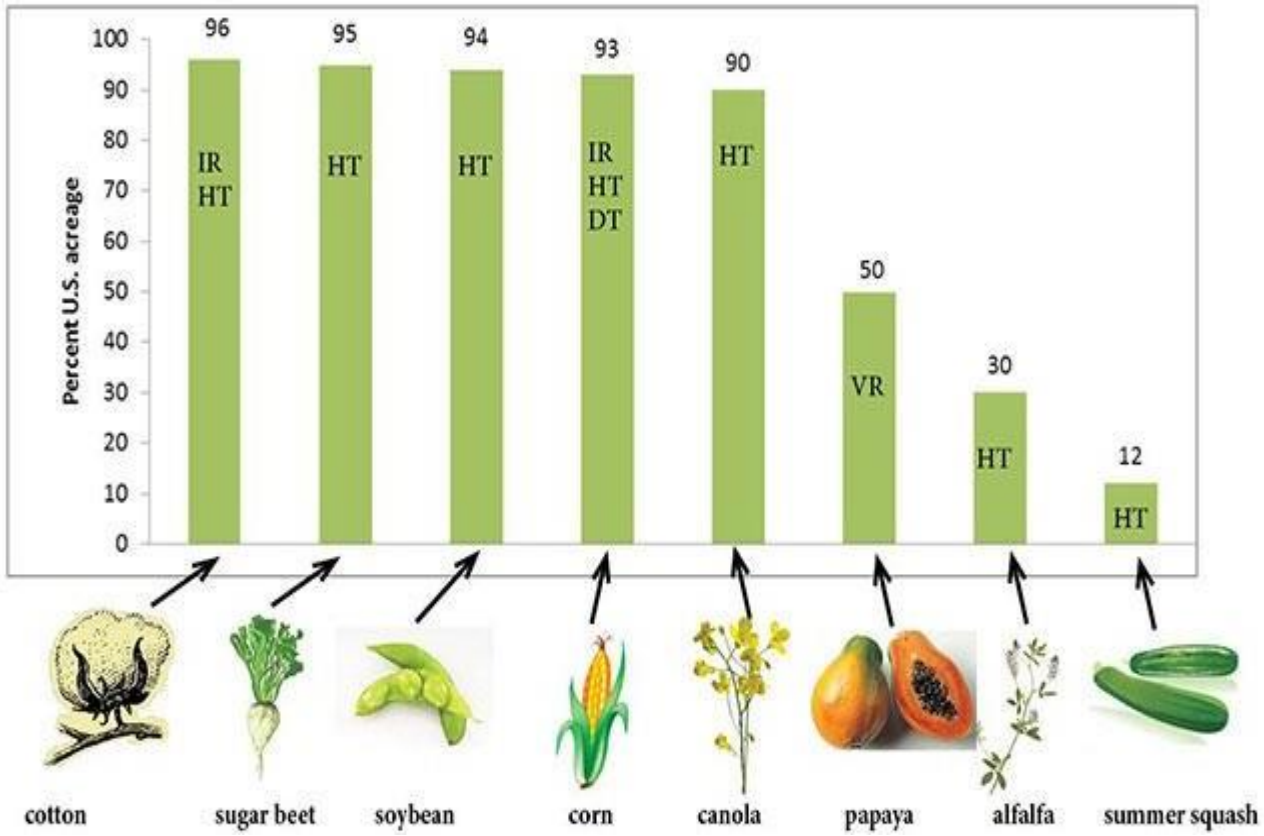
This resulted in excessive use of chemicals, there by polluting the soil and environment as well as various harmful effects to the consumer.

Application of biotechnology in the field of agriculture has greatly reduced the usage of fertilizers and chemicals.

Genetically Engineered Crops:

Using genetic engineering and recombinant DNA technology, genes for the desired trait are introduced in the species.

This type of genetically modified plant species is known as GM crop.



These GM plants have many benefits:

- Crops can be made insect and pest resistant
- Nutritional value of the food can be increased
- Increases the yield by many folds
- Reduces the use of harmful chemicals and fertilizers
- Crops can be made more tolerant to environmental stress
- Efficient mineral utilization by plants

- Y ield can also be increased by having a short maturing period

Examples of GM Plants

Golden rice:

Vitamin A enriched variety of rice.

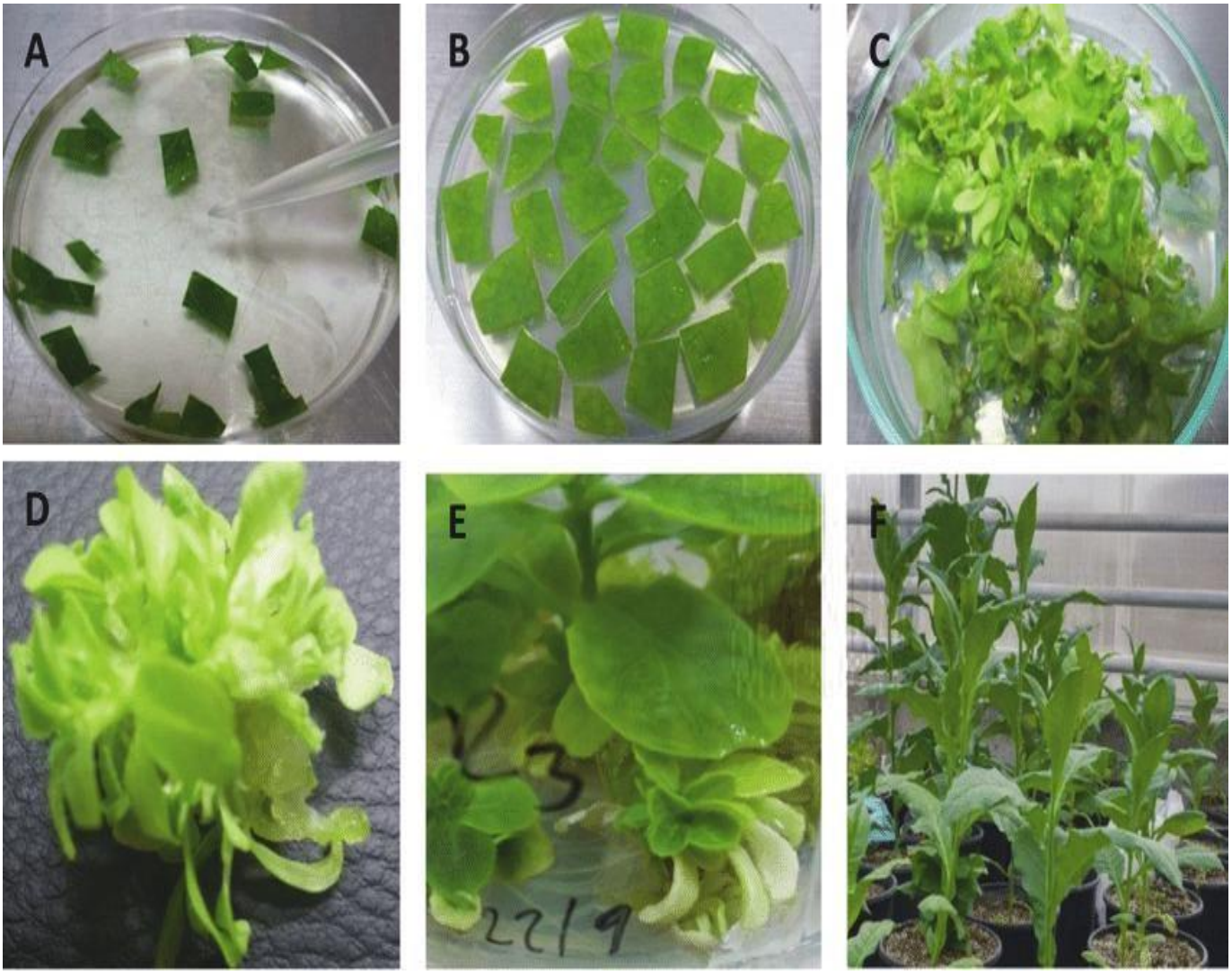
Bt.cotton, Bt.corn:

Bacillus thuringiensis produces an insecticidal protein, known as Bt toxin.

These insect-specific Bt toxin genes are in corporate into the genome of certain plants like cotton, corn, etc.

These modified crops have insect resistant quality.

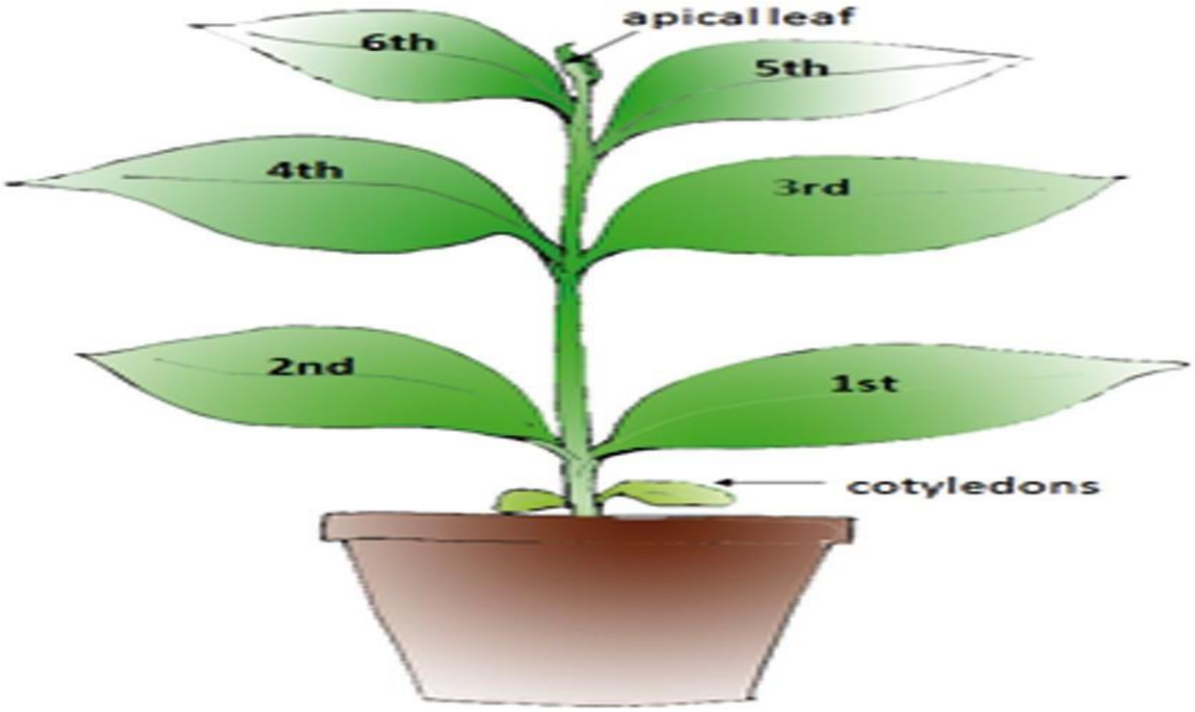
Pest resistant tobacco plant:



A nematode *Meloidogyne incognita* lives as a parasite in the root of tobacco plants. The plant is made resistant to infection by using the RNA interference technique. The nematode specific genes are introduced in the plant using *Agrobacterium* vector. The trans genic plant produces double-stranded RNA, which silences mRNA of the nematode and they are unable to survive.

Virus resistant plants:

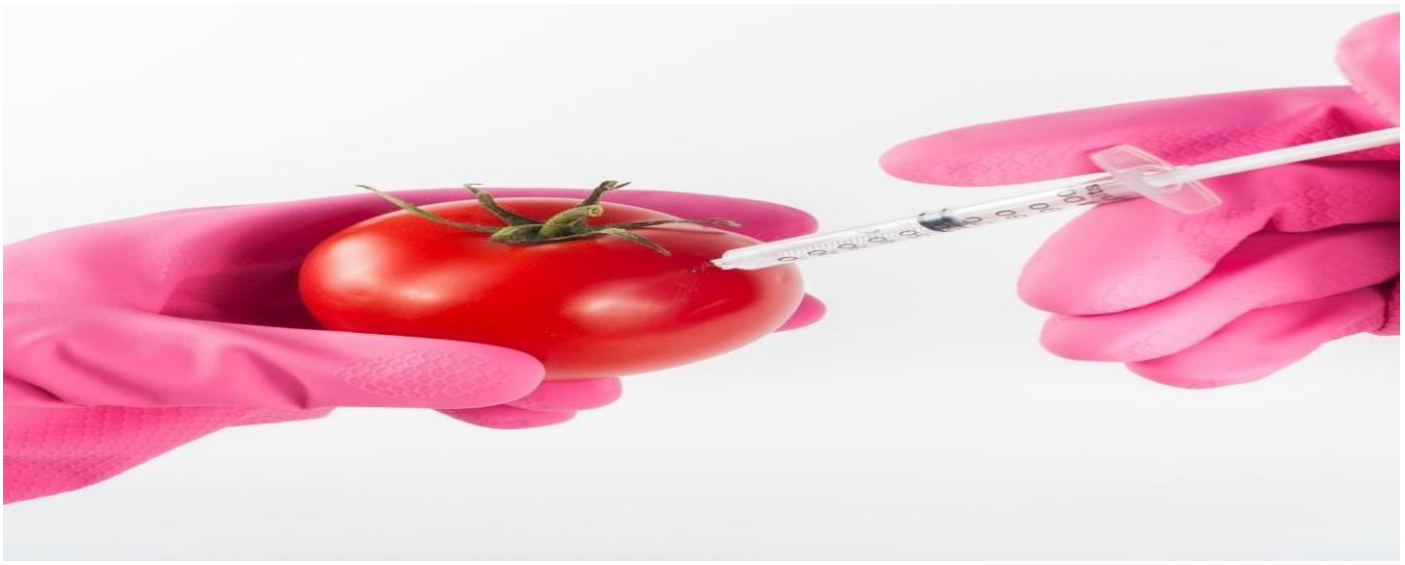
The gene encoding for the protein of virus coat is transferred to the host plant resulting in the virus-resistant plant species. This has been used to produce virus-resistant squash.



Flavour Savr Tomato:

Gene responsible for the production of the enzyme poly galacturonase is blocked. This enzyme is responsible for degrading pectin and softening of the fruit.

The transgenic variety of tomato can stay fresh and retain flavor for a longer duration.



2. Application of Biotechnology in Medicine

Biotechnology has vast applications in the medical field. Biotechnology is used for the rapeutic, diagnostic, scientific investigations for forensic studies, production of vaccines, antibiotics and various drugs.

Production of antibiotics, vaccines, enzymes and proteins:

Using recombinant DNA technology, many safe and therapeutic drugs have been produced. These drugs do not induce an allergic reaction, which may be the case if the same product is isolated from any animal source.

Production of antibiotics and vaccines:

Antibiotics are produced using plants. Desired genes are incorporated in plants and targeted proteins are produced. Edible vaccines have already been manufactured for some diseases, e.g. hepatitis B, measles, cholera.

Genetically Engineered Insulin:

Insulin is used for the treatment of diabetes. Earlier insulin was extracted from the pancreas of cattle and pigs, which has shown to induce allergic reactions.

Using recombinant DNA technology, genes coding for human insulin were incorporated in the plasmid of non-pathogenic strains of *E. coli.*

Forming chains of insulin, which are extracted and combined by disulfide bonds. The recombinant human insulin is known as **Humulin**.

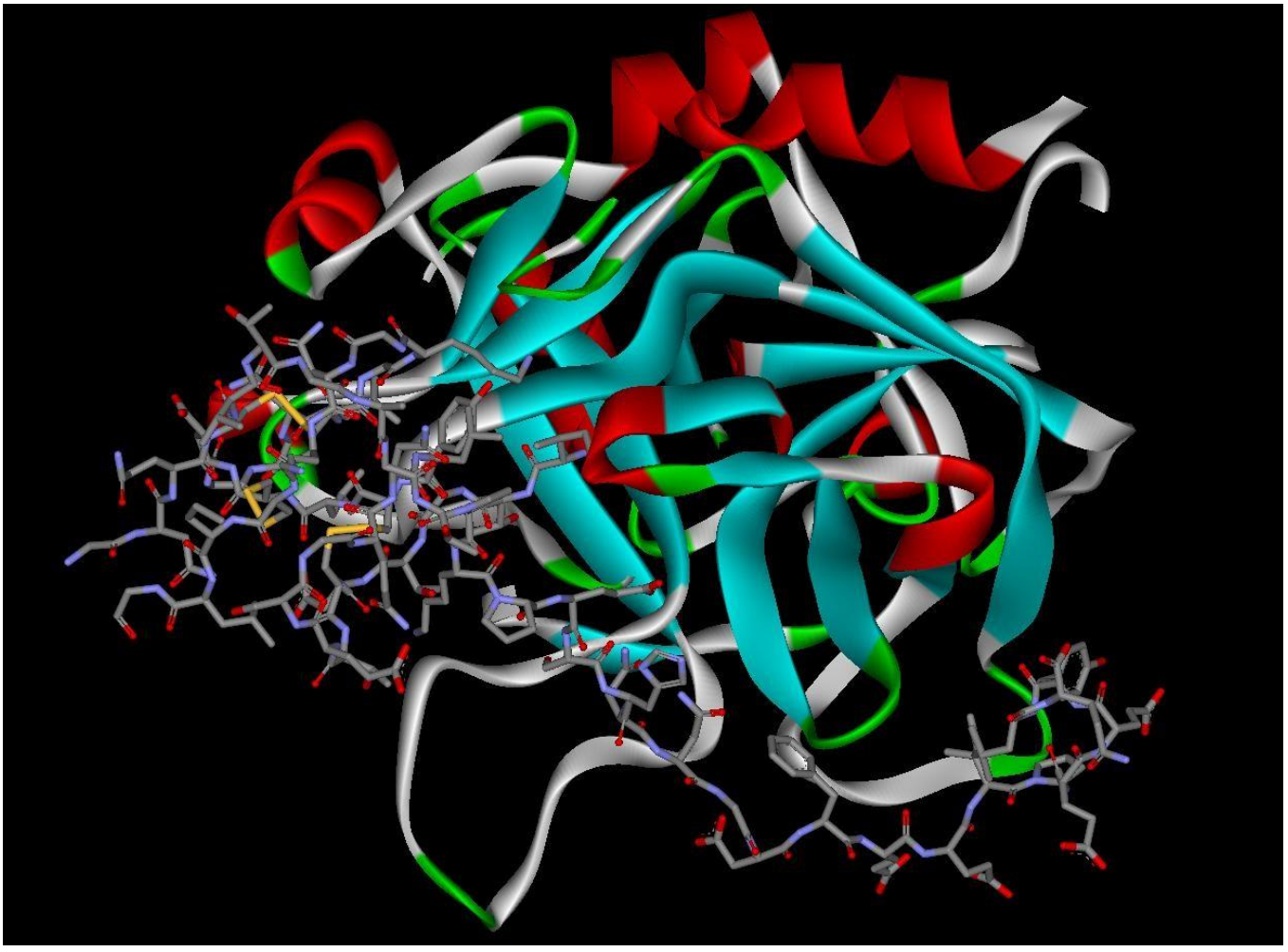
It is widely used to treat diabetic patients. **Digestive enzymes:** Micro organisms can be modified to produce digestive enzymes.

These micro organisms can be colonized in the digestive tract to suffice for the insufficient enzymes.

Hirudin Protein:

The gene coding for hirudin protein, which prevents blood clotting is transferred into *Brassica napus.*

The protein gets accumulated in the seeds, which can be purified and used medicinally.



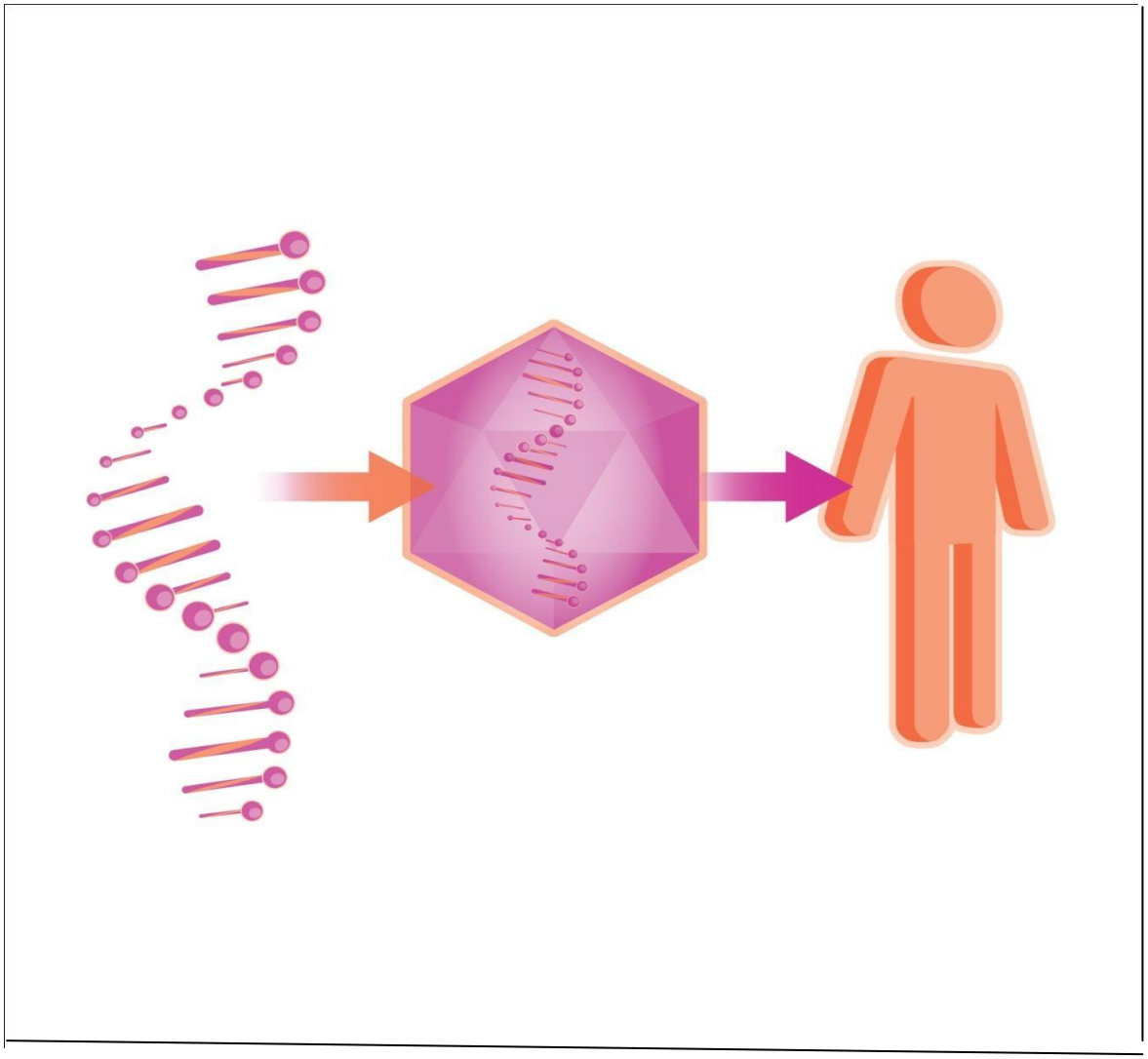
Single Cell Protein(SCP):

It is a microbial protein, which has high-quality protein and less fat. It is used as a protein-rich supplement for the human diet.

Gene Therapy:

Gene therapy is used incorrecting genetic defects in embryo and child.

Normal genes are delivered to the embryo or an individual with a faulty genes that the function of the faulty gene is restored.



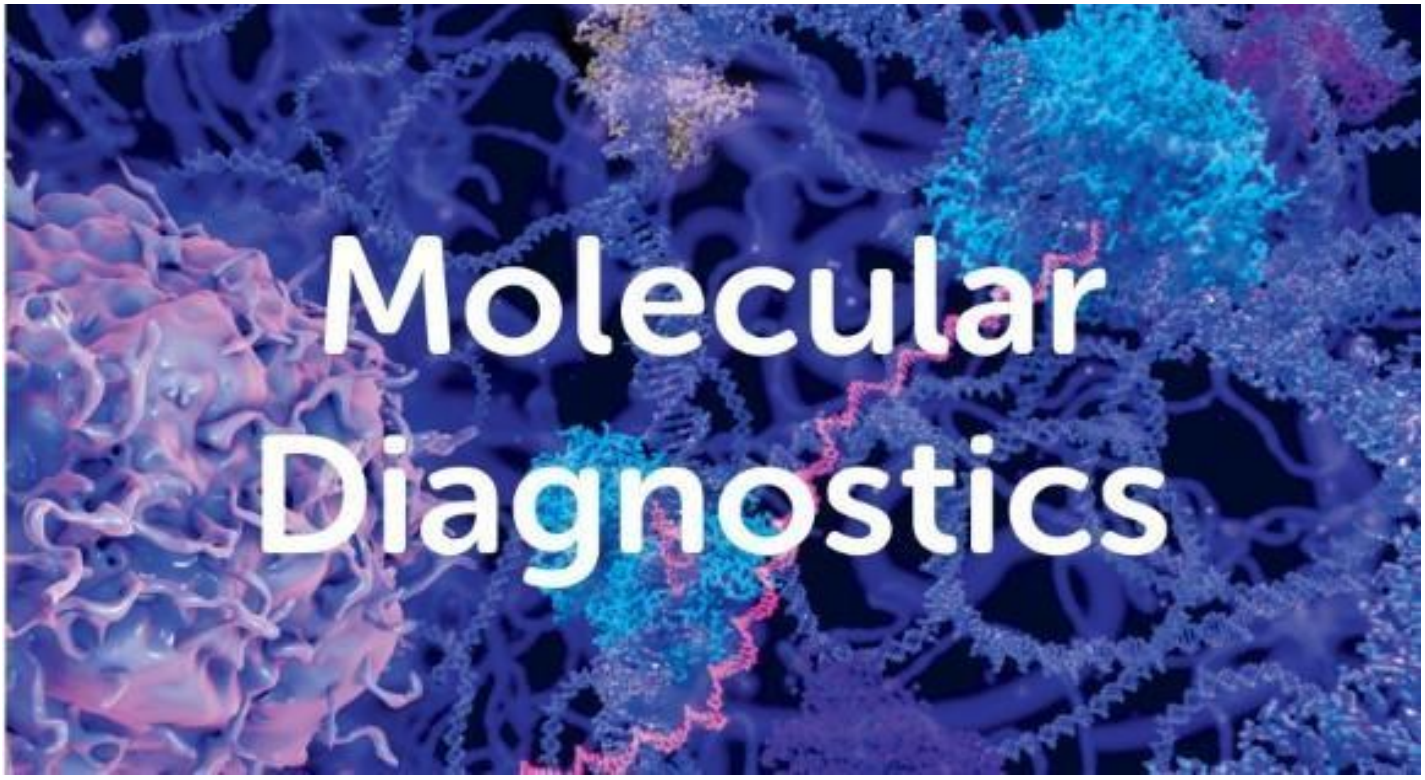
For the first time, gene therapy was performed on a girl with **a denosine de aminase(ADA) deficiency** in 1990.

This is caused due to the deletion of the gene coding for ADA. Functional adenosine deaminase cDNA is incorporated into the lymphocytes extracted from the blood of the patient using a retroviral vector and reintroduced in the body.

Genetically engineered lymphocytes have to be infused periodically. The disease can be cured permanently If the gene is isolated from marrow cell and it is introduced in the embryonic stage.

Molecular Diagnostics:

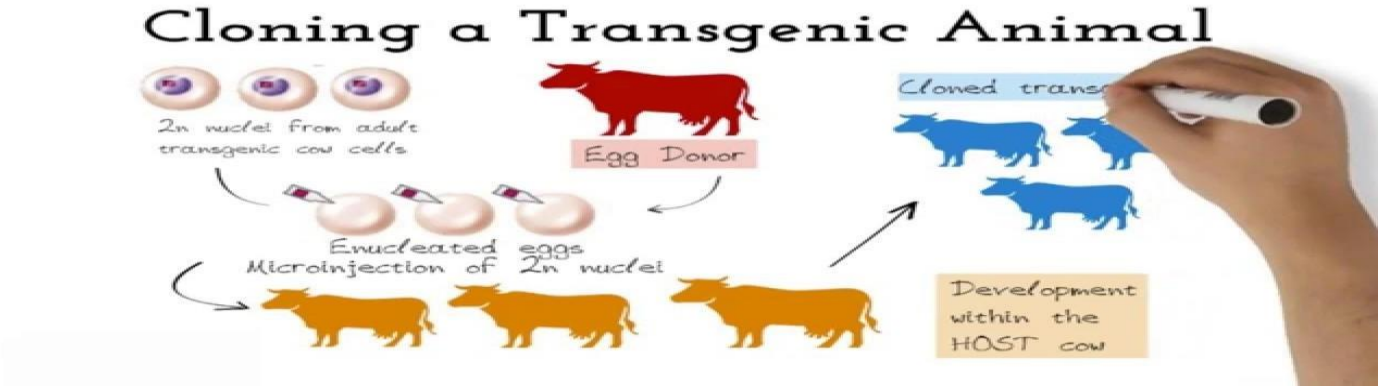
Biotechnology has proven useful in early diagnosis of disease. **PCR**(Polymerase chain reaction): very low concentration of virus and bacteria can be detected by amplifying the DNA.



PCR is used to detect the HIV virus in AIDS patients. Mutation of the gene in a cancer patient can also be detected by using this technique. **Elisa** (enzyme-linked immunos or bent assay): Presence of antibodies synthesized as a result of reaction with the antigen of the pathogen can be detected by this technique.

Transgenic Animals:

Transgenic animals are those animals whose genes are manipulated to express a foreign gene. These transgenic animals are useful in many ways, e.g.



- Study gene regulation during normal growth and development

- Understand the progression of the disease. Various treatments can be tried on transgenic models with life-threatening diseases
- For the production of various biological products, e.g. gene coding for proteinα-1-antitrypsin used to treat emphysema was incorporated to form the transgenic animal
- Rosie, the first transgenic cow, produced milk containing a human protein,α-lactalbumin
- Safety of vaccines can be tested on transgenic animals, e.g. the polio vaccine was tested on transgenic mice
- Toxicity of drugs can be tested on transgenic animals

2. Application of Biotechnology in Industry:

Industrial processes can be made more efficient and environment-friendly by using biotechnology.

- Using biotechnology enzymes can be produced in large quantities. This can be used as a biocatalyst for the synthesis of many chemicals
- Genetically modified plants supply different resources like starch, fuel, pharmaceuticals in huge quantity
- Proteases are used in detergents
- Bio fertilizers production
- The processed food industry is based on biotechnology and the use of micro organisms for the fermentation process
- Large scale production of fructose from glucose derived from in expensive sources
- Corn can be used in place of petroleum to synthesize chemicals
- Bio technology is useful in getting a better quality of products, e.g. cotton produced through biotechnology is warmer, stronger and wrinkle resistant
- Production of bio pesticide. Bio pesticides acts electively by killing pathogens such as bacteria, viruses and insects. These are not harmful like chemical pesticides
- Production of aquatic species by using bio technological tools has greatly enhanced the quality and growth of aquatic organisms

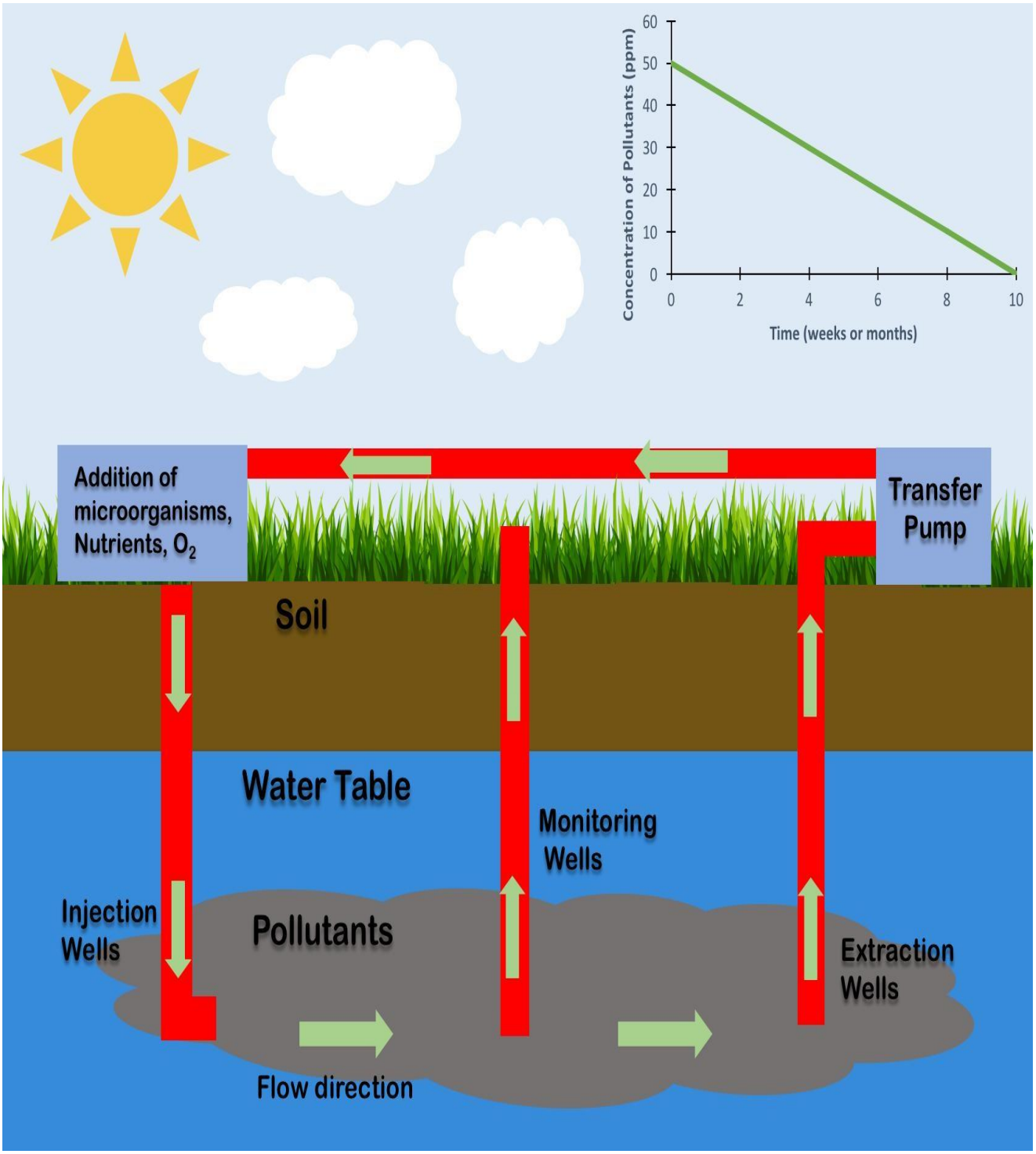
3. Environmental Application of Biotechnology

Biotechnology is useful in waste management and controlling pollutants and energy production.

- **<u>Waste Management:</u>** Industrial and food waste are pretreated in enzyme bio reactors and subsequently removed through the sewage system. Waste can be converted to bio-fuel.
- Plant and vegetable materials can be degraded by micro organisms to make biodegradable plastics.

<u>Bioremediation:</u> Micro organisms are deliberately introduced to water, soil, etc. to degrade the target pollutants.

- Bio processing reduces pollution by reducing harmful gases produced due to combustion of coal and oil.



EnergyProduction: Bio-fuels and petroleum products are produced using bio technology. Bio- methane, Bio-diesel and ethanol are produced on a commercial scale. Biotechnology is used to refine petroleum and coal from undesirable impurities. It makes oil less expensive and easier to refine.

MCQ:

1. Which of the following is commonly used as a vector for introducing a DNA fragment in human lymphocytes?

a)Xphage **(b) Retrovirus** (c) Tiplasmid (d)PBR 322

2. Which kind of therapy was given in 1990 to a four year old girl with Adenosine Deaminase deficiency (ADA)?

(a) Gene therapy (b)Chemotherapy (c)Immunotherapy (d)Radiation therapy

3. The two poly peptides of human insulin are linked together by___

(a) Phosphodiester bond (b)Covalent bond

(c) Disulphide bridges (d) Hydrogen bond

4. Which part of the tobacco plant is infected by cMeloidogyne incognitia?

(a)Leaf **(b)Root** (c) Stem (d) Flower

5.In Bt Cotton, the Bt toxin present in plant tissue as pro toxin is converted into active toxin due to_____

a) Alkaline PH of the insect gut (b)Acidic pH of the insect gut

(c)Action of gut microorganism (d)Presence of conversion factors in insect gut

6. The first human hormone produced by recombinant DNA technology is_

(a) Insulin (b) Thyroxin (c)Estrogen (d)Progesterone

7. Which of the following Bt crops is being grown in India by the farmers?

(a) Brinjal (b) Maize (c) Soyabean **(d)Cotton**

8. Tobacco plant resistant to a nematode have been developed by the introduction of DNA that produced in the host cells____

a) Both sense and anti-sense RNA (b)A particular hormone

(c)An antifeedant (d)A toxic protein

9. The first clinical gene therapy was given for treating____

a) Diabetes mellitus (b)Chicken pox

(c)Rheumatoidarthritis **(d)Adenosine Deaminase deficiency**

10. Which body of the Government of India regulates GM research and safety of introducing GM organisms for public services____

a) Bio-safety committee

b)Indian council for Agriculture Research

c)Genetic engineering Approval Committee

d)Research Committee on Genetic Manipulation.

11. The Taq polymerase enzyme is obtained from (NEET–2016)

a)Thermus aquaticus

b) Thiobacillus ferrooxidans

c) Bacillus subtilis

d) Pseudomonas subtilis

12.Which of the following is an endonuclease?(NEET–2016)

a) DNaseI

b) HindII

c) Protease

d) RNase restriction

13. Which of the following restriction enzymes produce bluntends?(NEET–2016)

a) HindIII

b) Xho

c) EcoRV

d) SalI

14. Which of the following is not a component of down stream processing? (NEET–2016)

a) Expression

b) Preservation

c) Purification

d) Separation

15. A foreign DNA and plasmid cut by the same restriction endonuclease can be joined to form a recombinant plasmid using (NEET – 2016)

a) Taq polymerase

b)Polymerase III

c) Ligase

d) Eco RI

16. DNA fragments separated on an agarose gel can be visualized after staining with _____ (NEET – 2017)

a) Ethidium bromide

b) Bromophenol blue

c) acetocarmine

d) anilineblue

17. A gene whose expression helps to identify transformed cells is known as ___(NEET– 2017)

a) Plasmid

b) Selectable marker

c) Structuralgene

d) vector

18. A single strand of nucleic acid tagged with a radioactive molecule is called (NEET–2012)

a) Plasmid

b) Probe

c) Selectablemarker

d) Vector

19. There is a restriction endonuclease called EcoRI. What does „co‟ partinit stand for? (NEET – 2011)

a) Coli

b) Colon

c) Cofactor

d) None of the above

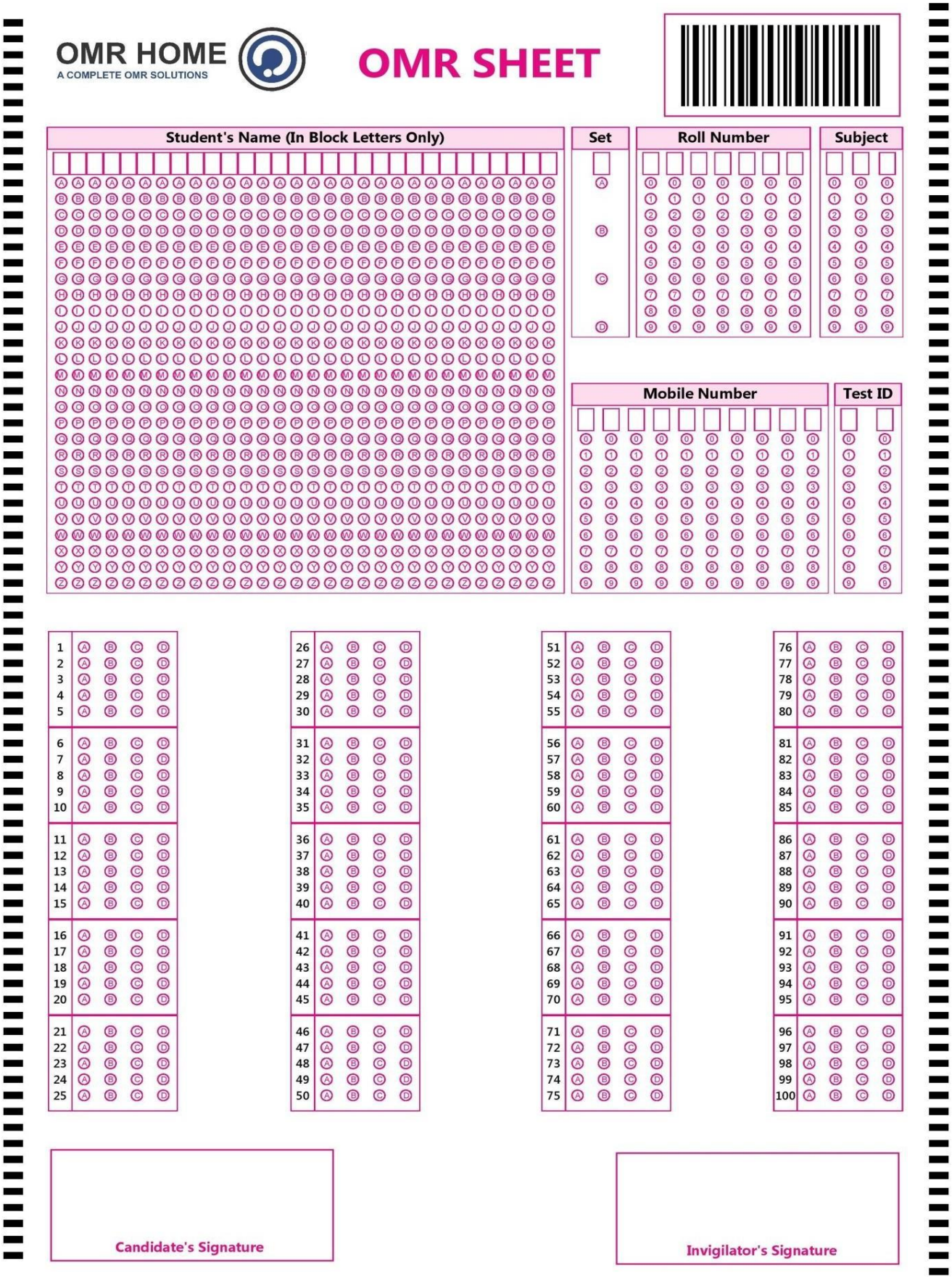
20. Agarose extracted from sea weeds finds use in_(NEET–2011)

a) Spectrophotometry

b) Gel electrophoresis

c) PCR

d) Tissue culture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UNIT–IV

MINERAL NUTRITION

INTRODUCTION

In this chapter we are going to learn about classification of minerals, their functions, deficiency diseases and symptoms, nitrogen metabolism and special modes of nutrition.

Further, how can these ideas help us to improve productivity in agriculture?Plants naturally obtain nutrients from atmosphere, water and soil.

Carbon, hydrogen and oxygen are called as skeletal elements and constitute about 94% of dry weight. These elements play an important role in the formation of organic compounds such as carbohydrates, fats and protein.

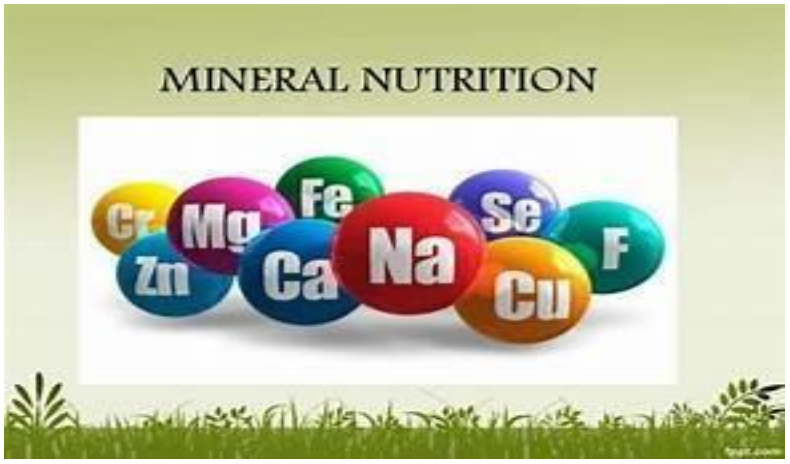
These non-mineral elements are obtained from air and water. Minerals are classified based on essentiality. Arnon and Stout (1939) gave criteria required for essential minerals:

1. Elements necessary for growth and development.

2. They should have direct role in the metabolism of the plant.

3. It cannot be replaced by other elements.

4. Deficiency makes the plants impossible to complete their vegetative and reproductive phase.



CLASSIFICATION OF MINERALS

CLASSIFICATION OF MINERALS BASED ON THEIR QUANTITY REQUIREMENTS

Essential elements are classified as Macro-nutrients, Micro nutrients and Unclassified minerals based on their requirements.

Essential minerals which are required in higher concentration are called Macronutrients.

Essential minerals which are required in less concentration called areas Micronutrients.

Minerals like Sodium, Silicon, Cobalt and Selenium are not included in the list of essential nutrients but are required by some plants, these minerals are placed in the list of unclassified minerals.

These minerals play specific roles for example, Silicon is essential for pest resistance, prevent water lodging and aids cell wall formation in Equisetaceae (Equisetum), Cyperaceae and Gramineae

Macro nutrients	Micro nutrients	Unclassified minerals
Excess than 10 mmole Kg-1 in tissue concentration or 0.1 to 10 mg per gram of dry weight.	Less than 10 mmole Kg-1 in tissue concentration or equal or less than 0.1 mg per gram of dry weight.	Required for some plants in trace amounts and have some specific functions.
Example: C, H, O, N, P, K, Ca, Mg and S	Example: Fe, Mn, Cu, Mo, Zn, B, Cl and Ni	Example: Sodium, Cobalt, Silicon and Selenium

CLASSIFICATIONOFMINERALSBASEDONMOBILITY

If you observe where the deficiency symptoms appear first, you can notice differences in old and younger leaves. It is mainly due to mobility of minerals.

Based on this, they are classified into

1. Actively mobile minerals.
2. Relatively immobile minerals.

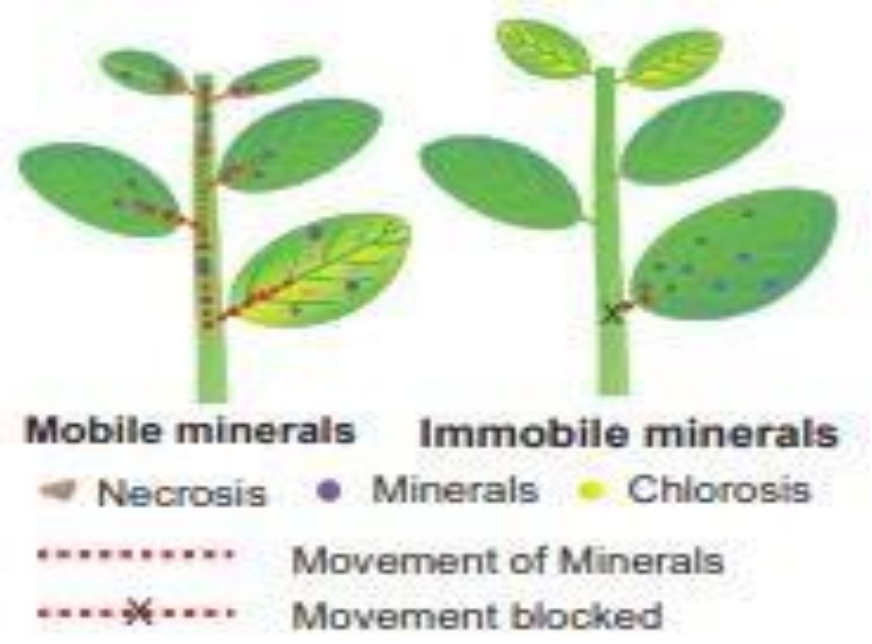
a. Actively mobile minerals

Nitrogen, Phosphorus, Potassium, Magnesium, Chlorine, Sodium, Zinc and Molybdenum.

Deficiency symptoms first appear on old and senescent leaves due to active movement of minerals to younger leaves.

b. Relatively immobile minerals

Calcium, Sulphur, Iron, Boron and Coppers hows deficiency symptoms first that appear on young leaves due to the immobile nature of minerals.



CLASSIFICATION OF MINERALS BASED ON THEIR FUNCTIONS

A. STRUCTURAL COMPONENT MINERALS:

Minerals like Carbon, Hydrogen, Oxygen and Nitrogen

B. ENZYME FUNCTION:

Molybdenum(Mo) is essential for nitrogenase enzyme during reduction of atmospheric nitrogen into ammonia.

Zinc(Zn) is an important activator for alcohol dehydrogenase and carbonic anhydrase.

Magnesium(Mg) is the activator for RUBP carboxylase oxygenase and PEP carboxylase. Nickel (Ni) is a constituent of urease and hydrogenase.

C. OSMOTICPOTENTIAL:

Potassium(K) plays a key role in maintaining osmotic potential of the cell. The absorption of water, movement of stomata and turgidity are due to osmotic potential.

D. ENERGY COMPONENTS:

Magnesium(Mg) in chlorophyll and phosphorous(P) in ATP.

FUNCTIONS, MODE OF ABSORPTION AND DEFICIENCY SYMPTOMS OF MACRO NUTRIENTS

Macro nutrients, their functions, their mode of absorption, deficiency symptoms and deficiency diseases are discussed here:

1. NITROGEN(N):

It is required by the plants in greatest amount. It is an essential component of proteins, nucleic acids, amino acids, vitamins, hormones, alkaloids, chlorophyll and cytochrome. It is absorbed by the plants as nitrates (NO_3).

Deficiency symptoms: Chlorosis, stunted growth, anthocyanin formation.

Stunted Growth

2. PHOSPHORUS(P):

Constituent of cell membrane, proteins, nucleic acids, ATP, NADP, phytin and sugar phosphate. It is absorbed as H2PO4 1 and HPO4 2 ions.

Deficiency symptoms: Stunted growth, anthocyanin formation, necrosis, inhibition of cambial activity, affect root growth and fruit ripening.

3. POTASSIUM(K):

Maintains turgidity and osmotic potential of the cell, opening and closure of stomata, phloem translocation, stimulate activity of enzymes, anion and cation balance by ion- exchange. It is absorbed as K1 ions.

Deficiency symptoms: Marginal chlorosis, necrosis, low cambial activity, loss of apical dominance, lodging in cereals and curled leaf margin.

4. CALCIUM(Ca):

It is involved in synthesis of calcium pectate in middle lamella, mitotic pindle formation, mitotic cell division, permeability of cell membrane, lipid metabolism, activation of phospholipase, ATPase, amylase and activator of adenyl kinase. It is absorbed as Ca21 exchangeable ions.

Deficiency symptoms: Chlorosis, necrosis, stunted growth, premature fall of leaves and flowers, inhibit seed formation, Blackheart of Celery, Hooked leaf tip in Sugar beet, Musa and Tomato.

Black Heart Of Celery

5. MAGNESIUM(Mg):

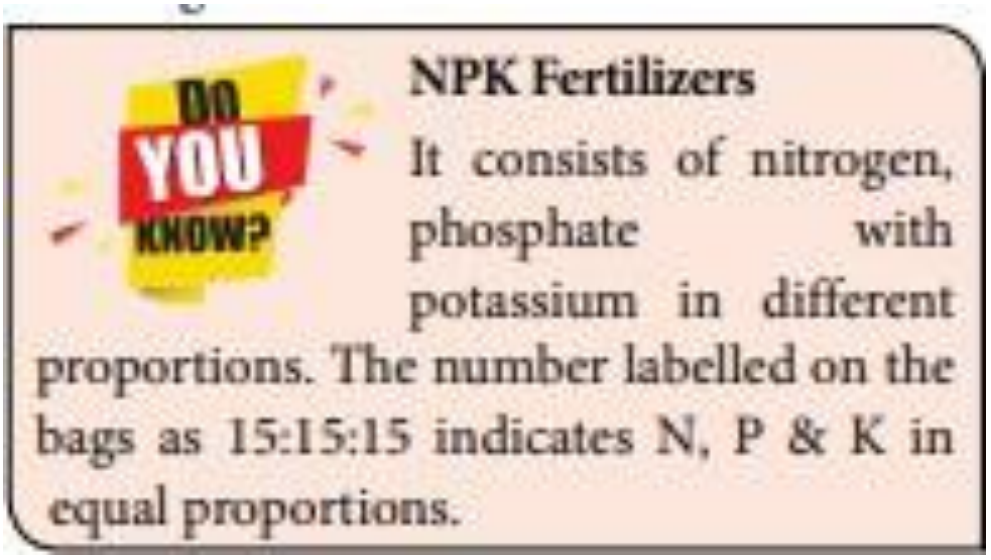
It is a constituent of chlorophyll, activator of enzymes of carbohydrate metabolism (RUBP Carboxylase and PEP Carboxylase) and involved in the synthesis of DNA and RNA. It is essential for binding of ribosomal sub units. It is absorbed as Mg21 ions.

Deficiency symptoms: Interveinal chlorosis, necrosis, anthocyanin(purple) formation and Sand drown of tobacco

6. SULPHUR(S):

Essential component of amino acids like cystine, cysteine and methionine, constituent of coenzymeA, Vitamins like biotin and thiamine, constituent of proteins and ferredoxin. Plants utilize sulphur as sulphate (SO4 2) ions.

Deficiency symptoms: Chlorosis, anthocyanin formation, stunted growth, rolling of leaf tip and reduced nodulation in legumes.



FUNCTIONS, MODE OF ABSORPTION AND DEFICIENCY SYMPTOMS OF MICRO NUTRIENTS

Micro nutrients even though required in trace amounts are essential for the metabolism of plants.

They play key roles in many plants. Example: Boron is essential for translocation of sugars, molybdenum is involved in nitrogen metabolism and zinc is needed for bio synthesis of auxin.

Here,we will study about the role of micro nutrients, their functions, their mode of absorption, deficiency symptoms and deficiency diseases.

1. IRON(Fe):

Iron is required lesser than macro nutrient and larger than micro nutrients, hence, it can be placed in any one of the groups.

Iron is an essential element for the synthesis of chlorophyll and carotenoids.

It is the component of cytochrome, ferredoxin, flavoprotein, formation of chlorophyll, porphyrin, activation of catalase, peroxidase enzymes. It is absorbed as ferrous (Fe21)and ferric (Fe31) ions.

Absorbtion of Fe2+ions are comparatively more than Fe3+ions. Mostly fruit trees are sensitive to iron.

Deficiency symptoms: Interveinal Chlorosis, formation of short and slender stalk and inhibition of chlorophyll formation.

2. MANGANESE(Mn):

Activator of carboxylases, oxidases, dehydrogenases and kinases, involved in splitting of water to liberate oxygen (photolysis). It is absorbed as manganous (Mn21) ions.

Deficiency symptoms: Interveinal chlorosis, grey spot on oats leaves and poor root system.

3. COPPER(Cu):

Constituent of plastocyanin, component of phenolases, tyrosinase, enzymes involved in redox reactions, synthesis of ascorbic acid, maintains carbohydrate and nitrogen balance, part of oxidase and cytochrome oxidase. It is absorbed as cupric (Cu21) ions.

Deficiency symptoms: Die back of citrus, Reclamation disease of cereals and legumes, chlorosis, necrosis and Exanthema in Citrus.

4. ZINC(Zn):

Essential for the synthesis of Indoleacetic acid(Auxin), activator of carboxylases, alcohol dehydrogenase, lactic dehydrogenase, glutamic acid dehydrogenase, carboxy peptidases and tryptophan synthetase. It is absorbed as Zn21 ions.

Deficiency Symptoms:Little leaf and mottle leaf due to deficiency of auxin, Interveinal chlorosis, stunted growth, necrosis and Khaira disease of rice.

5. BORON(B):

Translocation of carbohydrates, uptake and utilization of Ca11, pollen germination, nitrogen metabolism, fat metabolism, cell elongation and differentiation. It is absorbed as (borate) BO32 ions.

Deficiency symptoms:Death of root and shoot tips, premature fall of flowers and fruits, brown heart of beet root, internal cork of apple and fruit cracks.

6. MOLYBDENUM(Mo):

Component of nitrogenase, nitrate reductase, involved in nitrogen metabolism, and nitrogen fixation. It is absorbed as molybdate (Mo21) ions.

Deficiency symptoms: Chlorosis, necrosis, delayed flowering, retarded growth and whip tail disease of cauliflower.

7. CHLORINE(Cl):

It is involved in Anion–Cationbalance, cell division, photolysis of water. It is absorbed as Cl2 ions.

Deficiency Symptoms:Wilting of leaf tips

8. NICKEL(Ni):

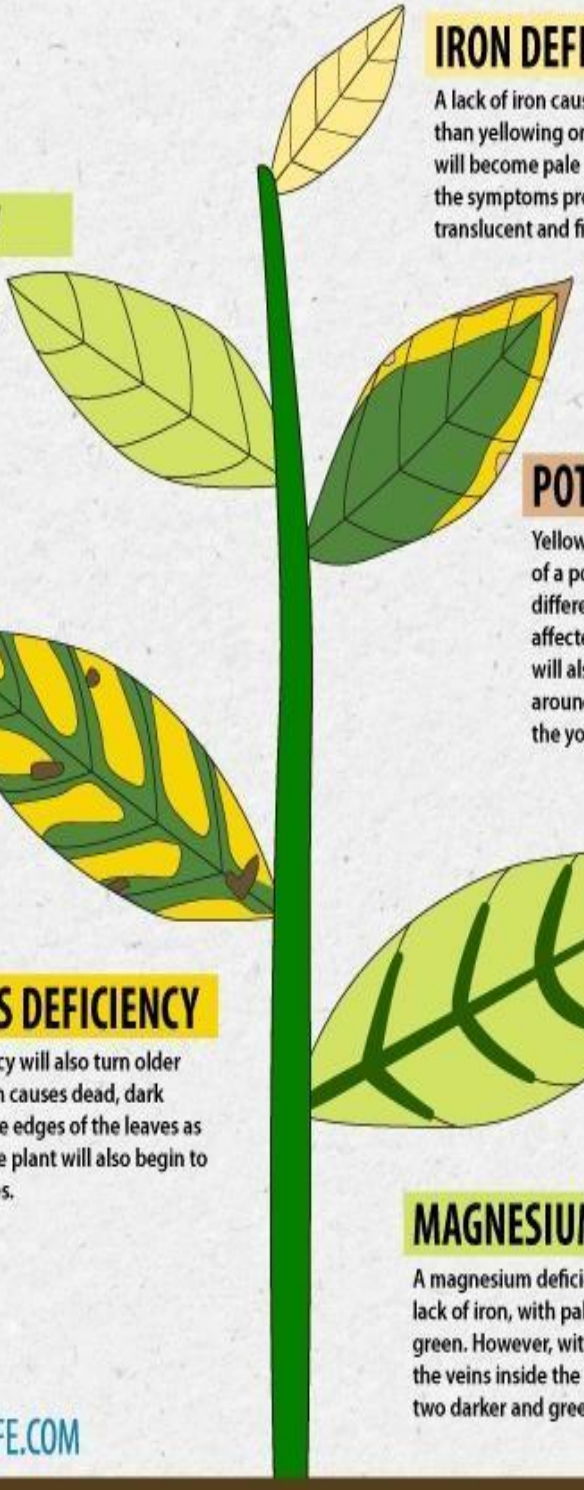
Cofactor for enzyme urease and hydrogenase.

Deficiency symptoms: Necrosis of leaf tips.

DEFICIENCY DISEASES AND SYMPTOMS

Name of the deficiency disease and symptoms	Deficiency minerals
1. Chlorosis (Overall)	Nitrogen, Potassium, Magnesium, Sulphur, Iron, Manganese, Zinc and Molybdenum.
a. Interveinal chlorosis	Magnesium, Iron, Manganese and Zinc
b. Marginal chlorosis	Potassium
2. Necrosis (Death of the tissue)	Magnesium, Potassium, Calcium, Zinc, Molybdenum and Copper.
3. Stunted growth	Nitrogen, Phosphorus, Calcium, Potassium and Sulphur.
4. Anthocyanin formation	Nitrogen, Phosphorus, Magnesium and Sulphur
5. Delayed flowering	Nitrogen, Sulphur and Molybdenum
6. Die back of shoot, Reclamation disease, Exanthema in citrus (gums on bark)	Copper
7. Hooked leaf tip	Calcium
8. Little Leaf	Zinc
9. Brown heart of Beet root and Internal cork of apple	Boron
10. Whiptail of cauliflower and cabbage	Molybdenum
11. Curled leaf margin	Potassium

NUTRIENT DEFICIENCIES IN PLANTS



IRON DEFICIENCY

A lack of iron causes fading leaf colors rather than yellowing or browning. The green hue will become pale and weak-looking, and as the symptoms progress the leaf will turn translucent and finally almost transparent.

NITROGEN DEFICIENCY

When the older leaves on a plant start to turn yellow or a sickly pale green, it's often a sign of a nitrogen deficiency. A lack of nitrogen means the plant doesn't produce enough chlorophyll for effective photosynthesis, causing dull yellow foliage alongside stunted and slow growth.

POTASSIUM DEFICIENCY

Yellowing leaves are also the first sign of a potassium deficiency. However, the difference here is that new growth is affected as well as mature leaves. There will also often be small brown spots around the leaf edges, particularly on the youngest leaves.

PHOSPHORUS DEFICIENCY

A phosphorus deficiency will also turn older leaves yellow, but often causes dead, dark brown spots around the edges of the leaves as well. Left untreated, the plant will also begin to shed the affected leaves.

MAGNESIUM DEFICIENCY

A magnesium deficiency looks very similar to a lack of iron, with pale leaves instead of vibrant green. However, with a magnesium deficiency, the veins inside the leaves will stay a shade or two darker and greener than the rest of the leaf.

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CHOOSE THE CORRECT ANSWER:

1. Carbon, hydrogen and oxygen are called as_elements.

a) Skeletal b) Macro c) Micro d)none of these

2. These non-mineral elements are obtained from air and____.

a) sun b)Water c) Minerals d) Oil

3. minerals which are required in higher concentration are called _____.

a)Micronutrients b)Essential nutrients

c)Macronutrients d) Both A and B

4. Essential minerals which are required in less concentration called are as_____.

a)Micronutrients b)Essential nutrients c)Macronutrients

d) Both A and B

5. Minerals like are not included in the list of essential nutrients but are required by some plants.

a) Sodium b) Silicon c) Cobalt d)All of these

6. _____Is a constituent of urease and hydrogenase.

a)Nickel b)Cobalt c)Silicon d)Uranium

7. The absorption of water, movement of stomata and turgidity are due to___.

a) Enzyme Function b)Osmotic Potential c)Energy Components

d)None Of These

8. Which one of the following is Energy Component in Chlorophyll?

a) Magnesium b)phosphate c)Sodium d)Cobalt

9.Pick out the manganese deficiency symptoms.

a) Interveinal chlorosis b)grey spot on oats leaves c)poor root system

d)All of these

10. Magnesium deficiency looks similar to __deficiency

a) iron b)cobalt c)calcium d)none of these

11. What are the two types of chlorosis?

a) Interveinal & marginal b)partial & marginal c)interveinal & partial

d)none of these

12. Carbon, hydrogen and oxygen constitute about of dry weight.

b)94% b)23% c)56% d)66%

13. Yellowing leaves are also the first sign of__

a) Potassium deficiency b)iron deficiency c)calcium deficiency

d)protein deficiency

14. The death of the tissue is also known as_

a) necrosis b)ferosis c)chlorosis d)both a and b

15. In plants Chlorine is absorbed as___ions.

a) Cl_2 b)CO_2 c)No_2 d)none of these

16. _____Indicates NPK fertilizer in equal proportion.

a) 12:12:12 b)13:13:13 c)14:14:14 d)15:15:15

17. ____Are an example of macro nutrition.

c) C b)H c)O d)all of these

18. Zinc is needed for bio synthesis of__.

a) auxins **b)toxins** **c)ferosis** **d)all of these**

19. Required for some plants in trace amount to have specific function is called as ____ minerals.

a) Micro **b) Macro** **c) Unclassified** **d) none of these**

20._____Nutrients are less than 10mmoleKg^{-1} in tissue concentration.

a) Micro **b) Macro** **c) Unclassified** **d) none of these**

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0 1 2 3 4 5 6 7 8 9

1 A B C D	26 A B C D	51 A B C D	76 A B C D
2 A B C D	27 A B C D	52 A B C D	77 A B C D
3 A B C D	28 A B C D	53 A B C D	78 A B C D
4 A B C D	29 A B C D	54 A B C D	79 A B C D
5 A B C D	30 A B C D	55 A B C D	80 A B C D
6 A B C D	31 A B C D	56 A B C D	81 A B C D
7 A B C D	32 A B C D	57 A B C D	82 A B C D
8 A B C D	33 A B C D	58 A B C D	83 A B C D
9 A B C D	34 A B C D	59 A B C D	84 A B C D
10 A B C D	35 A B C D	60 A B C D	85 A B C D
11 A B C D	36 A B C D	61 A B C D	86 A B C D
12 A B C D	37 A B C D	62 A B C D	87 A B C D
13 A B C D	38 A B C D	63 A B C D	88 A B C D
14 A B C D	39 A B C D	64 A B C D	89 A B C D
15 A B C D	40 A B C D	65 A B C D	90 A B C D
16 A B C D	41 A B C D	66 A B C D	91 A B C D
17 A B C D	42 A B C D	67 A B C D	92 A B C D
18 A B C D	43 A B C D	68 A B C D	93 A B C D
19 A B C D	44 A B C D	69 A B C D	94 A B C D
20 A B C D	45 A B C D	70 A B C D	95 A B C D
21 A B C D	46 A B C D	71 A B C D	96 A B C D
22 A B C D	47 A B C D	72 A B C D	97 A B C D
23 A B C D	48 A B C D	73 A B C D	98 A B C D
24 A B C D	49 A B C D	74 A B C D	99 A B C D
25 A B C D	50 A B C D	75 A B C D	100 A B C D

Candidate's Signature

Invigilator's Signature

UNIT-V

SOLUTIONS

INTRODUCTION

You have learnt about mixtures in your lower classes. Most of the substances that we encounter in our daily life are mixtures of two or more substances. The substances present in a mixture may exist in one or more physical state.

For example, when we burn wood, the smoke released is a mixture of solid carbon and gases like CO2, CO, etc. In some cases of mixtures, their components can be separated easily whereas in some other cases they cannot be.

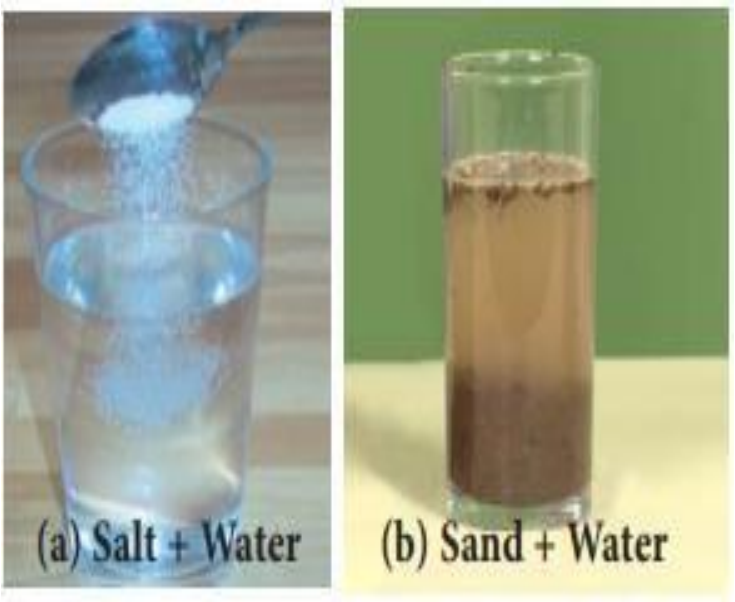
Consider the two mixtures, one which contains salt and water, and another which contains sand and water. Water is the one of the components in both the mixtures.

In the first case salt dissolves in water.

In the second case the sand does not dissolve in water.

Sand in water can be separated by filtration but salt cannot be separated as it dissolves in water to form a homogeneous mixture.

This kind of homogenous mixtures are termed as “solutions”.



A) Homogeneous Mixture

B) Heterogeneous Mixture

SOLUTIONS IN DAY-TO-DAY LIFE

One of the naturally existing solutions is sea water. We cannot imagine life on earth without sea water. It is a mixture of many dissolved salts. The another one is air. It is a mixture of gases like nitrogen, oxygen, carbon dioxide and other gases.

All the life forms on the earth are associated with solutions. Plants take solutions of nutrients for their growth from the soil. Most of the liquids found in human body including blood, lymph and urine are solutions.

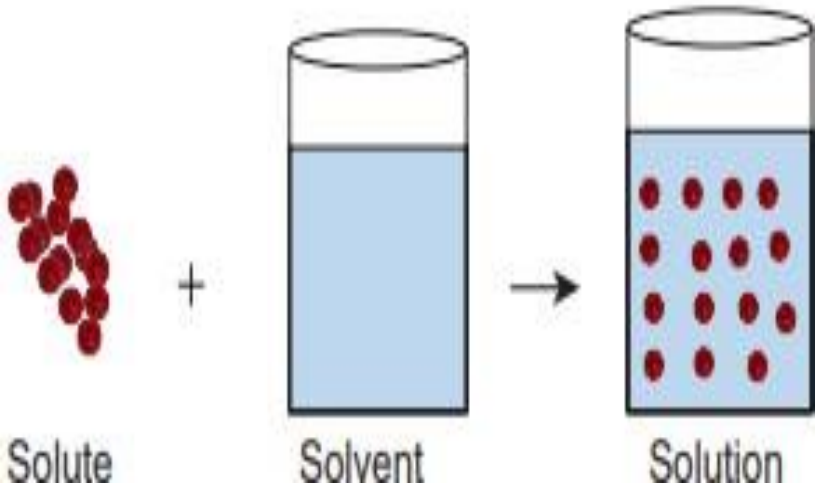
Day to day human activities like washing, cooking, cleaning and few other activities involve the formation of solutions with water. Similarly, the drinks what we take, like fruit juice, aerated drinks, tea, coffee etc. are also solutions.

Therefore, the ability of water to form solutions is responsible for sustenance of life.

COMPONENTS OF SOLUTIONS

We know that, a solution is a homogeneous mixture of two or more substances. In a solution, the component which is present in lesser amount (byweight), is called solute and the component, which is present in a larger amount (by weight) is called solvent.

The solute gets distributed uniformly throughout the solvent and thus forming the mixture homogeneous.So, the solvent acts as a dissolving medium in a solution. The process of uniform distribution of solute into solvent is called dissolution.



Formation of solution

A solution must at least be consisting of two components (a solute and a solvent). Such solutions which are made of one solute and one solvent (two components) are called binary solutions.

e.g. On adding copper sulphate crystals to water, it dissolves in water forming a solution of copper sulphate.

It contains two components i.e. one solute-copper sulphate and one solvent-water. So it is a binary solution. Similarly, a solution may contain more than two components. For example if salt and sugar are added to water, both dissolve in water forming a solution.

Here two solutes are dissolved in one solvent. Such kind of solutions which contain three components are called ternary solutions.

Formation of copper sulphate solution

Types of solutions

Based on the physical state of the solute and the solvent We know that substances normally exist in three physical states (phases) i.e., solid, liquid and gas.

In binary solutions, both the solvent and solute may exist in any of these physical states.

But the solvent constitutes the major part of the solution.

Its physical state is the primary factor which determine the characteristics of the solution. Therefore, there are different types of binary solutions as listed in Table 9.1

Table 9.1 Types of binary solutions

Solute	Solvent	Example
Solid solution		
Solid	Solid	Copper dissolved in gold (Alloys)
Liquid	Solid	Mercury with sodium (amalgam)
Liquid solution		
Solid	Liquid	Sodium chloride dissolved in water
Liquid	Liquid	Ethyl alcohol dissolved in water
Gas	Liquid	carbon-di-oxide dissolved in water (Soda water)
Gaseous solution		
Liquid	Gas	Water vapour in air (cloud)
Gas	Gas	Mixture of Helium-Oxygen gases,

Based on the type of solvent

Most of the substances are soluble in water. That is why, water is called as "Universal solvent".How ever some substances do not dissolve in water. Therefore, other solvents such as ethers, benzene, alcohols etc., are used to prepare a solution.

On the basis of type of solvent, solutions are classified into two types.Theyare aqueous solutions and non-aqueous solutions.

a) Aqueous solution:

The solution in which water acts as a solvent is called aqueous solution.

E.g. Common salt in water, Sugar in water, Copper sulphate in water etc.

b) Non–Aqueous solution:

The solution in which any liquid, other than water, acts as a solvent is called non aqueous solution. Solvent other than water is referred to as non-aqueous solvent. Generally, alcohols, benzene, ethers, carbon disulphide, acetone, etc., are used as non-aqueous solvents.

Examples for non-aqueous solutions: Sulphur dissolved in carbon disulphide, Iodine dissolved in carbon tetrachloride. As shown on figure 9.4

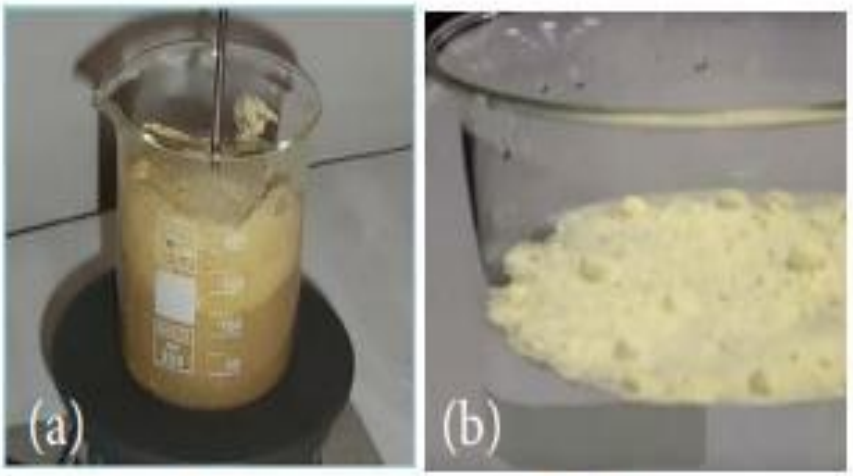


Figure 9.4 a) Sulphur is soluble in CS_2
b) Sulphur is insoluble in water

Based on the amount of solute

The amount of the solute that can be dissolved in the given amount of solvent is limited under any given conditions. Based on the amount of solute, in the given amount of solvent, solutions are classified into the following types:

(i) Saturated solution

(ii) Unsaturated solution

(iii) Super saturated solution

a) **Saturated solution:** A solution in which no more solute can be dissolved in a definite amount of the solvent at a given temperature is called saturated solution.

e.g.36g of sodium chloride in 100g of water at 25°C forms saturated solution. Further addition of sodium chloride, leave it undissolved.

b) **Unsaturated solution**: Unsaturated solution is one that contains less solute than that of the saturated solution at a given temperature. e.g. 10g or 20g or 30g of Sodium chloride in100g of water at 25°C forms an unsaturated solution.

c) **Super saturated solution:** Super saturated solution is one that contains more solute than the saturated solution at a given temperature. e.g. 40g of sodium chloride in 100g of water at 25°C forms super saturated solution.

This state can be achieved by altering any other conditions liken temperature, pressure. Super saturated solutions are unstable, and the solute is reappearing as crystals when the solution is disturbed.

Concentrated and dilute solutions

It is an other kind of classification of unsaturated solutions.

It expresses the relative concentration of two solutions with respect to their solutes present in the given amount of the solvent.

For example, you are given two cups of tea. When you taste them, you feel that one is sweeter than the other.

What do you infer from it? The tea which sweet more contains higher amount of sugar than the other.

How can you express your observation? You can say that the tea is stronger. Buta chemist would say that it is „concentrated".

When we compare two solutions having same solute and solvent, the one which contains higher amount of solute per the given amount of solvent is said to be concentrated solution and the another is said to be dilute solution

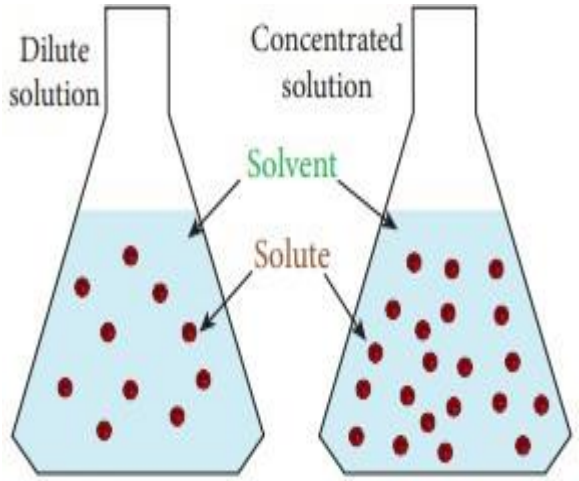


Figure 9.5 Dilute and Concentrated Solution

Differentiating solutions as dilute and concentrated is a qualitative representation. It does not imply the quantity of the solute. This difference is observed by means of some physical characteristics such as colour, density, etc.

Solubility

Usually, there is a limit to the amount of solute that can be dissolved in a given amount of solvent at a given temperature. When this limit is reached, we have a saturated solution and any excess solute that is added, simply settle down at the bottom of the solution.

The extent of dissolution of a solute in a solvent can be better explained by its solubility. Solubility is a measure of how much of a solute can be dissolved in a specified amount of a solvent.

Solubility is defined as the number of grams of a solute that can be dissolved in 100g of a solvent to form its saturated solution at a given temperature and pressure.

For example,36g of sodium chloride need to be dissolved in100g of water to form its saturated solution at 25°C.

Thus the solubility of NaCl in water is 36g at 25°C. The solubility is mathematically expressed as

Solubility=Mass of the solute × 100 Mass of the solvent

Table9.2Solubility of some common substances in water at 25°C

Name of the solute	Formula of the solute	Solubility g/100 g water
Calcium carbonate	$CaCO_3(s)$	0.0013
Sodium chloride	NaCl (s)	36
Ammonia	$NH_3(g)$	48
Sodium hydroxide	NaOH(s)	80
Glucose	$C_6H_{12}O_6(s)$	91
Sodium bromide	NaBr(s)	95
Sodium iodide	NaI(s)	184

Factors affecting solubility

There are three main factors which govern the solubility of a solute. They are:

(i) Nature of the solute and solvent

(ii) Temperature

(iii) Pressure

(i) Nature of the solute and solvent

The nature of the solute and solvent plays an important role in solubility. Although water dissolves an enormous variety of substances, both ionic and covalent, it does not dissolve everything. The phrase that scientists often use when predicting solubility is "like dissolves like."

This expression means that dissolving occurs when similarities exist between the solvent and the solute.

For example: Common salt is a polar compound and dissolves readily in polar solvent like water.

Non-polar compounds are soluble in non-polar solvents. **For example,** Fat dissolved in ether. But non-polar compounds, do not dissolve in polar solvents; polar compounds do not dissolve in non-polar solvents.

(ii) Effect of Temperature

Solubility of Solids in Liquid:

Generally, solubility of a solid solute in a liquid solvent increases with increase in temperature.

For example, a greater amount of sugar will dissolve in warm water than in cold water. In endothermic process, solubility increases with increase in temperature.

In exothermic process, solubility decreases with increase in temperature.

Solubility of Gases in liquid:

Do you know why is it bubbling when water is boiled? Solubility of gases in liquid decrease with increase in temperature.

Generally, water contains dissolved oxygen. When water is heated, the solubility of oxygen in water decreases, so oxygen escapes in the form of bubbles.

Aquatic animals live more in cold regions because, more amount of dissolved oxygen is present in the water of cold regions.

This shows that the solubility of oxygen in water is more at low temperatures.

(iii) Effect of Pressure

Effect of pressure is observed only in the case of solubility of a gas in a liquid. When the pressure is increased, the solubility of a gas in liquid increases.

The common examples for solubility of gases in liquids are carbonated beverages, i.e. soft drinks, household cleaners containing aqueous solution of ammonia, formalin1aqueous solution of formaldehyde, etc.

As shown as Figure 9.6

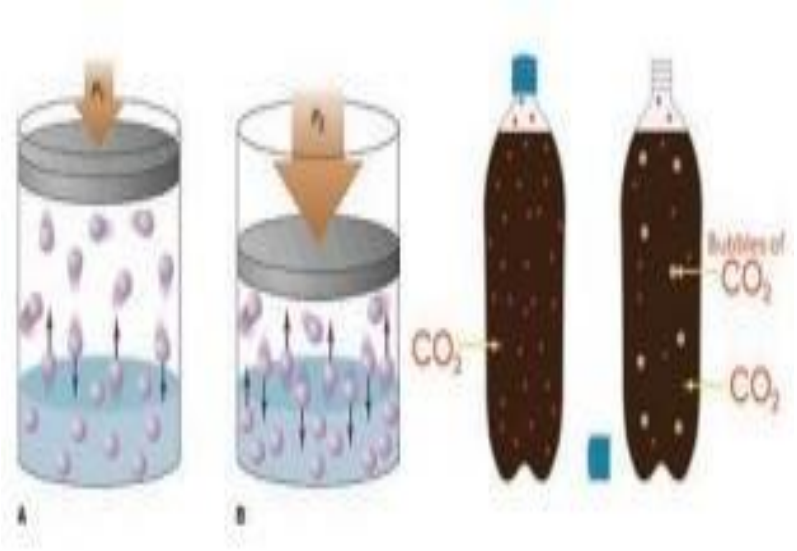


Figure 9.6 Effect of pressure on solubility

Concentration of a Solution

So far, we discussed what is a solution? What does it consist of and its types. Most of the chemical reactions take place in solutions form. So it is essential to quantify the solute in solvent to study the reactions. To quantify the solute in a solution, we can use the term “concentration”.

Concentration of a solution may be defined as the amount of solute present in a given amount of solution or solvent. Quantitatively, concentration of a solution may be expressed in different methods. But here, we shall discuss percentage by mass (% mass)and percentage by volume (% volume).

Mass percentage

Mass percentage of a solution is defined as the percentage by mass of the solute present in the solution. It is mostly used when solute is solid and solvent is liquid.

$$\textbf{Mass Percentage} = \frac{\textbf{Mass of the solute}}{\textbf{Mass of the solution}} \times 100$$

$$\textbf{Mass Percentage} = \frac{\textbf{Mass of the solute}}{\textbf{Mass of the solute} + \textbf{Mass of the solvent}} \times 100$$

For example: 5% sugar solution(by mass) means 5g of sugar in 95g of water. Hence it is made 100g of solution.

Usually, mass percentage is expressed as w/w(weight/weight); mass percentage is independent of temperature.

Volume percentage

Volume percentage is defined as the percentage by volume of solute(inml) present in the given volume of the solution.

$$\textbf{Volume Percentage} = \frac{\textbf{Volume of the solute}}{\textbf{Volume of the solution}} \times 100$$

$$\textbf{Volume Percentage} = \frac{\textbf{Volume of the solute}}{\textbf{Volume of the solution} + \textbf{Volume of the solvent}} \times 100$$

For example, 10% by volume of the solution of ethanol in water, means 10 ml of ethanol in 100ml of solution (or 90ml of water) Usually volume percentage is expressed as v/v (volume / volume).

It is used when both the solute and solvent are liquids. Volume percentage decreases with increases in temperature, because of expansion of liquid. You can notice that in the commercial products that we come across in our daily life.

Such as a solution of syrups, mouth wash, antiseptic solution, household disinfectants etc., the concentration of the ingredients is expressed as v/v.

Hygroscopy

Certain substances, when exposed to the atmospheric air at ordinary temperature, absorb moisture without changing their physical state. Such substances are called hygroscopic substances and this property is called hygroscopy.

Hygroscopic substances are used as drying agents.

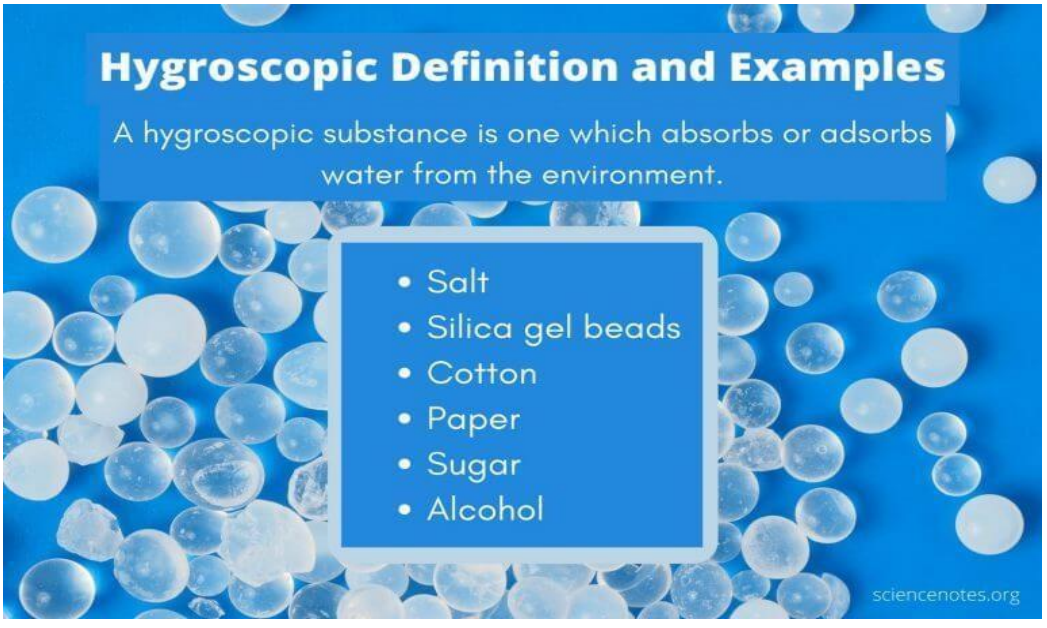
Example:

1. Conc. Sulphuric acid(H_2SO_4).

2. Phosphorus Pentoxide(P_2O_5).

3. Quick lime(CaO).

4. Silica gel(SiO_2)



Deliquescence

Certain substances which are so hygroscopic, when exposed to the atmospheric air at ordinary temperatures, absorb enough water and get completely dissolved. Such substances are called deliquescent substances and this property is called deliquescence.

Deliquescent substances lose their crystalline shape and ultimately dissolve in the absorbed water forming a saturated solution.

Deliquescence is maximum when:

1)The temperature is low
2)The atmosphere is humid

Examples: Caustic soda(NaOH), Caustic potash(KOH) and Ferric chloride($FeCl_3$)

As Shown On Figure 9.11

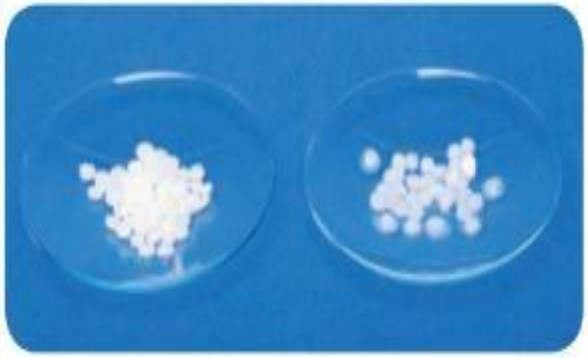


Figure 9.11 Deliquescence in Sodium hydroxide

Table 9.3 Difference between hygroscopic substances and deliquescence.

Hygroscopic substances	Deliquescence substances
When exposed to the atmosphere at ordinary temperature, they absorb moisture and do not dissolve.	When exposed to the atmospheric air at ordinary temperature, they absorb moisture and dissolve.
Hygroscopic substances do not change its physical state on exposure to air.	Deliquescent substances change its physical state on exposure to air.
Hygroscopic substances may be amorphous solids or liquids.	Deliquescent substances are crystalline solids.

CHOOSETHECORRECTANSWER:

1. Solution is a ____mixture.

a) Homogeneous b) Heterogeneous c) Ternary d)None of these

2. The process of uniform distribution of solute into solvent is called as__

a)Binary solution b)dissolution c)ternary solution

d)Both A and B

3. The solution which are made of one solute and one solvent are called as____.

a)Binary solution b)dissolution c)ternary solution

d)Both A and B

4. The kind of solutions which contain three components are called _.

a) Binary solution b)dissolution c)ternary solution

d)Both A and B

5. The solution in which water act as solvent is called as _.

a) Aqueous solution b)Non Aqueous solution c)both A and B

d)none of these

6. ____Is called as universal solvent.

a) Gas b)Solid c)Water d)Chloride

7. Deliquescence is maximum when the temperature is__.

a) Low b)High c)Medium d)Zero

8. A solution in which no more solute can be dissolved in a definite amount of the solvent at a given temperature is called _solution.

a) saturated b)unsaturated c)supersaturated d)none of these

9. When we compare two solutions having same solute and solvent, the one which contains higher amount of solute per the given amount of solvent is said to be _____solution.

a) concentrated b) binary c)ternary d) unsaturated

10. when exposed to the atmospheric air at ordinary temperatures, absorb enough water and get completely dissolved substances are called__substances.

a) Deliquescent b)Hygroscopy c)concentrated d)none of these

11. when exposed to the atmospheric air at ordinary temperature, absorb moisture without changing their physical state substances are called __substances.

a) Deliquescent b)Hygroscopy c)concentrated d)none of these

12. _____is a measure of how much of a solute can be dissolved in a specified amount of a solvent.

a) Solubility b)Solute c)Solvent d) none of these

13. Sulphur dissolved in carbon disulphide, Iodine dissolved in carbon tetra chloride are an example of ___.

b)Aqueous solution b)Non Aqueous solution c)both A and B

d)none of these

14. _____percentage is defined as the percentage by volume of solute(inml) present in the given volume of the solution.

a) Volume b)Mass c)Gas d)All of these

15. The nature of the solute and solvent plays an important role in _.

a) Solubility b)Solute c)Solvent d) none of these

16. Common salt is a __compound.

a) Polar b)Non polar c)Bipolar d)none of these

17. In _____process, solubility increases with increase in temperature.

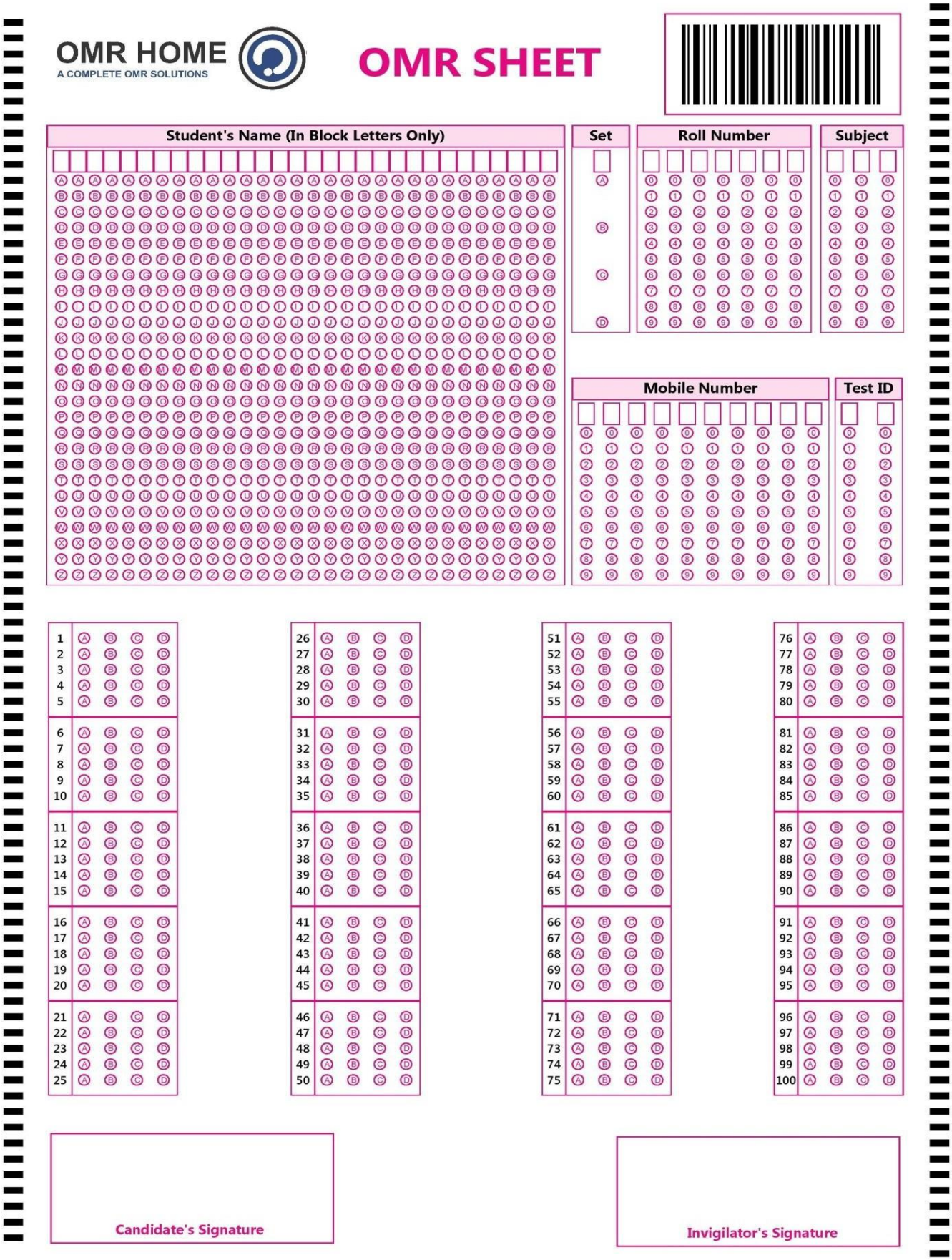
a)endothermic b) exothermic c)polar d) non polar

18. _____percentage of a solution is defined as the percentage by mass of the solute presentin the solution.

a) Volume b)Mass c)Gas d)All of these

19. Effect of _____is observed only in the case of solubility of a gas in a liquid.

a) Pressure b)Volume c)Temperature d)Gas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