



Types of Sets :

There are some useful sets:

(i) Null / Empty Set:-

The set which does not contain any element is called Null or Empty Set and is denoted by  $\emptyset$  or  $\{\}$  or  $\bar{O}$ .

(ii) Singleton Set:-

"The set which contains just one element (Entry) is called Singleton Set." For example  $A = \{1\}$ ,  $B = \{a\}$ .

(iii) Finite Set:-

"The set which contains limited number of entries is called Finite Set."

e.g.  $A = \{1, 3, 5, 7, 9\}$ .

(iv) Infinite Set:-

"The set which contains unlimited and uncountable entries is called Infinite Set."

For Example  $A = \{2, 3, 5, 8, \dots\}$

(v) Sub Set:-

If A and B are two non-empty sets and every element of A is also the element of B, then A is said to be a subset of B and is denoted as

$$A \subseteq B$$

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(vi) Super Set:-

If A and B are non empty sets and every element of A is also an element of B, then B is called Super set of A and is denoted as:

$$B \supseteq A$$

(vii) Proper Subset:-

If A and B are two nonempty sets and every element of A is also an element of B but at least one element of B is not an element of A, then A is said to be a proper subset of B and is denoted as

$$A \subset B$$

(viii) Improper Subset:-

If A and B are two nonempty sets and A is a subset of B such that every element of B is also an element of A, then A is said to be an improper subset of B and is denoted

$$A \equiv B$$

If Any set contains n elements then number of subsets will be  $2^n$ .

(ix) Power Set:-

"The set containing all the subsets of any set  $A$  is called power set of  $A$  and is denoted by  $P(A)$ ."

Power set of any set contains  $2^n$  elements if " $A$ " has  $n$  elements.

(x) Equal Sets:-

For  $A, B$  non empty sets, if  $A \subseteq B$  and  $B \subseteq A$  then  $A$  and  $B$  are equal and are denoted symbolically by  $A = B$ .

(xi) Universal Set:-

The set which contains all the elements of under consider sets is called Universal Set and is denoted by  $U$ .

(xii) Complementary Set:-

If  $A$  is subset of Universal Set  $U$ . Then  $U - A$  is called Complement of  $A$  and is denoted  $A^c$  or  $A'$ .

(xiii) Difference of two Sets:-

For two non-empty sets  $A, B$   $A - B$  or  $A / B$  is called difference of  $A$  and  $B$  and is defined as "those elements of which are not in  $B$ ".  
 $A - B \neq B - A$

(xiv) Equivalent Sets:-

"The sets containing equal number of elements are called Equivalent Sets."

For  $A, B$  Equivalent sets are denoted as  $A \sim B$

(xv) Disjoint Sets:-

"The sets which have no common element are called disjoint sets."

For  $A, B$  disjoint sets  $A \cap B = \emptyset$ .

(xvi) Overlapping Sets:-

"The two sets having at least one common element but none of them is subset of other, then sets are called overlapping sets."

- \* Empty <sup>set</sup> is a subset of every set.
- \* Empty set has no proper subset.
- \* Singleton set has one proper subset.
- \* Empty set has one subset. (itself)
- \* If  $A \subseteq B$  then  $A - B = \emptyset, B - A \neq \emptyset$
- \*  $A \cup A^c = U, A \cap A^c = \emptyset$
- \*  $\emptyset^c = U \Rightarrow U^c = \emptyset$
- \*  $P(\emptyset) \neq \emptyset$  but  $P(\emptyset) = \{\emptyset\}$
- \* " $\subseteq$ " symbol is called inclusion symbol."

## EXERCISE : 2.1

Q.1 Write in Set Builder notation:-

(i)  $\{6, 2, 3, \dots, 1000\}$

$\{x | x \in \mathbb{N} \wedge x \leq 1000\}$

or  $\{x | x \in \mathbb{N} \wedge x < 1001\}$

(ii)  $\{0, 1, 2, \dots, 100\}$

$\{x | x \in \mathbb{W} \wedge x \leq 100\}$

or  $\{x | x \in \mathbb{W} \wedge x < 101\}$

(iii)  $\{0, \pm 1, \pm 2, \dots, \pm 1000\}$

$\{x | x \in \mathbb{Z} \wedge -1000 \leq x \leq 1000\}$

(iv)  $\{0, -1, -2, \dots, -50\}$

$\{x | x \in \mathbb{Z}^+ \wedge -50 \leq x \leq 0\}$

(v)  $\{100, 101, 102, \dots, 400\}$

$\{x | x \in \mathbb{N} \wedge 100 \leq x \leq 400\}$

or  $\{x | x \in \mathbb{N} \wedge 99 < x < 401\}$

or  $\{x | x \in \mathbb{W} \wedge 99 < x < 401\}$

or  $\{x | x \in \mathbb{Z}^+ \wedge 99 < x < 401\}$

(vi)  $\{-100, -101, -102, \dots, -500\}$

$\{x | x \in \mathbb{Z}^+ \wedge -500 \leq x \leq -100\}$

or  $\{x | x \in \mathbb{Z}^+ \wedge -501 < x < -99\}$

(vii)  $\{\text{Peshawar, Lahore, Quetta, Karachi}\}$

$\{x | x \text{ is a provincial Capital of Pakistan}\}$

or  $\{x | x \text{ is a Capital of Every}$

Province of Pakistan  $\}$

(viii)  $\{\text{January, June, July}\}$

$\{x | x \text{ is month of year beginning with letter J}\}$

(ix) The set of all odd natural numbers.

$\{x | x \in \mathbb{O} \wedge x \in \mathbb{N}\}$

or  $\{x | x \text{ is an odd natural number}\}$

(x) The set of rational numbers.

$\{x | x \in \mathbb{Q}\}$

or  $\{x | x \in \mathbb{P}_q \text{ where } q \neq 0 \wedge p, q \in \mathbb{Z}\}$

(xi) The set of real Nos. b/w 1 and 2

$\{x | x \in \mathbb{R} \wedge 1 < x < 2\}$

(xii) The set of integer b/w -100 and 1000

$\{x | x \in \mathbb{Z} \wedge -100 < x < 1000\}$

or  $\{x | x \in \mathbb{Z} \wedge -99 \leq x \leq 999\}$

Q.2 Write in descriptive and tabular form:

(i)  $\{x | x \in \mathbb{N} \wedge x \leq 10\}$

T. form:  $\{1, 2, 3, \dots, 10\}$

D. form: The set of 1st 10 natural numbers.

or The set of natural nos. smaller than 11.

(ii)  $\{x | x \in \mathbb{N} \wedge 4 < x < 12\}$

T. form:  $\{5, 6, 7, 8, 9, 10, 11\}$

D. form: Set of natural numbers

between 4 and 12.

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(iii)  $\{x | x \in \mathbb{Z} \wedge -5 < x < 5\}$

In Tabular Form:-

$\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$

or  $\{0, \pm 1, \pm 2, \pm 3, \pm 4\}$

In Descriptive Form:-

The Set of integers between -5 to 5.

(iv)  $\{x | x \in \mathbb{E} \wedge 2 < x < 4\}$

In Tabular Form:-

$\{4\}$

In Descriptive Form:-

The Set of Even number between 2 and 4 containing 4.

(v)  $\{x | x \in \mathbb{P} \wedge x < 12\}$

In Tabular Form:-

$\{2, 3, 5, 7, 11\}$

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In Descriptive Form:-

The Set of prime numbers less than 12.

(vi)  $\{x | x \in \mathbb{O} \wedge 3 < x < 12\}$

In Tabular Form:-

$\{5, 7, 9, 11\}$

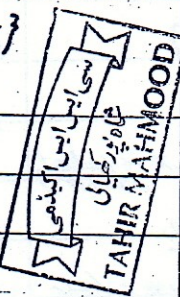
In Descriptive Form:-

The Set of Odd numbers between 3 and 12

(vii)  $\{x | x \in \mathbb{E} \wedge 4 \leq x \leq 10\}$

In Tabular Form:-

$\{4, 6, 8, 10\}$



In Descriptive Form:-

The Set of Even numbers 2 to 12.

(viii)  $\{x | x \in \mathbb{E} \wedge 4 < x < 6\}$

In Tabular Form:-

$\{\}$  or  $\phi$

In Descriptive Form:-

The Set of Even numbers between 4 and 6.

(ix)  $\{x | x \in \mathbb{O} \wedge 5 \leq x \leq 7\}$

In Tabular Form:-

$\{5, 7\}$

In Descriptive Form

The Set of Odd numbers between 3 and 9.

(x)  $\{x | x \in \mathbb{O} \wedge 5 \leq x < 7\}$

In Tabular Form:-

$\{5\}$

In Descriptive Form:-

The Set of Odd numbers between 3 and 7

(xi)  $\{x | x \in \mathbb{N} \wedge x + 4 = 0\}$

In Tabular Form:-

$\phi$  or  $\{\}$  ( $\because -4 \notin \mathbb{N}$ )

In Descriptive Form:-

The Set of natural numbers satisfying the Equation  $x + 4 = 0$

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(xii)  $\{x | x \in \mathbb{Q} \wedge x^2 = 2\}$

In Tabular Form

$\emptyset$  or  $\{ \}$  ( $\because x$  is radical number)

In Descriptive Form:

The Set of rational numbers whose square are 2

(xiii)  $\{x | x \in \mathbb{R} \wedge x = x\}$

In Tabular FormAll real numbers ( $\mathbb{R}$ )In Descriptive Form:The Set of real numbers which satisfy  $x = x$ 

(xiv)  $\{x | x \in \mathbb{Q} \wedge x = -x\}$

In Tabular Form:

$\{ \}$  or  $\emptyset$

In Descriptive Form:The Set of rational numbers for which  $x = -x$ 

(xv)  $\{x | x \in \mathbb{R} \wedge x \neq 2\}$

In Tabular Form

$\mathbb{R} - \{2\}$

In Descriptive Form:The Set of real numbers other than 2. **TAHIR**

or The Set of real numbers except 2.

(xvi)  $\{x | x \in \mathbb{R} \wedge x \notin \mathbb{Q}\}$

In Tabular Form

$\mathbb{R} - \mathbb{Q} = \mathbb{Q}'$

In Descriptive FormThe Set of real number without  $\mathbb{Q}$ .

Q.3 Which of the followings sets are finite and infinite?

(1) The Set of students of your class.

Finite Set.

(2) The Set of all Schools in Pakistan.

Finite Set

(3) The Set of natural numbers between 3 and 10

Finite Set.

(4) The Set of rational numbers between 3 and 10

Infinite Set.

(5) The Set of real numbers between 0 and 1

Infinite Set. **TAHIR**

(6) The Set of rational numbers between 0 and 1.

Infinite Set.

(7) The Set of whole number between 0 and 1.

Finite Set.

(8) The Set of all leaves of trees in Pakistan

Finite Set.



Q.6 What is the difference between  $\{a, b\}$  and  $\{\{a, b\}\}$ ?

Ans:  $\{a, b\}$  is set containing two elements while the set  $\{\{a, b\}\}$  is a set which contains just one element that is a set  $\{a, b\}$ .

Q.7 Which of the followings are True and which are false?

(i)  $\{1, 2\} = \{2, 1\}$

It is true because there is not any restriction (size  $n$ ) in order of elements in a set.

(ii)  $\emptyset \in \{\{a\}\}$

It is true because null set is always a subset of every set.

(iii)  $\{a\} \supseteq \{\{a\}\}$

It is false because  $\{a\}$  is not a super set of the set  $\{\{a\}\}$ .

(iv)  $\{a\} \in \{\{a\}\}$

It is true because  $\{a\}$  is an element of set  $\{\{a\}\}$ .

(v)  $a \in \{\{a\}\}$

It is false because  $a$  does not belong to  $\{\{a\}\}$ .

(vi)  $\emptyset \in \{\{a\}\}$

It is true because every set contains

Q.7 What is the number of elements of a power set of the following sets?

**KEEP in MIND:**

{ Power Set is a set which contains all the subsets of a set as an element. If a set contains  $n$  elements so the number of its subsets will be  $2^n$  So the number  $2^n$  is the number of elements of Power set. }

(i)  $\{ \}$

The no. of elements of power set of null set are

$$2^0 = 1$$

(ii)  $\{0, 1\}$

The no. of elements of power set of  $\{0, 1\}$  are

$$2^2 = 4$$

(iii)  $\{1, 2, 3, 4, 5, 6, 7\}$

The no. of elements of power set of given set are

$$2^7 = 128$$

(iv)  $\{0, 1, 2, 3, 4, \dots, 7\}$

The no. of elements of power set of given set are

$$2^8 = 256$$

(v)  $\{a, \{b, c\}\}$

The no. of <sup>elements of</sup> power set of a given set are

$$2^2 = 4$$



