

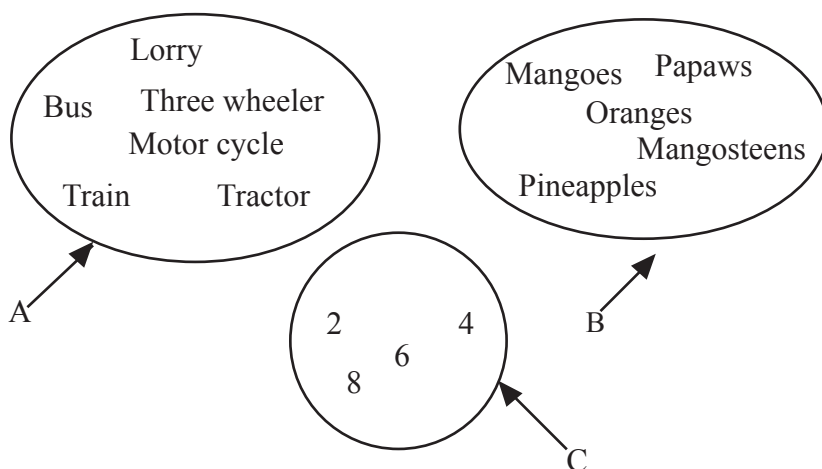
# 19

## Sets

After studying this lesson, you can get a good understanding of

- ★ symbols related to sets
- ★ a universal set
- ★ a null set
- ★ number of elements in a set

### 19.1 Introduction of sets



Study the objects enclosed in the closed figures A, B, and C in the above diagram.

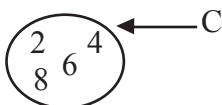
Can those objects in A, B, C, be identified as groups or objects selected with certainty?

Objects enclosed in A are vehicles that move on land which are sorted with certainty. Accordingly A can be identified as a set of vehicles which travel on land. B is a set of fruits, while C is a set of even numbers less than 10.

We have learned in grade 7 that a group where its elements can be decided with certainty is called a set.

What belongs to a set are called its elements.

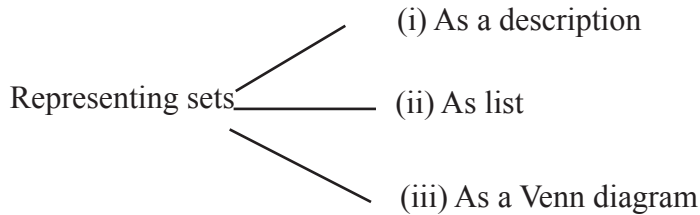
of C is a set of even numbers less than 10 then it can be represented by a figure as



When the elements of this set 2, 4, 6 and 8 are written in a line with two double brackets on either side, it is considered as listing of the set. Here it is necessary to use double brackets.

$$C = \{ 2, 4, 6, 8 \}$$

We have identified three ways of representing a set.

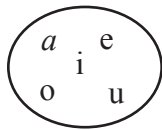


### Example 1

A certain set is described as the set of vowels in the English alphabet. Represent it,

- (i) as a Venn diagram
- (ii) as a list

(i) As a Venn diagram



(ii) As a list

$$\{a, e, i, o, u\}$$

### Exercise 19.1

(1) Copy the following groups in your exercise book and mark those which could be considered as sets with ✓ and those that cannot be considered as sets "×".

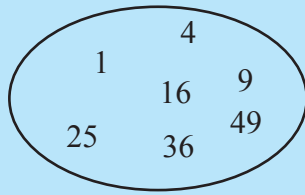
- (i) Tall children.
- (ii) Children in grade 8 who are taller than 1.35 m.
- (iii) The students in grade 8 who got more than 80% of marks for mathematics in the last term test.
- (iv) The intelligent students in grade 8.
- (v) Counting numbers.
- (vi) The students in Sri Lanka.
- (vii) Materials of light weight.
- (viii) The letters in the English alphabet.

(2) List out the elements in each of the following sets.

- (i) The set of odd numbers less than 10.
- (ii) The set of letters of the word MAHARAGAMA.

- (iii) The set of prime numbers less than 10.
- (iv) The set of subjects you learn in grade 8
- (v) The set of notes of money used in Sri Lanka

(3)



- Write the set of numbers in the Venn diagram as
- (i) a description
  - (ii) a list

## 19.2 The elements of a set

Let us consider the set  $A = \{1, 3, 5, 7, 9\}$ . The elements of this set are 1, 3, 5, 7 and 9. The symbol  $\in$  is used to indicate that each of these is an element of the set A.

Accordingly "3 is an element of A" can be indicated as

$$3 \in A$$

Similarly  $5 \in A, 7 \in A, 9 \in A$   $\in$  is a letter in the Greek alphabet.

$\notin$  indicates is not an element.

$4 \notin A$  indicates that, 4 is not an element of A.

### Exercise 19.2

(1) Write the following expressions in the exercise book and complete each of them, selecting the suitable symbol out of  $\in$  and  $\notin$ .

- (i)  $4 \text{ --- } \{\text{counting numbers}\}$
- (ii)  $5 \text{ --- } \{\text{even numbers}\}$
- (iii)  $A \text{ --- } \{\text{letters in the English alphabet}\}$
- (iv) Hare --- {animals}
- (v) Peacock --- {birds}
- (vi) Potatoes --- {fruits}

(2) Using,  $P = \{2, 3, 5, 7\}$  write  $\in$  or  $\notin$  as suitable in the blank spaces in the following expressions and complete them.

- (i)  $2 \text{ ----- } P$       (ii)  $4 \text{ ----- } P$       (iii)  $5 \text{ ----- } P$       (iv)  $1 \text{ ----- } P$

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### 19.3 The universal set

Let us consider the following sets

A = Set of even numbers      B = Set of odd numbers

C = Set of prime numbers      D = Set of square numbers

These can be indicated as lists of elements as given below

A = { 2 , 4 , 6 , 8 , --- }      C = { 2 , 3 , 5 , 7 , 11 , --- }

B = { 1 , 3 , 5 , 7 , --- }      D = { 1 , 4 , 9 , 16 , --- }

Now let us pay attention to a large set which includes the elements of all these sets. If we consider the set of counting numbers, it is clear that all the elements of the above sets are included in it.

The large set which includes the elements of a number of sets like this is called the universal set and is denoted by  $\epsilon$  .

Accordingly, the universal set of the sets explained above is.

$\epsilon = \{\text{counting numbers}\}$

$\epsilon = \{1 , 2 , 3 , 4 , 5 , \dots\}$

#### Example 2

Name a universal set which includes the set of students in grade 8.

A few suitable universal sets are given below.

- (i) {Students in grades 6 to 11}
- (ii) {Students in grade 6 and above}
- (iii) {Students in grade 11 and below}

This set can be expanded further by mentioning the name of the school, and then the universal set as, "The set of students of ....."

### 19.4 The Null set

If a set has no elements it is called a null set and is denoted by the symbol  $\phi$  .

### Example 3

- (i)  $P = \{\text{whole numbers between 0 and 1}\}$   
Are there whole numbers between 0 and 1?  
No. Hence  $P$  is a null set.

The null set is denoted by the symbol  $\phi$

Therefore  $P$  can be expressed as  
 $P = \phi$  or  $P = \{ \}$

- (ii) If the set of quadrupeds with wings is  $B$ ,  
 $B = \{\text{quadrupeds with wings}\}$   
 $B$  is a null set.  
 $B = \phi$  or  $B = \{ \}$

## 19.5 The number of elements in a set

$$P = \{\text{Even numbers less than 10}\}$$
$$= \{2, 4, 6, 8\}$$

$P$  has four elements.

The number of elements in set  $P$  is denoted by  $n(P)$  and accordingly,  
 $n(P) = 4$

### Example 5

- If  $A = \{\text{Letters of the word BABOON}\}$  find  $n(A)$ ?  
 $A = \{B, A, O, N\}$   
 $\therefore n(A) = \underline{\underline{4}}$

## Exercise 19.3

(1) Name a universal set relevant to each of the following sets.

- (i)  $\{\text{Students in grade 5 of the school}\}$  (ii)  $\{\text{Vowels in the English alphabet}\}$   
(iii)  $\{\text{Almirah, chair, table}\}$  (iv)  $\{\text{Television, Washing machine}\}$   
(v)  $\{10, 20, 30, 40, 50\}$  (v)  $\{\text{Mango, Pineapple, Banana}\}$

- (2) Write the number of elements of each of the following sets.
- (i)  $A = \{\text{Even numbers less than } 10\}$
  - (ii)  $P = \{\text{Odd prime numbers less than } 20\}$
  - (iii)  $Q = \{\text{The letters of the word SAHARA}\}$
  - (iv)  $R = \{\text{Square numbers between } 11 \text{ and } 20\}$
  - (v)  $S = \{\text{The results you get when a coin is tossed}\}$
- (3) (i) Write a set  $A$  in which  $n(A) = 3$   
(ii) Write a set  $B$  in which  $n(B) = 1$
- (4) Write an example for a set in which  $n(A) = 0$ . What is the special name of this set?
- (5) Is  $\{0\}$  a null set? Give reasons for your answer.

### Summary

- ★ When the elements of a set are written within double brackets it is known as listing.
- ★ An element belonging to a set is denoted by  $\in$  and not belonging by  $\notin$ .
- ★ If  $P = \{a, b, c, d\}$   $a \in P$ , and  $x \notin P$
- ★ The fact that  $P = \{a, b, c, d\}$  has 4 elements is indicated as  $n(P) = 4$ .
- ★ When there is a larger set including elements of a few sets it is named as the universal set.
- ★ The universal set is denoted by  $\epsilon$
- ★ A set having no elements is a null set and it is denoted by  $\phi$ .