Exercise 5.2

Question 1.
Classify the following sets into empty set, finite set and infinite set. In case of (non-empty) finite sets, mention the cardinal number.
(i) {all colours of a rainbow}
(ii) {x | x is a prime number between 7 and 11}
(iii) {multiples of 5}
(iv) {all straight lines drawn in a plane}
(v) {x | x is a digit in the numeral 550131527}
(vi) {x | x is a letter in word SUFFICIENT}
(vii) {x | x = 4n, n ∈ I and x < 10}
(viii) {x | x ∈ N, x is a prime factor of 180}
(ix) {x : x is a vowel in the word WHY}
(x) {x : x = 5n, n ∈ W and x < 60}
Solution:

(i) It is a finite set having 7 elements.

(ii) It is an empty set.

(iii) It is an infinite set having unlimited elements

(iv) It is an infinite set having unlimited number of elements.

(v) It is a finite set having 6 elements i.e.,0, 1, 2, 3, 5, 7.

(vi) It is a finite set having 8 elements i.e.,S, U, F, I, C, E, N, T.

(vii) It is an infinite set having the set of integers
i.e., unlimited number of elements.

(viii) It is a finite set having 3 elements.

(ix) {x : x is a vowel in the word WHY}
It is an empty set as there is no vowel in the word why

(x) {x : x = 5n, n ∈ W and x < 60}
= {5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55}
It is finite set and it has 12 elements.

Question 2.
Which of the following describe the same sets:
(i) {vowels of English alphabet} and {e, a, u, i, o}
(ii) {a, b, d} and {d, a, b, b}
(iii) {letters of PUPPET} and {E, T, P, U}
(iv) {1, 2, 3} and {2, 3, 4}

(v) {1, 2, 3, 4, 5} and {x | x ∈ N, x ≤ 5}

Solution:

(i) the given sets are the same sets.

(ii) These are the same sets.

(iii) The given sets are the same sets.

(iv) These are not the same sets.

(v) The given sets are the same sets.

Question 3.

Find pairs/groups of equal sets from the following sets:

A = {0, 1, 2, 3}

B = {x : x^2 < 10, x ∈ W}

C = {letters of word FOLLOW}

D = {days of a week}

E = {x | x ∈ W, x < 4}

F = {letters of word FLOW}

G = {Monday, Tuesday, …… , Sunday}

H = {letters of word WOLF}

Solution:

A = B = E because if we write B and E in tabular form,

we get the same elements.

C = F = H because the elements in a set can be rearranged

as each set can be written as {F, O, L, W} form.

D = G because if we write D in tabular we get the same elements.

Question 4.

Find pairs/groups of equivalent sets from the following sets.

A = {colours of a rainbow}

B = {letters of word GOOD}

C = {x : x is a digit in the numeral 371011489}

D = {letters of word TOM}

E = {x : x ∈ I, x^2 < 10}

F = {months of a year}

G = {days of a week}

H = {x | x = 3n, n ∈ W and n < 12}

I = {all even numbers between 1 and 53}

J = {all letters of English alphabets}

Solution:

A, C, E and G are equivalent sets as these
all have same number of elements i.e, 7 elements.
$B \Leftrightarrow D$ as n (B) = 3 = n (D)
$F \Leftrightarrow H$ as n(F)= 12 = n (H)
$I \Leftrightarrow J$ as n (I) = 26 = n (J)

Question 5.
In the following, find whether $A \subset B$ or $B \subset A$ or none of these:
(i) A = { 1, 2, 3}, B = {2, 3, 3, 3, 1, 3}
(ii) A = {2, 4, 6,….}, B = {all natural numbers}
(iii) $A = \{x \mid x \in I, x^2 < 20\}$, B = {0, 1, 2, 3, 4}
(iv) A = {letters of KING},
B = {letters of QUEEN}
Solution:

In the following, find whether
$A \subset B$ or $B \subset A$ or none of these
(i) A = { 1, 2, 3},B = {2, 3, 3, 3, 1, 3}
= {2, 3, 1}
$A \subset B$ and $B \subset A$; i.e., A = B
(ii) A = {2, 4, 6,....}, B = {all natural numbers}
= {1, 2, 3, 4, 5, 6, 7, ...}
$A \subset B$ but $B \not\subset A$
(iii) $A = \{x \mid x \in I, x^2 < 20\}$, B = {0, 1, 2, 3, 4}
= {0, 1, 4, 9, 16}
$= \{(0)^2, (1)^2, (2)^2, (3)^2, (4)^2\}$
B = {0, 1, 2, 3, 4}
$B \subset A$ but $A \not\subset B$
(iv) A = {letters of KING} = {K, I, N, G}
B = {letters of QUEEN} = {Q, U, E, N}
Here, $A \not\subset B$ and $B \not\subset C$
Neither $A \subset B$ nor $B \subset A$

Question 6.
State whether each of the following statement is true or false for the sets A and B where
A = {letters of CLOUD} and B = {letters of KOLKATA}

(i) $A \subset B$
(ii) $B \subset A$
(iii) $A \leftrightarrow B$
Solution:

$A = \{\text{letters of CLOUD}\} = \{C, L, O, U, D\}$

$B = \{\text{Letters of KOLKATA}\} = \{K, O, L, A, T\}$

(i) $A \subset B$: It is false because some elements of A are not the elements of B.

(ii) $B \subset A$: It is false because some elements of B is not a member of A.

(iii) $A \leftrightarrow B$. It is true as $n(A) = 5 = n(B)$.

Question 7.
Write all the subsets of the following sets:
(i) Φ
(ii) {3, 5}
(iii) {2, 4, 6}
Solution:

(i) Subset of Φ is Φ

(ii) Empty set is a subset of every set so,

the subsets are Φ, {3}, {5}, {3, 5}.

(iii) Empty set is a subset of every set.

So the subsets are Φ, {2}, {4}, {6}, {2, 4}, {4, 6}, (2, 6), (2, 4, 6}

Question 8.
If $A = \{x : x = 2n, n < 5\}$, then find A when
(i) $\xi = N$
(ii) $\xi = W$
(iii) $\xi = I$

Solution:

(i) Natural numbers less than 5 are, 1, 2, 3, 4.

Given x = 2n, putting n = 1, 2, 3, 4, we get,

x = 2 × 1, 2 × 2, 2 × 3, 2 × 4

= 2, 4, 6, 8.

The given set can be written as {2, 4, 6, 8}

(Every set is a subset of universal set i.e., A ⊂ ξ)

(ii) Whole numbers less than 5 are 0, 1,2, 3, 4.

Given 2n i.e., 2 × 0, 2 × 1, 2 × 2, 2 × 3, 2 × 4 i.e., 0, 2 4, 6, 8.

The given set i.e., A can be written as (0, 2, 4, 6, 8}

(Every set is a subset of universal set i.e., A ⊂ ξ)

(iii) Integers less than 5 are ....., -4, -3, -2, -1, 0, 1, 2, 3, 4

Given 2n i.e ....., 2 × -2, 2 × -1, 2 × 0, 2 × 1, 2 × 2, 2 × 3, 2 × 4,

i.e. .....-4, -2, 0, 2, 4, 6, 8.

The given set i.e. A can be written as {...., -4, -2, 0, 2, 4, 6, 8}

(Every set is a subset of universal set i.e., A ⊂ ξ)