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Sets: Chapter Introduction

1. What is a set?

A **set** is a **well-defined** collection of objects. Well-defined means that for any object we can say for certain whether it belongs to the collection or not. The objects are its **elements** (members).

Collection	Set?	Reason
Best cricketers of India	No	"Best" depends on opinion
Months whose names start with J	Yes	Exactly January, June, July
Even natural numbers from 1 to 10	Yes	Exactly 2, 4, 6, 8, 10

2. Writing a set

- Name sets with capital letters (A, B, N); write elements inside curly brackets { }, separated by commas.
- **Roster form:** list the elements, e.g. A = {2, 4, 6, 8, 10}. An element is not repeated; order does not matter.
- **Set-builder form:** describe the rule, e.g. A = {x : x is an even natural number, x ≤ 10}.
- ∈ "belongs to": 4 ∈ A. ∉ "does not belong to": 5 ∉ A.

3. Types of sets

Type	Meaning	Example
Empty (null) set ∅ or { }	no element	{x : x is a natural number, x < 1}
Finite set	a countable, limited number of elements	vowels {a, e, i, o, u}
Infinite set	elements never end	N = {1, 2, 3, …}

4. Union, intersection and Venn diagrams

A **Venn diagram** shows sets as circles inside a rectangle (the universal set U).

Union A ∪ B = {x : x ∈ A or x ∈ B}: everything in either set.
Intersection A ∩ B = {x : x ∈ A and x ∈ B}: only the common elements.

Solved example. A = {1, 2, 3}, B = {2, 3, 4}.
A ∪ B = {1, 2, 3, 4} (2 and 3 written once). A ∩ B = {2, 3}.

5. The chapter map

Sets and their representations → empty, finite, infinite, equal sets → subsets, power set, universal set → Venn diagrams → union, intersection, difference, complement.

Key takeaways

- Only a well-defined collection is a set.
- Roster form lists; set-builder form gives the rule.
- $\varnothing$ is empty; N is infinite.
- $\cup$ joins, $\cap$ keeps the common part.

Practice questions (CBSE style)

1. (MCQ) Which is a set? (a) good students (b) months starting with J (c) tall trees (d) famous films
2. (MCQ) If A = {1, 3, 5}, which is true? (a) $2 \in A$ (b) $3 \in A$ (c) $5 \notin A$ (d) $1 \notin A$
3. (Very short) Write {x : x is a prime number less than 10} in roster form.
4. (Very short) Is {x : x is a natural number less than 1} empty, finite or infinite?
5. (Short) Why is "beautiful flowers" not a set?
6. (Numerical) A = {1, 3, 5, 7}, B = {3, 5, 9}. Find $A \cup B$ and $A \cap B$.
7. (Numerical) Write the vowels of the English alphabet in set-builder and roster form.
8. (Application) A = {letters of the word "SET"}, B = {letters of "TEST"}. Are A and B equal? Explain.

Answer key

1. (b): it is well-defined, {January, June, July}.
2. (b) $3 \in A$.
3. {2, 3, 5, 7}.
4. Empty: no natural number is less than 1.
5. "Beautiful" depends on opinion, so the collection is not well-defined.
6. $A \cup B = \{1, 3, 5, 7, 9\}$; $A \cap B = \{3, 5\}$.
7. {x : x is a vowel of the English alphabet} = {a, e, i, o, u}.
8. A = {S, E, T}; B = {T, E, S} (repeated T written once). Same elements, so A = B.

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