Unit 1 · Set

STUDY NOTES

WHAT THE BLE ASKS

- **CDC's grid:** Sets: 3 of 50 marks
- **In our 10 model papers:** 1-mark ×30
- **Model paper's question (3 marks), around one Venn diagram**
  - **a. knowledge (1):** a definition
  - **b. understanding (1):** a set read from the diagram
  - **c. higher ability (1):** what kind of sets they become if something changes, **with a reason**

Key terms

Set: a well-defined collection of things, its **elements**.

Universal set U: everything being talked about.

Venn diagram: U as a rectangle, its subsets as circles or ovals inside it.

Disjoint sets: no element in common.

Overlapping sets: at least one common element **and** at least one that isn't common.

Equal sets: exactly the same elements; not overlapping.

Subset $A \subseteq B$: every element of A is in B.

Proper subset $B \subset A$: B is a subset of A with **fewer** elements.

Improper subset $B \subseteq A$: B has **all** the elements of A; then A, B are equal.

Formulas

2^n	n = number of elements **Use:** all the subsets of a set
$2^n - 1$	all but the set itself **Use:** proper subsets
1	the set itself **Use:** improper subsets

n	0	1	2	3	4	5	6
Subsets	1	2	4	8	16	32	64

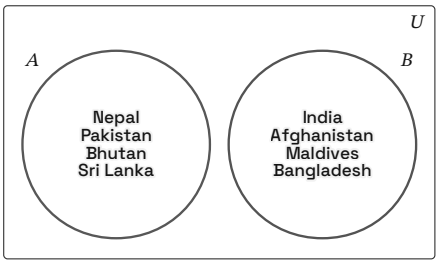
- each new element: every old subset leaves it out or takes it → the number **doubles**
- "in or out?" for n elements → $2 \times 2 \times \cdots \times 2 = 2^n$
- Braille: a letter = a subset of 6 dots → $2^6 = 64$ patterns; the empty set is the blank, 63 left

Writing a set

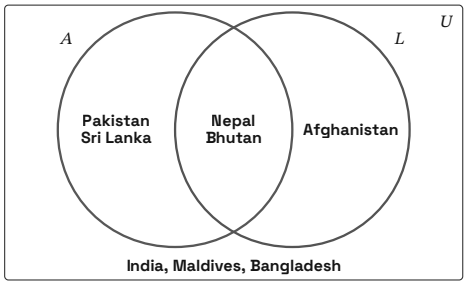
- **description:** {prime numbers less than 8}
- **listing** (tabulation): {2, 3, 5, 7}
- **set-builder:** $\{x : x \text{ is a prime number less than } 8\}$
- multiples never end: U usually gives the stopping point
- **multiples** of 6: 6, 12, 18…; **factors** of 6: 1, 2, 3, 6

Two sets in one picture

Relation	Common elements	Circles
Disjoint	none	apart
Overlapping	some, and each or one has others	cross, or one inside the other
Equal	all, nothing different	one circle, two names



Disjoint: no team in both groups, so the circles stay apart. Elements outside the circles are still in U.

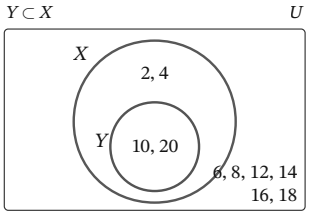


Overlapping: Nepal and Bhutan are in both, so they go where the circles cross.

- $\{1, 2\}$, $\{1, 2, 3\}$: overlapping; all of one lies inside → its circle inside the other
- **reading a circle:** include the overlap; it belongs to both
- **reading** U: everything in the rectangle, outside the circles too
- disjoint can depend on where U stops: multiples of 5 and of 6 in U up to 20 share nothing; up to 30 they meet
- empty the overlap → the sets become disjoint; to make sets disjoint, take the common elements out of one

Subsets

- "**every**": one element of A outside B → not a subset
- a subset is a **set**, in brackets: $\{2\} \subseteq \{1, 2\}$; an element: $2 \in \{1, 2\}$
- read like $<$, $\leq$: $\subset$ strictly smaller; $\subseteq$ "or the same"
- $\{1, 2\} \subset \{1, 2, 3\}$; $\{1, 2, 3\} \subseteq \{3, 2, 1\}$
- equal sets: each is an improper subset of the other
- **common subsets** of two sets: made of the common elements only; $\{2, 4, 6\}$, $\{1, 2, 3\}$ → $\{\}$, $\{2\}$



A subset in a Venn diagram: $Y \subset X$, so Y's circle is drawn inside X's.

- every set: exactly **one** improper subset, itself
- **empty set** $\{\}$: a subset of every set; a proper subset of every set except itself
- why: it has no element that could fail
- some books write $\subset$ for every subset: in the exam say the kind in words too

Every subset, by size (for $\{a, b, c\}$):

1. none: $\{\}$
2. one: $\{a\}$, $\{b\}$, $\{c\}$
3. two: $\{a, b\}$, $\{a, c\}$, $\{b, c\}$
4. all: $\{a, b, c\}$ (improper)

SAARC's eight countries, every case:

Sets	Share	Relation
the two football groups	nothing	disjoint
first group, landlocked	Nepal, Bhutan	overlapping
landlocked, all SAARC	every landlocked one; U has more	$L \subset U$
"landlocked", "no coast"	everything	equal

- mammals $\subset$ vertebrates
- birds, mammals disjoint
- mammals, animals that fly overlapping (bats)
- an empty overlap: some sets **can't** share (even, odd); some only didn't, by who was counted

COMMON MISTAKES

✗ overlap left out when reading a set
✓ a set is its whole circle, the overlap too.

✗ elements outside the circles left out of U
✓ they are still in U.

✗ $\subset$, $\subseteq$, $\in$ mixed up
✓ proper, improper, an element.

✗ $\{\}$ forgotten when listing subsets, or counted as improper
✓ it is a proper subset.

✗ a kind of set with no reason
✓ name the common elements, or say there are none.

✗ equal sets called overlapping
✓ nothing different, so equal.