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SRI VIDYA ARADHANA ACADEMY
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PCMB — PHYSICS CHEMISTRY MATHEMATICS BIOLOGY
NEET/JEE

Topic: Sets

Mathematics **Assignment 02 • Subsets, Power Set & Intervals** Chetan Sir

"You don't have to be brilliant today, only a little better than you were yesterday."

$A \subseteq B$: every element of A is in B. **Proper subset** $A \subset B$: $A \subseteq B$ but $A \neq B$. $\varnothing$ is a subset of *every* set.
A set with n elements has $\boxed{2^n}$ **subsets**, $2^n - 1$ **proper subsets**, $2^n - 1$ **non-empty subsets**.
Power set $P(A)$ = set of all subsets of A, so $n\big(P(A)\big) = 2^n$ and $n\big(P(P(A))\big) = 2^{2^n}$. **Intervals:** (a,b) excludes ends, $[a,b]$ includes them.

SECTION A : ELEMENT ($\in$) vs SUBSET ($\subseteq$)

1. State true or false:
(i) $2 \in \{1,2,3\}$ (ii) $\{2\} \in \{1,2,3\}$
(iii) $\{2\} \subseteq \{1,2,3\}$ (iv) $\varnothing \subseteq \{1,2,3\}$
(v) $\varnothing \in \{1,2,3\}$ (vi) $\{1,2\} \subset \{1,2,3\}$

2. Let $A = \{1,2,\{3,4\},5\}$. State which are true:
(i) $\{3,4\} \subset A$ (ii) $\{\{3,4\}\} \subset A$ (iii) $1 \subset A$
(iv) $\{1,2,3\} \subset A$ (v) $1 \in A$ (vi) $\{1,2,5\} \subset A$ **[NCERT]**

3. For $A = \{1,2,\{3,4\},5\}$, state which are *incorrect*:
(i) $\{3,4\} \in A$ (ii) $\{1,2,5\} \in A$ (iii) $\varnothing \in A$
(iv) $\varnothing \subset A$ (v) $\{\varnothing\} \subset A$ **[NCERT]**

4. Fill each blank with $\subseteq$ or $\not\subseteq$:
(i) $\{3,4,5\}$ ___ $\{1,2,3,4,5\}$ (ii) $\{1,2,3\}$ ___ $\{2,3,4\}$
(iii) $\{x : x \text{ even natural}\}$ ___ $\mathbb{Z}$
(iv) $\{x : x \text{ a triangle}\}$ ___ $\{x : x \text{ a rectangle}\}$
(v) $\{x : x \text{ prime}\}$ ___ $\mathbb{N}$

SECTION B : SUBSETS & POWER SET

5. Write down all the subsets of $\{a,b,c\}$.

6. Write down all the *proper* subsets of $\{1,2,3\}$.

7. List all the subsets of the set $\{1,\{2\}\}$. **[NCERT]**

8. Write the power set $P(\{7,10,11\})$ and verify it has $2^3 = 8$ elements.

9. Find the universal set with the least number of elements for $A = \{x : x^2 - 5x + 6 = 0\}$ and $B = \{x : x^2 - 3x + 2 = 0\}$. **[NCERT]**

10. Which can be a universal set for $A = \{1,3,5\}$, $B = \{2,4,6\}$, $C = \{0,2,4,6,8\}$: (i) $\{0,1,\ldots,6\}$ (ii) $\varnothing$ (iii) $\{0,1,\ldots,10\}$ (iv) $\{1,2,\ldots,8\}$? **[NCERT]**

11. If $P(A) = P(B)$, what is the relation between A and B? **[NCERT]**

SECTION C : COUNTING SUBSETS (Integer Type)

12. The total number of subsets of a set containing 5 elements is _____ . **[NCERT]**

13. The number of proper subsets of $\{1,2,3\}$ is _____ . **[NCERT]**

14. The number of non-empty subsets of $\{1,2,3,4\}$ is _____ . **[NCERT]**

15. Two finite sets have m and n elements. The number of subsets of the first is 48 more than that of the second. Find m and n.

16. Find $n\{P(P(P(P(\varnothing))))\}$. **[NCERT]**

17. If a set A has exactly 128 subsets, the number of elements in A is _____ .

18. The number of subsets of $\{1,2,3,4,5\}$ that contain the element 3 is _____ .

SECTION D : INTERVALS

19. Write as intervals:
(i) $\{x \in \mathbb{R} : -3 < x < 5\}$ (ii) $\{x \in \mathbb{R} : 2 \le x \le 9\}$
(iii) $\{x \in \mathbb{R} : -7 < x \le 0\}$ (iv) $\{x \in \mathbb{R} : 4 \le x < 11\}$

20. Write in set-builder form:
(i) $(-3,0)$ (ii) $[6,12]$ (iii) $(6,12]$ (iv) $[-23,5)$ **[NCERT]**

21. Write the interval representing (i) all non-negative reals, (ii) all negative reals. **[NCERT]**

SECTION E : MULTIPLE CHOICE

22. The number of proper subsets of a set with n elements is
(A) 2^n (B) 2^n-1 (C) 2^n-2 (D) n^2

23. If $A=\varnothing$, then $P(A)$ is
(A) $\varnothing$ (B) $\{\varnothing\}$ (C) $\{0\}$ (D) $\{\varnothing,\{\varnothing\}\}$

24. $n\big(P(P(P(\varnothing)))\big)$ equals
(A) 2 (B) 4 (C) 8 (D) 16

25. If $X=\{8^n-7n-1 : n\in\mathbb{N}\}$ and $Y=\{49(n-1) : n\in\mathbb{N}\}$, then
(A) $X\subseteq Y$ (B) $Y\subseteq X$
(C) $X=Y$ (D) None of these

26. Which of the following is a subset of *every* set?
(A) $\{0\}$ (B) $\varnothing$
(C) $\{\varnothing\}$ (D) the universal set

ANSWER KEY

1. (i)T (ii)F (iii)T (iv)T (v)F (vi)T
2. (ii), (v), (vi) are true
3. (ii), (iii), (v) are incorrect
4. (i)$\subseteq$ (ii)$\not\subseteq$ (iii)$\subseteq$ (iv)$\not\subseteq$ (v)$\subseteq$
5. $\varnothing$, $\{a\}$, $\{b\}$, $\{c\}$, $\{a,b\}$, $\{a,c\}$, $\{b,c\}$, $\{a,b,c\}$
6. $\varnothing$, $\{1\}$, $\{2\}$, $\{3\}$, $\{1,2\}$, $\{1,3\}$, $\{2,3\}$
7. $\varnothing$, $\{1\}$, $\{\{2\}\}$, $\{1,\{2\}\}$
8. $\varnothing$, $\{7\}$, $\{10\}$, $\{11\}$, $\{7,10\}$, $\{7,11\}$, $\{10,11\}$, $\{7,10,11\}$
9. $\{1,2,3\}$
10. (iii)
11. $A=B$
12. 32
13. 7
14. 15
15. $m=6$, $n=4$
16. 16
17. 7
18. 16
19. (i)$(-3,5)$ (ii)$[2,9]$ (iii)$(-7,0]$ (iv)$[4,11)$
20. (i)$\{-3<x<0\}$ (ii)$\{6\le x\le 12\}$ (iii)$\{6<x\le 12\}$ (iv)$\{-23\le x<5\}$
21. (i)$[0,\infty)$ (ii)$(-\infty,0)$
22. B
23. B
24. B
25. A
26. B