Set Theory Questions and Answers

1. Define a set and give an example of a set that includes three different types of fruits.
   Answer: A set is a collection of distinct objects. Example: {apple, banana, cherry}.

2. If $S = \{a, e, i, o, u\}$, does the letter 'e' belong to set S? Represent your answer using the appropriate set notation.
   Answer: Yes, $e \in S$.

3. Is the set of all even numbers a finite or infinite set? Explain your reasoning.
   Answer: Infinite, because even numbers extend indefinitely.

4. Consider the sets $A = \{2, 4, 6, 8, 10\}$ and $B = \{4, 8\}$. Is set B a subset of set A? Justify your answer using the definition of a subset.
   Answer: Yes, $B \subseteq A$ as all elements of B are in A.

5. If the universal set U is the set of all single-digit numbers, and $A = \{1, 2, 3\}$, what is the complement of set A?
   Answer: $A' = \{4, 5, 6, 7, 8, 9\}$.

6. Write the set $\{1, 3, 5, 7, 9\}$ using set-builder notation.
   Answer: $\{x \mid x$ is an odd number less than 10$\}$.

7. Given two sets $A = \{1, 2, 3\}$ and $B = \{3, 4, 5\}$, find $A \cap B$ and $A \cup B$.
   Answer: $A \cap B = \{3\}$, $A \cup B = \{1, 2, 3, 4, 5\}$.

8. Give an example of a scenario where the empty set is the correct answer. Describe the scenario and represent the empty set using proper notation.
   Answer: The set of cats that are also dogs is an empty set, $\emptyset$.

9. Consider a set $X = \{15, 20, 25, 30\}$. Which elements of set X are divisible by 5? List them in set notation.

Answer: All elements, $X = \{15, 20, 25, 30\}$.

10. Are the sets $A = \{x \in \mathbb{N} : x$ is a prime number less than 10$\}$ and $B = \{2, 3, 5, 7\}$ equal? Explain your answer.
    Answer: Yes, both sets contain the same prime numbers less than 10.

11. A <u>set</u> is a well-defined collection of distinct objects, considered as an object in its own right. Each object in a set is called an <u>element</u>.

12. If $A = \{2, 4, 6, 8\}$, then 4 is an <u>element</u> of set A.

13. If every element of set B is also an element of set A, then B is a <u>subset</u> of A.

14. If set B is a subset of set A, and both sets have the exact same elements, then A and B are <u>equal</u>.

15. The universal set, often denoted as $\underline{U}$, contains every object under consideration, and every set in the context is a <u>subset</u> of the universal set.

16. The set $\{x \mid x$ is a positive integer less than 5$\}$ in set-builder notation is written as $\underline{\{1, 2, 3, 4\}}$.

17. The <u>empty</u> set, represented by $\emptyset$, is the set that contains no <u>elements</u>.

18. The notation $a \in A$ means that a is an <u>element</u> of set A.

19. A set with a countable number of elements is called a <u>finite</u> set, whereas a set with uncountable elements is called an <u>infinite</u> set.

20. In the set of all vowels $V = \{a, e, i, o, u\}$, the letter "e" is an <u>element</u>, and any consonant is not an <u>element</u> of set V.