## Warm Up

Ash Ketchum needs a team of 3 pokemon for his next gym battle. He must have one water, one fire, and one grass. He can choose from the following:


Water: Squirtle, Lapras, Totodile
Fire: Charmander, Cyndaquil ch Cy
Grass: Bulbasaur, Chikorita is ch


## Sample Spaces,

 Subsets and Basic Probability
## Sample Space

- Sample Space: The set of all possible outcomes of an experiment.
- List the sample space, S , for each of the following:
a. Tossing a coin

$$
\cdot \mathrm{S}=\{\mathrm{H}, \mathrm{~T}\}
$$

b. Rolling a six-sided die

- $S=\{1,2,3,4,5,6\}$
c. Drawing a marble from a bag that contains two red, three blue and one white marble
- $\mathrm{S}=\{$ red, blue, white $\}$


## Intersections and Unions of Sets

- The intersection of two sets ( $A \cap B$ ) is the set of all elements in both set A AND set B.
- The union of two sets $A \cup B$ is the set of all elements in set A OR set B (or both).
- Example: Given the following sets, find $A$ and $A$

$$
\begin{aligned}
& \mathrm{A}=\{1,3,5,7,9,11,13,15\} \quad \mathrm{B}=\{0,3,6,9,12,15\} \\
& \mathrm{A} \rightarrow \mathrm{~B}=\{3,9,15\} \\
& \mathrm{A} \text { त } \mathrm{B}=\{0,1,3,5,6,7,9,11,12,13,15\}
\end{aligned}
$$

## Venn Diagrams

- Sometimes drawing a diagram helps in finding intersections and unions of sets.
- A Venn Diagram is a visual representation of sets and their relationships to each other using overlapping circles. Each circle represents a different set.



## Use the Venn Diagram to answer

 the questions below: $7_{s}^{\prime}$
\{1,2,3,4,6,12\}
2. What are the elements of set B ?
\{1,2,4,8,16\}
3. Why are 1,2 , and 4 in both sets?

4. What is $A$ ?
$\{1,2,4\}$
5. What is A ?
\{1,2,3,4,6,8,12,16\}

In a class of 60 students, 21 sign up for chorus, 29 sign up for band, and 5 take both. 15 students in the class are not enrolled in either band or chorus
6. Put this information into a Venn Diagram. If the sample space, S , is the set of all students in the class, let students in chorus be set A and students in band be set B. 60
7. What is $A$ ? $B$ ? 8. What is $A$ ?



## $A$ or $B=\{45\}$

$A$ and $B=\{5\}$

## Compliment of a set

- The complement of a set is the set of all elements NOT in the set.
- The compliment of a set, $A$, is denoted as $A^{C}$ or $\mathrm{A}^{\prime}$
- Ex:

$$
S \stackrel{\text { ample Space }}{=}\{\ldots-3,-2,-1,0,1,2,3,4, \ldots\}
$$

$$
{ }^{\text {Subset }} A=\{\ldots-2,0,2,4, \ldots\}
$$

If $A$ is a subset of $S$, what is $A^{C}$ ?


$$
A^{C}=\{-3,-1,1,3, \ldots\}
$$


9. What is $A^{\prime}$ ? $\quad B^{C}$ ?
$\{39\} \quad\{31\}$
10. What is $(A)^{C}$ ?

60-5 55
60.45

## Basic Probability

- Probability of an event occurring is:


## $P(E)=\underline{\text { Number of Favorable Outcomes }}$

## Total Number of Outcomes

Your answer can be written as a fraction or a \%. (Remember to write it as a \%, you need to multiply the decimal by 100)

- We can use sample spaces, intersections, unions, and compllments of sets to help us find probabilities of events.
$>$ Note that $\mathbf{P}\left(\mathrm{A}^{\mathrm{C}}\right)$ is every outcome except (or not) A , so we can find $P\left(A^{C}\right)$ by finding $1-P(A)$

An experiment consists of tossing three coins.
12. List the sample space for the outcomes of the experiment. \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}
13. Find the following probabilities:
a. $\mathrm{P}($ all headst
$1 / 8$ or $12.5 \%$
b. P (two tails)
$3 / 8$ or $37.5 \%$
c. P (no heads)
$1 / 8$ or $12.5 \%$
Complenents
d. Pat least one tail)

7/8 or 87.5\%
How could you use compliments to find d?
The compliment of at least one tail is no tails, so you could do $1-P($ no tails $)=1-1 / 8=7 / 8$ or $87.5 \%$

A bag contains six red marbles, four blue marbles, two yellow marbles and 3 white marbles. One marble is drawn at random.
14. List the sample space for this experiment.
\{red, white, blue, yellow\}
15. Find the following probabilities:
a. P(red)

15 total 1
b. P (blue or white)
$7 / 15$ or $47 \% \quad 4 /+3 \quad 7 / 5$
c. P (not yellow) $13 / 15$ or $87 \%$

$$
15-2\left(\frac{13}{15}\right.
$$

Given the Venn Diagram below, find the probability of the following if a student was selected at random:
16.) $P($ blonde hair) $13 / 26$ or $1 / 2$ or 0.5 or $50 \%$

17.) $P(b l o n d e ~ h a i r ~ a n d ~ b l u e ~ e y e s) ~$ $8 / 26$ or $4 / 13$ or 0.308 or $30.8 \%$
18.) $\mathrm{P}($ blonde hair or blue eyes) $15 / 26$ or 0.577 or $57.7 \%$
19.) $P$ (not blue eyes)
$16 / 26$ or $8 / 13$ or 0.615 or $61.5 \%$

