PUNNETT SQUARE CHEAT SHEET

Below is a sampling of Punnett Square problems that you will be expected to solve. In order to do this, you will also have to understand the meaning of the terms below.

- **Genotype**: The letters that make up the individual. E.g. ***TT or Tt***
- **Phenotype**: The physical characteristics of the particular trait. E.g. ***Tall or short***
- **Dominant trait:** Signified by capital letter-E.g. ***T***. If the traits you are using are dominant or recessive, this trait will "overpower" the recessive trait and will be expressed. E.g. ***Tt***
- **Recessive trait:** Signified by small case letter-e.g. ***t***. An organism with a recessive allele for a particular form of a trait will have that form only when the dominant allele for the trait is not present
- **Homozygous:** Has same letters. E.g. ***TT*** or ***tt*** (same alleles for trait)
- **Heterozygous:** Has different letters. E.g. ***Tt*** (different alleles for trait)
- **Purebred trait:** Also known as true breeding. Individuals genotype is homozygous and will only make one type of gamete. E.g TT will always produces T, and T. tt will always produce t, and t.
- **Gamete**: sex cells. Represented by letter N (meaning they are haploid-contain half the chromosomes
- **P generation**: The parental generation (Usually the first one in a genetic cross)
- **F_1 generation**: The ***first*** generation of offspring from P generation (means first filial: Latin for "son")
- **F_2 generation**: The ***second*** generation of offspring from P generation (means first filial: Latin for "son")
- **Monohybrid Cross**: Also known as a Single-Factor Cross. Only one trait is used in the genetic cross. E.g. T=Tall, t=short. Example: Tt x Tt
- **Dihybrid Cross**: Also known as a Two-factor Cross. Two trait are used in the genetic cross. E.g. T=Tall, t=short & B=Black fur, b=white fur. Example TtBb x TTBB
- **Incomplete Dominance**: One allele is not completely dominant over the other. There is a blending with the heterozygous offspring. E.g. RR=Red, Rr=Pink, and rr=white
- **Co-dominance**: Both alleles contribute to the phenotype. Offspring will have combination of two alleles. E.g. RR=Red hair, Rr=Roan (mix of red and white hairs-almost looks pink), and rr=white
- **Sex-linked trait**: Genes located on the sex-chromosomes called ***sex-linked genes***. Usually found on the ***X chromosome***. X-linked alleles are always expressed in males because males have only one X chromosome.
- **Multiple Alleles**: There are more than two-choices for the allele. Example is human blood group genes. There are three possible alleles for this gene. ***I^A, I^B, and i.*** ***I^A*** and ***I^B*** are ***co-dominant.*** There are four possible phenotypes: ***A, B, AB, and O.***
- **Genotypic ratios**: The ratio of different genotype in the offspring from a genetic cross. E.g 1:2:1
- **Phenotypic ratios**: The ratio of different phenotypes in the offspring from a genetic cross. E.g 3:1

Dominant and Recessive
(T = Tall & t = short
Cross: Tt x Tt

	T	t
T	TT	Tt
t	Tt	tt

Genotypic ratio: 1 : 2 : 1 (TT=25% Tt=50% tt=25%)
Phenotypic ratio: 3 : 1 (Tall=75% Short=25%)

Incomplete Dominance
(TT = Tall & Tt = Medium & tt = short
Cross: Tt x Tt

	T	t
T	TT	Tt
t	Tt	tt

Genotypic ratio: 1 : 2 : 1 (TT=25% Tt=50% tt=25%)
Phenotypic ratio: 1 : 2 : 1 (Tall=25% Medium=50% Short=25%)

co dominance
(BB = Black & BW = tan & WW = white
Cross: BW x BW

	B	W
B	BB	BW
W	BW	WW

Genotypic ratio: 1 : 2 : 1 (BB=25% BW=50% WW=25%)

Phenotypic ratio: 1 : 2 : 1 (White=25% Tan=50% Black=25%)

Sex-linked
H = normal & h = hemophilia
Cross: XX^h x X^hY

	X	X^h
X^h	X^hX	X^hX^h
Y	XY	X^hY

Genotypic ratio: 1:1:1:1
(X^hX =25% X^hX^h=25% XY=25% X^hY=25%)

Phenotypic ratio: 1:1:1:1
Female carrier =25% Female hemophilia =25%
Male normal =25% Male hemophilia =25%

Multiple Alleles
Cross: AB x AO

Blood Type	
Phenotype	Genotype
Type A	AA and AO
Type B	BB and BO
Type AB	AB
Type O	00

	A	B
A	AA	AB
O	AO	BO

Genotypic ratio: 1:1:1:1
(AA =25% AB=25% AO=25% BO=25%)

Phenotypic ratio: 1:1:1:1
(Type A =50% Type AB =25% Type B =25%

Dihybrid Cross
Dominant and Recessive
T=Tall, t=short
B=Black, b=white
Cross: TtBb x TtBb

	TB	Tb	tB	tb
TB	TTBB	TTBb	TtBB	TtBb
Tb	TTBb	TTbb	TtBb	Ttbb
tB	TtBB	TtBb	ttBB	ttBb
tb	TtBb	Ttbb	ttBb	ttbb

Genotypic ratio: 1:2:2:1:4:1:2:2:1

Phenotypic ratio: 9:3:3:1

Dihybrid Cross
Dom.-Rec. / Sex-linked
T=Tall, t=short
H=Normal, h=hemophilia
Cross: homozygous Tall female carrier w/ short male
Cross: X^hXTT x XYtt

	X^hT	X^hT	XT	XT
Xt	X^hXTt	X^hXTt	XXTt	XXTt
Xt	X^hXTt	X^hXTt	XXTt	XXTt
Yt	X^hYTt	X^hYTt	XYTt	XYTt
Yt	X^hYTt	X^hYTt	XYTt	XYTt

Genotypic ratio: 4:4:4:4 or 1:1:1:1

Phenotypic ratio: 4:4:4:4 or 1:1:1:1