Genetics Review

Terms:

The main terms have been identified in the online quiz. Here is a good list.

1. Gene (both definitions)
2. Locus
3. Allele
4. Heterozygous
5. Homozygous
6. Genotype
7. Phenotype
8. Dominant
9. Recessive
10. incomplete dominance
11. Pleiotropic
12. Multi-gene trait
13. epistatic/epistasis
14. true-breeding (see 5)
15. trisomy

Crosses

Data will be similar to those seen in VGL (but maybe not identical). Questions like the online quiz in which you need to do a Punnet square to answer a multiple choice will be there. You should be able recognize in a cross whether a trait is dominant, recessive or shows incomplete dominance. You should also recognize sex-linked. To do this, you should know the sorts of ratios expected for a cross (1:2:1 for genotype, 3:1 for phenotype if simple dominance; 1:2:1 for both genotype *and* phenotype if incomplete dominance). Examples:

Incomplete dominance:

True-breeding Red flower by true-breeding white flower gives all pink flowers in the F1. F1 cross depicted below:

	R	**W**
R	RR	RW
W	RW	WW

The RR is red, ww is white, RW is pink (1:2:1)
Neither allele is dominant
Reds and whites are each always true-breeding
Pinks give 1:2:1 when bred to each other
Red by pink gives 50% each RR (red) and RW (pink)
Same for white by pink.

If, say, red were dominant, ¾ of the flowers would be red.

X-linked:

The small sex chromosome *does not* have the same genes as the large. So, our "Y" chromosome will not have alleles that can cover up mutant recessive alleles. Since males only have one X (or females only have one "W" in birds), Recessive traits are seen far more often in the "heterogametic" sex (XY in humans). Also, for sex-linked traits, it matters whether the mother or father has the trait in question. Males get there lone X from their mother.

white male X red female	**X^w**	**Y**
X^r	**X^rX^w**	**X^rY**
X^r	**X^rX^w**	**X^rY**

Consider white-eyed male by red-eyed female fly:
The F1 looks normal, with white-eyes being recessive.
If I had done it with a white-eyed female and a red-eyed male, I would get:

Red male X white female	**X^r**	**Y**
X^w	**X^rX^w**	**X^wY**
X^w	**X^rX^w**	**X^wY**

All the males are white-eyed.
All the females are red-eyed heterozygotes.
You might want to practice filling out the squares for the expected F1 cross for each of these cages (X^rX^w by X^rY and X^rX^w by X^wY).

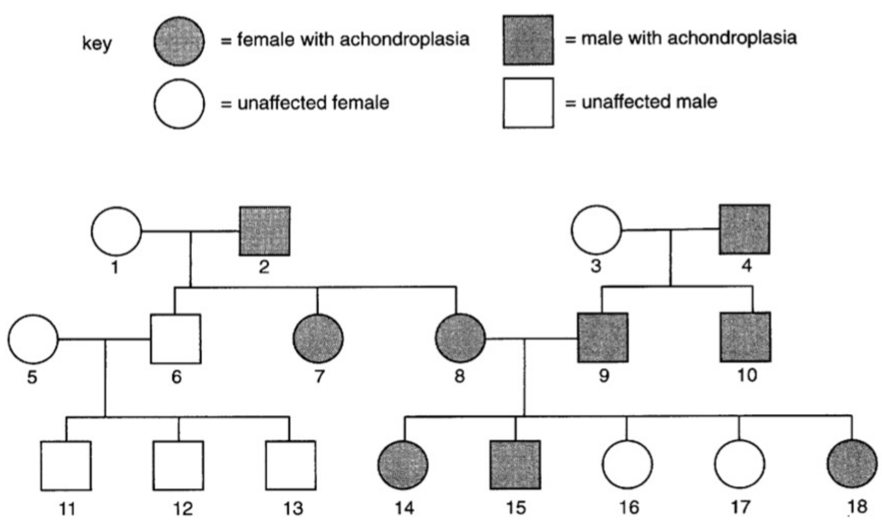
Dihybrid:

You should be able to recognize the patterns expected for both a dihybrid (9:3:3:1) and test cross (1:1:1:1) and perform a chi-square to assess if there is likely linkage (test the null hypothesis that any deviation is random fluctuation). Equations will be provided. The blog has examples of these.

DON'T BE SHOCKED if a cross combines components of these (eg, a sex link in a dihybrid cross).

Pedigree:

They will be simple. The key thing to look for is any parents that have one trait ("A") and have offspring with the other trait ("B"). B is therefore recessive since it was covered up in the parents. It doesn't matter whether "A" or "B" were considered the mutant trait (or "affected").Below is a pedigree for achondroplasia (a form of dwarfism). Look at individuals 8



and 9. They are both dwarfs and have unaffected offspring (16 and 17). Thus, this form of dwarfism is dominant and individuals 8&9 are heterozygous.
For X-linked, you see a recessive show up far more in males, as before. But, you never see passage from father to son, as you would for a very rare Y-linked.

Karyotype:

Again, simple. Look for trisomy (three copies of one chromosome). Look for whether the individual is XY or XX. The chromosomes will be aligned for you, if there is a karyotype.

Hardy-Weinberg.

(I looked it up, it is an "e" in Weinberg).
Just be able to use the equation to determine if a trait is in equilibrium or not and, perhaps more importantly, understand what it means if the allelic frequencies are in equilibrium. That is, there is no *net* selection. If they are not in equilibrium, there is likely some selective pressure on the trait. Terms from this section include:

Founder effect	Allelic Frequency	Gene flow