Genetics Extra Practice

Part I: Fill in each blank with the most appropriate answer. Some words may be used more than once.

1. A person's blood type is determined by multiple alleles (since there are more than two alleles).
   - The I^A allele and the I^B allele must be codominant, since both are expressed at the same time.
   - The i allele is recessive.
2. O⁻ is considered the universal donor because it can donate blood to all blood types.
3. AB⁺ is considered the universal recipient because it can receive all blood types.
4. The genotypes for blood type A can be written I^AI^A or I^Ai.
5. The genotypes for blood type B can be written I^BI^B I^Bi.
6. The genotype for blood type AB can be written I^AI^B.
7. The genotype for blood type O can be written ii.
8. Sickle cell anemia is caused by two different alleles that are codominant, since both are expressed at the same time when heterozygous.
9. The effects of the dominant and recessive allele blend or form an intermediate form of the phenotype in incomplete dominance.
10. Hair color, eye color and skin tone are all polygenic traits because they are each controlled by several genes.
11. With complete dominance of a single trait there should be 2 (a number) different phenotypes whereas in incomplete dominance there will be 3 (a number) different phenotypes.

[redacted]

13. A sex-linked trait is found on either the X or the Y chromosome, but never both.
14. A chart of a family record that shows how a trait is inherited over several generations is called a pedigree.
15. An X-linked recessive disorder is more likely to appear in males since they only inherit one recessive allele, where as a female must inherit two recessive alleles.

Incomplete Dominance

1. Oompah Loompas can have red, blue or purple hair. Purple hair results from the heterozygous condition. Show the genotypes and corresponding phenotypes for hair color. Is this an example of codominance or incomplete dominance?

Genotypes	Phenotypes
RR	→ red
BB	→ blue
RB	→ purple

2. Orville Oompah has purple hair and is married to Opal Oompah who brags that she has the bluest hair in the valley. How many of Opal's children will be able to brag about their blue hair also?

	R	B
B	RB	BB
B	RB	BB

50%.

3. In orchids, red flower color (C^R) is incompletely dominant to white (C^W). Heterozygous flowers (C^RC^W) are pink. Wild Bill, the rogue botanist, has one pink flower (C^RC^W) and some white flowers (C^WC^W) in his greenhouse. He wants to get a pure strain of red orchids. Unfortunately the red orchids (C^RC^R) are found only in the wild rain forest where it is illegal to collect them. How could Wild Bill get a pure strain of red orchids without breaking the law? (Make sure to show your Punnett Squares.)

Option 1: allow pink flower to self-pollinate

	C^R	C^W
C^R	C^RC^R	C^RC^W
C^W	C^RC^W	C^WC^W

1/4 of offspring will be red

once 2 reds are produced Bill should cross-pollinate these plants to produce pure red orchids

Codominance

1. List the possible genotypes for the following blood types:

Genotypes	Phenotypes
I^Ai I^AI^A	A
I^Bi I^BI^B	B
I^AI^B	AB
ii	O

2. What combination of alleles represents codominance?
   AB blood → I^AI^B. Both traits physically appear
3. Could two individuals with type A ever produce an offspring with type O blood? Explain your answer completely.
   Yes! I^Ai × I^Ai 25% of offspring will be ii → type O
4. A wealthy elderly couple die together in an accident. Soon a man shows up to claim their fortune, saying that he is their only son who ran away from home as a boy. Other relatives dispute his claim. Hospital records show that the deceased couple were type AB and O. The claimant to the fortune is type O. Could he be their son? Explain your answer completely.
   No! 2 recessive "i" alleles are needed for offspring to have type O blood → parent w/ type AB (I^AI^B) cannot pass on the recessive "i"

Sex-linked Traits

Sample Problem:

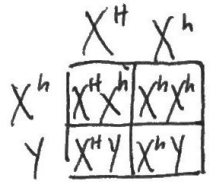
Hemophilia is a recessive sex-linked disorder. A man (XY) with hemophilia marries a homozygous woman with normal blood. Predict the potential genotypes and phenotypes of their offspring.

Step 1: Determine the genotypes of the parents

Father: X^hY Mother: X^HX^H

Step 2: Set up a Punnett square

	X^H	X^H
X^h	X^HX^h	X^HX^h
Y	X^HY	X^HY



Problems – Show all work!!!!!!

1. A woman who is heterozygous for hemophilia marries a normal man. What will be the possible phenotypic ratio of their children?

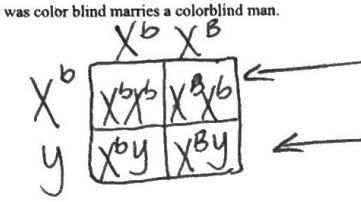
2 (hemophiliac) : 2 (no expression)

2. colorblindness is a recessive sex-linked trait. A normal sighted woman whose father was color blind marries a colorblind man.
   a. What is the probability that they will have a son who is color blind?

50%.

   b. What is the probability that they will have a color blind daughter?

50%.

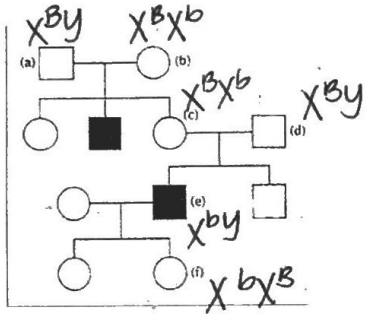


of 2 genotypes for girl offspring
1/2 is colorblind

of 2 genotypes for boy offspring
1/2 is colorblind

Pedigrees

1. In the pedigree to the right:
   a. is the trait dominant or recessive?
   b. is it a sex-linked trait? yes!
   c. What are the genotypes of the labeled individuals (a-f)
      a. d.
      b. e.
      c. f.



2. In the pedigree to the right:
   a. is the trait dominant or recessive?
   b. is it a sex-linked trait? no!
   c. What are the genotypes of the labeled individuals (a-e)
      a. d.
      b. e.
      c.