Practice with Sex Linkage and Other Cool Stuff - Solutions

1. a) all red eyed, half male
b) 1/4 red eyed female, 1/4 white eyed female, 1/4 red eyed male, 1/4 white eyed male
c) half female, all red eyed; half male, all white eyed.
d) half females are carriers; half males are white-eyed

2. a) P X^HX^h x X^Hy
F_1 X^hy
b) no because father is normal so cannot donate X^h

3. a) P X^NX^n x X^ny
F_1 X^nX^n, X^ny, X^NX^n, X^Ny

b) X^NX^N individual would have to receive X^N from father who would be dead
c) unlikely that X^N would live long enough to breed, also heterozygous individuals would be less common in nature.

4. B – black, b - brown; X^{v+} - red, X^v - vermillion
a) P $b+b+X^{v+}X^{v+}$ (wild type female) x bbX^vy (brown-bodied, vermillion-eyed male)
F_1 $b+bX^{v+}X^v$, $b+bX^{v+}y$ - all wild type
b) P $b+bX^{v+}X^v$ (wild-type female) x $b+bX^{v+}y$ (wild-type male)
F_1 $b+b+X^{v+}X^{v+}$, $b+b+X^{v+}y$, $b+bX^{v+}X^{v+}$, $b+bX^{v+}y$, $b+b+X^{v+}X^v$, $b+b+X^vy$, $b+bX^{v+}X^v$, $b+bX^vy$, $b+bX^{v+}X^{v+}$, $b+bX^{v+}y$, $bbX^{v+}X^{v+}$, $bbX^{v+}y$, $b+bX^{v+}X^v$, $b+bX^vy$, $bbX^{v+}X^v$, bbX^vy
- 9 wild type:3 black body, vermilion eyes:3 brown body, red eyes:1 brown body, vermillion eyes
c) P $bbX^{v+}X^{v+}$ (brown-eyed female) x $b+bX^vy$ (vermilion-eyed male)
F_1 $b+bX^{v+}X^v$, $b+bX^{v+}y$, $bbX^{v+}X^v$, $bbX^{v+}y$ - 2 wild type:2 brown body, red eyes

5. a) 0 - Jake always gives the normal allele
b) $P(X^hy) = 1/2 \times 1/2 = 1/4$
c) 1/2 - Lauren gives the mutant allele half the time
d) P(4 X^hy sons) = 1/2 x 1/2 x 1/2 x 1/2 = 1/16
e) Assuming her mother is normal and not a carrier, she would inherit the X^h allele from her father all the time, making her a carrier.
f) 1/2 chance of being a carrier; 1/2 chance of having hemophilia. She must inherit the X^h from her father so she could not be free of the allele.

6. 1/4 to have a color blind daughter. 1/2 that first son will be color blind. Notice that we are told the child is a son so we do not have to consider the probability of that happening.

7. a) 1/4 (b) 1/2 (c) 1/4 (d) 2

8. a) P X^BX^B x X^Oy
F_1 X^BX^O, X^By - calico females and black males
b) P X^BX^O x X^Oy
F_1 X^BX^O, X^OX^O, X^By, X^Oy - calico females, orange females, black males, orange males
c) P X^BX^O x XBy
F_1 X^BX^B, X^By, X^OX^B, X^Oy - ¼ calico females
d) Cross as above. No calico males unless nondisjunction occurs resulting in Klinefleter syndrome.

9. P $X^{Col}y$ x $X^{Col}X^{?}$

F1 Daughter is $X^{col}X^{col}$ so a recessive allele must have been donated by each parent. The mother must be heterozygous. The man cannot be the father of the child.