

Learning Genetics Can Be Fun - Solutions

1. a) tG (b) TG, tG (c) TG, Tg, tG, tg (d) TG, Tg
2. a) genotype (b) gamete (c) genotype (d) gamete
3. Two black dogs could be homozygous black (BB) or heterozygous black (Bb). Yellow must be homozygous, therefore cannot be the same genotype as black.
4. P Cc x Cc Both parents are normal but carry the allele for CF.
 F₁ CC, Cc, Cc, cc One in four children will inherit it.
5. a) P Rr x rr
 b) R, r and r, r
 c) F₁ Rr, Rr, rr, rr 1 round:1 wrinkled
 d) F₂ RR, Rr, Rr, rr 3 round:1 wrinkled
6. P Ll x ll
 F₁ Ll, Ll, ll, ll 1 long:1 short
7. P T₋ x tt - almost 1:1 therefore unknown parent must be heterozygous.
 F₁ 327 tall: 321 short Note: homozygous (TT) would give ALL tall plants in F₁.
8. The presence of all smooth in the offspring means smooth is dominant.
 P SS x ss
 F₁ Ss
 F₂ 3:1
9. a) P Ss x Ss
 F₁ SS, Ss, Ss, ss
 b) P S₋ x
- The female must be heterozygous as she produced non-spotted pups. The unknown male must be homozygous recessive (ss). If he were homozygous dominant, all pups would be spotted. If he were heterozygous, you would expect a 3:1 ratio in pups.
10. (i) P T₋ x tt The male must be heterozygous (Tt) to be able to produce
 F₁ tt both trotters and pacers. If he were homozygous dominant
 (ii) P T₋ x tt he would produce only trotters.
 F₁ Tt
 (iii) P T₋ x Tt
 F₁ tt
11. Normal woman Pp (must be heterozygous because father was albino)
 Husband pp
 Husband's parents both Pp
 Children Pp, Pp, pp
12. Perform a test cross. W₋ x ww

13. a) P ggFf x G_Ff
F₁ Ggff

b) We would need a mermaid to be born with blue hair. This would tell us that the mother is heterozygous.

14. B - black; b - white; S - short; s - long

a) P BBSs x bbss
F₁ BbSs, Bbss 1 black, short:1 black, long

b) P BbSs x bbss
F₁ BbSs, Bbss, bbSs, bbss 1 black, short:1 black, long: 1 white, short:1 white, long

c) P BBss x BbSs
F₁ BBSs, BBss, BbSs, Bbss 1 black, short:1 black, long

d) i) (a) 1/2 (b) 1/4 (c) 1/2
ii) (a) 1/2 (b) 1/4 (c) 1/2
iii) (a) 0 (b) 1/4 (c) 0

15. B - black; b - white; S - solid; s- spotted

male female
a) P B_S_ x bbS_
F₁ 2 BbS_ , 2 bbS_

Some white pups so the male must be Bb. The absence of any non-spotted pups suggests that female A is SS but we can't say for sure.

b) P BbSs x B_S_
F₁ bbss the presence of white, non-spotted pups means that female B must be BbSs

c) BbSs x bbss
F₁ bbSs, bbss, BbSs, Bbss
The genotype of female C can be determined from her phenotype.

16. P Pp x Pp
F₁ PP, Pp, Pp, pp chance of PKU is 1/4

17. P Bb x Bb
F₁ BB, Bb, Bb, bb

a) 1/4 (b) 1/4 (c) 1/2

d) 1 homozygous brown:2 heterozygous brown:1 homozygous blonde. Phenotype: 3 brown:1 blonde

e) not possible because blonde (b) is recessive

f) P Cc x cc

F₁ Cc, cc 1/2 of offspring will have curly hair.

g) 1/2

h) No. Straight is recessive.

18. Parents are AaBbCC x AabbCc
P (AAbbCc) = P(AA) x P(bb) x P(Cc)
P(AA) = 1/4

$$P(bb) = 1/2$$

$$P(Cc) = 1/2$$

$$P(AAbbCc) = 1/4 \times 1/2 \times 1/2 = 1/16$$

19. S^R - round; S^L - long

$$P S^R S^R \times S^L S^L$$

$$F_1 S^R S^L, S^R S^L, S^R S^L, S^R S^L$$

$$P S^R S^L \times S^R S^L$$

$$F_2 S^R S^R, S^R S^L, S^R S^L, S^L S^L \quad (\text{incomplete dominance})$$

20. $P Aa \times Aa$

$F_1 AA, Aa, Aa, aa$ - 1/4 unaffected, 1/2 affected with sickle cell trait, 1/4 affected with sickle cell disease

21. $C^R C^R$ - chestnut; $C^M C^M$ - cremello; $C^M C^R$ - palomino

$$P C^M C^R \times C^M C^M$$

$$F_1 C^M C^M, C^R C^M \quad 1 \text{ cremello}:1 \text{ palomino}$$

22. $P F^R F^W \times F^R F^W$

$$F_1 F^R F^R, F^R F^W, F^R F^W, F^W F^W$$

a) 2 pink

b) 1/4 red

c) 1/4 white

d) 1:2:1

23. woman $I^B _$ x man $I^A _$

$F_1 ii$ is possible if mother and father were both heterozygous. The facts are inconclusive.

16. $P S^N S^M \times S^N S^M$

$F_1 S^N S^N, S^N S^M, S^N S^M, S^M S^M$ 25% chance of having homozygous recessive child

24. $P ii \times I^A I^B$

$$F_1 I^A i, I^B i$$

AB & could produce AB offspring if % were type A, B, or AB; she could never produce type O in F_1 because she always donates either A or B.

25. Parents 1

$$I^A _ \times I^B _$$

F_1 only parents capable of producing type AB (Baby 3)

Parents 2

$$ii \times ii$$

F_1 only type O (Baby 4)

Parents 3

$$I^A I^B \times ii$$

F_1 these parents can produce babies of type A or B but only one baby remains (Baby 1)

Parents 4

$I^B_ \times I^B_$

F₁ these parents cannot produce a type A baby (Baby 2)

26. a) P $C^hC^a \times C^aC^a$
F₁ C^hC^a, C^aC^a 1 himalayan:1 albino
- b) P $CC^a \times C^hC^a$
F₁ $2 C_ , C^h_ , C^aC^a$
- c) P $C^hC^h \times C^hC^a$
F₁ C^hC^h, C^hC^a 1 chinchilla:1 light gray
- d) P $C^hC^h \times C^aC^a$ test cross
F₁ $5 C^hC^a, 5 C^hC^a$

27. a) 4 children
b) A is Dd, B is Dd
c) M is dd, N is dd

28.

