2.1.3 Review Questions

P^Y: yellow P^R: red.

1. For a particular plant, a cross between a purebred variety with blue flowers and a purebred variety with white flowers results in a plant with light-blue flowers. The cross is written as:
   BB (blue) × bb (white) → Bb (light blue)
   a) What kind of dominance is suggested by this result? Explain why.

Incomplete dominance: the heterozygote phenotype is inbetween that of the homozygotes.

b) Draw a Punnett square for a cross between two plants with light-blue flowers. Show both the genotype and the phenotype of the offspring in each box.

♀Bb × ♂Bb

	B	b
B	BB blue	Bb l. blue
b	Bb l. blue	bb white

2. If 120 flowers are produced in the F_2 generation from the cross in question 1,
   a) predict how many flowers will have the genotypes:
   - BB 30
   - Bb 60
   - bb 30

   b) predict how many will have the phenotypes:
   - blue 30
   - light blue 60
   - white 30

3. a) An imaginary flowering plant with orange petals is crossed with another plant with the same phenotype. The offspring consist of 10 plants with orange petals, 5 plants with red petals, and 5 plants with yellow petals. Suggest an explanation for this pattern of inheritance.

orange-petal plant is heterozygote P^YP^R, and colour is incompletely dominant.

	P^Y	P^R
P^Y	P^YP^Y yellow	P^YP^R orange
P^R	P^YP^R orange	P^RP^R red

→ $1P^YP^Y : 2P^YP^R : 1P^RP^R$

1 yellow : 2 orange : 1 red

   b) A plant with an orange flower is crossed with a plant with a red flower. If 60 offspring are produced, how many plants of each phenotype (red, orange, and yellow) are likely to be produced?
   - red 30
   - orange 30
   - yellow 0

	P^Y	P^R
P^R	P^YP^R orange	P^RP^R red
P^R	P^YP^R orange	P^RP^R red

4. Three common alleles in human blood types are A, B, and o. The o allele is recessive to both the A and the B alleles. Allele A makes a protein that produces molecule A, which attaches to the red blood cell's membrane. Allele B works the same way, resulting in molecule B attaching to the cell's membrane. The o allele does not code for a protein, and no molecule attaches to the membrane for this allele. Match each genotype with the appropriate blood type: Type A, Type O, Type B, or Type AB. Record your answers on the lines provided.

Genotype	
a) oo	Type O
b) AA	Type A
c) Bo	Type B
d) Ao	Type A
e) BB	Type B
f) AB	Type AB

5. Draw a Punnett square showing a cross between a father with genotype Ao and a mother with genotype AB.

	A	o
A	AA	Ao
B	AB	Bo

genotypic ratio:
1AA : 1Ao : 1AB : 1Bo

phenotypic ratio:
2 Type A : 1 Type AB : 1 TypeB

a) What is the probability that the child will have blood Type A? 50%

b) What is the probability that the child will be homozygous Type A? 25%

6. A mother has Type A blood and her daughter has Type B blood. Is it possible that the father has Type O blood? Explain your answer.

No, not possible.
If mother is Type A & daughter is Type B, mother cannot be homozygous. Genotype must be "Ao".
Daughter must have gotten "o" allele from mother; must be Bo genotype; must have gotten "B" allele from father.
If father has a copy of "B" allele, he must be either Type B or Type AB. He cannot be Type O.

7. A mother has Type A blood and the father has Type B blood. Is it possible for their son to have Type O blood? Explain your answer.

Yes. Mother could be "Ao" or "AA" genotype.
Father could be "Bo" or "BB" genotype.

Suppose they are "Ao" & "Bo" respectively.
Then...

	B	o
A	AB	Ao
o	Bo	oo

genotypic ratio:
1AB : 1Ao : 1Bo : 1oo

phenotypic ratio:
1 TypeAB : 1 TypeA : 1 Type B : 1 Type O.

In this cross, there is a 25% chance of Type O in their son.

8. The inheritance of eye colour in fruit flies is sex linked.

♀ = female ♂ = male
X^R = red eye (dominant)
X^r = white eye (recessive)

a) Use the symbols above to draw a Punnett square showing the outcome of a mating of a female with one allele for red eyes and one allele for white eyes with a white-eyed male.

♀ X^RX^r × ♂ X^rY

	X^r	Y
X^R	X^RX^r red ♀	X^RY red ♂
X^r	X^rX^r wht ♀	X^rY wht ♂

b) What percentage of the offspring will have:
- white eyes? 50%
- red eyes? 50%

c) Are the red-eyed male offspring able to pass the white-eyed trait on to the next generation? Explain your answer.

No, they are not. They do not have a copy of the white-eye allele.

d) Are the red-eyed female offspring able to pass the white-eyed trait on to the next generation? Explain your answer.

Yes. They are heterozygous, with one of each of the red-eye and white-eye alleles. This means that although their phenotypes are red-eyed, they are carriers of the white-eye allele and can pass it on.