

Genetics Concept Questions

1. Serendipity played a big part in Mendel's choice of the garden pea. Explain. (They were available to him and are easy to grow. They are large and easy to see and had traits that showed simple inheritance)
2. Explain how the dominant phenotype can have more than one genotype. (A dominant phenotype would result if a person were heterozygous or homozygous dominant.)
3. A mother has two alleles for a given trait. How many does she give to an offspring? What principle of genetics describes this? (She gives only 1 because alleles are separated according to the law of segregation.)
4. Plants grown by vegetative propagation (*i.e.*, by cuttings) have exactly the same traits as the parent plants. Plants grown from seeds may vary from the parent plants in many ways. Explain. (Vegetative propagation is asexual.)
5. What principle of genetics states that the inheritance of one characteristic does not affect the inheritance of another? (independent assortment)
6. Does the height of a pea plant affect the color of its flowers? Why or why not? (The law of independent assortment states that traits are inherited separately unless they are on the same chromosome.)
7. Is it possible to be heterozygous for a trait and show the recessive phenotype? Explain. (No. The dominant allele results in the dominant phenotype.)
8. Of all the chromosomes in one of your cells, half came from each of your parents. About what fraction came from each of your grandparents? (1/4) Your great-grandparents? (1/8)
9. In a monohybrid cross between homozygous dominant and homozygous recessive parents, there are 32 offspring in the F₂ generation. How many of the offspring would you expect to show the recessive trait? (8)
10. What is a test cross? Why does one use it? Explain the two possible outcomes and what it tells you. (A cross between an unknown genotype and a homozygous recessive is called a test cross and it reveals the genotype of the unknown individual.)
11. In sheep, white coat is dominant. Black is recessive. Occasionally, a black sheep appears in a flock. Black wool is worthless. How could a farmer eliminate the genes for black coat from the flock? (The farmer should eliminate from the flock both parents and all offspring whenever a black sheep appears.)
12. In a certain animal, one variety always has a hairy tail while another always has a naked tail. How would you determine which trait is dominant? (Cross the two breeds. Most of the offspring will show the dominant trait)
13. A couple has three sons and one daughter. What is the probability that a fifth child will be female? Explain your answer. (1/2; these are independent events)
14. Explain why probability is a useful genetic tool. (It can be used to predict the outcome of crosses and to give advice to parents.)
15. Explain why a large sample is more statistically reliable than a small sample? (Irregularities are not as significant in a large sample.)
16. A roan calf's parents were a white cow and a red bull. What is the roan's genotype? Can two roans mate and produce all roans? Explain. (The roan is heterozygous. Two roan parents can produce all roan offspring if they produced all heterozygous offspring.)
17. A flower grower is looking for new varieties of petunias. He crosses a yellow flower plant with a blue one and gets green flowered plants. Explain how this is possible. (incomplete dominance)
18. What makes the inheritance of human ABO blood groups interesting? (It is an example of multiple alleles, codominance, and simple dominance.)
19. Mary has blood type A and she marries John, whose blood type is B. They have three children: Joan, James and Pete. Joan has blood type O, James has blood type A, and Pete has blood type B. Explain how this is possible. (Mary and John are both heterozygous.)

20. If a man who has type O blood marries a woman who is heterozygous for type B blood, what is the probability of them having a child with B type blood? ($\frac{1}{2}$) Type O blood? ($\frac{1}{2}$)
21. Mr. and Mrs. Doe had a child named Flo at the same time Mr. and Mrs. Roe had their son Joe. The Roes took Joe home, and after looking at him they claimed that Joe was not their child. They were going to sue the Hospital for the mix up. The Hospital took the blood types of all six individuals to try and prove there was no mix up. The results of the tests were as follows: Mr. Roe had A blood type; Mrs. Roe had A blood type; Joe had O blood type; Mr. Doe had O blood type; Mrs. Doe had AB blood type and Flo had A blood type. Was there a mix up? Explain. (Mrs. Doe could not have a child with type O blood because she must always donate either A or B.)
22. What are polygenic traits? Give an example of a trait controlled by polygenic inheritance. (They are controlled by more than one gene. Examples include eye color, skin color, and height.)
23. Why are there more males with sex-linked genetic disorders than females? (Males have only one X chromosome so if they have a recessive allele they will show the phenotype.)
24. Huntington's chorea is a dominant neurological disorder that usually appears when a person is between 35 and 45 years of age. Many people with Huntington's chorea, however, do not show symptoms until they are well into their sixties. How does the slow development of the disease explain why it has not been eliminated by natural selection. (If the disease does not affect you until after you have reproduced then it is too late - it has already been passed to offspring.)
25. Explain the significance of identifying the alleles which cause genetic disorders. (This allows us to study the gene/allele for treatment or prevention and to provide predictions and counseling to couples who may carry it.)
26. In most cultures, it is unacceptable to marry your immediate relatives. Using the principles of genetics, explain why inbreeding in humans is discouraged. (The presence of recessive alleles in heterozygous individuals is masked by the presence of dominant alleles. In matings between close relatives (who may carry the same recessive alleles) the chance of producing homozygous recessive offspring increases.)
27. What does it mean if we say genes are linked? Which law of inheritance do linked genes violate? (It means they are inherited together. This seems to defy the law of independent assortment.)
28. How are crossover frequencies used to make chromosome maps. (The cross over frequency is directly proportional to the distance between genes. By observing the frequency of crossing over we can estimate the distance between genes.)
29. What causes incomplete linkage? (During crossing over, pieces of chromosomes switch places meaning alleles can be separated.)
30. In humans, which parent determines the sex of the offspring? Explain. (The male because the female can only donate X.)
31. While examining a population of fruit flies, you notice that a certain trait never appears in males. How can you account for this? (It is sex-linked with the recessive allele being lethal.)