

## Heredity, Genetics and Cloning Review

1. An organism's physical appearance is its  
A) Genotype       B) Phenotype      C) Codominance      D) Hetrozygous
2. When sex cells combine to produce offspring, each sex cell will contribute  
 A) one fourth of the normal number of chromosomes  
B) half the normal number of chromosomes.  
C) the normal number of chromosomes  
D) twice the normal number of chromosomes.
3. Sickle cell anemia is a disease where the shape of a person's hemoglobin (red blood cell) is abnormal. Sickle cell anemia is a **recessive** disease. A couple has three children and each has a different genotype: SS, Ss and ss. According to the children's genotype, what are the parents' genotypes and which child (children) will have sickle cell anemia?  
A) One parent's genotype is SS and the other is ss and the child that will have sickle cell anemia is the child with the ss genotype.  
B) The parent's genotype are both Ss and the children that will have sickle cell anemia are the children with the SS and Ss genotypes.  
 C) The parent's genotype are both Ss and the child that will have sickle cell anemia is the child with the ss genotype.  
D) One parent's genotype is Ss and the other is ss and the children that will have sickle cell anemia are the children with the ss and Ss genotypes.
4. What does the notation *tt* mean to geneticists?  
A) two dominant alleles      C) at least one dominant allele  
 B) two recessive alleles      D) one dominant and one recessive allele
5. Which nitrogen base in RNA is NOT part of DNA?  
A) adenine      B) guanine      C) cytosine       D) uracil
6. Why are sex-linked traits more common in males than in females?  
A) All alleles on the X chromosome are dominant.  
B) All alleles on the Y chromosome are recessive.  
 C) A recessive allele on the X chromosome will always produce the trait in a male.  
D) Any allele on the Y chromosome will be codominant with the matching allele on the X chromosome.
7. A carrier is a person who has  
 A) one recessive and one dominant allele for a trait.  
B) two recessive alleles for a trait.  
C) two dominant alleles for a trait.  
D) more than two alleles for a trait.

8. The lab technician at your high school asked you to make cue cards of the protein synthesis process. However, you dropped them on the way to school.

Cue Cards Protein Synthesis

Translation occurs at the ribosome. The ribosome moves along the mRNA strand reading each nucleotide triplet.

The newly formed mRNA travels from the nucleus into the cytoplasm and attaches to a ribosome.

The resulting polypeptide chain, once complete, folds into a specific shape in the cytoplasm.

Unzipped DNA serves as a blueprint for mRNA.

Transcription occurs. This is the process through which a DNA sequence is copied to produce a complementary mRNA.

The tRNA carries amino acids to the site of each nucleotide triplet. These amino acids link together.

You must place the cards in the correct order. Indicate the correct step number next to cue card description.

- A) 1-2-4-3-5-6      C) 5-1-6-4-2-3  
B) 4-5-2-1-6-3      D) 5-2-3-4-1-6

9. A man has brown eyes, but produced a daughter with blue eyes. What type of gametes can he produce?

- A) He can produce B gametes only      C) He can produce b gametes only  
B) He can produce B and b gametes      D) Males do not produce gametes

10. How many mRNA codons will attach to a DNA sequence consisting of 12 nucleotides?

- A) 3      B) 4      C) 12      D) 36

11. Bob looks much more like his mother than his father. He decided to ask his four friends who are genetic geeks why that is. Which friend is correct?

- A) Friend 1 says it is because he inherited more chromosomes from his mother.  
B) Friend 2 says it is because his mother's genes are probably more recessive than his father's.  
C) Friend 3 says it is because his mother's genes are probably more dominant than his father's.  
D) Friend 4 says it is because his mother gave him more genes.

12. Colour blindness is a sex-linked trait. Which statement best describes what occurs to the offspring?

- A) Girls are more likely to be colour blind because it is carried on the 'X' chromosome.
- B) Boys are more likely to be colour blind because it is carried on the 'Y' chromosome.
- C) A girl is sure to be colour blind if her mother is colour blind.
- D) A boy is sure to be colour blind if his mother is colour blind.

13. Three students are discussing protein synthesis.

Cassandra says, "During protein synthesis, a messenger RNA must be built based on the DNA." "No, no, no!" objects Ivan. "During protein synthesis, transfer RNA is needed to transport amino acids to the ribosomes." Sylvia adds, "You're both right, but you're talking about two different processes in protein synthesis. You should also know that the messenger RNA produced in the nucleus attaches itself to a ribosome during protein synthesis."

Which of the three students is referring to the transcription stage in his or her description of protein synthesis?

*Cassandra*

14. Using the lead DNA strand below, answer the questions.

CCG TAC GCT ACC ACT GGT TTC TAC CCC CCT ATT

Give the complimentary strand.

*GGC ATG CGA TGG TGA CCA AAG ATG GGG GGA TAA*

Give the mRNA strand.

*GGC AUG CGA UGG UGA CCA AAG AUG GGG GGA UAA*

Give the tRNA strand

*CCG UAC GCU ACC ACU GGU UUC UAC CCC CCU AUU*

Give the sequence of amino acids produced.

*Gly start-Arg-trp-stop pro lys start-gly-gly-stop*

15. In his research, Mendel cross-pollinated a pure-line pea plant with round seeds and a pure-line pea plant with wrinkled seeds. Given that the allele for round seeds is dominant over the allele for wrinkled seeds, what percentage of the first-generation plants obtained had round seeds? Explain your answer, using a Punnett square.

	R	R
r	Rr	Rr
r	Rr	Rr

*100% round - all heterozygous*

16. Mendel then cross-pollinated two individuals from the first generation described in the previous question. Was the percentage of individuals with round seeds the same among the new generation? If not, what is the percentage? Explain your answer, using a Punnett square.

	R	r
R	RR	Rr
r	Rr	rr

75% round No  
25% wrinkled

17. There are four children in the Chapel family. Lewis and Louise have brown eyes, and Olivia and Oliver have blue eyes. The parents, Denis and Denise, have brown eyes. What are their genotypes? Describe how you arrived at your answer, assuming that eye colour is determined by a single gene whose allele for brown eyes is dominant over the allele for blue eyes.

	B	b
B	BB	Bb
b	Bb	bb

Both parents must be Bb. They have brown eyes, but produced blue eyed children.

18. Protein synthesis occurs as a result of certain processes in a cell. Place the following steps in the correct order.

- A. An mRNA is formed.  
B. tRNA bond with the mRNA. Amino acids are joined together.  
C. The synthesized protein detaches itself from the ribosome and folds into its final shape.  
D. The two strands of DNA separate.  
E. An mRNA attaches itself to a ribosome.

D → A → E → B → C

19. Does each of the following statements refer to DNA or RNA?

- a- I do not contain any thymine. RNA  
b- Most of the time, I am a molecule made up of two complementary strands. DNA  
c- One of my nitrogenous bases is uracil. RNA  
d- I act as a messenger during protein synthesis. RNA

20. Among the character traits studied in fruit flies is the length of their wings. Two shapes are possible for this character trait: normal wings and miniature wings. If two pure-line individuals with normal wings are crossbred, what proportion of the offspring will also have normal wings? Explain your answer.

	N	N
N	NN	NN
N	NN	NN

100%

21. When a fruit fly has an allele for normal wings and an allele for miniature wings, its phenotype for this character trait is "normal-winged."

- a) Is this individual homozygous or heterozygous for the character trait?
- b) Which of the two alleles is dominant? *Normal*
- c) Which of the two alleles is recessive? *miniature*
- d) What would be the possible genotype or genotypes for a fruit fly with normal wings? *NN or Nn*
- e) What would be the possible genotype or genotypes for a fruit fly with miniature wings? *nn*

22. In tomatoes, the allele for purple stems (P) is dominant over the allele for green stems (p). Second, the allele for red fruit (R) is dominant over the allele for yellow fruit (r). Two tomato plants that are heterozygous for the two character traits are crossbred.

Supposing that 160 new plants are obtained, use a Punnett square to show how many of them, in theory, will have:

- a) a purple stem and yellow fruit 30
- b) a purple stem and red fruit 90
- c) a green stem and yellow fruit 10
- d) a green stem and red fruit 30

	<i>PR</i>	<i>Pr</i>	<i>pR</i>	<i>pr</i>
<i>PR</i>	<i>PPRR</i>	<i>PPRr</i>	<i>PpRR</i>	<i>PpRr</i>
<i>pR</i>	<i>PpRR</i>	<i>PpRr</i>	<i>ppRR</i>	<i>ppRr</i>
<i>Pr</i>	<i>PpRr</i>	<i>Pprr</i>	<i>PpRr</i>	<i>Pprr</i>
<i>pr</i>	<i>PpRr</i>	<i>Pprr</i>	<i>ppRr</i>	<i>pprr</i>

23. There are many inherited characteristics found in humans. A genetically determined characteristic or condition is called a trait. One trait involves ear wax. Wet ear wax is dominant to dry ear wax. Another is eyelash length. Long eyelashes are dominant to short ones. Lily has dry ear wax and long eyelashes. She has four children with Massimo, who has wet ear wax and long eyelashes.

Lily is heterozygous for long eyelashes. Massimo is heterozygous for long eyelashes and he is homozygous for wet ear wax,

What is the genotype of each parent?

*Lily = wwLl      Massimo = WWLl*

24. The table below provides generic information on three guinea pigs.

	Description	Genotype
Guinea pig #1	Has black coloured fur and dark eyes	BbDD
Guinea pig #2	Has black coloured fur and red eyes	BBdd
Guinea pig #3	Has white fur and dark eyes	bbDd

- a- Which guinea pig is heterozygous for black fur? 1  
 b- Which guinea pig is homozygous for red eyes? 2  
 c- What is the dominant allele for fur colour? B  
 d- What is the recessive allele for eye colour? d

25. *Drosophila melanogaster*, the common fruit fly, is used extensively in genetic research. In one such research experiment, a female fly with red eyes was crossed with a male fly with black eyes. The results of the cross were 400 offspring. Of the 400 offspring, 196 have red eyes and 204 have black eyes. Red eye colour is a recessive trait. What is the genotype of each parent fly? Justify your answer using a Punnett square.

	B	b
b	Bb	bb
b	Bb	bb

50% black  
 50% red