Genetics

1. What 3 chemical components make up each nucleotide?
	1. Sugar, Phosphate group, nitrogenous base
2. What are the names of the 4 nucleotides (bases) and which ones are complimentary to each other (form hydrogen bonds together)?
	1. Adenine (A) binds with Thymine (T); Guanine (G) binds with Cytosine (C)
3. Which nitrogenous bases are purines and which and which ones are pyrimidines; what is the difference in their structures?
	1. A and G are purines and have two carbon rings each; T and C are pyrimidines which have one carbon ring each.
4. What three- dimensional structure that looks like a twisted ladder does DNA form?
	1. A Double Helix
5. List the 4 main differences between DNA and RNA
	1. RNA is usually single stranded and less stable than DNA;
	2. It contains ribose instead of deoxyribose, and
	3. It incorporates uracil instead of thymine
6. How does the function of DNA differ from that of various types of RNA?
	1. DNA forms an organism’s genome and remains mostly unchanged; whereas various types of RNAs are constantly being synthesized and can be transient (since RNA is not very stable). While DNA acts mostly as a template, RNA acts to transfer information (mRNA) or molecules (tRNA).
7. Which cellular process produces two copies of DNA?
	1. Rplication
8. Where in a eukaryotic cell is DNA copied?
	1. Nucleus
9. During transcription what macromolecule serves as the template and what molecule is synthesized?
	1. mRNA is synthesized from a DNA template.
10. What is the name of an enzyme that adds subunits to a growing chain during transcription and what is the DNA unit called that is usually transcribed?
	1. RNA polymerase; gene
11. What is the last step in protein synthesis called and what organelle made of rRNAs and proteins is required for this process?
	1. Translation; ribosome
12. What brings the appropriate amino acid to the mRNA template during protein synthesis?
	1. tRNA (transfer RNA)
13. How many nucleotides on the mRNA stand for each amino acid and what is this sequence called?
	1. Three nucleotides represent one amino acid; this triplet is called a codon
14. What is the basis of the Chromosome Theory of Inheritance?
	1. It identifies chromosomes as the carriers of genetic material and the basis for all genetic inheritance
15. Who studied genetic mutants of fruit flies, showed that genes reside on chromosomes, and after whom a unit of chromosomal distance is named (cM)?
	1. Hunt Morgan
16. Who discovered that the three dimensional structure of DNA is a double helix?
	1. James Watson and Francis Crick (with help from Maurice Wilkins and Rosalind Franklin).
17. Which 3 scientists or groups of scientists conducted experiments that provided evidencethat DNA was the genetic material?
	1. Griffith; Avery and colleagues; and Hershey and Chase
18. Who worked with garden peas and is considered the father of modern genetics?
	1. Gregor Mendel
19. What is the difference between homzygotes and heterozygotes; phenotype and genotype
	1. A homozygote is an individual that has teo of the same alleles (aa or AA); while a heterozygote has one of each allele- dominant and recessive (Aa)/ Phenotype is a visible trait that is due to the genotype ( the set of alleles present in the genome).
20. What is the difference between a monohybrid vs. a dihybrid cross?
	1. Monohybrid cross considers the inheritance pattern of one trait; while a dihybrid cross examines teo traits at the same time.
21. What are the 2 laws and 1 principle of Mendel and what so they mean?
	1. Principle of Dominance: certain variations of genes (alleled) mask others in heterzygotes (dominant mask recessive alleles).
	2. Law of Segregation: during gamete formation alleles on homologous chromosomes separate from each other
	3. Law of Independent Assortment: alleles of different genes assort independently of one another during gamete formation because there are various ways that chromosomes may be aligned at metaphase (each can line up on the left or right).
22. When calculating the probability that two independent events will BOTH happen, what mathematical operation would you use; what operation would you use; what operation would you use if you want to calculate the probability that one OR another event will happen?
	1. Multiplication; addition
23. What is the probability that a parent will pass one of their alleles to their offspring?
	1. ½ or 50 %
24. How would you determine the genotype and phenotype ratios of offspring of 2 heterozygous parents using rules of probability.
	1. As x Aa cross would result in the following offspring
	2. Genotypes: ¼ AA. 1?2 Aa, and ¼ aa (1:2:1 ratio); AA= ½ x ½ (probability of receiving A from a heterozygote parent is ½), Aa or aA+ (1/2 x ½) + (1/2 x 1/2), and aa = ½ x ½,
	3. Phenotypes: ¾ “A” and ¼ “a” phenotypes (3:1 ratio): The ¾ is due to the fact thay both AA and Aa genotypes represents the “A” phenotype, ¼ + ½ =¾
25. What is a Punnett Square and how is it constructed? ( draw and fill in a Punnett square for a monohybrid cross where both parents are heterozygous)
	1. A Punnett Square is a diagram that is used to predict offspring genotype frequencies of a particular cross.



1. How would you compare and contrast complete dominance, co-dominance and incomplete dominance?
	1. Each of these terms describes how two alleles are represented in an individual. When complete dominance, which Mendel studied, is the mode of inheritance, one allele (A) is dominant to another (a); while in co-dominance both alleles are equally expressed and incomplete dominance the heterozygote looks unlike either of the homozygotes.
2. How are multiple allele traits different from what Mendel studied and how many alleles of a particular gene can each individual have?
	1. When Mendel studied inheritance patterns he considered traits that had only two variations (alleles) of that trait; but some traits have more than two possible alleles (multiple alleles). Even if many alleles are possible choices, each individual can only have two alleles: one from the mother and one from the father.
3. During what process do similar sequences of homologous chromosomes exchange genetic material?
	1. Crossing over (recombination) during meiosis.
4. How are genes on the X-chromosome inherited differently in males than genes on other chromosomes and what is the resulting genotype called?
	1. Since males only have one X chromosome, the genes located there are represented by only one allele each. This type of a genotype is called hemizygous.
5. What is a point mutation?
	1. Change of one DNA base pair for another.
6. How is a missense mutation different from a nonsense mutation?
	1. A missense mutation is when one amino acid is changed for another one which can change the function of the resulting protein, while a nonsense mutation is when an amino acid is changed for a stop codon, resulting in a shorter protein.
7. What causes a frameshift mutation and how does it affect a protein sequence?
	1. An insertion or a deletion of any number of nucleotides (except three or any multiple of three) can cause a frameshift, which results in a shift of how codons are recognized by tRNAs and therefore will alter all amino acids after this mutation.
8. Are frameshift mutations more or less serious than point mutations in decreasing protein function than most other point mutations?
	1. Most frameshift mutations are more serious than point mutations especially when they occur near the beginning of the protein since they disrupt all of the amino acids that follow.
9. What are deletion and insertion mutations?
	1. A deletion is when DNA is removed and an insertion is when DNA is added; so these two types of mutations are opposites of each other.
10. What is the name of the mutation that results in a piece of DNA being flipped or reversed within a chromosome?
	1. An inversion
11. What 3 effects could mutations have on a protein?
	1. No effect (silent mutation), faulty protein, or no protein made
12. How are monosomies and trisomies similar and different?
	1. Both are abnormalities in the number of chromosomes; monosomy is when a person’s cells have a single representative of one of the homologous chromosome pairs, whereas a trisomy is represented by 3 instead of 2 chromosomes.
13. What is an example of a trisomy?
	1. Downs Syndrome