1. Diagram a replicon with the ori site, two replication forks, leading and lagging strands, helicase, topoisomerase, primase and RNA primers, Okazaki fragments, DNA polymerases, and DNA ligase with short explanation on the functions of each enzyme. Make sure you label the 3' to 5' directions and they are correct. (10 pt.)

Explain the following:

ori site

leading and lagging strands

helicase

topoisomerase

primase

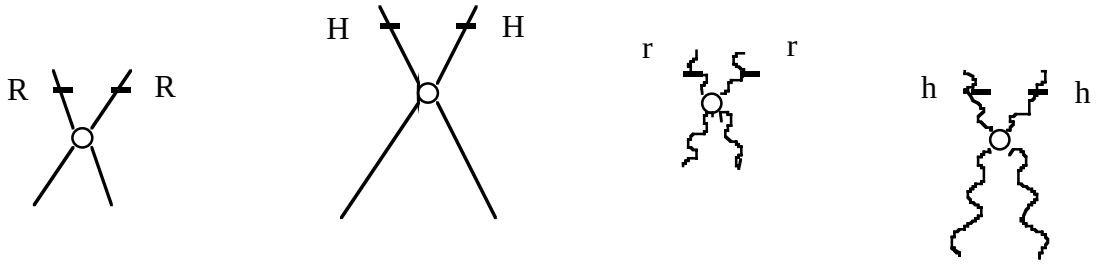
RNA primers

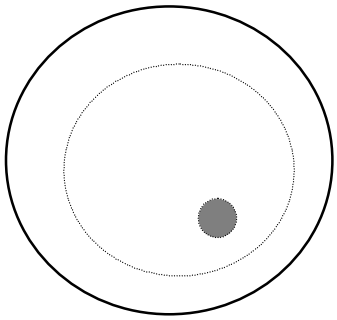
Okazaki fragments

DNA polymerases

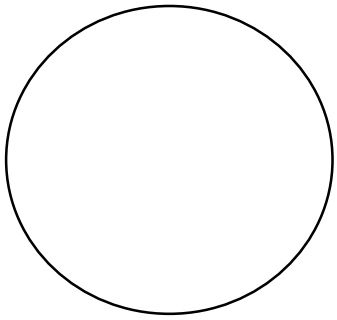
DNA ligase

2. Diagram the four stages of mitosis. Use the following symbols for chromosomes, loci, and alleles.

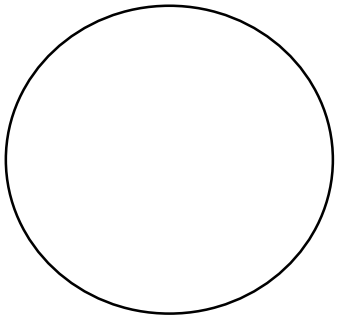




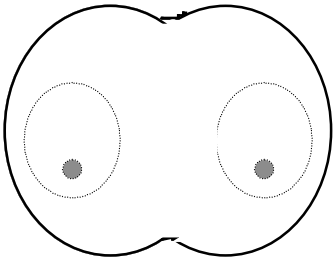
#1 Prophase



#2 anaphase

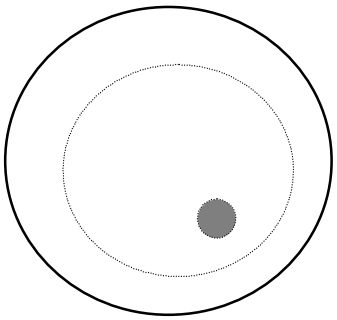


#3 metaphase

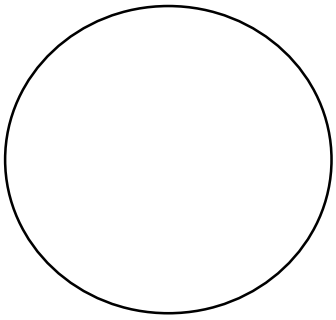


#4 telophase

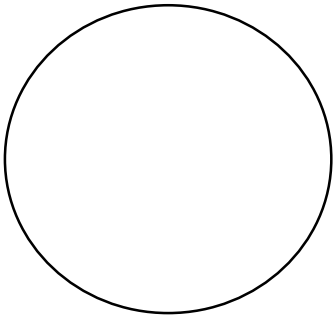
3. Diagram the eight stages of meiosis. Use the chromosomes and alleles described above in your drawings.



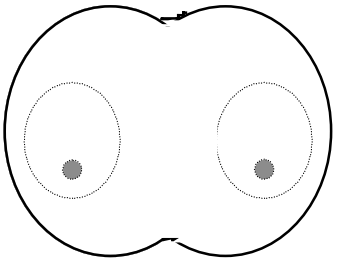
#1 Prophase I



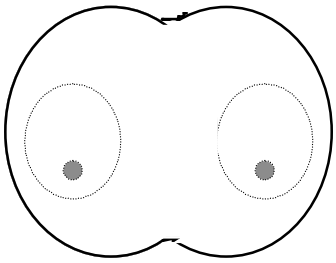
#2 Metaphase I



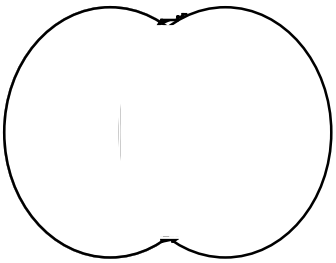
#3 Anaphase I



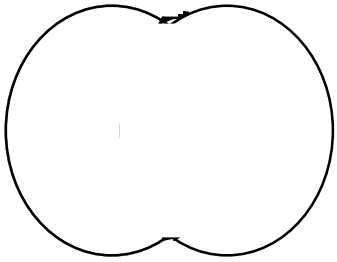
#4 Telophase I



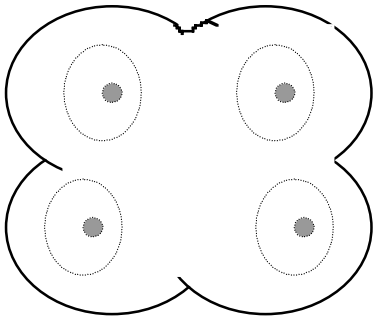
#5 Prophase II



#6 Metaphase II



#7 Anaphase



#8 Telophase

Fill in the blanks (1 point each)

4. In 1951 Henrietta Lacks died of cervical cancer, Her cancerous cells are maintained in culture today, and are called _____ cells.
5. When a DNA molecule double in the _____ phase, a chromosome is then comprised of two joined (bivalent) structures called chromatids.
6. Bacteria have a short sequence site where DNA synthesis begins called the _____ site.
7. During prophase I of meiosis a unique event occurs that results in the formation of recombinant chromosomes. This event is called _____.
8. _____ is the fusion of two gametes.
9. The nucleus of cell is full of grainy material called _____.
10. A fertilized egg is called a(n) _____.
11. Prokaryotic cells divide by the process of _____.
12. The chromosomes of most sexually reproducing eukaryotes come in pairs called _____.
13. The phase of mitosis when the chromatin condenses is called _____.
14. A specialized disk-shaped structure on the chromatids that attaches the mitotic spindle to the centromere is called the _____.
15. The collapsing and folding of the DNA molecule is accomplished with the aid of special basic (+ charged) _____ that are called _____.
16. A special pattern of DNA clustering, so that individual chromosomes can be recognized by their lengths, centromere position, and banding pattern when stained with specific dyes results in a _____.
17. One of the normal processes that regulates the pace of the cell cycle is cell aging or how many times the cell can divide, called _____.
18. When cells stop dividing because they run out of free space this is called _____.
19. A cell with three homologous sets of chromosomes is called a _____ cell.
20. Nondisjuction causes the production of _____ cells.
21. In plants a _____ _____ forms at the equatorial region of the cell near the end of cell division.
22. Process that ensures that only one of each pair of chromosomes is included in a gamete is _____.
23. The process that ensures the genetic information is passed on to a cell's daughter cells is _____.
24. Half of all human cancers have defective _____ protein associated with their cells.
25. At metaphase of mitosis, each chromosome consists of _____ chromatid(s), _____ centromere(s), and _____ kinetochores.

26. The collection of all the genes in an organism is called the _____.
27. Most genes that specify proteins are called _____.
28. Cells that contain only one set of chromosomes are said to be _____.
29. Body of cells of a multicellular organism that are not germ cells are called _____ cells.

30. Chromosomes that are not identified as sex chromosomes are called _____.
31. Alternative versions of the same gene are called _____.
32. A convenient graphical method for determining all of the possible combinations of gamete alleles is a cross is called a(n) _____.
33. The cross of a dominant phenotype with a recessive phenotype that is intended to reveal the genotype of the dominant phenotype is called a(n) _____.
34. Genes that are carried on the same chromosome are called _____ genes.
35. When single chromatids in homologous chromosomes break, exchange material, and rejoin, we say that _____ has occurred.
36. A cross between two parents that differs by a single trait is a _____ cross.
37. The physical appearance of a character is the _____, while the gene constitution is the _____.
38. A cross between two parents that differs by two independent traits is a _____ cross.
39. The region of the chromosome occupied by a gene is called a _____.
40. When a cross is made and the trait disappears in the F_1 generation, only to reappear in the F_2, the trait is probably _____.
41. A person who is heterozygous for a recessive trait or a female that does not exhibit a sex-linked character is a _____.
42. When one expression of one gene depends on the expression of another gene, the genes demonstrate _____.
43. A _____ is a feature, such as flower color; a _____ is a particular form of a character, such as a white flower.
44. When both traits are expressed, then the alleles are said to be _____.
45. When one trait does not completely mask another trait (red + white = pink), this is _____ dominance.
46. Cleft chin is a sex-linked dominant trait. A man with a cleft chin marries a woman with a round chin. What proportion (percent) of their female progeny will show the trait? _____. What proportion of their male progeny will show the trait? _____.
47. A linkage group corresponds to a group of genes on the same _____.

48. The purine bases are _____ and _____.
49. The pyrimidine bases are _____ and _____.
50. The DNA molecule is a double _____.
51. The X-ray crystallographs of the English chemist _____ _____ were essential for the discovery of the structure of the DNA molecule.
52. Arthur Kornberg showed that DNA could replicate in the test tube if it contained intact DNA for a template, a mixture of four precursors – the four nucleoside triphosphates, and _____ _____.
53. Material that changed R strain pneumococcus into the virulent S strain was originally referred to as the _____ _____.
54. _____ are Y-shaped regions of DNA where the two strands of the helix have come unzipped.
55. The _____ is how often mutations occur.
56. A _____ is the removal of one or more nucleotides.
57. The _____ function of the DNA polymerase reduces the number of mistakes by the square of the frequency of the error rate.

58. The number of nucleotides required to specify one amino acid is called a _____.
59. Codons that signal the end of a polypeptide chain are called _____.
60. Because the same code is used by nearly all species, the genetic code is said to be _____.
61. The process by which DNA transmits its information to RNA is called _____.
62. The starting signal for mRNA synthesis is a special sequence of DNA called a _____.
63. The grouping of nucleotide triplets that code for a protein is called the _____ _____ _____.
64. A stretch of DNA that includes several genes under coordinated control is called a(n) _____.
65. In the _____ cell type, the cell transcribes the mRNA for a gene, but modifies the pre-mRNA before it reaches the cytoplasm.
66. The *lac* repressor is an example of a _____, a molecule that inhibits transcription.
67. The part of a protein that determines whether translation will continue in the cytosol or at the endoplasmic reticulum is the _____ sequence.
68. A mRNA molecule with several ribosomes attached at the same time is called a(n) _____.
69. The fact that some tRNA molecules do not have to pair exactly is called the _____ effect.
70. The portion of the tRNA molecule that complementary base base-pairs with the mRNA is called the _____.
71. A type of mutation that is an insertion or a deletion of a single base is a(n) _____ mutation.
72. Three codons in the genetic code that do not specify amino acids are called _____ codons.

73. Genes that can move around the genome and sometimes inactivate other genes are called _____.
74. A virus that infects bacterium is called a _____.
75. If the outside surface of the virus is a protein coat it is called a _____.
76. Viruses attach to the host cell's _____.
77. Viruses that break open and kill their host cells upon release are called _____ viruses.
78. _____ replication is when the mobile genes are separate from the DNA of the host cell and can be replicated even when the host DNA is not replicating.
79. Two simple transposons that lie near each other on the host genome that can jump together in a combination that is called a _____.
80. Viral genes whose expressed proteins interfere with the host cell's ability to control cell division are called _____.
81. Molecules in potential host cells that cut foreign viral DNA into nonfunctional pieces are called _____.
82. The theory that states that present-day mitochondria and chloroplasts are descended from prokaryotes that came to live inside ancient eukaryotic cells is called the _____ theory.

83. The in vitro amplification of specific strands of DNA is a process called _____.
84. The use of living organism for practical purposes is called _____.
85. External agents that can cause the DNA in the cells of an organism to mutate are called _____.
86. A DNA molecule that consists of two or more segments that are not found together in nature is said to be _____.
87. An enzyme that cuts DNA into fragments is called _____.
88. By comparing the sizes of restriction fragments researchers can produce a _____, which shows how the restriction sites are placed within a piece of DNA.
89. DNA sequences from viruses, plasmids, and other mobile genes that are capable of carrying recombinant DNA into cells are called _____.
90. A molecule that is complementary to the mRNA from which it was copied is called _____.
91. _____is a technology researchers are developing to deliver normal genes to the tissues of people whose own genes are somehow defective.
92. DNA fragments that vary in length are said to be polymorphic and are called _____.
93. Organisms in which a particular gene has been inactivated are called _____.
94. A _____ animal has recombinant DNA integrated into its own genetic material.
95. A circular cloning vector that replicates autonomously with a cell is a _____.
96. _____ _____ is obtained by reverse transcription of mRNAs.
97. _____ library consists of a collection of DNA molecules that represent mRNAs, while a _____ library represents an organisms' total DNA.
98. Sex-linked recessive diseases affect _____ more than _____.
99. Sex-linked dominant diseases affect _____ more than _____.
100. _____ _____ is a process whereby an abnormal gene is replaced by a normal one.

The Genetic Code

		Second Base			
		U	C	A	G
First Base	U	UUU PHE	UCU SER	UAU TYR	UGU CYS
	U	UUC PHE	UCC SER	UAC TYR	UGC CYS
	U	UUA LEU	UCA SER	UAA STOP	UGA STOP
	U	UUG LEU	UCG SER	UAG STOP	UGG TRP
	C	CUU LEU	CCU PRO	CAU HIS	CGU ARG
	C	CUC LEU	CCC PRO	CAC HIS	CGC ARG
	C	CUA LEU	CCA PRO	CAA GLN	CGA ARG
	C	CUG LEU	CCG PRO	CAG GLN	CGG ARG
	A	AUU ILE	ACU THR	AAU ASN	AGU SER
	A	AUC ILE	ACC THR	AAC ASN	AGC SER
	A	AUA ILE	ACA THR	AAA LYS	AGA ARG
	A	AUG MET	ACG THR	AAG LYS	CGG ARG
	G	GUU VAL	GCU ALA	GAU ASP	GGU GLY
	G	GUC VAL	GCC ALA	GAC ASP	GGC GLY
	G	GUA VAL	GCA ALA	GAA GLU	GGA GLY
	G	GUG VAL	GCG ALA	GAG GLU	GGG GLY

67. Examine the following strand of DNA. Fill in the chart for the complementary DNA strand, the mRNA and polypeptide (protein) molecules. (15 pt.)

Non template strand 5'-	A	T	G	C	G	C	T	T	A	T	A	C	A	T	T	-3'
Template strand 3'-																-5'
mRNA 5'-																-3'
tRNA 3'-																-5'
Protein - H_2N-																-COOH

Study guide.

1. Know the types of cell division.
2. Describe how *Escherichia coli* divides.
3. What is an ori site?
4. How is DNA able to fit in the nucleus of an eukaryotic cell?
5. What is a homolog?
6. What is a centromere?
7. What are sister chromatids?
8. What is a kinetochore? What is its function?
9. What is the diploid number of chromosomes? Haploid number? How do these numbers relate to chromosome pairs?
10. What is a karyotype and how are they used? How are chromosomes arranged in a karyotype?
11. What are the parts of the cell cycle? What is the function of each?
12. When is DNA duplicated?
13. Be able to identify and draw the stages of mitosis.
14. What happens to the cell and chromosomes at each stage of mitosis?
15. How is the cell cycle regulated?
16. What is cancer? How does it relate to the cell cycle?
17. What is apoptosis?
18. What is cytokinesis and explain what happens in animals and plants. How are they different.
19. What are the three types of meiosis, what are their differences, what organisms will you find them?
20. Be able to identify the different stages of meiosis. Be able draw meiosis. How does meiosis differ from mitosis?
21. What is crossover? What are chiasmata? When does this occur?
22. Know how to calculate the number of possible gametes that can be produced from different numbers of organisms.
23. Explain the law of segregation.
24. Explain the law of independent assortment.
25. What is non-disjunction?
26. What are the genotypes of down syndrome, Turner's syndrome, klinefelter's, and metamale? What are the characteristics of each?
27. What are the steps to gamete development in animals? i.e. spermatogenisis and oogenisis.
28. Define a sertoli cell, primary spermatocyte, secondary spermatocyte, spermatid, primary oocyte, secondary oocyte, polor body, barr body and why can males produce sperm into their 90s.
29. In animal development, describe the stages of the sea urchen. i.e. cleavage, blastula, gastrula, blastopore and gastrulation.
30. What are the three germ tissues and what to they develop into?
31. Describe the development process in a flowering plant? Double fertilization?
32. Define a gene, genotype, phenotype, transmission genetics, and molecular genetics.
33. What are the laws of inheritance?
34. Compare and contrast blending of inheritance and particulate inheritance.
35. What are the advantages and disadvantages of sexual and asexual reproduction?
36. Define an allele, homozygous and heterozygous.
37. Define dominance, recessive, incomplete dominance, and codominance.
38. What is epistasis and know some examples?
39. Know Mendel's experiments.
40. Be able to do a Punnett square with a monohybrid and a dihybrid.
41. Be able to read a pedigree.
42. Be able to identify and autosomal dominant, autosomal recessive, x-linked dominant, and x-linked recessive.
43. What is polygenic and what effect does it have?
44. What are linked genes?
45. Describe Griffith's experiment.
46. Describe Hersey and Chases experiment.
47. Watson and Crick's contribution along with Rosalin Franklin's contribution.
48. What is the Watson and Crick's DNA structure?
49. Know the base-pairing rules and the purines and pyrimadines.
50. Know what 5' and 3' mean.
51. How do we know that DNA is replicated semiconservatively?

52. Be able to diagram a prokaryotic replication bubble with the following parts: *ori* site, replication forks, leading strand, lagging strand, helicase, topoisomerase, primase, ss binding protein, RNA primers, Okazaki fragments, DNA polymerase I and III, DNA ligase, 3' to 5' reading, 5' to 3' synthesis. Know the function of the protein and enzymes in the replication bubble.
53. What is the difference between prokaryotic and eukaryotic replication?
54. Describe PCR and what does it stand for?
55. Know the mutations and how they are repaired using visible light.
56. What is the central dogma of DNA?
57. What is transcription and what is the enzyme that does this?
58. What are the bases in RNA?
59. What is a codon?
60. What are the stop and start codons?
61. Be able to interpret the genetic code given a strand of DNA or RNA.
62. What is tRNA and its function?
63. How does the Ribosomes produce a protein? Know the function of the A and P site. Know the steps of translation.
64. Know where replication, transcription and translation take place in prokaryotic and eukaryotic cells.
65. What are viruses and how do they affect host cells?
66. What is bacterial recombination?
67. What is conjugation?
68. What is transformation?
69. What is transduction?
70. What are transposons?
71. Know the Lac operon and how it is regulated. Induction and what induces the operon.
72. How are telomers replicated?
73. What are exons and introns and what cells have them?
74. How does gel electrophoresis work?
75. What are restriction enzymes and what do they do? What is an RFLP?
76. What is DNA fingerprinting?
77. Explain sticky ends and plasmids.
78. What is a DNA library?
79. What is a knockout animal?
80. What is a transgenic animal?
81. What is a chimeric?
82. What is gene therapy and how does it work?
83. What is cloning? Is Dolly dead or alive?