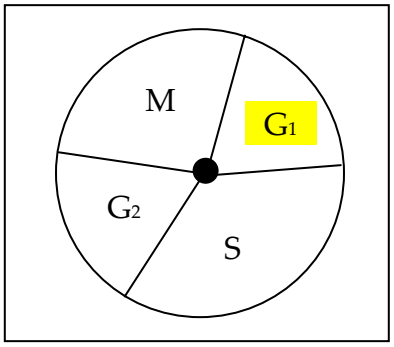
Heredity and Genetics (8%)

I. Basic Vocabulary

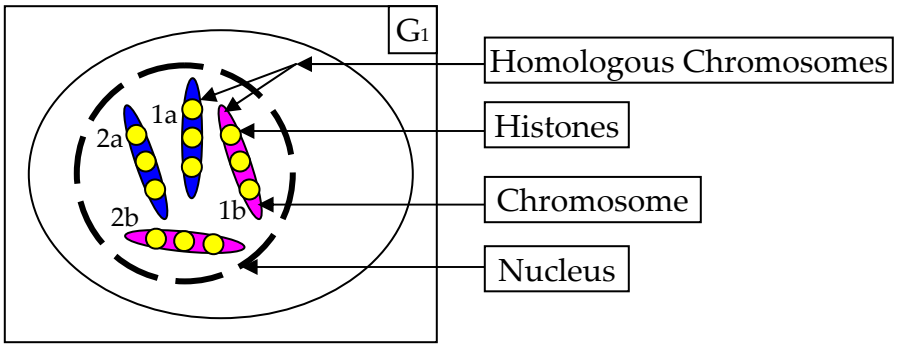
a. G Phase



i. Chromosomes: Threadlike linear strands of DNA and associated proteins in the nucleus of eukaryotic cells that carry the genes and functions in the transmission of hereditary information

ii. Histones: Proteins on the chromosomes that help package them

iii. Homologous Chromosomes: "Pair" of chromosomes carrying the same order of genes → one from each parent

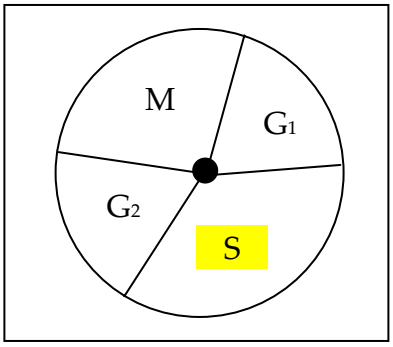


Maternal Chromosomes
Paternal Chromosomes

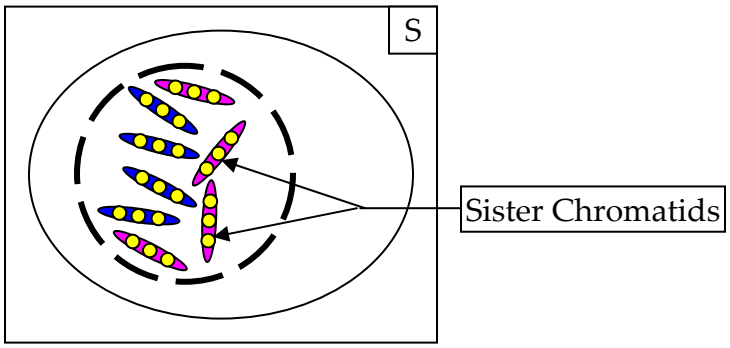
iv. Diagram:

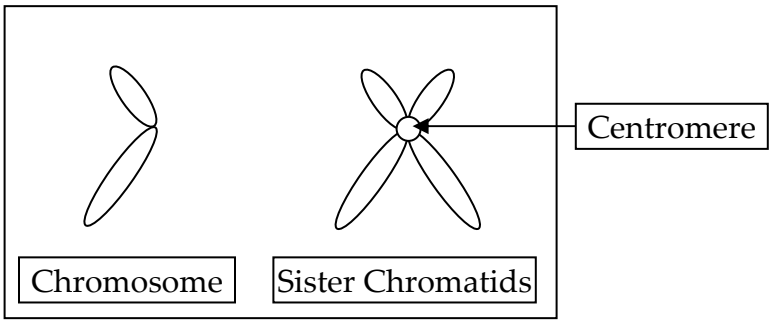
1. Homologous chromosomes 1a and 1b contain the same order of genes but may have different alleles
2. Same with 2a and 2b

b. S Phase



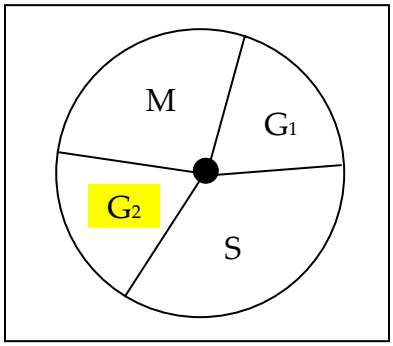
i. Replication: The cell makes copies of each chromosome
ii. Sister Chromatids: Two identical chromosomes
iii. Centromere: Attach two sister chromatids together

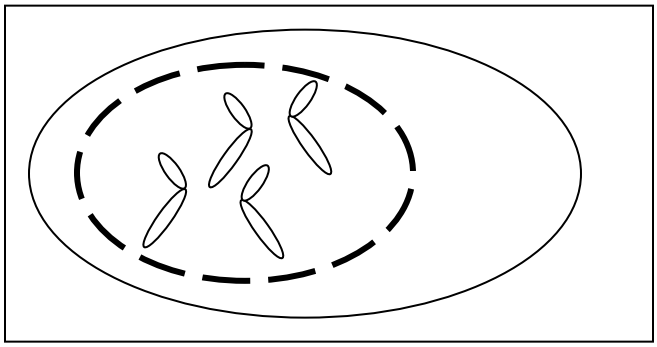




iv. Diagrams
    1. The cell replicates each chromosome
    2. The sister chromatids attach to each other at the center

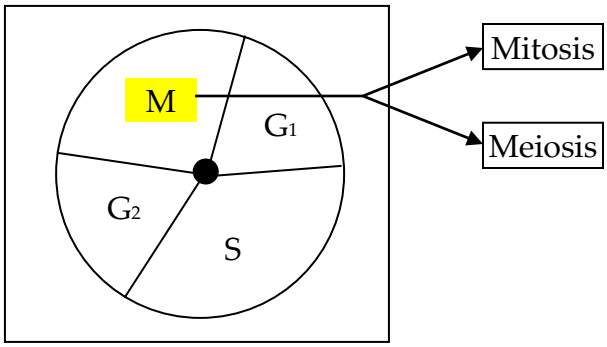
c. G_2 Phase





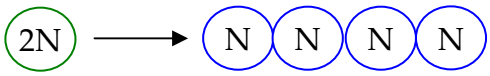
i. Diagrams
   1. Cell growth period
   2. Safety checks on replication occur

d. M Phase



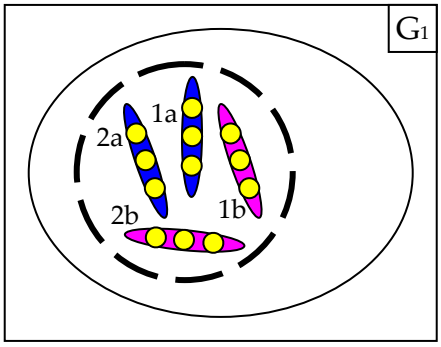
II. Meiosis vs. Mitosis

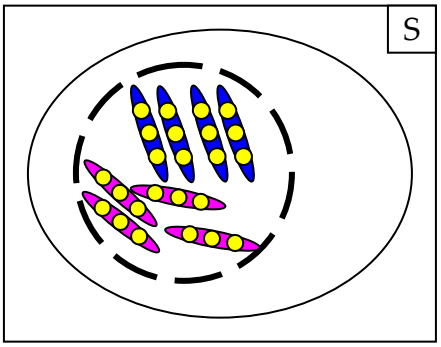
a. General facts

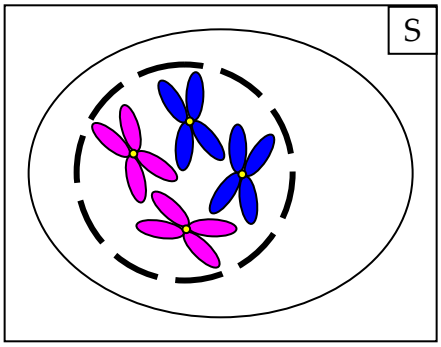
Mitosis	Meiosis
To make 2 identical cells 100% of the chromosomes 1 Diploid → 2 Diploids	To make 4 gametes 50% of the chromosomes 1 Diploid → 4 Haploids
<u>Process</u>	
1. Prophase 2. Metaphase 3. Anaphase 4. Telophase	1. Meiosis I a. Prophase I b. Metaphase I c. Anaphase I d. Telophase I 2. Meiosis 2 (Mitosis) a. Prophase II b. Metaphase II c. Anaphase II d. Telophase II
	

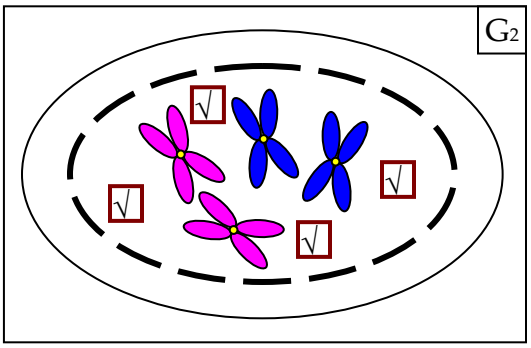
b. Process diagram

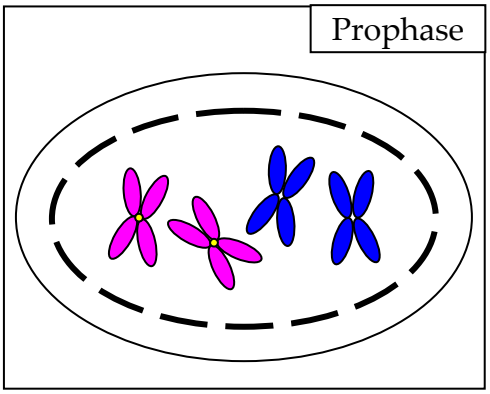
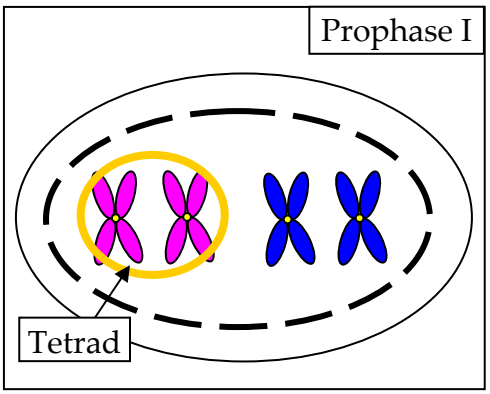
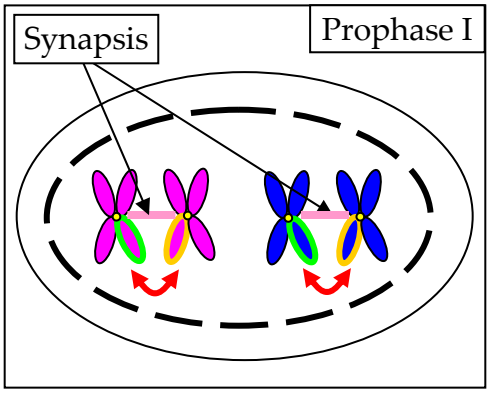
Cell Replication

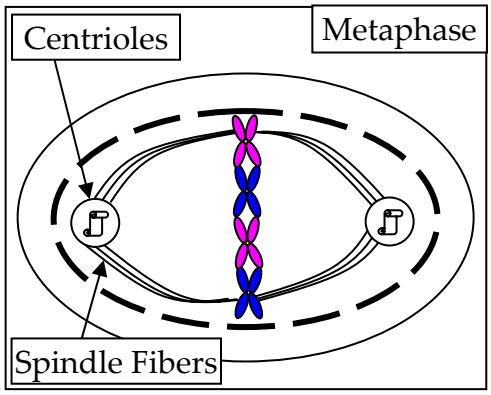




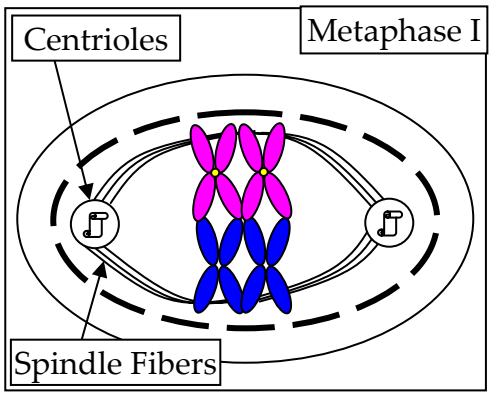




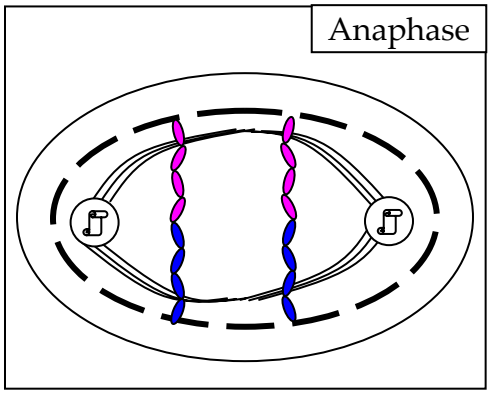
Mitosis	Meiosis 1
	
• Chromosomes become visible	• Chromosomes stand beside their homologous chromosome pairs • **Tetrad:** 2 pairs of homologous chromosomes
	
	• **Synapsis**: Where homologous chromosomes join to form a tetrad • **Recombination:** Random genes within chromosomes cross between homologous pairs



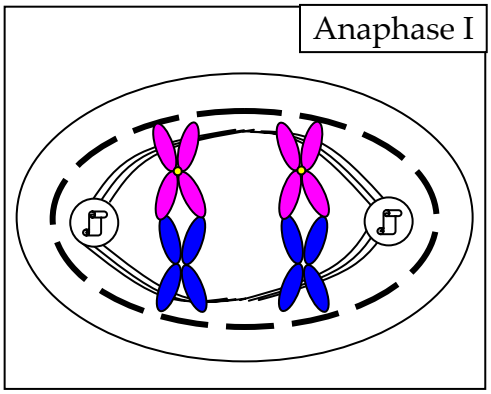
- Sister chromatids line down the center of the cell
- Centrioles attach to spindle fibers which in turn hold the chromosomes



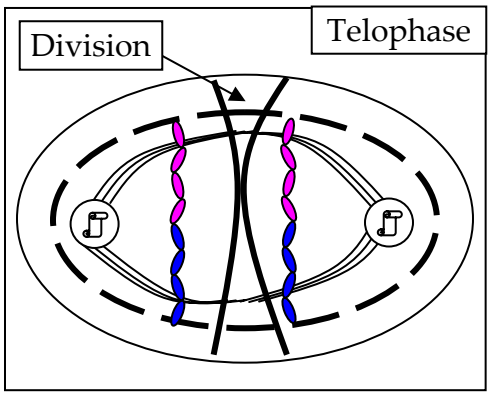
- Sister chromatids line down the center of the cell
- Homologous chromosomes line up beside one another
- Centrioles attach to spindle fibers which in turn hold the chromosomes

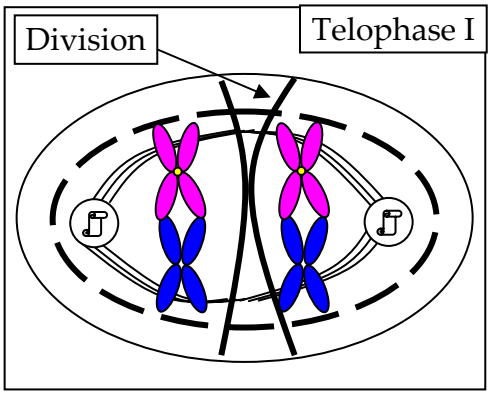


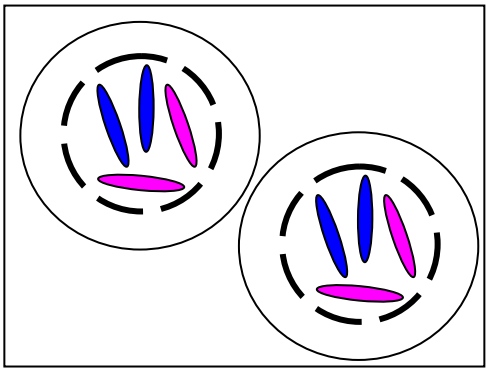
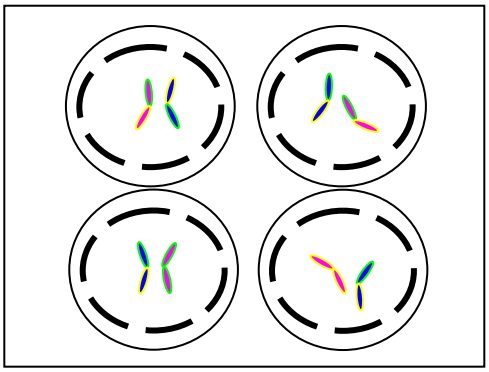
- Sister chromatids are pulled apart



- Homologous chromosomes are pulled apart





• The cell divides into two cells • Animal cell: Cleavage furrow forms • Plant cell: Cell plate forms	• Homologous chromosomes are pulled apart • Animal cell: Cleavage furrow forms • Plant cell: Cell plate forms
☺	Meiosis 2 "2-Cell MITOSIS"
<u>RESULT</u>	
 • 2 cells identical to the original cell	 • 4 cells slightly different than the original cell
2N → 2N 2N	2N → N N N N

III. Alleles

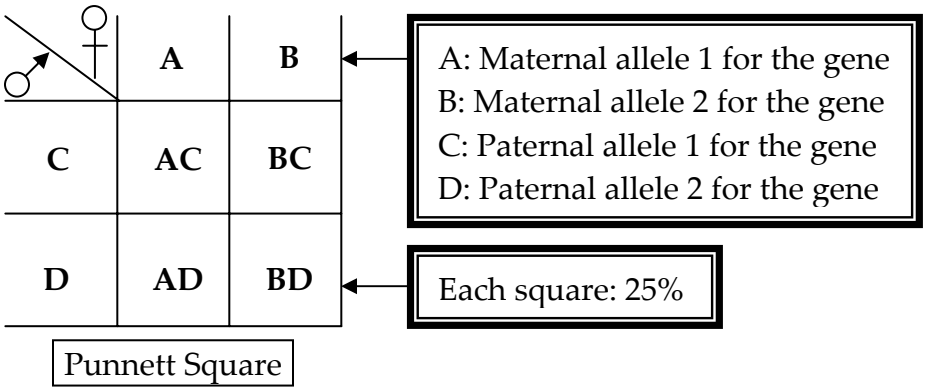
a. Vocabulary

i. Genotype: Coded genetic make-up
ii. Phenotype: Visible hereditary effects
iii. Dominant Allele: (Represented by Upper Case Letter)
iv. Recessive Allele: (Represented by Lower Case Letter)
v. Heterozygous: 2 Different alleles
vi. Homozygous: 2 Same alleles
vii. Linked: 2 genes on the same chromosome

IV. Crossing

a. Vocabulary

i. Punnett Square: Chart showing probabilities of gene distribution in offspring



Punnett Square

ii. Monohybrid Cross: One trait examined in punnett squares
iii. Codominant: Both alleles show in the phenotype
    1. i.e. Rooster
        a. Black = B
        b. Red = b
        c. Bb = Black and Red
iv. Incomplete Dominance
    1. i.e. Flowers
        a. Blue = B
        b. Red = B'
        c. Bb = Purple
v. Autosomal Traits: On non-sex-linked chromosomes
    1. Genes on non-sex-linked chromosomes
    2. 44/46 chromosomes are non-sex-linked chromosomes

vi. Sex Linked Traits: On sex-linked chromosomes

1. Genes on sex chromosomes
2. 2/46 chromosomes are sex chromosomes
    a. XX (girl) or XY (boy)
3. Use XX and XY with superscripts to identify alleles

vii. Carrier Female: To carry a disease on one X chromosome but not on the other

1. X^HX^h

V. Diseases

a. Sickle Cell Anemia
    i. Point mutation
        1. 1 amino acid difference
    ii. Hemoglobin chain mutation
    iii. Autosomal recessive
b. Tay Sachs
    i. Lack an enzyme that metabolizes a certain lipid
    ii. Autosomal recessive
c. Cystic Fibrosis
    i. Channel protein mutation
    ii. Autosomal recessive
d. PKU
    i. Problem converting an amino acid (Phenylalanine)
    ii. Autosomal recessive
e. Albinism
    i. Absence of skin color (Melanin)
    ii. Autosomal recessive
f. Huntington's
    i. Autosomal dominant
g. Hemophilia
    i. Blood clotting
    ii. X-linked recessive