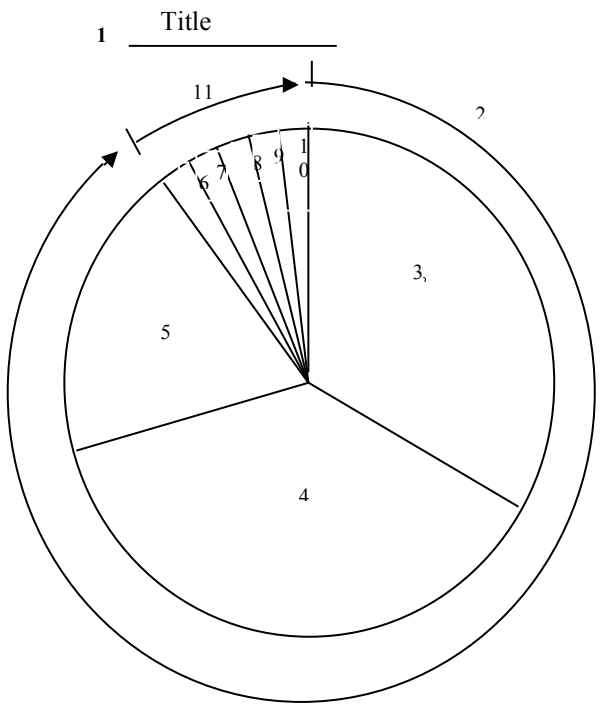
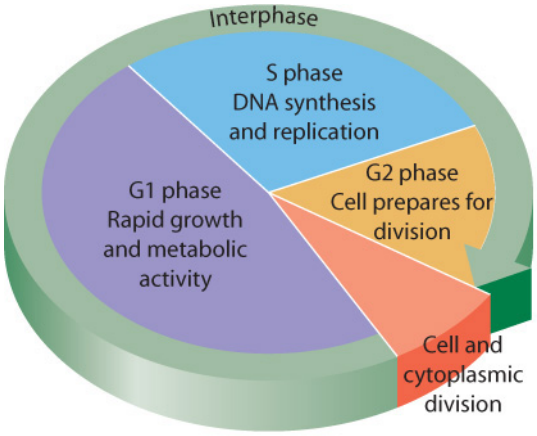
UNIT C1 – Cell Division

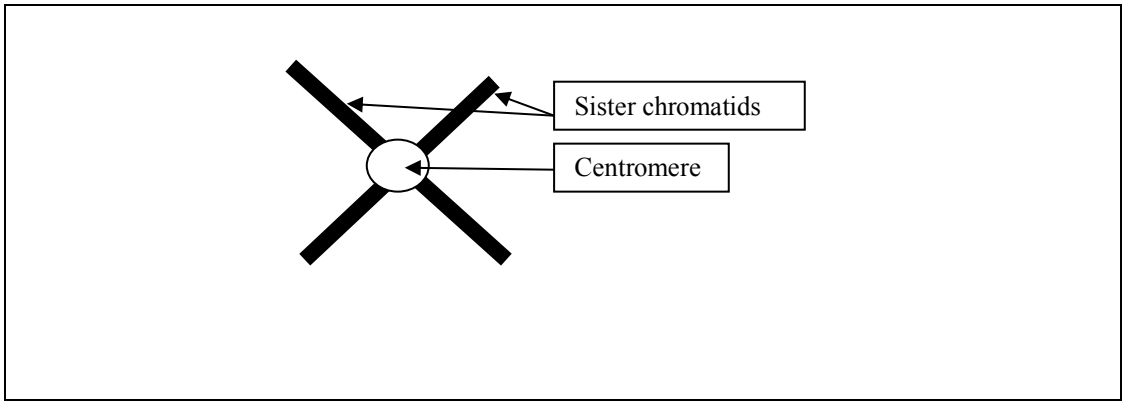
Identify the events labelled by number on left diagram



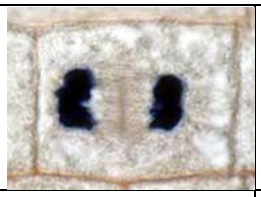
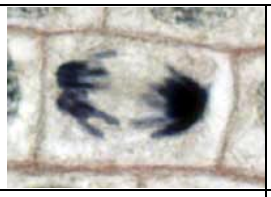


Area	Event	Description
1	Cell Cycle	The life span of a cell
2	Interphase	Phase that prepares the cell for mitosis and cell division
3	Gap 1 or G1	Preparing cell by rapid growth
4	Synthesis	DNA replication
5	Gap 2 G2	Final cell preparation
6	Prophase	Initial mitotic phase – 4 main events (see p. 3)
7	Metaphase	Alignment on equator
8	Anaphase	Division of chromatids to poles
9	Telophase	Movement to end of cell, preparation for division
10	Cytokinesis	Cell division
11	Mitosis	Staged process which ends with cell division

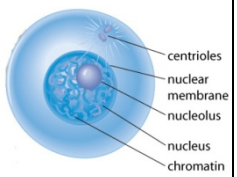
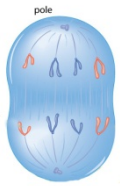
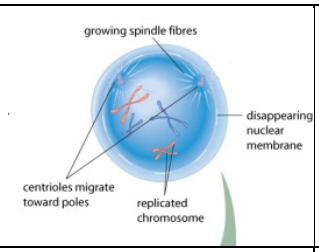
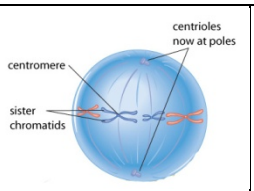
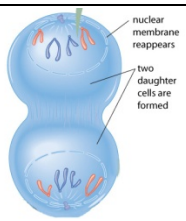
***Draw** a chromosome. **Label** 2 sister chromatids and the centromere.*



Identify *each mitotic phase.* ***Describe*** *what you see in each diagram that helped you to identify it.*

				
Description	Movement to pole farther along, chromatin since indistinctive. Cell plate visible between chromatin	Chromatids moving from poles. Looks like 2 spiders	Alignment on equator	Nuclear membrane still formed, chromosomes short and thick (distinctive)

Identify *each mitotic phase.*

				
Interphase/Pro	**Anaphase**	**Prophase**	**Metaphase**	**Telo/Cyto**

***Match** the following terms*

H	DNA	A.	regions on DNA that code for proteins
A	Genes	B.	state of mother and daughter cells during mitosis
L	Chromosomes	C.	general events that occur during the life of a cell
E	Chromatin	D.	region that holds sister chromatids together
K	Sister Chromatids	E.	DNA molecules uncoiled and tangled
D	Centromere	F.	pinching-in of cell membrane, initiating division
B	Diploid	G.	responsible for chromosomes movement
G	Spindle Fibres	H.	the molecules that contain genes
I	Centrioles	I.	separate and form the poles for cell division
C	Cell Cycle	J.	process of cell division
J	Cytokinesis	K.	two identical DNA molecules
F	Cleavage furrow	L.	DNA molecule coiled very tightly around protein molecules, visible under light microscope

***Identify** when the phase where the events occur.*

Event	Interphase	Prophase	Metaphase	Anaphase	Telophase
Chromosomes move to poles				**X**	
Chromosomes shorten/thicken		**X**			
Spindle fibres appear		**X**			
Centrioles form the poles		**X**			
Chromosomes align on equator			**X**		
Chromosomes in form of chromatin					**X**
Cleavage furrow					**X**
Chromosomes duplicate	**X**				
Cytokinesis begins					**X**
Centromere divides				**X**	
Nuclear membrane disappears		**X**			
Nuclear membrane reappears					**X**

Arrange *each of the following sets of statements in sequential order*

1. Metaphase
2. Prophase — **4 , 2 , 1 , 3**
3. Telophase
4. Interphase

1. cleavage furrow begins
2. chromosomes duplicate — **2 , 4 , 3 , 1**
3. centromere divides
4. chromosomes shorten and thicken

1. spindle fibres appear
2. chromosomes separate — **1 , 4 , 2 , 3**
3. cytokinesis occurs
4. chromosomes align of equator

Describe *the DNA content when comparing*

Start of interphase and the beginning of prophase **Double the chromosomes to begin prophase**

Beginning of metaphase and in late anaphase **Chromosomes separate in anaphase**

Identify *the types of cells that mitosis occurs in with the types of cells that meiosis occurs in?*

Mitosis **Somatic/autosomal/diploid cells**

Meiosis **Gamates/sex cells/haploid cells**

In what phase of the cell cycle does a cell spend most of its time? Why this phase takes the largest portion of time.

Interphase b/c the cell must duplicate everything prior to division

During prophase, which two structures are visible and what structure starts to disappear. Explain why this occurs.

Visible – centrioles and spindles, Disappear – nuclear membrane

This occurs so the chromosomes can be pulled to opposite poles

Compare *chromatin and chromosomes.* ***Identify*** *the phase of mitosis do we see chromatin and in which phase do the chromatids become visible?*

	Comparison	Phase
Chromatin	**Chromatids that are strung out and elongated**	**Telophase**
Chromosomes	**Short, thick visible**	**Prophase**

Define *the following terms and form a sentence using the words.*

Synapsis	**A time period in the meiotic process**
Homologous Chromosomes	**2 similar chromosomes, eg. Chr. #1 from each parent AKA. homologues**
Tetrad	**2 homologues**
Crossing Over	**When 2 homologues exchange genetic information**

During synapsis 2 homologous chromosome intertwine and become a tetrad and crossing over occurs

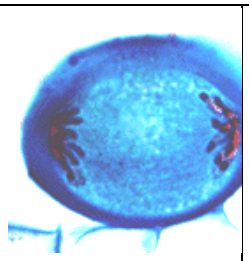
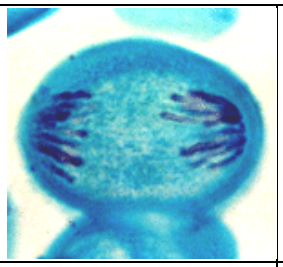
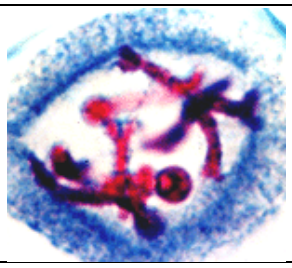
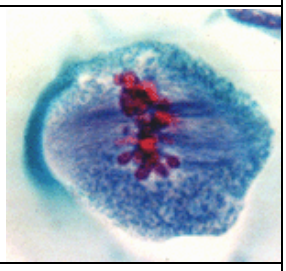
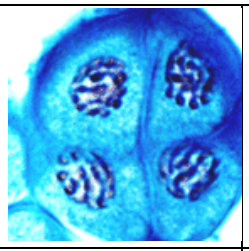
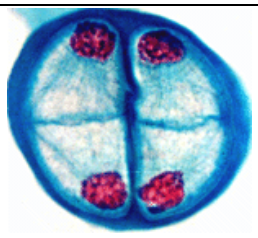
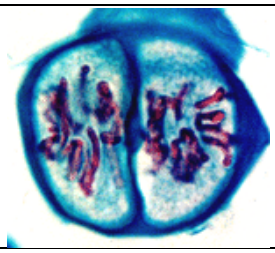
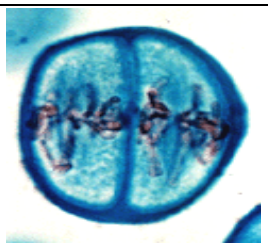
Explain *the difference between the terms haploid and diploid*

Haploid – half complement of chromosomes (n), Diploid – full complement (2n)

What process is responsible for restoring the diploid chromosome number in the human life cycle?

Fertilization (n + n = 2n, sperm + egg = zygote)

Identify *each meiotic phase.* ***Describe*** *what you see in each diagram that helped you to identify it.*

Meiosis I				
				
Description	2 poles – Meiosis I, later on because of movement Telophase I	2 poles – Meiosis I, still moving Anaphase I	Chromosomes short thick and within nucleus Prophase I	Chromosomes on equator Metaphase I
Meiosis II				
				
Description	4 Normal looking cells Telophase II	4 cells having moved Telo or Ana II	2 cells with short/thick chrom Prophase II	2 cells on equator Meetaphase II

In the space below ***draw*** *a diagram showing the chromosome arrangement of metaphase I and metaphase II?*

Metaphase I

X X X X X X X X X
X X X X X X X X X

Metaphase II

X X X X X X X X X

During which meiotic phase do

Chromatids separate? **Anaphase II**

Homologous chromosomes separate? **Anaphase I**

Comparing Mitosis and Meiosis *Place a check mark on the chart below to classify the different statements as events that occur in Mitosis, Meiosis or both*

Event	Mitosis	Meiosis
1 cell division	**X**	
2 cell divisions		**X**
Interphase occurs once	**X**	
Interphase occurs twice	**Neither**	**Neither**
2 daughter cells formed	**X**	
4 daughter cells formed		**X**
Parent cell is diploid	**X**	
Daughter cells are diploid	**X**	
Daughter cells are haploid		**X**
Parent (2n = 46) Daughter (n = 23)		**X**
Parent (2n = 46) Daughter (2n = 46)	**X**	
Occurs in gametes (sex cells)		**X**
Occurs in somatic cells (autosomes)	**X**	

Why is Meiosis II more similar to Mitosis than Meiosis I?
Both involve chromatid separation not separation of a homologous pair

Complete *the following about nondisjunction*

Define the term nondisjunction **Improper separation of genetic material**

During which phase does it occur? **Metaphase when spindles are attached**

Does it affect mitosis or meiosis? **Meiosis**

n – 1 is **Monosomic** A human with this condition would have **45** chromosomes

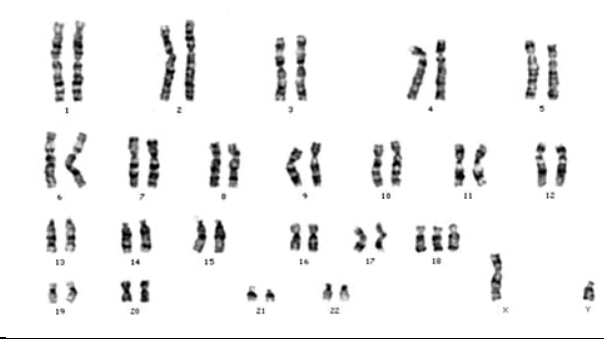
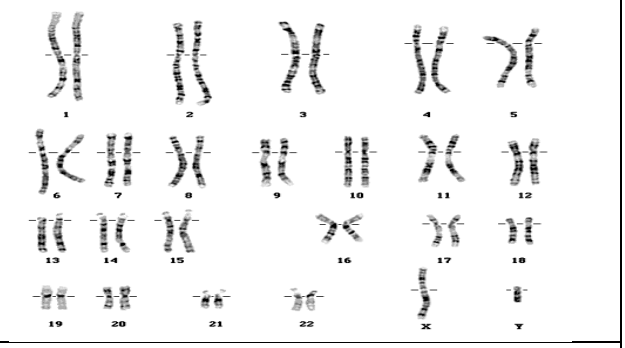
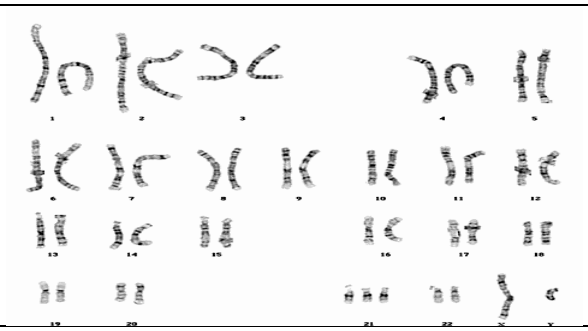
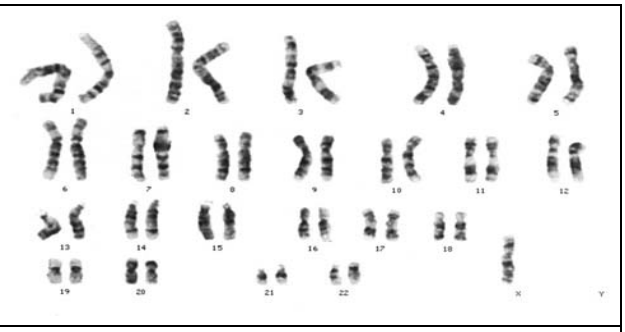
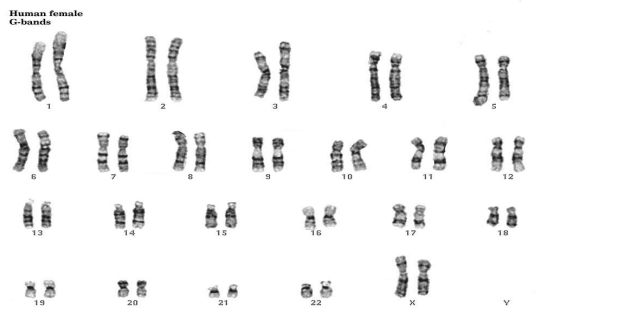
n + 1 is **Trisomic** A human with this condition would have **47** chromosomes

Compare gamete interaction for identical and fraternal twins

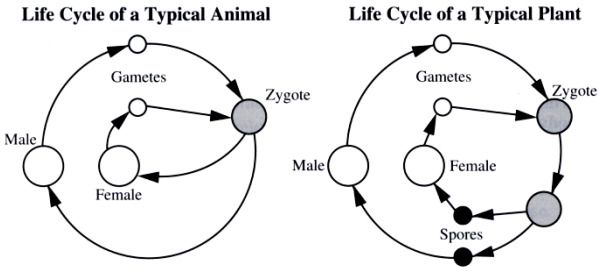
Twin Type	Gamete Interaction (eg. # sperm w/ # egg)
Identical Twins	**1 egg + 1 sperm that separates after fertilization**
Fraternal Twins	**2 diff eggs with 2 diff sperm that divide properly**

*For **each** Karyotype identify*

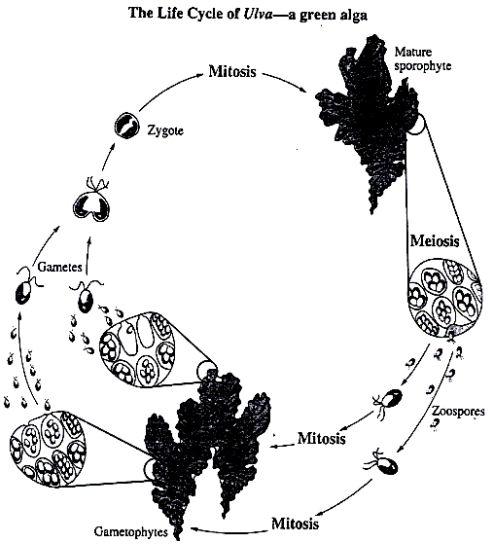
1. *Male or female, and "Normal" or Nondisjunction (if nondisjunction, circle the affected pair)*
2. *Chromosome pair affected and type of disorder – ie. Trisomy 5 or Monosomy 23, etc.*

	
Male – Trisomy 18	**Male - Normal**
	
Male – Trisomy 21	**Female – Monosomy 23**
	
Male – Trisomy 23	**Female – Normal**

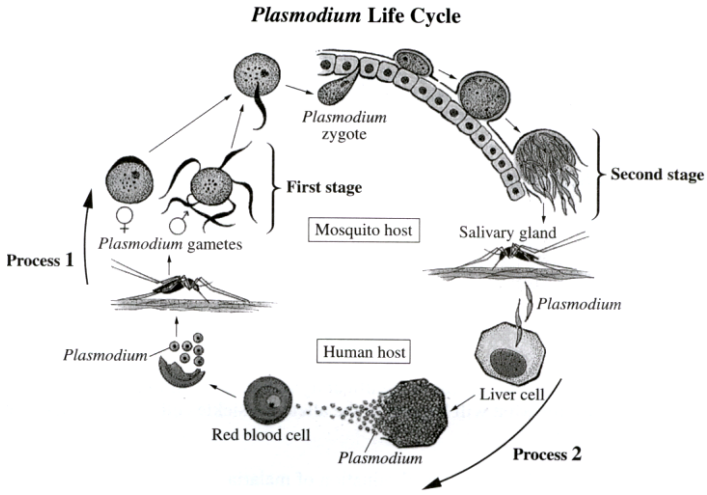
*For each phase of life in the life cycles below, identify whether the phase is haploid (n) or diploid (2n), and **circle** where **fertilization** is shown in the cycle.*



Male	**Diploid**
Spores	**Haploid**
Zygote	**Diploid**
Female	**Diploid**
Gametes	**Haploid**



Zygote	**Diploid**
Zoospores	**Haploid**
Gametes	**Haploid**
Gametophyte	**Haploid**
Mature Sporophyte	**Diploid**



Plasmodium	**Diploid**
Zygote	**Diploid**
Gametes	**Haploid**
Process 1	**Mitosis**
Process 2	**Meiosis**