

Meiosis, Mendel, and Genetics **Essential Questions**

#1. How many chromosomes in each body cell (somatic cell)? In each gamete (sex cell)? What is body cell division called? What is sex cell division called?

- _____ chromosomes in _____ cells (body cells)
- _____ chromosomes in _____ cells (gametes)
- Body cell division is _____
- Sex cell division is _____

#2. What is the difference between homologous chromosomes and chromatids?

- Homologous chromosomes are two _____ (not identical) of chromosomes, one inherited from mom and one from dad (23 _____ chromosomes = 46 total chromosomes)
- Sister chromatids are duplicate _____ of chromosomes that remain attached by a _____.

#3. List the five stages of mitosis and what happens in each.

1. _____ – chromosomes _____ to 96; cell spends 90% of time here
2. _____ – chromosomes thicken and nucleus disappears; _____ line form at opposite sides of nucleus
3. _____ – chromosomes line up in _____ of cell; spindle fibers form
4. _____ – chromosomes _____ equally with 46 on each side of cell
5. _____ – cell pinches off into two identical _____ cells (cytokinesis)

#4. Draw mitosis and meiosis

#5. List the stages of 8 Meiosis and explain what happens in each

Interphase – chromosomes double to 96; cell spends 90% of time here

1. _____ I – _____ & _____ fibers get ready, nuclear membrane breaks down, _____ pair up
2. _____ I – spindle fibers align _____ in the middle of the cell
3. _____ I - _____ pulled to opposite sides of the cell
4. _____ I – cell splits in two by cytokinesis, _____ separated into two cells (diploid)
5. _____ II - _____ & spindle fibers get ready, nuclear membrane breaks down,
6. _____ II - spindle fibers align attached _____ in the middle of the cell
7. _____ II - _____ pulled to opposite sides of the cell
8. _____ II – 2 cells split into 4 by cytokinesis, nuclear membranes form around half (haploid) number of chromosomes called _____

#6 What is the difference between metaphase in Mitosis and metaphase I in Meiosis?

- In Metaphase I (Meiosis) homologous chromosomes line up in the middle of the cell in _____
- In Metaphase (Mitosis) homologous chromosomes line up in the middle _____ of each other.

#7 What is crossing over? When does it occur? Why is it beneficial?

- Crossing over is the exchange of genetic material by non-sister _____ during meiosis.
- Crossing over occurs in _____ I (Meiosis).
- Crossing over causes genetic _____.

#8. What is tetrad formation?

- During Prophase I (Meiosis), _____ come together to form a _____.

#9. Failure of chromosomes to separate evenly during anaphase of meiosis is called?

- Nondisjunction which causes retardation (47 chromosomes) or death (45 chromosomes)

#10. What are the differences between Mitosis and Meiosis?

MITOSIS	MEIOSIS
1. In Metaphase homologous chromosomes line up _____	1. In Metaphase I homologous chromosomes line up _____
2. In Anaphase <u>sister</u> _____ separate.	2. In Anaphase I <u>homologous</u> _____ separate
3. In the end <i>daughter</i> cells have <u>the same</u> (two copies - _____) number of chromosomes as parent.	3. In the end new <i>gametes</i> have <u>half the</u> (one copy - _____) number of chromosomes as parent.

11. Who was Gregor Mendel and what was he famous for?

- _____ of Genetics
- Austrian monk who grew _____ plants and discovered dominant and recessive _____

12. What is the difference between self-pollination and cross-pollination?

- Self Pollination occurs when a plant's own _____ (male part) fertilizes its own _____ (female part)
- Cross Pollination requires an insect, wind, bird, or man to transfer _____ (male part) from one plant to the _____ (female part) of another plant

13. What is an allele?

- Alternative forms of a _____ (half a gene)
- Ex. Aa → A (one allele), and a (other allele)
- During Meiosis, half the number of _____ and half the _____ separate into gametes

14. What is the difference between a dominant allele and a recessive allele?

- Dominant alleles _____ their characteristics and are _____ (B)
- Recessive alleles stay _____ unless it pairs with another _____ allele and is shown using a lower case letter. (b)

15. What is the difference between a purebred gene and a hybrid gene?

- Purebred genes have both the _____ case letters (AA, BB or aa, bb)
 - Called _____
- Hybrid genes have one _____ case letter and one _____ case letter. (Aa, Bb)
 - They are usually _____ than purebreds. WHY?
 - Called _____

16. What does F1 and F2 refer to?

- P1 = genotypes of the _____ being crossed
- F1 = genotypes of the _____ generation of children
- F2 = genotypes of the _____ generation of children

17. Draw a Punnett square of a hybrid tall male crossed with a hybrid tall female.

18. What is the difference between genotype and phenotype?

- Genotype is the _____ combination (letters) or gene percent probabilities of the offspring (Genes!)
- Phenotype is the _____ of the genes (Physical Appearance!)

19. List the three genotypes.

- _____ (purebred dominant) - AA, BB
- _____ (hybrid) - Aa, Bb
- _____ (purebred recessive) - aa, bb

20. What is a monohybrid cross?

- The crossing of parents with only _____ or trait
- Punnett square with _____ boxes
- One _____ over each box
- _____ alleles inside each box
- 1:1, 1:2:1, or 3:1 _____ ratios

#21. What is a dihybrid cross?

- Crossing parents with _____ different _____ or characteristics.
- Punnett square with _____ boxes
- Two _____ over each box
- _____ alleles inside each box
- _____ combinations are 1-3 1-4 2-3 2-4
- Crossing heterozygotes results in 9:3:3:1 _____ ratios

22. How is probability used in Genetics?

- _____ = $\frac{\text{\# of ways an event can occur}}{\text{\# of total possible outcomes}}$
- Probability is used to determine the _____ of having a child with a specific _____

23. What is the difference between haploid and diploid?

- Haploid (1N) = _____ the number of chromosomes represented inside _____ (sex cells)
- Diploid (2N) = the _____ number of chromosomes inside _____ (body cells)

24. What is a homologous chromosome?

- Paired _____ of chromosomes with genes for the same traits in the same location (locus)

25. What does crossing over refer to?

- Exchange of genetic material between _____ during meiosis which results in new allele _____ in the gametes

26. What are the stages of meiosis and what happens in each?

Interphase – Chromosomes double

1. _____ I – nucleus disappears; chromosomes thicken
2. _____ I – chromosomes line up in center with homologue; spindle fibers attach to centromeres
3. _____ I – spindle fibers from centrioles pull homologous chromosomes evenly to opposite sides of cell
4. _____ I – cell cleaves into two daughter cells
5. _____ II – spindle fibers attach to the centromere of the two sister chromatids
6. _____ II – sister chromatids line up in the middle of cell
7. _____ II – sister chromatids are pulled evenly to opposite sides of cell
8. _____ II – cell cleaves into four gametes with half (haploid) the number of chromosomes

27. What is a test cross?

- Monohybrid cross in which an _____ genotype is crossed with a homozygous recessive.
- If the unknown genotype is homozygous dominant, all the offspring will be _____
- If the unknown genotype is heterozygous, half of the offspring will be homozygous _____

28. What are Mendel's 2 laws?

1. Law of _____ – the two copies of a gene segregate (separate) during sex cell formation
 - One _____ of a gene per sex cell
2. Law of _____ – allele pairs separate independently during sex cell formation
 - Genes don't always separate together – blue eyes and blond hair don't always separate _____

#29. What is a recessive allele? What are some diseases caused by recessive alleles?

- Weak or _____ allele
- Usually written with a _____ case letter (Ex. a or b)
- _____ is caused by recessive alleles in a Homozygous recessive individual

#30. What is a Heterozygous genotype? Why are heterozygous individuals usually carriers, but don't get the disease?

- Heterozygous = _____
- Usually written with one _____ case letter and one _____ case (Ex. Aa or Bb)
- Carriers have _____ good copy of the gene and so don't get the disease, but can pass it on to their kids

#31. What is the difference between Homozygous dominant and homozygous recessive?

- Homozygous = _____
- Usually written with two _____ letters (Ex. AA or aa, BB or bb)
- Homozygous dominant = 2 _____ alleles (AA, BB)
- Homozygous recessive = 2 _____ alleles (aa, bb)

#32. What is the Homozygous dominant genotype? What are some diseases that are caused by Dominant alleles?

- Two _____ alleles
- Usually written with two _____ letters (Ex. AA or BB)
- _____ disease is caused by dominant alleles

#33. What is the difference between co-dominance and incomplete dominance?

- Co-dominance – When both alleles are _____ expressed. (two traits _____ show up)
Ex. Black Rat x White Rat → _____ offspring
- Incomplete Dominance – Neither allele is _____ and the alleles are expressed in a _____ trait. (two traits _____ to express a third trait)
Ex. Black Rat x White Rat → _____ offspring

#34. What are polygenic traits?

- A trait determined by _____ than one gene
- Ex. Eye color is determined by at least _____ genes

35. What are Sex-linked Characteristics?

- Mutation carried on the "X" _____
- Male needs 1 _____ X and female needs 2 _____ X's to have the disease.
- Three examples: _____, _____, _____

#36. What is a Karyotype and what does it test for?

- Chromosomes are photographed, _____, and observed for any _____

#37. What is Non-disjunction and what does it cause?

- Failure of chromosomes to _____ evenly during meiosis causing one _____ or one _____ chromosome in the gametes.
- Examples: Down's Syndrome – _____ 21, Triple X (Super Female) _____, Turner's Syndrome _____, Klinefelter's Syndrome _____

#38. What does "Congenital" mean?

- Abnormality at _____

#39 What is a Human Pedigree chart? How do you interpret it?

- A record of _____ over a number of _____
- Males are _____, females are _____
- Unaffected is _____, affected is _____ and half-_____ is a carrier
- _____ can be determined based on affected and unaffected individuals
- _____ for passing on a gene can also be determined.

#40. What are Drosophila? Why are they important in genetics?

- Fruit fly used in studying _____ because of its _____ (8) chromosomes