



1. Define *homologous chromosomes*.

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2. Explain *reduction division*.

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3. State the function of meiosis.

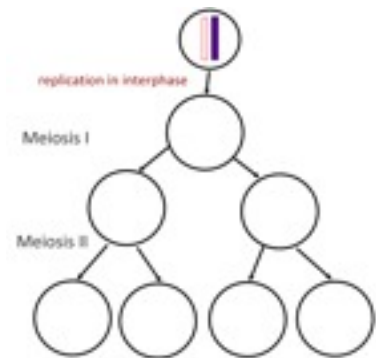
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4. Add chromosomes and annotate the diagram below summarizing the steps in meiosis.

Identify the stage where *crossing over* occurs and state its effect.



5. Compare mitosis and meiosis:

	Mitosis	Meiosis
Number of divisions		
Number of daughter cells		
Chromosome number in daughter cells		
Functions:		



6. Outline the major events and movements of chromosomes occurring at these stages of meiosis:

Meiosis I		Meiosis II	
Interphase		Interphase	<i>No replication occurs in interphase between Meiosis I and II.</i>
Prophase I		Prophase II	
Metaphase I		Metaphase II	
Anaphase I		Anaphase II	
Telophase I		Telophase II	
Cytokinesis		Cytokinesis	

7. Deduce the answers to these questions.

a. A cell with a diploid number of 12 chromosomes meiosis. How many daughter cells will be produced and with how many chromosomes in each?

- Cells:
- Chromosomes:

b. A gamete contains 18 chromosomes. How many chromosomes in the somatic cell?

- Chromosomes:

c. A diploid cell with 16 chromosomes undergoes meiosis. How many chromatids are present in metaphase I?

- Chromatids:





8. A cell with a chromosome number ( $n$ ) of 3 undergoes meiosis. Draw a series of diagrams to outline the steps of meiosis.

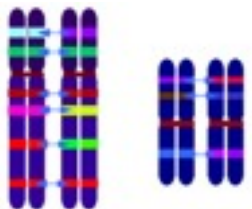




9.

10. Describe what you can see in this image.

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11. Distinguish between *chromosomes*, *sister chromatids* and *bivalents*.

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12. State during which stage of meiosis is the image in Q8 most likely to be seen.

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13. Outline the process of crossing over and annotate the diagram.

Synapsis

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Chiasma formation

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Separation



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14. State the effect of crossing over in terms of genetic diversity.

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15. A diploid cell carries genes A and B. There are dominant and recessive alleles for these genes. The cell is heterozygous for both genes.

a. What combination of gametes could be produced if there was no crossing over?

- AB or \_\_\_\_

$$\frac{AB}{ab}$$

b. What combinations of gametes could be produced if a chiasma formed between the loci of genes A and B?

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16. The rough image shows chromosomes forming chiasmata.

How many of the following structures are present?

*Chromosomes:*

*Centromeres:*

*Sister Chromatids:*

*Chiasmata:*



17. Outline how *random orientation* in metaphase I leads to further genetic variation.

State the number of orientations possible in human cells.





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18. Mendel made many advances in genetics through careful observation and statistical analysis.

a. State Mendel's Law of Independent Assortment

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b. What assumption is made here?

○ There is no \_\_\_\_\_

c. Explain the link between the law of independent assortment and meiosis.

○

○

○

○

19. Outline how sexual reproduction leads to even further genetic variation within a species.

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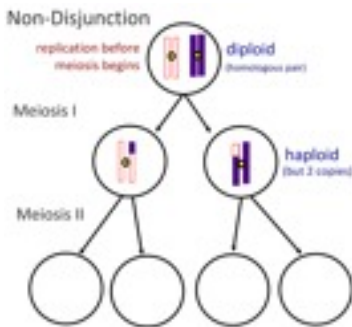
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20. Annotate the diagram below to show what happens in *non-disjunction* in meiosis II.



21. Describe how non-disjunction and fertilisation lead to *trisomy*.

- Non-disjunction:
- Fertilisation:

22. Distinguish between non-disjunction and trisomy.

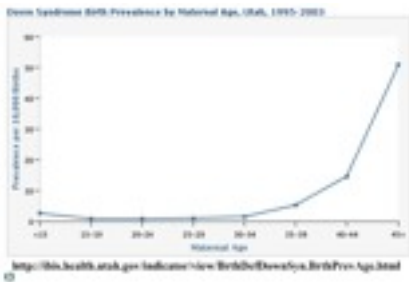
- Non-disjunction:
- Trisomy:



23. Compare the outcomes of non-disjunction in anaphase I with anaphase II:

Non-disjunction in...	Anaphase I	Anaphase II
Number of normal cells		
Cells with extra chromosome ( $n+1$ )		
Cells with chromosome missing ( $n-1$ )		

24. Using information in the graph, outline the effect of maternal age on likelihood of Down Syndrome:



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25. Describe the effects of *Down syndrome*.

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26. Compare the outcomes of non-disjunction in anaphase I with anaphase II:

Non-disjunction in...	Anaphase I	Anaphase II
Number of normal cells		
Cells with extra chromosome ( $n+1$ )		
Cells with chromosome missing ( $n-1$ )		

27. A **karyotype** can be used to test for non-disjunction disorders. Fetal cells are taken and the number of chromosomes counted. Outline how these cells are retrieved:

*Chorionic Villus Sampling (CVS):*

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*Amniocentesis:*

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28. Describe how performing a nuchal translucency (NT) scan can reduce the number of healthy fetuses terminated as a result of amniocentesis. <http://www.guardian.co.uk/society/2009/may/16/health-nhs>

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29. State three visual aspects of homologous chromosomes which can be used to identify them for the purpose of a karyotype?

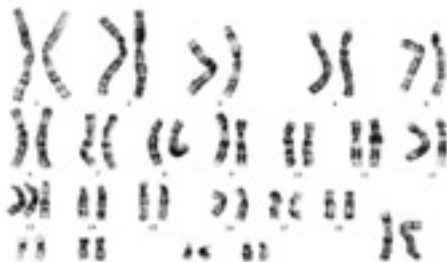
a. Banding patterns

b.

c.



30. Analyse this karyotype:



<http://www.tokyo-med.ac.jp/genet/kry/tril13k.jpg>

Gender:

Condition:

**Remember: Meiosis is the key to success in Biology.** If we understand how meiosis works and gives rise to genetic variation, we can understand how life has evolved and adapted. Make sure you can explain all of the ways in which meiosis leads to variation amongst a population.



## Works Cited

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