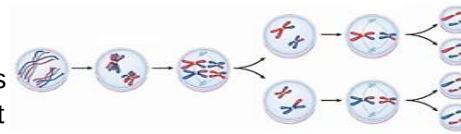
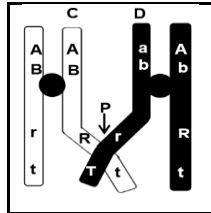


**MEIOSIS** is a type of cell division whereby a diploid cell (**somatic cell**) divides to form four different haploid gametes (sex cells). Diploid cells have two sets of chromosomes. Haploid cells only have one set of chromosomes. In males it occurs inside the testes and in female it occurs inside the ovaries.



## The significance (importance) of Meiosis

- **Production of haploid gametes**
- **The halving effect of meiosis overcomes the doubling effect of fertilisation, thus maintaining a constant chromosome number from one generation to the next.**



1.1 During which phase does this process take place?

- **Prophase 1**

1.2 Name the point/region P

- **Chiasmata**

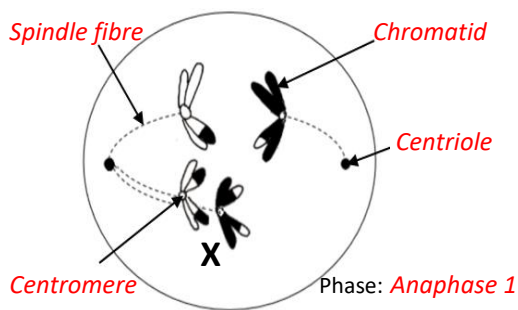
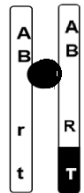
1.3 Describe what happens during the process shown above

- **Homologous chromosomes lie next to each other**
- **Chromatids overlap/touch at the chiasmata**
- **And genetic information is exchanged/swapped**

1.4 Explain the importance of this process

- **Introduces genetic variation in gametes**
- **May lead to new characteristics (Favourable/un-)**
- **Affecting the chance of survival of the organism (natural selection)**

1.5 Draw a labelled diagram, showing chromosome C, at the end of this process.



Label above diagram

| Meiosis 1                                                                                                                                                                                          | Meiosis 2                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Phase: Prophase 1</b><br><b>Reason/s:</b> <ul style="list-style-type: none"> <li>• Spindle fibres forming</li> <li>• Crossing over occurs</li> <li>• Nuclear membrane Disintegrating</li> </ul> | <b>Phase: Prophase 2</b><br><b>Reason/s:</b> <ul style="list-style-type: none"> <li>- Spindle fibres forming</li> <li>- Single chromosomes visible</li> </ul> |
| <b>Phase: Metaphase 1</b><br><b>Reason/s:</b> <ul style="list-style-type: none"> <li>• Homologous chromosomes arranged at the equator</li> </ul>                                                   | <b>Phase: Metaphase 2</b><br><b>Reason/s:</b> <ul style="list-style-type: none"> <li>- Single chromosomes arranged at the equator</li> </ul>                  |
| <b>Phase: Anaphase 1</b><br><b>Reason/s:</b> <ul style="list-style-type: none"> <li>- (Full) chromosomes moves to the opposite poles</li> </ul>                                                    | <b>Phase: Anaphase 2</b><br><b>Reason/s:</b> <ul style="list-style-type: none"> <li>- Chromatids moves to the opposite poles</li> </ul>                       |
| <b>Phase: Telophase 1</b><br><b>Reason/s:</b> <ul style="list-style-type: none"> <li>- Two cells forms with full (replicated) chromosomes</li> </ul>                                               | <b>Phase: Telophase 2</b><br><b>Reason/s:</b> <ul style="list-style-type: none"> <li>- Four cells forms with unreplicated Chromosomes</li> </ul>              |

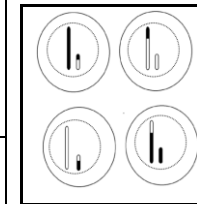
NB...Homologous chromosomes also called "BIVALENT" when crossing over occurs

Explain the arrangement of the chromosome at X (diagram on the left).

- **Non-disjunction of homologous chromosomes (X) occurred during Anaphase 1**
- **(Homologous chromosomes failed to separate)**

Explain the disorder that will result, due to the mistake occurring at X, if it represents chromosome pair 21 in humans.

- **Non-disjunction of chromosome pair 21 during anaphase I in humans to form abnormal gametes with an extra copy of chromosome 21**
- **The fusion between an abnormal gamete (24 chromosomes) and a normal gamete (23 chromosomes) may lead to Down syndrome**



4.1 How many chromosomes:

- Are present in EACH cell
  - **2**
- Were present in the original cell at the start of meiosis
  - **4**

4.2 The cells in the diagram are NOT identical

(a) Name TWO processes during meiosis that lead to the cells being different from one another.

- **Crossing over**
- **Random arrangement**

(b) Explain the significance to a species of the cells being different from one another.

- **Gametes formed will be genetically different**
- **leading to variation in the offspring**
- **This increases a species chances of survival**

4.3 Mention THREE similarities between Meiosis and Mitosis

- **DNA Replication occurs in both**
- **Spindle fibres forms in both**
- **Both forms new cells at the end**

4.4 Differences between Mitosis and Meiosis

| Mitosis                                     | Meiosis                                     |
|---------------------------------------------|---------------------------------------------|
| TWO daughter cells produced                 | FOUR daughter cells produced                |
| Diploid chromosome number in daughter cells | Haploid chromosome number in daughter cells |
| Genetically Identical cells produced        | Genetically Different cells produced        |
| Produces somatic cells                      | Produces gametes                            |

**Random arrangement:** During Metaphase 1 (or 2) homologous chromosomes (or chromosomes) may line up either way on the equator. (see separate document)...

**Homologous chromosomes:** Chromosomes that carry the same set of genes. (Are of the Same size, Same shape and Same length).....