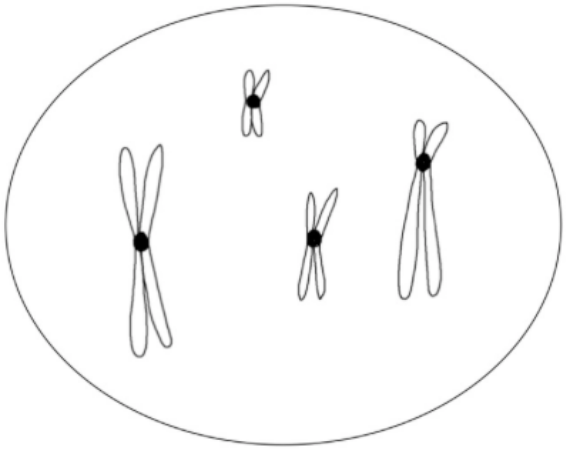
1. Your friend says that the cell shown below contains four diploid chromosomes. Is your friend correct? Please explain fully why or why not. **(2 marks)**



*Your friend is **incorrect**, because although there are four chromosomes, these are not 'diploid.'*

***Diploid** means that there are two copies of each type of chromosome in an organism or a cell, but it is never used to describe chromosomes. The cell shown here is actually **haploid**, as there is only one of each type of chromosome.*

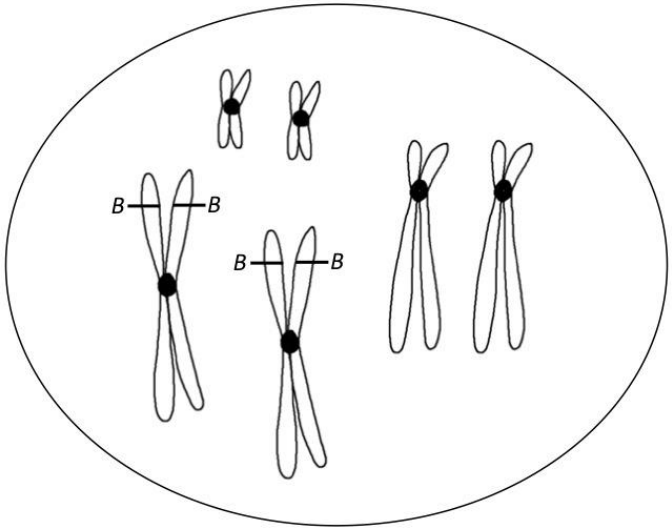
*(In this example, these chromosomes have two DNA molecules each, joined by a centromere. This indicates that these chromosomes are **replicated**. This cell therefore is haploid (n=4), with replicated chromosomes.)*

2. Please explain, in your own words, the difference between the terms diploid vs. replicated as they relate to chromosomes. **(2 marks)**

As in the previous question, 'diploid' is used to describe cells or organisms, but never chromosomes. Diploid means that there are two copies of each chromosome type in a cell. In contrast, a replicated chromosome means that there are two DNA molecules (identical copies called sister chromatids), joined by a single centromere.

3. Draw a diagram of a eukaryotic cell that satisfies the following criteria: **(3 marks)**

- The cell is diploid, and contains a total of six chromosomes and 12 DNA molecules
- Two of the chromosomes have centromeres closer to one end of the chromosome
- The remaining chromosomes have centromeres approximately in the middle of the chromosome; two of these chromosomes carry a gene identified as "B"



Characteristics to look for:

- *The cell should have obvious pairs of chromosomes (i.e., it should be diploid)*
- *The chromosomes should be replicated (i.e., 12 DNA molecules ÷ six chromosomes = 2 sister chromatids in each chromosome)*
- *One pair of chromosomes should have the centromere closer to one end of the chromosome (the centromere should be in the same place in both chromosomes, because those chromosomes form a homologous pair)*
- *The other four chromosomes should have centromeres approximately in the middle of the chromosome (chromosomes that form pairs should have the centromere in the same place)*
- *The chromosomes carrying gene "B" should clearly be homologous to one another (and should both have centromeres in the middle of the chromosome). There should be four copies of gene "B" (one on each sister chromatid in these chromosomes), and gene "B" should be in the same location on each chromatid.*