In summary, the cell cycle, the organised sequence of events in preparation for cell division arising in a cell. The cell cycle is a four-stage system in which the cell increases in size (gap 1, or G1, stage), copies its DNA (synthesis, or S, stage), prepares to break (gap 2, or G2, stage), and splits (mitosis, or M, stage).

Interphase, which accounts for the time between cell divisions, is made up of stages G1, S and G2. It also "decides" on the basis of the stimulatory and inhibitory signals a cell receives whether it can join and continue through the cell cycle and eventual cell division.

7/7

2. **Which major event during meiosis is most likely to produce deviations from Mendel's laws?**

Crossing over produces deviations from mendel's laws. Crossing over refers to exchange of genetic material during sexual reproduction between two homologous chromosomes' non-sister chromatids that results in recombinant chromosomes. These recombinant chromosomes have a mixture of parental characteristics. It occurs during prophase 1 of meiosis. As a result of crossing over, a new arrangement of maternal and paternal alleles on the same chromosome can occur. This way it is possible to have any combination of parental alleles in an offspring. For genes that are closer together on a chromosome, the likelihood that a recombination event will separate the two genes is smaller than if they were farther apart. For genes that are essentially "linked" or close together, they are more likely to segregate together and therefore have a lower frequency of recombination.

2/2

3. **Explain, with examples, the concept of *jumping genes* in prokaryotes.**

Jumping genes are also known as transposable elements (TEs). These TEs are DNA sequences that move from one area of the genome to another area of the genome. They don't really "jump". The two mechanisms of TE action are through either a cut-and-paste method or a copy-and-paste method. In the cut-and-paste method, the TE exits its original location and enters a new location in the genome. In the copy and paste method, a copy of the TE is made, and this copy is then inserted into a new location within the genome. The original location still contains the TE. Depending on where the TEs insert into the genome, they can result in mutations if the point of insertion is within a protein coding region. TEs are present in prokaryotes as well. There are two main types of bacterial TEs: Transposons and insertion sequences (IS). IS are relatively small and only contain genes required for their transposition, most notably, the gene called "Transposase". This enzyme catalyzes some of the recombination reactions for inserting or removing the TE from the DNA. At both ends of the IS is a short-inverted repeat sequence. This inverted repeat section allows transposase to recognize and identify the ends of the TE when it catalyzes transposition.

Transposons on the other hand, are more complex. They have inverted repeat sequences at each end enclosing a central region with many genes. These additional genes often also code for antibacterial/antibiotic resistance. Genes included here could be those involved in resistance to various antibiotics. They can jump from plasmid DNA to chromosomal DNA and vice-versa therefore permanently encoding antibiotic resistance within the bacteria. As these TEs move to different areas of the genome and are propagated, resistance to these antibiotics increases among the bacterial species.

Examples of TEs include P elements that were discovered within Drosophilla melongaster. These TEs can also be artificially produced to induce expression of certain genes within organisms.