Q7. <u>Briefly discuss</u> the information above, highlighting the importance of *checkpoints* in the cell cycle to prevent mistakes that occurred during the interphase or in mitosis from being passed forward to every new cell produced. In your answer, you are expected to <u>explain</u> what checkpoints are, in <u>which stages</u> they occur, and <u>indicate</u> what the possible fate of a cell would be in case the checkpoints <u>did not</u> pick up mistakes during the interphase or cell division.

Towards the end of the G1 phase it will be evaluated if the DNA is damaged in any way, if the conditions looks promising the cell will commit to the cell cycle. This will be determined by external signals and factors e.g. growth, energy levels of the cell. The cell can then proceed to DNA replication and enter the S phase. The checkpoint here is referred to as the restriction point. After the restriction point the extracellular growth factors will no longer be required since it has now been replicated. (Foster, Yellen, Xu, Saqcena, 2010)

In G2 the condition are checked to see whether or not all chromosomes have been replicated successfully and that the replicated strands of DNA are not damaged. If the cell's condition is proven sufficient it will continue into the M phase. If the cell goes onto the M phase before the DNA has been repaired, it will enter programmed cell death after the division.

In the M phase it checks to determine that all the sister chromatids are attached to the stirke microtubules in the correct way, then the cell proceeds to anaphase.

All checkpoints are vital to prevent mutations that many cluber there are mistakes the chromosome distribution. If this happens that mutation on the bassed to every taw cell the abnormal cell produces. In the checkpoints the relicione can be halted eithin temporary or permanently depending on how the call compromised. This there is a sthe G0 phase.

In the early embryo there is a spindle checkpoint mechanism regulating the chromosome segregation. It delays anaphase until the microtubules have caught all kinetochores. (Encalada, Willis, Lyczak, Bowerman, 2005)

Question 8: Carefully read and analyse the Text extract 3 and the Diagram 2, and then address Q8.

Text extract 3:

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"The duration of the cell cycle phases varies considerably in different kinds of cells. For a typical rapidly proliferating human cell with a total cycle time of 24 hours, the G1 phase might last about 11 hours, S phase about 8 hours, G2 about 4 hours, and M about 1 hour. Shorter cell cycles (30 minutes or less) occur in early embryo cells shortly after fertilisation of the egg. There is no G1 or G2 phase, and DNA replication occurs very rapidly in these early embryonic cell cycles, which therefore consist of very short S phases alternating with M phases" (Cooper, 2000).

Diagram 2: Comparison of early embryonic cell cycle with somatic cell cycle (Nature Education, 2000).