	INDIAN SCHOOL AL WADI AL KABIR	
Class: XI	**DEPARTMENT OF SCIENCE 2024 – 25** **SUBJECT: BIOLOGY**	**Date :25/04/2024**
Worksheet No: 3 **WITH ANSWERS**	**CHAPTER: CELL CYCLE AND DIVISION**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT	**CLASS & SEC:**	**ROLL NO.**

OBJECTIVE TYPE QUESTIONS (1 MARK EACH)

Q1. _____ and _____ coined the term "Meiosis".
   a) Van Burin and Hertwig
   b) Boveri and Stuka
   c) Walleye and Hofmeister
   d) Farmer and Moore

Q2. Chromatids coiling in the meiotic and mitotic division is _____
   a) Plectonemic in both
   b) Paranemic in both
   c) Paranemic in mitosis and plectonemic in meiosis
   d) Plectonemic in mitosis and paranemic in meiosis

Q3. When there is an increase in the condensation of chromatin during the process of cell
    division –
   a) Heterochromatin increases.
   b) Euchromatin increases.
   c) Differentiation of euchromatin & heterochromatin decreases
   d) Differentiation of euchromatin & heterochromatin increases.

Q4. The condensation of chromosomes is observed in _____
   a) Prophase 1
   b) Anaphase 1
   c) Metaphase 1
   d) None of the above

Q5. Nuclear DNA replicates in the _____ phase.
   a) G2 phase
   b) M phase
   c) S phase
   d) None of the above

Q6. _____ is a form of cell division which results in the creation of gametes or sex cells.

   a) Mitosis
   b) Meiosis
   c) Miosis
   d) None of the above

Q7. ____ is the number of DNA in the chromosome at the G2 stage of the cell cycle
   a) 1
   b) 2
   c) 3
   d) 0

Q8. The stage which serves as a connecting link between meiosis 1 and meiosis 2
   a) Interphase 2
   b) Interphase 1
   c) Interkineses
   d) None of the above

Q9. The longest stage in the cell cycle is
   a) Interphase
   b) Anaphase
   c) Metaphase
   d) None of the above

Q10. The _____ state implies the exit of cells from the cell cycle
   a) S
   b) G1
   c) G2
   d) G0

ASSERTION AND REASON (1M)

A. Assertion and Reason are true, and the reason is the correct explanation.
B. Assertion and Reason are true, but the reason is not the correct explanation.
C. Assertion is a true statement, but Reason is false.
D. Assertion and Reason are false statements.

Q.11. Assertion: Mitosis is important in the life of an organism, especially in the growth of a
           multicellular organism.
      Reason: Mitosis restores the nucleocytoplasmic ratio.

Q12. Assertion: In animal cells, the cytokinesis is marked by the appearance of a furrow in
           plasma membrane.
      Reason: In plant cells, the formation of the new cell wall starts with the formation of
           simple precursor called cell plate.

Q13. Assertion: Mitosis is often called indirect division.
      Reason: Mitosis divides a parent cell into two daughter cells.

SHORT ANSWER TYPE QUESTIONS (2 MARKS EACH)

Q14. What do you understand by the term cell reproduction?

Q15. What is the importance of chromosomal replication during the interphase?

Q16. Is there mitosis without DNA replication in the 'S' phase, and can there be DNA replication without cell division?

Q17. Telophase is said to be the reverse of prophase. Describe the statement.

LONG ANSWER TYPE QUESTION (3 MARK EACH)

Q18. Describe the following events that take place during interphase.

Q19. What is the significance of Meiosis?

CASE STUDY BASED QUESTIONS (4M)

In a cancer cell, several genes change (mutate) and the cell become defective. There are two general types of gene mutations. One type, dominant mutation, is caused by an abnormality in one gene in a pair. An example is a mutated gene that produces a defective protein that causes the growth-factor receptor on a cell's surface to be constantly "on" when, in fact, no growth factor is present. The result is that the cell receives a constant message to divide. This dominant "gain of function gene" is often called an oncogene (onco = cancer).
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A gene mutation may allow an already abnormal cell to invade the normal tissue where the cancer started or to travel in the bloodstream (metastasize) to remote parts of the body, where it continues to divide. A normal cell can become damaged in different ways.
A cell can become abnormal when part of a gene is lost (deleted), when part of a chromosome is rearranged and ends up in the wrong place (translocation), or when an extremely small defect occurs in the DNA, which results in an abnormal DNA "blueprint" and production of a defective protein occurs.
In summary, cancer cells have defects in normal cellular functions that allow them to divide, invade the surrounding tissue, and spread by way of vascular and/or lymphatic systems. These defects are the result of gene mutations sometimes caused by infectious viruses.

Q20. i) What do you understand by 'gene mutation'?
    ii) What is the definition of metastasize?
    iii) How does a cell become a cancer cell?
    iv) Other than mutations what are the different ways the cell can become cancerous?

VERY LONG ANSWER TYPE QUESTIONS (5 MARK EACH)

Q21. Describe the different phases occurring in meiotic prophase – I. Also, mention the chromosomal events during each stage.

Q22. Analyse the following events during every stage of the cell cycle and notice the following two parameters-

(i) Number of chromosomes changed per cell

(ii) Amount of DNA content (C) changed per cell

ANSWER KEY
A1. d) Farmer and Moore
A2. d) Plectonemic in mitosis and paranemic in meiosis
A3. c) Differentiation of euchromatin & heterochromatin decreases
A4. a) Prophase 1
A5. c) S phase
A6. b) Meiosis
A7. b) 2
A8. c) Interkinesis
A9. a) Interphase
A10. d) G0

A11. A) Mitosis results in the production of diploid daughter cells with identical genetic complement. In multicellular organism, growth is due to mitosis. Cell growth results in disturbing the ratio between the nucleus and the cytoplasm. It, therefore, becomes essential for the cell to divide and to restore the nucleocytoplasmic ratio.

A12. B) In an animal cell, cytokinesis is marked by the appearance of a furrow in the plasma membrane. The furrow slowly deepens and ultimately joins in the center dividing the cell cytoplasm into two.

A13. (b) Mitosis is often said as an indirect division. It is the method of equal division of nuclei. It is an elaborate process which includes a series of important changes in the nucleus as well as in cytoplasm.

A14: Cell reproduction: Reproduction is an essential phenomenon in the continuity of life. Rudolf Virchow discovered that new cells arise by the division of pre-existing cells.
Reproduction is mainly classified into two types:
Sexual reproduction
Asexual reproduction.
The growth and development of the living being depend on cell division. The single-celled zygotes, by the process of cell division, develop into an adult having many cells.

A15. Interphase is a stage that occurs between successive cell divisions. It is considered the resting stage of the nucleus as it does not show any morphological changes. But physiologically, it is a very active stage in the life of a cell as the cell prepares itself for division and many biochemical changes occur during this stage.

A16: No, without DNA replication, mitosis does not occur. Because during the S phase, DNA synthesis or replication of DNA takes place and DNA replication is essential for cell division.
Yes, DNA replication can take place without the cell division process. To prepare for cell division, DNA replication is necessary. Cell division is the next logical step that occurs post-cell division.

A17: The condensation of the chromosomal material initiates the prophase. During this process, chromatin condensation occurs, and the chromosomal material untangles.
Also, at the start of the final stage of mitosis, that is, the telophase phase, the chromosomes arrive at the respective poles and then de-condense and lose their individuality. When observed under a compound microscope, the cells at the end of the prophase stage do not show organelles like golgi complexes, nucleolus, endoplasmic reticulum, and the nuclear envelope. The nuclear envelope then gathers around the chromosomes cluster at the telephone stage: the Golgi complex, ER, and nucleolus reform.

A18: Interphase involves a series of changes that occur during the preparation of a cell for division. It is said to be the period during which the cell experiences growth and DNA replication in a definite and orderly manner. Interphase is majorly divided into three phases.
(i) G1 phase
(ii) G2 phase
(iii) S phase
G1 phase: The G1 phase is the stage during which the cell grows and prepares the DNA for its replication. Also, in this phase, the cell becomes metabolically active.

S phase: S phase is the stage during which DNA synthesis occurs. In other words, during this phase, the amount of DNA doubles, but the number of chromosomes remains the same.

G2 phase: In the G2 phase, the cell continues to grow and prepares itself for division. The proteins and RNA required for mitosis are synthesized during this stage.

A19. Meiosis is said to be a process involving a reduction in the amount of genetic material. It comprises two successive nuclear and cell divisions, with a single cycle of DNA replication. As a result, four haploid cells are generated at the end of Meiosis II.

The Significance of Meiosis-
Meiosis maintains the constant chromosome number from generation to generation. It also reduces the chromosome number to half because the fertilization process restores the original number in the zygote.
Variations are caused by the cross-over of the daughter cells and the random distribution of homologous chromosomes between daughter cells. Variations also play an important role in evolution.
The introduction of certain abnormalities generates chromosomal mutations. These chromosomal mutations generated may be advantageous for an individual.

A20.i) Gene mutation is any change in the genes of the chromosome. Any change in the base pairing or the number of genes in a certain location.
ii) Metastasizing means the spreading of cancer cells.
iii) Cell can become a cancerous cell once the oncogene is activated or the 'gain of function gene' is on.
iv) Virus which can mutate in the cell and lead to infinite cell division.

A21. During the meiotic prophase – I, entities like genetic recombination and variation in sexually reproducing take place. Also, the chromosomal events during each stage are-
Leptotene stage-
In this stage, the chromosomes are long, thin and slender, where the chromatin network gets exposed and threads appear clear.
Also, it contains a diploid number of chromosomes.

Zygotene stage-
In this stage, the similar chromosomes turn intimately associated with the

Synapse. And as the synapses are exact, pairing occurs between the chromosomes and corresponding individual units.These chromosomes appear thicker and shorter.

Pachynema Stage-
In this stage, the synaptic chromosomes become intimately related to each other. There are thick and short pairs of chromosomes crossed over one another, and the chiasmata are visible clearly.

Diplotene Stage-
The homologous chromosomes start detaching from each other and the Chiasmata tend to shift away, resulting in the terminalization of chiasmata.
Also, the chromosomes detach and result in incomplete separation.
The nucleolus and nuclear membrane also start to fade.

Diakinesis
In this stage, the bivalents are distributed randomly after further condensation.
Also, the paired chromosomes separate, and the terminalisation of chiasmata is concluded with the disappearance of the nucleolus and nuclear membrane.

A22.During the process of Meiosis, the number of chromosomes and the amount of DNA change are.
(i) Number of chromosomes (N) changed per cell
During the Anaphase I stage of the meiotic cycle, the homologous chromosomes separate and start moving toward their poles, respectively. As a result, the bivalent chromosomes get divided into two sister chromatids and receive half the chromosomes in the parent cell. Therefore, the number of chromosomes reduced in the meiotic cycle anaphase I.

(ii) Amount of DNA content (C) changed per cell
During the anaphase II stage of the meiotic cycle, the chromatids separate through the splitting of the centromere. It is said that the centromere holds together the sister chromatids present in each chromosome. By this, the chromatids move toward their respective poles. And at each pole, a haploid number of chromosomes with a haploid amount of DNA is present.

During the mitosis process, the number of chromosomes always remains the same. The DNA duplicated in the S phase gets separated and forms two daughter cells during the anaphase stage. Through this result, the DNA content (C) of the two newly formed daughter cells remains the same.

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