



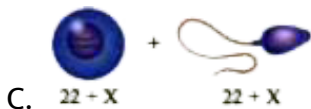
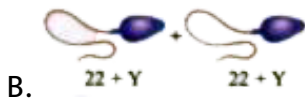
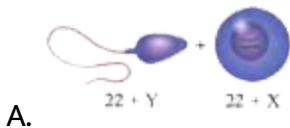
## BIOLOGY

### BOOKS - CENGAGE BIOLOGY

### CELL CYCLE AND CELL DIVISION

#### Mandatory Exercise

1. Which diagram illustrates fertilisation that would most likely lead to the development of a normal human male?

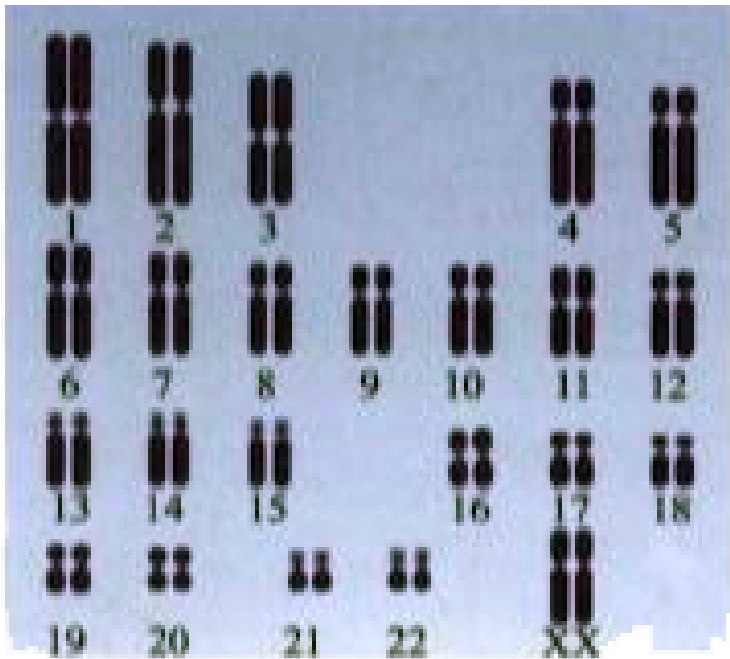




Answer: A

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2. Use the following diagram to answer questions.



What would be the sex of the individual with the above chromosome complement?

A. Male

B. Female

C. Not enough information available to determine the sex of the individual.

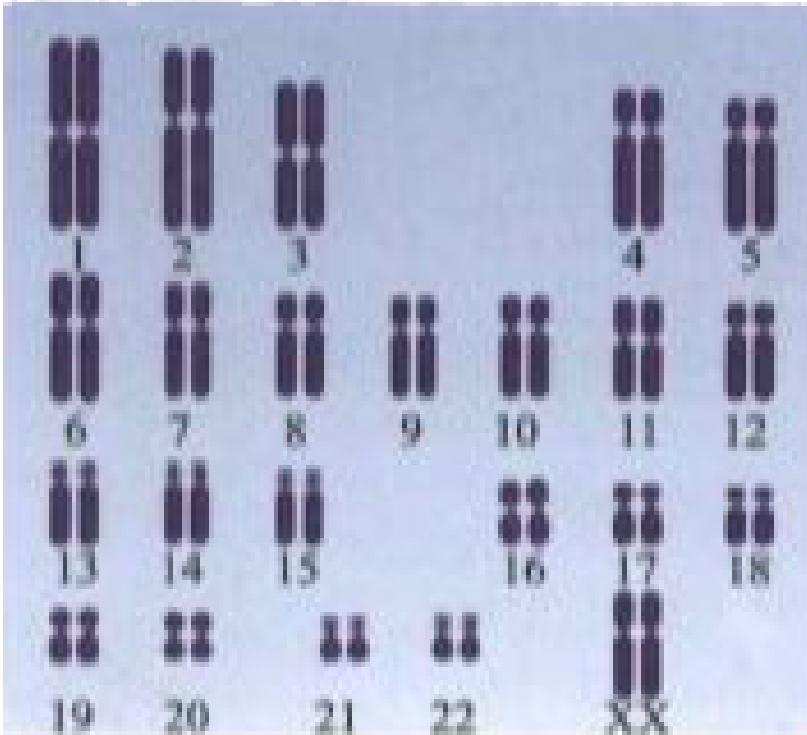
D. A male with one extra X chromosome.

**Answer: A::B**



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3. Use the following diagram to answer questions (a), (b), and (c).



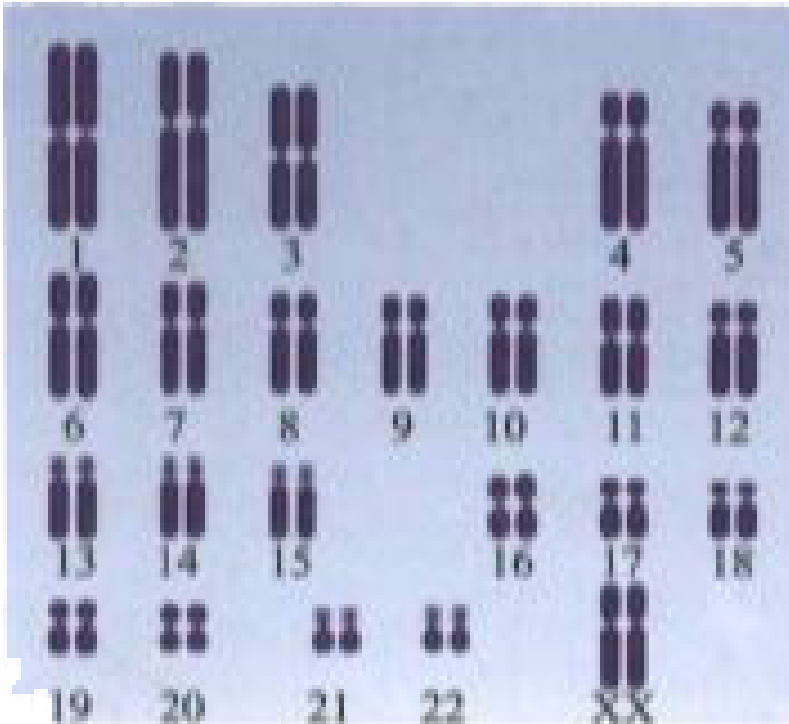
Which of the following statements is true?

- A. The individual would be expected to have a genetic disorder.
- B. The individual would be expected to be a male.
- C. The individual's diploid number is 46
- D. The individual's haploid number is 46.

Answer: C

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4. Use the following diagram to answer questions (a), (b), and (c).



This type of diagram is called

A. a Punnett square

B. a blood sample

C. a pedigree

D. a karyotype

**Answer: C::D**



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5. Decision of  $G_0$ -phase occurs

A. at the end of telophase

B. towards the end of cytokinesis

C. towards the end of  $G_1$  phase

D. towards the middle of  $G_1$  phase

**Answer: D**



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6. Circle the term in each of the following that includes all the other in the list.

A. gene, DNA synthesis, mitosis, cytokinesis, cell cycle

B. S subphase, cytokinesis, interphase, mitosis, cell cycle

C. cell division, binary fission, mitosis, meiosis

D. S subphase,  $G_1$  subphase, interphase,  $G_2$  subphase

**Answer:**



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7. The sequence of the cell cycle is

A.  $M$ ,  $G_1$ ,  $G_2$  and  $S$

B.  $G_1$ ,  $G_2$ ,  $S$  and  $M$

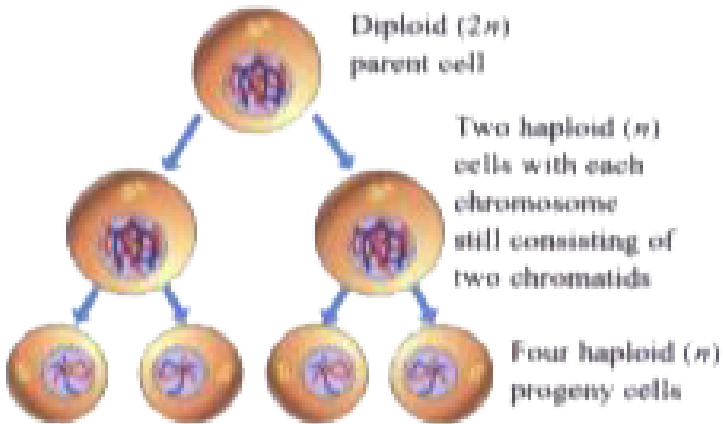
C.  $S$ ,  $M$ ,  $G_1$  and  $G_2$

D.  $G_1$ ,  $S$ ,  $G_2$  and  $M$

Answer: D

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8. Identify the process:

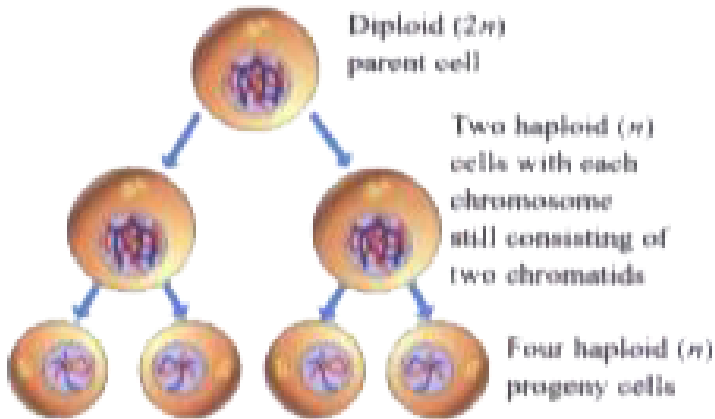


Name the process

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9. Identify the process:



The process in the figure takes place in cells.

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10. The tissue(s) where mitosis occurs most rapidly. Circle the correct answer.

Brain / muscle/skin/ intestinal wall / adult bone/ blood/bone marrow

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11. Which of the following is not a part of a chromosome?

- A. DNA
- B. Centriole
- C. Centromere
- D. Chromatin

**Answer: B**

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12. Which symbol represents the mitotic cell division?

- A.  $2n \rightarrow 2n$
- B.  $2n \rightarrow n$
- C.  $n \rightarrow 2n$
- D.  $n + n \rightarrow 2n$

**Answer: A**

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**13.** Explain the difference between a centromere and a centriole

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**14.** Division of the nucleus is called \_\_\_\_\_

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**15.** Division of the cytoplasm is called \_\_\_\_\_

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16. Karyokinesis and cytokinesis make up the \_\_\_\_\_ phase of the cell cycle.

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17. If a body cell has 68 chromosomes at the beginning of a mitotic cell cycle, each daughter cell will have \_\_\_\_\_ chromosomes at the end.

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18. State True or False:

New cells can arise by the division of similar pre-existing cells.

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19. State True or False:

The most part of the cell cycle consists of the mitotic phase.



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**20.** State True or False:

Cytokinesis is the last step in cell division.



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**21.** State True or False:

During metaphase, chromosomes line up around the periphery of the cell.



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**22.** State True or False:

Chromosomes duplicate during the S stage of interphase



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23. Distinguish cytokinesis from karyokinesis.

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24. Write answers for the following questions

What is a cell cycle?

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25. Write answers for the following questions

Which phase of cell cycle DNA synthesis takes place?

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26. Write answers for the following questions

Define between mitosis and meiosis.

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27. Write answers for the following questions

What is crossing over?



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28. Write answers for the following questions

How many mitotic division takes place for the formation of 1024 cells?



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29. Write answers for the following questions

How many cells are formed after 6 mitotic division in a cell?



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30. Write answers for the following questions

What is synapsis?

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31. Write answers for the following questions

Draw the chromosomes in the diagrams given below:



Prophase I



Metaphase I



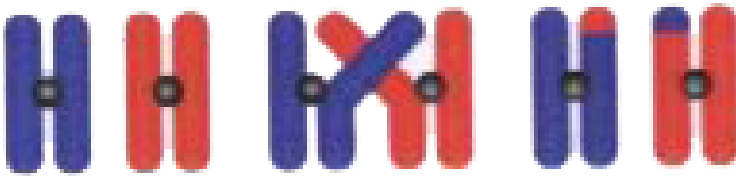
Anaphase II

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32. Write answers for the following questions

Which process is illustrated in the diagram below?





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33. Write true or false for the following.

Meiosis-I division is called as heterotypic or reduction division.

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34. Write true or false for the following.

Synapsis takes place in pachytene stage of prophase-I of meiosis.

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**35.** Write true or false for the following.

Cytokinesis is associated with the division of nucleus.



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**36.** Write true or false for the following.

$G_0$  phase is the resting phase of cells, where no division occur.



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**37.** Write true or false for the following.

Mitosis process is not associated with the growth and cell repair.



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**38.** Write true or false for the following.

Crossing over is the exchange off genetic material between two non-

sister chromatids of homologous chromosome.



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**39.** Write true or false for the following.

$G_2$  phase is also called post mitotic phase.



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**40.** Write true or false for the following.

Mitosis takes place in the somatic cells and meiosis takes place in the germ cells.



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**41.** Write true or false for the following.

In animal cell, cytokinesis takes place through cell plate formation.



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42. Fill in the blanks:

In animal cells, the inside part of cytokinesis begins during \_\_\_\_\_

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43. Fill in the blanks:

If a parent cell has 30 chromosomes, then after mitosis, each daughter cell will have \_\_\_\_\_ chromosomes.

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44. Fill in the blanks:

In mitosis, just after duplication, the two sister \_\_\_\_\_ remain attached at the \_\_\_\_\_

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**45.** Fill in the blanks:

Genetic recombination from crossing over between \_\_\_\_\_ chromatids of chromosome.

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**46.** Fill in the blanks:

Synapsis is pairing of \_\_\_\_\_ chromosome.

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**47.** Fill in the blanks:

Colchicine is obtained from \_\_\_\_\_

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**48.** Fill in the blanks:

Movement of chiasma at the end of chromosomes in prophase I is called \_\_\_\_\_



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**49.** Fill in the blanks:

Histone protein synthesis takes place during \_\_\_\_\_ phase of cell cycle.



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**50.** Fill in the blanks:

Spindle fibre is made up of \_\_\_\_\_ protein.



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**51.** Fill in the blanks:

Cells undergoing meiosis are called \_\_\_\_\_



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**52.** Match the following columns.

Column-I

Column-II

A. Interkinesis

1. Mitotic poison

B. Tubulin synthesis

2. S-Phase

C. Disjunction

3. Spindle fibre

D. Histone synthesis

4. Anaphase

E. Colchicine

5. Diakinesis

F. Terminalisation

6. Interphase between meiosis I and meiosis II

G. Nuclear division

7. Plant cell

H. Cytoplasmic division

8. Animal cell

I. Centriole

9. Cytokinesis

J. Cell plate formation

10. Karyokinesis



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**53.** In each of the following questions, a statement of Assertion is given

followed by corresponding statement of Reason of the statement, mark

the correct alternative as directed below.

**Assertion :** In mitosis, two identical cells are produced from a single cell, and karyokinesis is followed by cytokinesis.

**Reason:** Cytokinesis is of two types.

- A. If both Assertion and Reason are true, and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but Reason is false.
- D. If both Assertion and Reason are false.

**Answer: B**



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**54.** In each of the following questions, a statement of Assertion is given followed by corresponding statement of Reason of the statement, mark



the correct alternative as directed below.

Assertion : Division of cytoplasm is called cytokinesis.

Reason: This cytokinesis is due to the cell plate formation or by cleavage

- A. If both Assertion and Reason are true, and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but Reason is false.
- D. If both Assertion and Reason are false.

**Answer: B**



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**55.** In each of the following questions, a statement of Assertion is given followed by corresponding statement of Reason of the statement, mark

the correct alternative as directed below.

Assertion: In mitosis, prophase has no sub-stages.

Reason: In meiosis, prophase has six sub-stages.

- A. If both Assertion and Reason are true, and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but Reason is false.
- D. If both Assertion and Reason are false.

**Answer: C**



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**56.** In each of the following questions, a statement of Assertion is given followed by corresponding statement of Reason of the statement, mark the correct alternative as directed below.

Assertion : Histone proteins are synthesized during S-phase.

Reason: Histone proteins formed are associated with DNA, to form bead like nucleosomes.

- A. If both Assertion and Reason are true, and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but Reason is false.
- D. If both Assertion and Reason are false.

**Answer: A**



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57. In each of the following questions, a statement of Assertion is given followed by corresponding statement of Reason of the statement, mark the correct alternative as directed below.

Assertion : Meiotic division occurs in reproductive cells.

Reason: Synapsis occurs during zygotene of meiosis.

- A. If both Assertion and Reason are true, and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but Reason is false.
- D. If both Assertion and Reason are false.

**Answer: B**

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**58.** How many chromosomes shall be present in a diploid cell at mitotic anaphase if its egg cell has 10 chromosomes?

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59. If  $n = 16$  in plant cell, then how many number of bivalents are present in metaphase-I of meiosis?

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60. If egg of an organism has 10 picogram (Pg) of DNA in its nucleus. How much DNA would be present in a diploid cell of same organism having G2-phase of meiosis?

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61. If the number of bivalents are 8 in metaphase-I, then what shall be the number of chromosomes in daughter cells after meiosis-I and meiosis-II respectively?

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62. If there are 30 chromosomes in  $G_1$ -phase, then what will be number of bivalents in zygotene stage ?

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63. If the sperm and egg cells of the housefly have six chromosomes, how many chromosomes will be there in the maggot larvae?

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## Consolidated Exercise

1. Prior to meiosis, DNA replication occurs, so each chromosome contains two sister chromatids that are identical to the original chromosome. Meiosis is divided into two nuclear divisions: meiosis I and meiosis II. Each of these nuclear divisions shares many aspects of mitosis and can be divided into the same phases: prophase, metaphase,

anaphase, and telophase, however, between the two divisions, DNA replication does not occur. Through this process, one diploid cell will divide into four haploid cells. During meiosis I. the pairs of homologous chromosomes are separated from each other. During prophase I, the homologous chromosomes line up together. During this time, crossing over can occur (the exchange of DNA between homologous chromosomes). Crossing-over increases the new allele combinations in the gametes. Without crossing-over, the offspring would always inherit all of the many alleles on one of the homologous chromosomes. (An allele is an alternative form of a gene which is located at a specific position on a specific chromosome.) Because of crossing-over, the alleles on the homologous chromosomes can be scrambled to pass on unique combinations of alleles on the chromosome. Also, during prophase I. the spindle forms and the chromosomes condense as they coil up tightly. The spindle has the same function as in mitosis.

Briefly describe the similarities between the meiosis and mitosis processes.



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2. Prior to meiosis, DNA replication occurs, so each chromosome contains two sister chromatids that are identical to the original chromosome. Meiosis is divided into two nuclear divisions: meiosis I and meiosis II. Each of these nuclear divisions shares many aspects of mitosis and can be divided into the same phases: prophase, metaphase, anaphase, and telophase, however, between the two divisions, DNA replication does not occur. Through this process, one diploid cell will divide into four haploid cells. During meiosis I, the pairs of homologous chromosomes are separated from each other. During prophase I, the homologous chromosomes line up together. During this time, crossing over can occur (the exchange of DNA between homologous chromosomes). Crossing-over increases the new allele combinations in the gametes. Without crossing-over, the offspring would always inherit all of the many alleles on one of the homologous chromosomes. (An allele is an alternative form of a gene which is located at a specific position on a specific chromosome.) Because of crossing-over, the alleles on the homologous chromosomes can be scrambled to pass on unique combinations of alleles on the chromosome. Also, during prophase I.



the spindle forms and the chromosomes condense as they coil up tightly. The spindle has the same function as in mitosis.

How many haploid cells will result from one diploid cell after it has undergone meiosis?



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**3.** Prior to meiosis, DNA replication occurs, so each chromosome contains two sister chromatids that are identical to the original chromosome. Meiosis is divided into two nuclear divisions: meiosis I and meiosis II. Each of these nuclear divisions shares many aspects of mitosis and can be divided into the same phases: prophase, metaphase, anaphase, and telophase, however, between the two divisions, DNA replication does not occur. Through this process, one diploid cell will divide into four haploid cells. During meiosis I, the pairs of homologous chromosomes are separated from each other. During prophase I, the homologous chromosomes line up together. During this time, crossing over can occur (the exchange of DNA between homologous chromosomes).

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During prophase I, a unique process occurs. Provide the name and brief definition of this process.



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4. Prior to meiosis, DNA replication occurs, so each chromosome contains two sister chromatids that are identical to the original chromosome. Meiosis is divided into two nuclear divisions: meiosis I and meiosis II. Each of these nuclear divisions shares many aspects of

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What are the advantages of that process?



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5. A somatic cell of an animal has 18 chromosomes.

What is the diploid number of chromosomes for this animal?



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6. A somatic cell of an animal has 18 chromosomes.

How many chromosomes would be present in a haploid cell for this animal?



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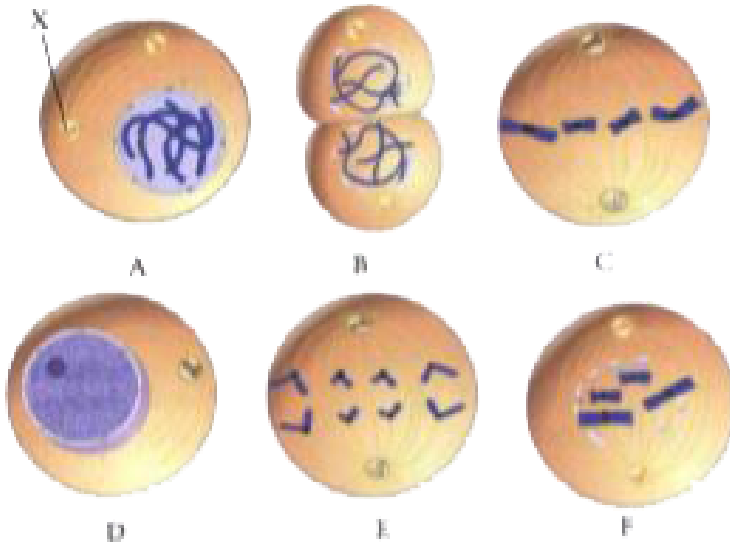
7. A somatic cell of an animal has 18 chromosomes.

If a somatic cell of this animal is divided by mitosis, how many chromosomes would each daughter cell contain?



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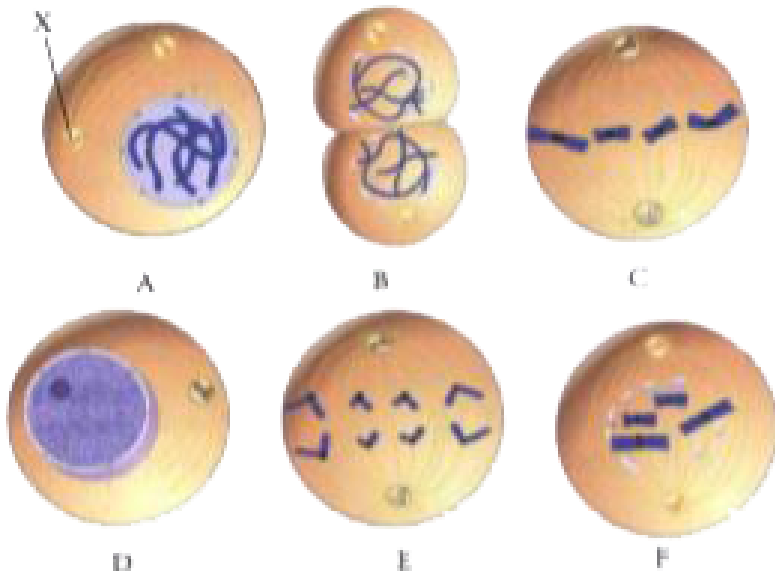
8. The diagrams below show cells in various phases of the cell cycle. Note the cells are not arranged in the order in which the cell cycle occurs. Use these diagrams to answer the following questions.



Which cell is in metaphase?

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9. The diagrams below show cells in various phases of the cell cycle. Note the cells are not arranged in the order in which the cell cycle occurs. Use these diagrams to answer the following questions.

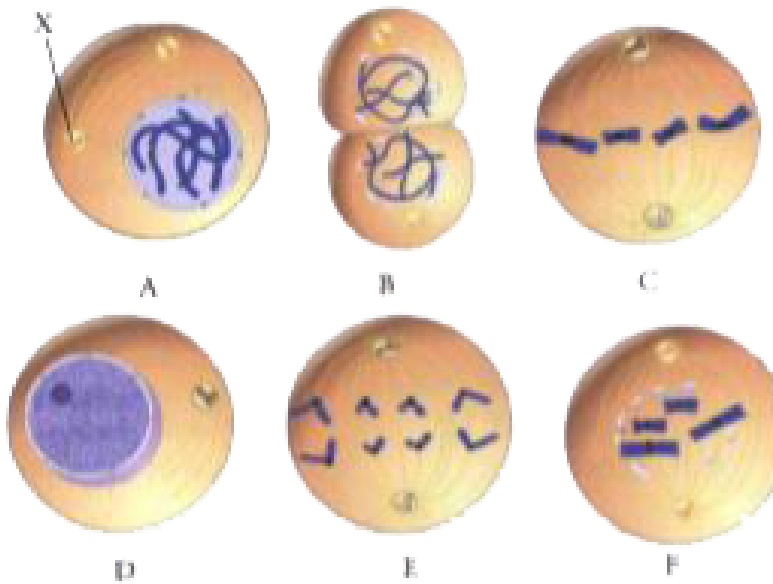


Which cell is in the first phase of M phase (mitosis)?



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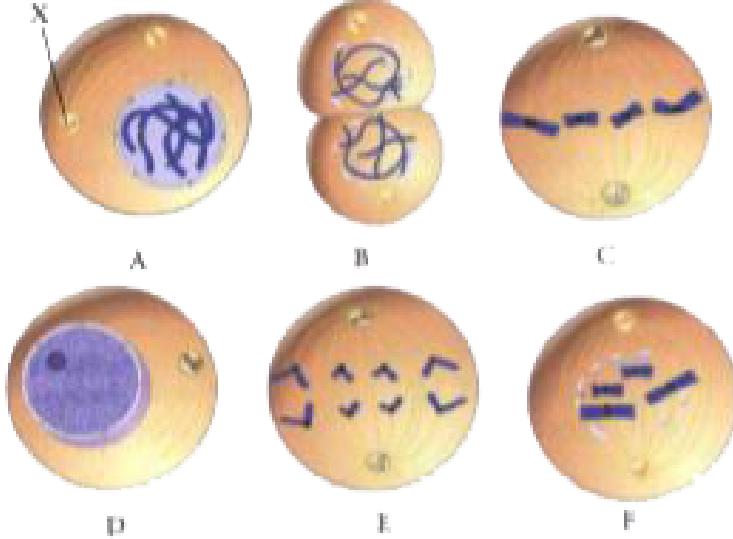
**10.** The diagrams below show cells in various phases of the cell cycle. Note the cells are not arranged in the order in which the cell cycle occurs. Use these diagrams to answer the following questions.



In cell A, what structure is labelled X?

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**11.** The diagrams below show cells in various phases of the cell cycle. Note the cells are not arranged in the order in which the cell cycle occurs. Use these diagrams to answer the following questions.

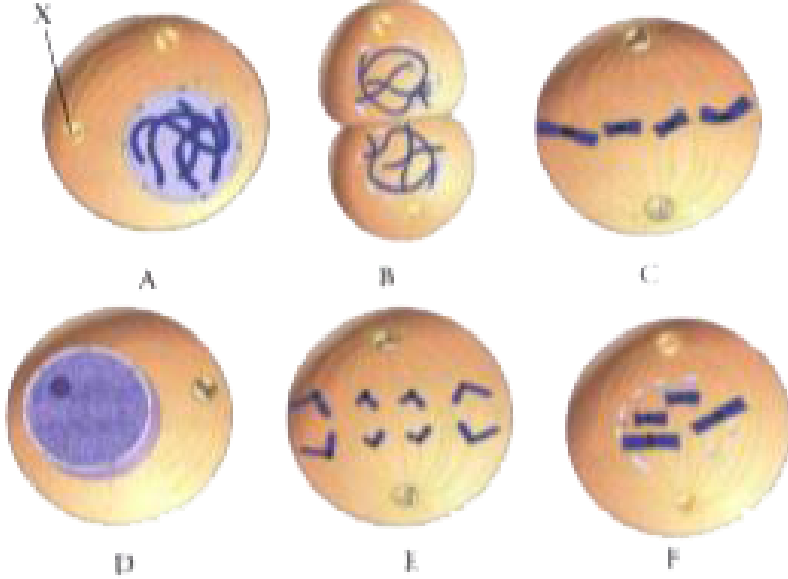


List the diagrams in order from first to last in the cell cycle.

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**12.** The diagrams below show cells in various phases of the cell cycle. Note the cells are not arranged in the order in which the cell cycle occurs. Use these diagrams to answer the following questions.



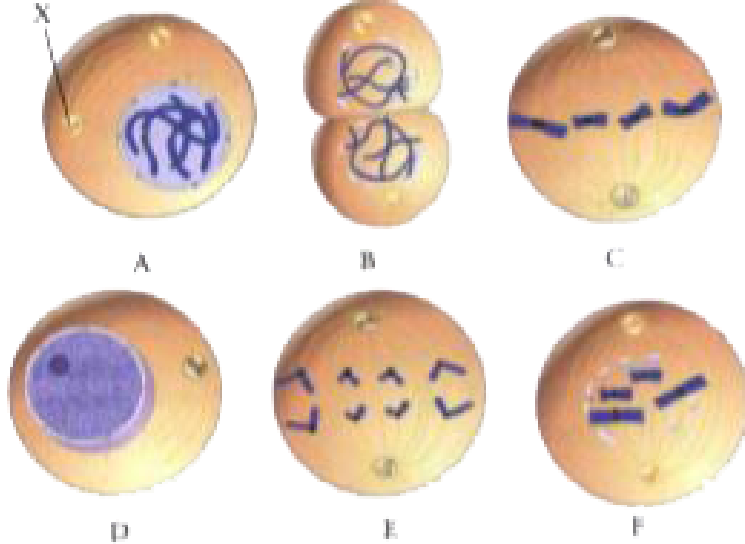


(i) Are the cells depicted plant or animal cells?

(ii) Explain your answer.

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**13.** The diagrams below show cells in various phases of the cell cycle. Note the cells are not arranged in the order in which the cell cycle occurs. Use these diagrams to answer the following questions.



What is the longest phase of the cell cycle?

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**14.** Each characteristic or event given below applies to mitosis, meiosis, or both. Indicate the types of cell division in the lines provided.

One cell divides two times to form four cells \_\_\_\_\_

Formation of gametes (egg and sperm) \_\_\_\_\_

Zygote (fertilised egg) divides to form the trillion- celled baby \_\_\_\_\_

Daughter cells have the identical chromosomes as the parent cell \_\_\_\_\_

Pairing up and crossing-over between homologous chromosome pairs occurs at prophase. \_\_\_\_\_



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15. Liver cells, bone cells, nerve cells, and muscle cells are called \_\_\_\_\_  
cells.

Sperm cells and egg cells are called \_\_\_\_\_



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16. Complete the following table:

	Mitosis	Meiosis
Purpose of division	Growth and repair	_____
Where process occurs in body	_____	_____
Number of chromosomes in daughter cells after division	_____	Half original number
Daughter cells are	Identical to parent cell	_____

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17. Match the names of scientists in column A with their discoveries in column B. (There could be more than one correct option.)

A	B
(i) Edward Strasburger	(p) Mitosis in plant cell
(ii) Walther Flemming	(q) The term 'mitosis'
(iii) Farmer and Moore	(r) The term 'meiosis'
	(s) Mitosis in animal cell
	(t) First observation of meiosis

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18. Match the phases of mitosis in column A with statements in column B. (There could be more than one correct answer.)

A	B
(i) Prophase	(p) Nucleolus appears within each new nucleus
(ii) Metaphase	(q) Centromeres divide
(iii) Anaphase	(r) Chromosomes become visible
(iv) Telophase	(s) Spindle fibres begin to form
(v) Interphase	(t) DNA replicates
	(u) Replicated strands move towards opposite poles
	(v) Chromosomes form a line across the middle of the cell
	(w) Nuclear membrane forms around each set of chromosomes
	(x) Cell grows

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19. \_\_\_\_\_ is a disease that occurs when cells divide uncontrollably.

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20. Fill in the blanks with appropriate answers from the box.

Summary of telophase

Telophase is the final phase of \_\_\_\_\_ and \_\_\_\_\_. During telophase the \_\_\_\_\_ envelope reforms and the \_\_\_\_\_ reappears within the nucleus. Chromosomes elongate and, once again, are described as \_\_\_\_\_. By the end of telophase, the cytoplasm from the original cell usually divides to form daughter cells by a process called \_\_\_\_\_.



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21. Histone protein synthesis occurs during

- A.  $G_1$  -Phase
- B.  $G_2$ - phase
- C.  $S$ - phase
- D. Prophase

**Answer: C**



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**22.** Crossing over occurs during

- A. leptotene
- B. pachytene
- C. diplotene
- D. diakinesis

**Answer: B**



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**23.** Nuclear envelope reappears at

- A. metaphase

B. anaphase

C. cytokinesis

D. telophase

**Answer: D**



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**24.** Transfer of genes from one chromosome to another and vice-versa during synapsis is called

A. Exchange

B. Chiasmata

C. Crossing over

D. Translocation

**Answer: C**



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25. The sequence of cell cycle is

- A. S, M,  $G_1$  and  $G_2$
- B.  $G_1$ ,  $G_2$ , S and M
- C.  $M_G - 1$ ,  $G_2$  and S
- D.  $G_1$ , S,  $G_2$  and M

**Answer: D**



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26. Nuclear envelope disappears at

- A. Anaphase
- B. Metaphase
- C. Prophase

D. Telophase

**Answer: C**



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**27. Cytokinesis is**

- A. Nuclear division
- B. Cytoplasmic division
- C. Chromosome division
- D. None of the above

**Answer: B**



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**28. Plant cells lack**

A. centrioles

B. asters

C. spindle fibres

D. Both A and B

**Answer: D**



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**29. What is the proper sequence in mitosis ?**

A. prophase, metaphase, anaphase, telophase

B. anaphase, telophase, prophase, metaphase

C. metaphase, telophase, anaphase, prophase

D. prophase, metaphase, telophase, anaphase

**Answer: A**



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**30.** Chiasmata are first seen in

- A. Leptotene
- B. Zygotene
- C. Pachytene
- D. Diplotene

**Answer: D**

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**31.** In mitosis ,centromere divides during

- A. prophase
- B. metaphase
- C. anaphase

D. telophase

**Answer: C**



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**32. Colchicine arrest mitosis at**

A. prophase

B. metaphase

C. anaphase

D. interphase

**Answer: B**



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**33. Mitosis can be studied in**

A. Onion root tip

B. Garlic root tip

C. Tendril tip

D. All of the above

**Answer: A**



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**34.**  $G_1$ ,  $S$  and  $G_2$  are stages of

A. interphase

B. prophase

C. metaphase

D. anaphase

**Answer: A**



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35. Chromosome number is restored by

- A. meiosis
- B. mitosis
- C. crossing over
- D. interphase

**Answer: A**



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36. homologous chromosomes separates during

- A. metaphase
- B. anaphase
- C. metaphase

D. none

**Answer: B**



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**37.** During mitosis ER and nucleolus begin to disappear at

A. metaphase

B. early prophase

C. late prophase

D. late metaphase

**Answer: C**



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**38.** Crossing over requires an enzyme



A. Recombinase

B. Ligase

C. Polymerase

D. Endonuclease

**Answer: A**



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**39.** In mitosis, the number of chromosomes

A. becomes double

B. becomes half

C. remain unchanged

D. none of these

**Answer: C**



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40. At what stage does the number of chromosomes become half ?

- A. Prophase I
- B. Metaphase I
- C. Anaphase I
- D. Telophase I

**Answer: C**

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41. Cell cycle was discovered by

- A. Farmer and Moore
- B. Howard and Pelc
- C. Remak

D. Fleming

**Answer: B**



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**42.** Invisible stage of M-phase is

A.  $G_1$  -Phase

B.  $S$

C.  $G_2$

D.  $G_0$

**Answer: B**



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**43.** Amitosis was discovered by

- A. Remak
- B. Fleming
- C. Farmer
- D. Moore

**Answer: A**



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**44.** Where can we study mitosis ?

- A. Brain
- B. Nail base
- C. Kidneys
- D. Legs

**Answer: B**



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45. Plant and animal cell divisions differ in

- A. cell plate
- B. prophase
- C. telophase
- D. metaphase

**Answer: A**

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46. Bouquet stage occurs during

- A. Leptotene
- B. Zygotene
- C. Pachytene

D. Diplotene

**Answer: A**



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47. Phase of shortest duration is

A. prophase

B. metaphase

C. anaphase

D. telophase

**Answer: C**



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48. Crossing over takes place in

A. Pachytene

B. Diakinesis

C. Zygotene

D. Leptotene

**Answer: A**



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**49.** Which is the shortest phase in the cell cycle?

A.  $G_1$

B.  $G_2$

C.  $S$

D. M Phase

**Answer: D**



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50. Which of the following serves as a mitotic spindle poison?

- A.  $Ca^{2+}$
- B.  $Mg^{2+}$
- C. Tubulin
- D. Colchicine

Answer: D

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51. During mitosis, metaphase differ from anaphase in having

- A. Same number of chromosome and half number of chromatids
- B. Half number of chromatids and half number of chromosomes
- C. Half number of chromosomes and same number of chromatids



D. Same number of chromosomes and same number of chromatids

**Answer: A**



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52. In a chromosome, on the sides of centromere disc-shaped structure are present called

A. Telomere

B. Centromere

C. Kinetochore

D. Chromocentre

**Answer: C**



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53. Dyad is a pair of

- A. Sister chromatids
- B. Non-sister chromatids
- C. Homologous chromosome
- D. Non-homologous chromosome

**Answer: A**



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54. Replication of centriole occurs during

- A. Interphase
- B. Prophase
- C. Late prophase
- D. Late anaphase

**Answer: A**



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**55.** Best material for the study of mitosis is

- A. Tubulin
- B. Root tip
- C. Leaf tip
- D. Ovary

**Answer: B**



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**56.** How many chromosomes will the cell have at  $G_1$  after S and after Mitotic phase respectively?

A. 14, 14,7

B. 14, 14, 14

C. 7,7,7

D. 7, 14, 14

**Answer: D**



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**57.** In which stage of mitosis chromosomes arrange on equatorial plate?

A. Prophase

B. Anaphase

C. Metaphase

D. Telophase

**Answer: C**



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58. What are the major features of prophase in mitosis?

- A. Chromosome condense
- B. Crossing-over between homologous chromosomes
- C. Nuclear envelope breaks up
- D. Chiasmata formation

**Answer: A::C::D**



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59. Sexual reproduction requires which of the following?

- A. Meiosis
- B. Amitosis

C. Gamete formation

D. Fertilisation

**Answer: A::C::D**

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**60.** There is DNA replication during the stages of

A. interphase prior to mitosis

B. interphase prior to meiosis I

C. interphase between meiosis I and meiosis II

D. cytokinesis

**Answer: A::B::D**

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61. Sister chromatids move apart in which of the following stages?

A. Metaphase I of meiosis

B. Anaphase of mitosis

C. Anaphase I of meiosis

D. Anaphase II of meiosis

**Answer: A::B::D**



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62. Which of the following distinguishes prophase I of meiosis I from mitotic prophase?

A. The number of chromatids per chromosome

B. Synapsis

C. Crossing-over

D. The number of homologues

**Answer: A::B::C::D**



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## Olympiad And Ntse Level Exercises

1. Dr. Johnson has discovered an amazing species of yeast that can grow on high quantity chocolate bars. He discovered a particular species when chocolate was not available, a diploid cell ( $2n = 32$ ) can divide by meiosis producing four haploid spores and the same cell undergoes mitosis, how many chromosomes will each resulting cell contain?

- A. 16 and 8
- B. 8 and 32
- C. 32 and 16
- D. 16 and 32



**Answer: D**



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2. In each of the following questions two statements are given. One of them is assertion A and the other is reasoning R.

Assertion: When in the cell the amount of DNA material is increased in comparison to the RNA. meiosis is found to occur.

Reason: It maintains a definite and constant number of the chromosomes in an organism.

- A. If both A and B are true, then R is the correct explanation of A
- B. If both A and B are true, then R is not the correct explanation of A
- C. If A is true, then R is false
- D. If both A. and R are false.

**Answer: A**



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3. Assume the cell has a diploid number of 4. If the above chromosomes are in the tetrad or bivalent stage of meiosis, which statement below is correct about the events of anaphase I?

- A. Two of the tetrads will go to one cell, and two will go to the other
- B. Sister chromatids will break apart and each will go in one of four cells.
- C. One member of each homologous pair will go into each of the two cells.
- D. The tetrads will separate but each new cell will still be diploid since each chromosome has two chromatids.

**Answer: C**



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4. The amount of DNA per cell of a particular species is measured in cells found at various stages of meiosis, and the following amounts are obtained. Match the amounts of DNA on the left with the corresponding stages of the cell cycle on the right. You may use more than one stage for each amount of DNA

Stage of Mitosis	Amount of DNA per cell
a. G1	(p) 3.7 pg
b. Prophase I	(q) 7.3 pg
c. G2	(r) 14.6 pg
d. Following telophase II and cytokinesis	
e. Anaphase I	
f. Metaphase II	

- A. a,f-q,d-p,b,c,e-r
- B. a,b-p,d,e-q,c-r
- C. a,c-q,b,e-pd,f-r
- D. e,c-r,d,f-p,a,b,c-q

**Answer: A**



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5. A thief plans to cross a mansion. The mansion is surrounded by guards.

- (i) There are guards wearing black dress present inside the mansion.
- (ii) There are guards wearing blue dress outside the mansion.
- (iii) There is only one door through which the thief can enter the mansion.

What is this compared to?

- A. (i)-extrinsic proteins, (ii)-intrinsic proteins,(iii)-peripheral proteins
- B. (i)-intrinsic proteins, (ii)-extrinsic proteins, (iii)-transmembrane proteins
- C. (i)-transmembrane proteins, (ii) -intrinsic proteins, (iii)-peripheral proteins
- D. (i)-intrinsic proteins, (ii)-transmembrane proteins, (iii)-extrinsic proteins

**Answer: B**



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6. The Latin phrase *omnis cellula e cellula* refers to a cellular principle. Which of the following statements is the best translation of this phrase?

- A. The cell is the basic unit of all structures
- B. All cells arise only from pre-existing cells
- C. Tissues are composed of similar cells
- D. All organisms consists of one or more cells

**Answer: B**



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7. Which of the following is NOT offered as evidence in support of the endosymbiotic theory, the belief that an eukaryotic cell has evolved as a committee of prokaryotic cells?

- A. Mitochondria and chloroplasts are similar in size and structure to some species of bacteria
- B. The ribosomes of chloroplasts and mitochondria are similar to eubacteria
- C. Mitochondria and chloroplasts can actively break away from eukaryotic cells and live on their own
- D. Mitochondria and chloroplasts have their own DNA coding separate from the eukaryotic nucleus

**Answer: C**



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## Challenging Exercise

1. Humans have 23 pairs of chromosomes. During mitotic cell division, sister chromatids get separated to opposite sides of the cell (during anaphase), resulting in two sets of identical chromosomes. The cell divides, becoming two distinct cells, each with their own nucleus. Usually mitosis occurs with no problems, however, there have been cases where the chromatids do not separate properly. If the sister chromatids do not separate during anaphase, what would the two resulting nuclei look like? How many chromosomes would be in each of the resulting nuclei, assuming this is a human cell?



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2. Jellyfish reproduce asexually. This means, they do not need to use energy looking for a mate, doing courtship rituals, and mating. What are the advantages and disadvantages jellyfish have from asexual reproduction? Name two.



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3. What is colchicine?



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4. Colchicine prevents

- A. Condensation of chromosomes
- B. Completion of metaphase
- C. Interphase
- D. Replication of chromosomes

**Answer: B**



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5. In organisms that reproduce sexually, how similar are the offsprings to their parents? Explain.



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6. A cell of maize at anaphase has 10 chromatids going to each pole. What anaphase is it?



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