

CHAPTER 8—CELL REPRODUCTION

MULTIPLE CHOICE

1. In order to fit within a cell, DNA becomes more compact by
- breaking apart into separate genes.
 - extending to form very long, thin molecules.
 - wrapping tightly around associated proteins.
 - being enzymatically changed into a protein.

ANS: C DIF: 1 OBJ: 8-1.1

2. Chromatids are
- dense patches within the nucleus.
 - bacterial chromosomes.
 - duplicate halves of a chromosome.
 - prokaryotic nuclei.

ANS: C DIF: 1 OBJ: 8-1.1

3. A protein disk that attaches two chromatids to each other in a chromosome is called a
- chloroplast.
 - centromere.
 - gamete.
 - centriole.

ANS: B DIF: 1 OBJ: 8-1.1

4. Which of the following is *not* a true difference between the chromosomes of eukaryotes and those of prokaryotes?
- Eukaryotic chromosomes are linear, while those of prokaryotes are circular.
 - Eukaryotic chromosomes are found free in the nucleus, while those of prokaryotes are attached to the cell membrane.
 - Eukaryotes usually have more than one chromosome, while prokaryotes have only one chromosome.
 - Eukaryotic chromosomes contain DNA, while prokaryotic chromosomes contain a different form of genetic material.

ANS: D DIF: 2 OBJ: 8-1.2

5. The chromosomes in your body
- exist in 23 pairs.
 - include two sex chromosomes.
 - include 44 autosomes.
 - All of the above

ANS: D DIF: 1 OBJ: 8-1.4

6. A student can study a karyotype to learn about the
- molecular structure of a chromosome.
 - genes that are present in a particular strand of DNA.
 - medical history of an individual.
 - number of chromosomes present in a body cell.

ANS: D DIF: 1 OBJ: 8-1.3

7. A diploid cell is one that
- has two homologues of each chromosome.
 - is designated by the symbol $2n$.
 - has chromosomes found in pairs.
 - All of the above

ANS: D DIF: 1 OBJ: 8-1.5

8. diploid : body cell :: haploid :
- sex chromosome
 - chromosome
 - reproductive cell
 - zygote

ANS: C DIF: 1 OBJ: 8-1.5

9. The diploid number of chromosomes in a human skin cell is 46. How many chromosomes are in a human egg cell?
- 46
 - 92
 - 23
 - 12.5

ANS: C DIF: 1 OBJ: 8-1.5

10. How many chromosomes are in the body cells of an organism that has a haploid number of 8?
- 4
 - 8
 - 12
 - 16

ANS: D DIF: 1 OBJ: 8-1.5

11. Binary fission
- occurs when two cells collide with each other.
 - produces excess energy.
 - creates new species.
 - is the process by which bacteria reproduce.

ANS: D DIF: 1 OBJ: 8-2.1

12. The chromosome of a bacterium
- is wrapped around proteins.
 - has a circular shape.
 - occurs in multiple pairs within the cell.
 - is found within the nucleus.

ANS: B DIF: 1 OBJ: 8-1.2

13. In a bacterium, cell division takes place when
- its nucleus divides.
 - the cell splits into two cells, one of which receives all of the DNA.
 - the DNA is copied, a new cell membrane forms between the DNA copies, and the cell splits into two cells.
 - None of the above

ANS: C DIF: 1 OBJ: 8-2.1

14. The stage of the cell cycle that occupies most of the cell's life is
- G₁.
 - M.
 - G₂.
 - interphase.

ANS: D DIF: 1 OBJ: 8-2.3

15. Which of the following shows the correct sequence of the cell cycle?
- C → M → G₁ → S → G₂
 - S → G₁ → G₂ → M → C
 - G₁ → S → G₂ → M → C
 - None of the above

ANS: C DIF: 1 OBJ: 8-2.3

16. growth : G₁ ::
- mitosis : meiosis
 - mitochondria replication : S
 - cytokinesis : M
 - DNA copying : S

ANS: D DIF: 2 OBJ: 8-2.3

17. metaphase : prophase ::
- anaphase : cytokinesis
 - G₂ : S
 - thylakoid : grana
 - carbon fixation process : Calvin cycle

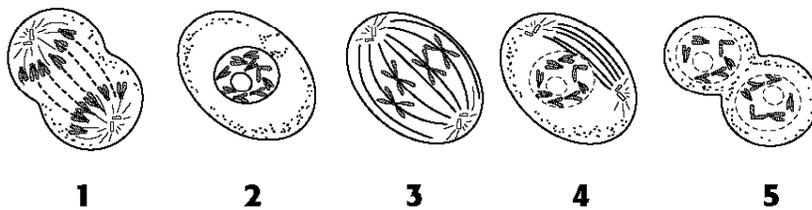
ANS: B DIF: 2 OBJ: 8-2.4

18. The phase of mitosis that is characterized by the arrangement of all chromosomes along the equator of the cell is called
- telophase.
 - metaphase.
 - anaphase.
 - prophase.

ANS: B DIF: 1 OBJ: 8-2.4

19. A spindle fiber is a specialized form of
- microtubule.
 - flagellum.
 - cilium.
 - chromosome.

ANS: A DIF: 1 OBJ: 8-2.4



20. Refer to the illustration above. The cell in diagram 1 is in
- metaphase.
 - telophase.
 - anaphase.
 - prophase.

ANS: C DIF: 2 OBJ: 8-2.4

21. Refer to the illustration above. Mitosis begins with the stage shown in diagram
- 1.
 - 2.
 - 3.
 - 4.

ANS: D DIF: 2 OBJ: 8-2.4

22. Refer to the illustration above. The cell shown in diagram 5 is in
- metaphase.
 - telophase.
 - anaphase.
 - prophase.

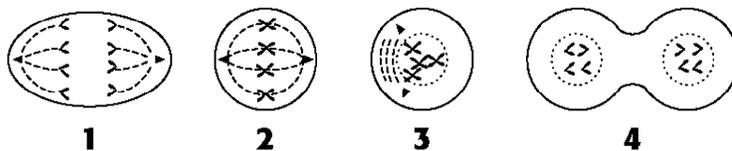
ANS: B DIF: 2 OBJ: 8-2.4

23. A typical human cell contains 46 chromosomes. After mitosis and cytokinesis, each of the two new cells formed from the original cell
- has 23 chromosomes.
 - grows new chromosomes from existing DNA.
 - has a complete set of 46 chromosomes.
 - None of the above

ANS: C DIF: 1 OBJ: 8-2.2

24. As a result of mitosis, each of the two new cells produced from the original cell during cytokinesis
- receives a few chromosomes from the original cell.
 - receives an exact copy of all the chromosomes present in the original cell.
 - donates a chromosome to the original cell.
 - receives exactly half the chromosomes from the original cell.

ANS: B DIF: 1 OBJ: 8-2.2



25. Refer to the illustration above. Which of the following correctly indicates the order in which these events occur?
- 1, 2, 3, 4
 - 3, 2, 1, 4
 - 2, 1, 3, 4
 - 1, 3, 2, 4

ANS: B DIF: 2 OBJ: 8-2.4

26. Refer to the illustration above. During which stage do the centromeres divide?
- 1
 - 2
 - 3
 - 4

ANS: A DIF: 2 OBJ: 8-2.4

27. 5 : cell cycle ::
- 6 : prophase
 - 9 : cytokinesis
 - 3 : meiosis
 - 4 : mitosis

ANS: D DIF: 2 OBJ: 8-2.4

28. In plant cells, cytokinesis occurs when
- the chromosomes make exact copies of themselves.
 - spindle fibers are formed.
 - a new cell wall forms.
 - osmotic pressure is too low.

ANS: C DIF: 1 OBJ: 8-2.5

29. Mitosis is a process by which
- DNA is replicated.
 - cytokinesis occurs.
 - cells grow in size.
 - a cell's nucleus divides.

ANS: D DIF: 1 OBJ: 8-2.4

30. Which of the following statements is *true*?
- Prokaryotes divide by mitosis.
 - Eukaryotes have circular chromosomes.
 - Animal cells form new cell walls when they divide.
 - Cytokinesis differs in plant cells and animal cells.

ANS: D DIF: 1 OBJ: 8-2.5

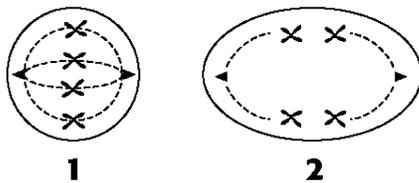
31. Separation of homologues occurs during
- mitosis.
 - meiosis I.
 - meiosis II.
 - fertilization.

ANS: B DIF: 1 OBJ: 8-3.2

32. The difference between anaphase of mitosis and anaphase I of meiosis is that
- the chromosomes line up at the equator in anaphase I.
 - centromeres do not exist in anaphase I.
 - chromatids do not separate at the centromere in anaphase I.
 - crossing-over occurs only in anaphase of mitosis.

ANS: C DIF: 1 OBJ: 8-3.1

Diagrams 1 and 2 show cells from an organism with a diploid chromosome number of 4.



33. Refer to the illustration above. Which of the cells will be a diploid cell at the completion of division?
- 1
 - 2
 - Both
 - Neither

ANS: A DIF: 2 OBJ: 8-3.1

34. Refer to the illustration above. Which of these cells is in the process of dividing to form gametes?
- a. 1
 - b. 2
 - c. Both
 - d. Neither

ANS: B DIF: 2 OBJ: 8-3.5

35. When crossing-over takes place, chromosomes
- a. mutate in the first division.
 - b. produce new genes.
 - c. decrease in number.
 - d. exchange corresponding segments of DNA.

ANS: D DIF: 1 OBJ: 8-3.3

36. The exchange of segments of DNA between the members of a pair of chromosomes
- a. ensures that variation within a species never occurs.
 - b. acts as a source of variations within a species.
 - c. always produces genetic disorders.
 - d. is called *crossing*.

ANS: B DIF: 1 OBJ: 8-3.3

COMPLETION

1. Following replication of its DNA, each chromosome contains two _____, which are attached to each other by a centromere.

ANS: chromatids

DIF: 1 OBJ: 8-1.1

2. Chromosomes that are not involved in sex determination are called _____.

ANS: autosomes

DIF: 1 OBJ: 8-1.4

3. A picture of a cell's chromosomes is called a(n) _____.

ANS: karyotype

DIF: 1 OBJ: 8-1.4

4. _____ is the process by which bacteria split asexually into two identical organisms.

ANS: Binary fission

DIF: 1 OBJ: 8-2.1

5. In bacteria, cell division takes place in two stages. First the _____ is copied, and then the cell splits.

ANS: DNA

DIF: 1 OBJ: 8-2.1

6. The sequence of events that occurs in a cell from one mitotic division to the next is called the _____.

ANS: cell cycle

DIF: 1 OBJ: 8-2.4

7. Collectively, the time spent in $G_1 + S + G_2$ is called _____.

ANS: interphase

DIF: 1 OBJ: 8-2.3

8. Microtubules that extend from the poles of a cell to the centromeres during cell division are called _____.

ANS: spindle fibers

DIF: 1 OBJ: 8-2.4

9. In mitosis, anaphase follows _____.

ANS: metaphase

DIF: 1 OBJ: 8-2.4

10. Chromosomes coil up into short rods during _____.

ANS: prophase

DIF: 1 OBJ: 8-2.4

11. During cell division, plant cells form a new _____ in the center of the cell.

ANS: cell wall

DIF: 1 OBJ: 8-2.5

12. In eukaryotic cells, _____ takes place after the nucleus divides.

ANS: cytokinesis

DIF: 1 OBJ: 8-2.5

13. The stage of meiosis during which homologues line up along the equator of the cell is called _____.

ANS: metaphase I

DIF: 1 OBJ: 8-3.2

14. After a new nuclear membrane forms during telophase of mitosis or meiosis, the _____ divides, resulting in two cells.

ANS: cytoplasm

DIF: 1 OBJ: 8-2.2

15. The process called _____ guarantees that the number of chromosomes in gametes is half the number of chromosomes in body cells.

ANS: meiosis

DIF: 1 OBJ: 8-3.1

16. A reciprocal exchange of corresponding segments of DNA is called _____.

ANS: crossing-over

DIF: 1 OBJ: 8-3.3

17. The cells resulting from meiosis in either males or females are called _____.

ANS: gametes

DIF: 1 OBJ: 8-3.1

18. As a result of spermatogenesis, four cells are produced that can all develop into sperm cells. As a result of oogenesis, only _____ cell(s) develop(s) into (an) egg cell(s).

ANS:

one

1

DIF: 1 OBJ: 8-3.5

19. Control of the cell cycle occurs at three main _____.

ANS: checkpoints

DIF: 1 OBJ: 8-2.6

20. Cancer occurs as a result of disorders in cell _____.

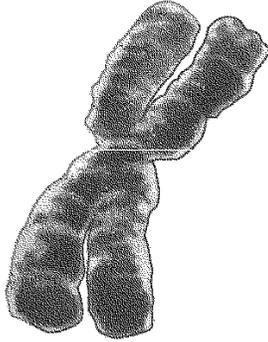
ANS: division

DIF: 1

OBJ: 8-2.6

ESSAY

1.



Refer to the illustration above. Identify the structure in the illustration and discuss its importance during eukaryotic cell division. Write your answer in the space below.

ANS:

This is a chromosome, which is made of DNA. During mitosis, the nucleus of a cell divides into two nuclei, each containing a complete set of the cell's chromosomes. Thus, each new cell formed during cell division contains identical DNA.

DIF: 2

OBJ: 8-2.2

2. What would happen if the chromosome number were not reduced before sexual reproduction? Write your answer in the space below.

ANS:

The number of chromosomes in the offspring would be double the number in the parents. The number and characteristics of chromosomes in cells determine the traits of the organism. The organism would almost certainly not survive the doubling of its chromosomes, and even if it did survive and reproduce, then the number of chromosomes would become unmanageably large after only a few generations.

DIF: 2

OBJ: 8-1.3

3. Briefly describe the five stages of the cell cycle. Write your answer in the space below.

ANS:

The G_1 stage of the cell cycle is the phase of cell growth. This is followed by the S stage, during which DNA is copied. G_2 involves the cell preparing for cell division. The M phase is when mitosis occurs. The cell cycle concludes with cytokinesis. The newly formed cells then enter into a new cell cycle, repeating these stages.

DIF: 2

OBJ: 8-2.3

4. Compare the features of mitotic metaphase, meiotic metaphase I, and meiotic metaphase II. Write your answer in the space below.

ANS:

During mitotic metaphase, the diploid number of chromosomes of the cell line up single file across the equator of the cell. Meiotic metaphase I is characterized by the homologous chromosomes lining up as pairs (double file) along the equator. Metaphase II of meiosis is similar to mitotic metaphase, except that the number of chromosomes is the haploid number rather than the diploid number. These chromosomes line up single file across the cell equator.

DIF: 2 OBJ: 8-3.4

5. Explain how offspring resulting from sexual reproduction differ from offspring resulting from asexual reproduction.

ANS:

Offspring from sexual reproduction have two parents. They were produced through meiosis and fertilization. They are genetically different from either parent but have similarities to both. Offspring from asexual reproduction arise through mitosis in one parent. They are identical genetically to that parent.

DIF: 2 OBJ: 8-3.6

6. A great deal of research on the causes of and a possible cure for cancer focuses on mitosis. Why? Write your answer in the space below.

ANS:

Cancer is a disease in which cells grow and undergo mitosis at an abnormally high rate. If the causes of uncontrolled mitosis of cancerous cells could be determined, perhaps cancer could be slowed or cured.

DIF: 2 OBJ: 8-2.6