

Essentials of Genetics, 10e (Klug)
Chapter 2 Mitosis and Meiosis

1) Living organisms are categorized into two major groups based on the presence or absence of a nucleus. What group is defined by the presence of a nucleus?

- A) eukaryotic organism
- B) virus
- C) eubacterium
- D) archaea
- E) bacteriophage

Answer: A

Section: 2.1

Bloom's Taxonomy: Remembering/Understanding

2) What is the name of the membranous structure that compartmentalizes the cytoplasm of eukaryotic organisms?

- A) ribosome
- B) mitochondria
- C) cytosol
- D) endoplasmic reticulum
- E) nucleoid

Answer: D

Section: 2.1

Bloom's Taxonomy: Remembering/Understanding

3) Organized by the centrioles, what structures are important in the movement of chromosomes during cell division?

- A) mitochondria
- B) chloroplasts
- C) cell walls
- D) spindle fibers
- E) centromeres

Answer: D

Section: 2.1

Bloom's Taxonomy: Remembering/Understanding

4) Which of the following is not a true statement about mitochondria?

- A) the mitochondrial genome is contained in the nucleus
- B) the mitochondria duplicate themselves
- C) the mitochondria transcribe and translate their own genetic information
- D) mitochondria are found in plants and animals
- E) mitochondria are sites for cellular respiration

Answer: A

Section: 2.1

Bloom's Taxonomy: Applying/Analyzing

5) The nucleolus organizer region (NOR) is responsible for production of what type of cell structure?

- A) nucleolus
- B) ribosome
- C) chromatids
- D) mitochondria
- E) endoplasmic reticulum

Answer: B

Section: 2.1

Bloom's Taxonomy: Remembering/Understanding

6) Which of the following terms defines a chromosome in which the centromere is near one end, but not at the end of a chromosome?

- A) acentric
- B) submetacentric
- C) metacentric
- D) acrocentric
- E) telocentric

Answer: D

Section: 2.2

Bloom's Taxonomy: Remembering/Understanding

7) The diploid chromosome number of an organism is usually represented as $2n$. Humans have a diploid chromosome number of 46. What would be the expected haploid chromosome number in a human?

- A) 92
- B) 16
- C) 12
- D) 24
- E) 23

Answer: E

Section: 2.2

Bloom's Taxonomy: Applying/Analyzing

8) Which of the following is incorrect?

- A) a locus is a gene site on a chromosome
- B) an allele is an alternate form of the same gene
- C) sex chromosomes are not strictly homologous
- D) homologous chromosomes contain identical genetic information
- E) a karyotype is generated from a metaphase spread

Answer: D

Section: 2.2

Bloom's Taxonomy: Remembering/Understanding

9) Which of the following is true about sex-determining chromosomes?

- A) They are independent during meiosis.
- B) They do not participate in meiosis.
- C) They act like homologous chromosomes during meiosis so each gamete will get one sex chromosome.
- D) They have the same gene configuration and same loci.
- E) They are always metacentric.

Answer: C

Section: 2.2

Bloom's Taxonomy: Applying/Analyzing

10) During interphase of the cell cycle, _____.

- A) centrioles migrate
- B) sister chromatids move to opposite poles
- C) the nuclear membrane disappears
- D) cytokinesis occurs
- E) DNA content essentially doubles

Answer: E

Section: 2.3

Bloom's Taxonomy: Remembering/Understanding

11) What significant genetic function occurs in the S phase of the cell cycle?

- A) cytokinesis
- B) karyokinesis
- C) DNA synthesis
- D) chromosome condensation
- E) centromere division

Answer: C

Section: 2.3

Bloom's Taxonomy: Remembering/Understanding

12) When cells withdraw from the continuous cell cycle and enter a "quiescent" phase, they are said to be in what stage?

- A) G1
- B) G2
- C) G0
- D) M
- E) S

Answer: C

Section: 2.3

Bloom's Taxonomy: Remembering/Understanding

13) A cell in the G2 phase of the cell cycle _____.

- A) contains twice as much DNA as in the G1 phase
- B) contains twice as many chromosomes as in the G1 phase
- C) contains twice as much DNA and twice as many chromosomes as in the G1 phase
- D) contains the same amount of DNA as in the G1 phase
- E) contains the same amount of chromatids as in the G1 phase

Answer: A

Section: 2.3

Bloom's Taxonomy: Applying/Analyzing

14) Which of the following represents the correct sequence of events in mitosis?

- A) prophase-metaphase-prometaphase-anaphase-telophase
- B) telophase-prophase-prometaphase-metaphase-anaphase
- C) prophase-prometaphase-metaphase-anaphase-telophase
- D) prometaphase-prophase-metaphase-anaphase-telophase
- E) anaphase-metaphase-prometaphase-prophase-telophase

Answer: C

Section: 2.3

Bloom's Taxonomy: Remembering/Understanding

15) Migration of chromosomes is made possible by the binding of the spindle to the _____.

- A) kinetochore
- B) telomere
- C) centriole
- D) equatorial plate
- E) centrosome

Answer: A

Section: 2.3

Bloom's Taxonomy: Remembering/Understanding

16) Which protein directly holds the chromatid arms together prior to anaphase of mitosis?

- A) shugoshin
- B) cohesin
- C) separase
- D) middle lamella
- E) histone

Answer: B

Section: 2.3

Bloom's Taxonomy: Remembering/Understanding

17) The event referred to as disjunction occurs during _____.

- A) prophase
- B) prometaphase
- C) metaphase
- D) anaphase
- E) telophase

Answer: D

Section: 2.3

Bloom's Taxonomy: Remembering/Understanding

18) Normal diploid somatic (body) cells of the mosquito *Culex pipiens* contain six chromosomes. Assuming that all nuclear DNA is restricted to chromosomes and that the amount of nuclear DNA essentially doubles during the S phase of interphase, how much nuclear DNA would be present in metaphase I of mitosis? Note: Assume that the G1 nucleus of a mosquito cell contains 3.0×10^{-12} grams of DNA.

- A) 3.0×10^{-12} g
- B) 6.0×10^{-12} g
- C) 1.5×10^{-12} g
- D) 0.75×10^{-12} g
- E) 12×10^{-12} g

Answer: B

Section: 2.3

Bloom's Taxonomy: Evaluating/Creating

19) At which stage of cell division do sister chromatids go to opposite poles?

- A) mitotic anaphase and anaphase of meiosis I
- B) mitotic anaphase and anaphase of meiosis II
- C) anaphase of meiosis I only
- D) mitotic anaphase only
- E) when they don't get along

Answer: B

Section: 2.4

Bloom's Taxonomy: Remembering/Understanding

20) Which of the following are the areas where chromatids intertwine during meiosis?

- A) synapsis
- B) chiasma
- C) tetrad
- D) bivalent
- E) nondisjunction

Answer: B

Section: 2.4

Bloom's Taxonomy: Remembering/Understanding

21) During meiosis, chromosome number reduction takes place in _____.

- A) anaphase II
- B) anaphase I
- C) metaphase I
- D) prophase I
- E) telophase II

Answer: B

Section: 2.4

Bloom's Taxonomy: Remembering/Understanding

22) A bivalent at prophase I contains _____ chromatids.

- A) one
- B) two
- C) three
- D) four
- E) eight

Answer: D

Section: 2.4

Bloom's Taxonomy: Evaluating/Creating

23) In an organism with 52 chromosomes, how many tetrads would be expected to form during meiosis?

- A) 13
- B) 26
- C) 52
- D) 104
- E) 208

Answer: B

Section: 2.4

Bloom's Taxonomy: Evaluating/Creating

24) In an organism with 52 chromosomes, how many chromatids would be expected in each cell after the second meiotic division?

- A) 52
- B) 26
- C) 13
- D) 104
- E) 208

Answer: B

Section: 2.4

Bloom's Taxonomy: Evaluating/Creating

25) The meiotic cell cycle involves _____ number of cell division(s) and _____ number of DNA replication(s).

- A) one; one
- B) one; two
- C) two; one
- D) two; two
- E) two; zero

Answer: C
Section: 2.4

Bloom's Taxonomy: Remembering/Understanding

26) If a typical somatic cell has 64 chromosomes, how many chromosomes are expected in each gamete of that organism?

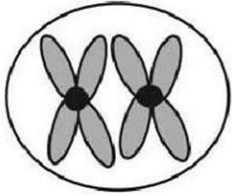
- A) 8
- B) 16
- C) 32
- D) 64
- E) 128

Answer: C
Section: 2.4

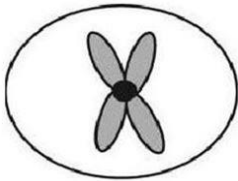
Bloom's Taxonomy: Remembering/Understanding

27) The ant, *Myrmecia pilosula*, is found in Australia and is named bulldog because of its aggressive behavior. It is particularly interesting because it carries all its genetic information in a single pair of chromosomes. In other words, $2n = 2$. (Males are haploid and have just one chromosome.) Which of the following figures would most likely represent a correct configuration of chromosomes in a metaphase I cell of a female?

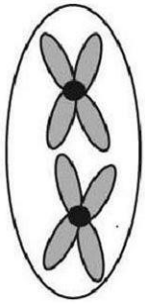
A)



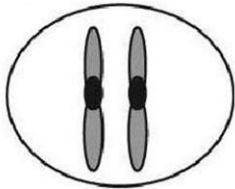
B)



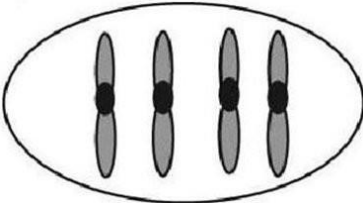
C)



D)



E)



Answer: A

Section: 2.4

Bloom's Taxonomy: Evaluating/Creating

28) For the purposes of this question, assume that a G1 somatic cell nucleus in a female *Myrmecia pilosula* contains 2 picograms of DNA. How much DNA would be expected in a metaphase I cell of a female?

- A) 16 picograms
- B) 32 picograms
- C) 8 picograms
- D) 4 picograms
- E) Not enough information is provided to answer the question.

Answer: D

Section: 2.4

Bloom's Taxonomy: Evaluating/Creating

29) What is the outcome of synapsis, a significant event in meiosis?

- A) side-by-side alignment of nonhomologous chromosomes
- B) dyad formation
- C) monad movement to opposite poles
- D) side-by-side alignment of homologous chromosomes
- E) chiasma segregation

Answer: D

Section: 2.4

Bloom's Taxonomy: Remembering/Understanding

30) Which of the following is true about the second meiotic division?

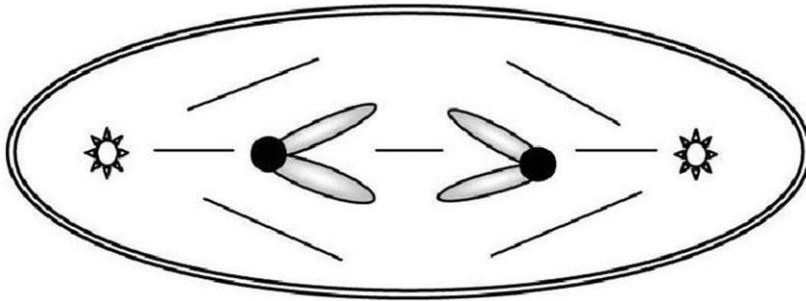
- A) Sister chromatids disjoin and are pulled to opposite poles.
- B) Homologous chromosomes are pulled apart resulting in dyads at each pole.
- C) Nondisjunction would lead to extra bivalents forming.
- D) Synapsis occurs in the second meiotic division.
- E) The products are four identical gametes.

Answer: A

Section: 2.4

Bloom's Taxonomy: Remembering/Understanding

31) The accompanying sketch depicts a cell from an organism in which $2n = 2$ and each chromosome is metacentric.



Which of the following is the correct stage for this sketch?

- A) anaphase of mitosis
- B) anaphase of meiosis I
- C) anaphase of meiosis II
- D) telophase of mitosis
- E) telophase of meiosis II

Answer: C

Section: 2.4

Bloom's Taxonomy: Applying/Evaluating

32) The horse (*Equus caballus*) has 32 pairs of chromosomes, whereas the donkey (*Equus asinus*) has 31 pairs of chromosomes. How many chromosomes would be expected in the somatic tissue of a mule, which is a hybrid of these two animals?

- A) 63
- B) 64
- C) 62
- D) 60
- E) 126

Answer: A

Section: 2.4

Bloom's Taxonomy: Applying/Analyzing

33) In figure 2-10, an organism with a haploid number of 2 (diploid 4) generates 4 combinations of chromosomes at the end of meiosis. An organism with a haploid number of 4 would generate 16 chromosomal combinations, and that of 6 would generate 64 chromosomal combinations. Based on this pattern, an organism with a haploid number of 10 will produce _____ combinations of chromosomes at the end of meiosis.

- A) 10
- B) 100
- C) 10,000
- D) 32
- E) 1024

Answer: E

Section: 2.4

Bloom's Taxonomy: Evaluating/Creating

34) An organism with a diploid chromosome number of 46 will produce _____ combinations of chromosomes at the end of meiosis.

- A) 23
- B) 46
- C) 8388608
- D) 529
- E) 7.04×10^{13}

Answer: C

Section: 2.4

Bloom's Taxonomy: Evaluating/Creating

35) Which of the following is not a source of genetic variation in meiosis?

- A) crossing over
- B) law of independent assortment
- C) the random lining up of chromosomes on the metaphase plate
- D) tetrad formation
- E) polar body formation

Answer: E

Section: 2.5

Bloom's Taxonomy: Remembering/Understanding

36) In a healthy male, how many sperm cells would be expected to form from (a) 400 primary spermatocytes? (b) 400 secondary spermatocytes?

- A) (a) 800; (b) 800
- B) (a) 1600; (b) 1600
- C) (a) 1600; (b) 800
- D) (a) 400; (b) 400
- E) (a) 400; (b) 800

Answer: C

Section: 2.5

Bloom's Taxonomy: Applying/Analyzing

37) In a healthy female, how many secondary oocytes would be expected to form from 100 primary oocytes? How many first polar bodies would be expected from 100 primary oocytes?

- A) 200; 50
- B) 100; 50
- C) 200; 200
- D) 100; 100
- E) 50; 50

Answer: D

Section: 2.5

Bloom's Taxonomy: Applying/Analyzing

- 38) There is about as much nuclear DNA in a primary spermatocyte as in _____ spermatids.
- A) 0.5
 - B) 1
 - C) 2
 - D) 3
 - E) 4

Answer: E

Section: 2.5

Bloom's Taxonomy: Applying/Analyzing

- 39) List, in order of appearance, all the cell types expected to be formed during spermatogenesis.
- A) spermatogonia, primary spermatocyte, secondary spermatocyte, spermatid, spermatozoa
 - B) primary spermatocyte, secondary spermatocyte, spermatozoa, spermatid, spermatogonia
 - C) spermatozoa, spermatid, spermatogonia, primary spermatocyte, secondary spermatocyte
 - D) spermatogonia, spermatozoa, spermatid, primary spermatocyte, secondary spermatocyte
 - E) primary spermatocyte, secondary spermatocyte, spermatid, spermatozoa, spermatogonia

Answer: A

Section: 2.5

Bloom's Taxonomy: Remembering/Understanding

- 40) In plants, spores are produced by the process of _____.
- A) binary fission
 - B) mitosis
 - C) meiosis
 - D) oogenesis
 - E) spermatogenesis

Answer: C

Section: 2.6

Bloom's Taxonomy: Remembering/Understanding

- 41) Mitotic chromosomes are estimated to be _____ fold more compacted than chromatin in interphase.
- A) 50
 - B) 100
 - C) 500
 - D) 1,000
 - E) 5,000

Answer: E

Section: 2.7

Bloom's Taxonomy: Remembering/Understanding