

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) 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. 1) _____
- A) 0.75×10^{-12} g
B) 6.0×10^{-12} g
C) 12×10^{-12} g
D) 1.5×10^{-12} g
E) 3.0×10^{-12} g
- 2) The meiotic cell cycle involves _____ number of cell division(s) and _____ number of DNA replication(s). 2) _____
- A) two; two B) two; one C) one; one D) two; zero E) one; two
- 3) Which if the following is true? 3) _____
- A) Cells are considered to be $2n$ after meiosis I.
B) A chromosome always contains the same number of chromatids, regardless of phase of the mitotic or meiotic cell cycle.
C) Sister chromatids in mitosis are not identical.
D) A chromosome may contain one or two chromatids in different phases of the mitotic or meiotic cell cycle.
E) Cells are $4n$ after S phase.
- 4) Which of the following are the areas where chromatids intertwine during meiosis? 4) _____
- A) chiasma
B) bivalent
C) nondisjunction
D) synapsis
E) tetrad
- 5) How many haploid sets of chromosomes are present in an individual cell that is pentaploid ($5n$)? 5) _____
- A) 5
B) 4
C) 3
D) 2
E) It is impossible to tell with the information given.
- 6) List, in order of appearance, all the cell types expected to be formed during spermatogenesis. 6) _____
- A) spermatogonia, primary spermatocyte, secondary spermatocyte, spermatid, spermatozoa
B) spermatozoa, spermatid, spermatogonia, primary spermatocyte, secondary spermatocyte
C) primary spermatocyte, secondary spermatocyte, spermatozoa, spermatid, spermatogonia
D) primary spermatocyte, secondary spermatocyte, spermatid, spermatozoa, spermatogonia
E) spermatogonia, spermatozoa, spermatid, primary spermatocyte, secondary spermatocyte

- 7) Which chromosome has a telomere but the p arm is much shorter than the q arm? 7) _____
A) sex chromosome
B) acrocentric
C) telocentric
D) metacentric
E) submetacentric
- 8) The stage at which "sister chromatids go to opposite poles" immediately follows which of the stages listed below? 8) _____
A) mitotic metaphase
B) metaphase of meiosis I
C) metaphase of meiosis II
D) A and B
E) A and C
- 9) When cells withdraw from the continuous cell cycle and enter a "quiescent" phase, they are said to be in what stage? 9) _____
A) M B) S C) G1 D) G0 E) G2
- 10) The centromere of a chromosome separates during _____. 10) _____
A) prometaphase
B) interphase
C) prophase
D) anaphase
E) telophase
- 11) During interphase of the cell cycle, _____. 11) _____
A) DNA content essentially doubles

B) sister chromatids move to opposite poles
C) DNA recombines
D) the nuclear membrane disappears
E) RNA replicates
- 12) In a healthy male, how many sperm cells would be expected to be formed from (a) 400 primary spermatocytes? (b) 400 secondary spermatocytes? 12) _____
A) (a) 1600; (b) 1600
B) (a) 800; (b) 800
C) (a) 100; (b) 800
D) (a) 400; (b) 400
E) (a) 1600; (b) 800
- 13) Which of the follow could occur if a cell cycle checkpoint was missed? 13) _____
A) An unreplicated chromosome could be put through mitosis.
B) The cell cycle would be arrested until the error could be corrected.
C) DNA would mutate during G2.
D) The spindle apparatus would not form.
E) Cohesin could not function correctly.

- 14) A G1 somatic cell nucleus in a female diploid *Myrmecia pilosula* (bulldog ant) contains 2 picograms of DNA. How much DNA would be expected in a metaphase I cell of a female? 14) _____
- A) 32 picograms
 B) 8 picograms
 C) 16 picograms
 D) 4 picograms
 E) Not enough information is provided to answer the question.
- 15) *Myrmecia pilosula* (the bulldog ant) actually consists of several virtually identical, closely related species, with females having chromosome numbers of 18, 20, 32, 48, 60, 62, and 64. Assume one crossed a female of species (A) with 32 chromosomes and a male of species (B) with 9 chromosomes (males are haploid, and each gamete contains the n complement). How many chromosomes would one expect in the body (somatic) cells of the female offspring? 15) _____
- A) 9 B) 4.5 C) 25 D) 41 E) 32
- 16) 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? 16) _____
- A) 64 B) 62 C) 63 D) 60 E) 126
- 17) 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? 17) _____
- A) 50; 50 B) 100; 100 C) 100; 50 D) 200; 50 E) 200; 300
- 18) In plants, which stage is haploid? 18) _____
- A) polar body
 B) gametophyte
 C) germ cell
 D) sporophyte
 E) spermatozoa
- 19) Name two cellular organelles, each containing genetic material, which are involved in either photosynthesis or respiration. 19) _____
- A) peroxisomes and mitochondria
 B) rough and smooth endoplasmic reticula
 C) chloroplasts and mitochondria
 D) chloroplast and endoplasmic reticulum
 E) lysosome and chloroplast
- 20) Which of the following is diploid? 20) _____
- A) megaspore
 B) zygote
 C) egg
 D) gametophyte
 E) sperm

- 21) During meiosis, chromosome number reduction takes place in _____. 21) _____
 A) anaphase II
 B) prophase I
 C) anaphase I
 D) telophase II
 E) metaphase I
- 22) The nucleolus organizer region (NOR) is responsible for production of what type of cell structure? 22) _____
 A) nucleolus
 B) endoplasmic reticulum
 C) ribosome
 D) chromatids
 E) mitochondria
- 23) An organism with a diploid chromosome number of 46 will produce _____ combinations of chromosomes at the end of meiosis. 23) _____
 A) 46
 B) 529
 C) 23
 D) 7.04×10^{13}
 E) 8388608
- 24) A typical G1 nucleus is 2n and contains 2C (two complements) of DNA. Which of the following is true? 24) _____
 A) A cell in G2 is 4n and contains 2C of DNA.
 B) A prophase cell is 4n and contains 4C of DNA.
 C) A cell in metaphase is 2n and contains 2C of DNA.
 D) A cell in prophase is 2n and contains 4C of DNA.
 E) A cell in prophase is 2n and contains 2n of DNA.
- 25) You may have heard through various media of an animal alleged to be the hybrid of a rabbit and a cat. Given that the cat (*Felis domesticus*) has a diploid chromosome number of 38 and a rabbit (*Oryctolagus cuniculus*) has a diploid chromosome number of 44, what would be the expected chromosome number in the somatic tissues of this alleged hybrid? 25) _____
 A) 82 B) 38 C) 41 D) 40 E) 44
- 26) Which of the following is true about the second meiotic division? 26) _____
 A) Sister chromatids are pulling apart.
 B) The products are four identical gametes.
 C) Nondisjunction would lead to extra bivalents forming.
 D) Synapsis occurring in the second meiotic division.
 E) Homologous chromosomes are pulling apart.
- 27) How many haploid sets of chromosomes are present in a diploid individual cell with a chromosome number of 32? 27) _____
 A) 8 B) 32 C) 1 D) 16 E) 2

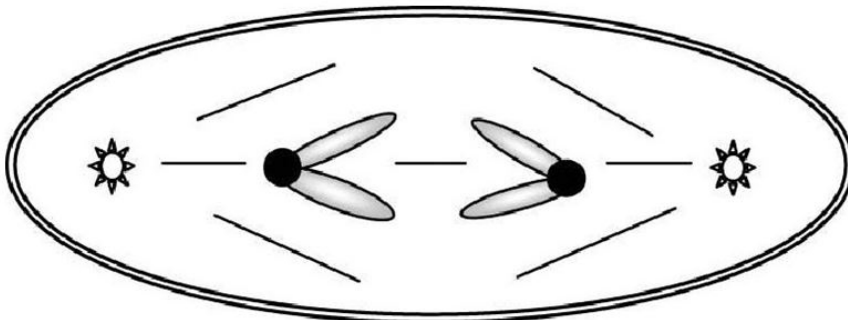
28) Which term describes meiosis I? 28) _____
 A) reducatational
 B) equinational
 C) middling
 D) multiplicative
 E) confrontational

29) You have identified a mutant in human cells that when shifted to 37°C, the microfilaments depolymerize (fall apart). Which of the following would be true about this mutant at 37°C? 29) _____
 A) The sister chromatids would no longer be attached to each other.
 B) The cells would no longer be able to produce ATP.
 C) The cells would change shape.
 D) The endoplasmic reticulum could still import polypeptides but could no longer synthesize lipids.
 E) The mitochondria would no longer work.

30) If a typical somatic cell has 64 chromosomes, how many chromosomes are expected in each gamete of that organism? 30) _____
 A) 16 B) 64 C) 8 D) 128 E) 32

31) After meiosis II, _____ would be formed. 31) _____
 A) tetrads B) chiasma C) monads D) dyads E) synapsis

32) Given that each G1 nucleus from this organism contains 16 picograms of DNA, how many picograms of chromosomal DNA would you expect in the cell shown below? 32) _____

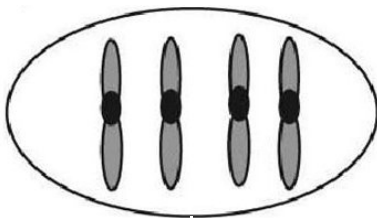


A) 2 B) 32 C) 4 D) 8 E) 16

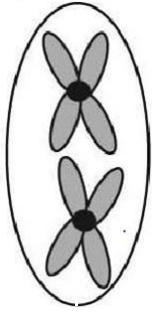
33) Which of the following is true about sex-determining chromosomes? 33) _____
 A) They are independent during meiosis.
 B) They act like homologous chromosomes during meiosis so each gamete will get one sex chromosome.
 C) They do not participate in meiosis.
 D) They are always metacentric.
 E) They have the same gene configuration and same loci.

- 34) Which of the following would occur if there was no chiasma formation in prophase I? 34) _____
A) All gametes would have the same phenotype.
B) All gametes would have the same genotype.
C) In a heterozygote, there would only be a 1:1:1:1 formation after meiosis II, never a 2:2.
D) Mosaic chromosomes would form.
E) In a heterozygote, there would only be a 2:2 formation after meiosis II, never a 1:1:1:1.
- 35) If a typical G1 nucleus contains 2C (two complements) of DNA, a gamete that is haploid (n) contains _____ of DNA. 35) _____
A) 0.5C B) 2C C) 1C D) 3C E) 4C
- 36) Electron microscopy of metaphase chromosomes demonstrated various degrees of coiling. What was the name of the model that depicted this process? 36) _____
A) packing
B) folded-fiber
C) condensation
D) double-stranded
E) chromatid folding
- 37) What is the outcome of synapsis, a significant event in meiosis? 37) _____
A) dyad formation
B) monad movement to opposite poles
C) chiasma segregation
D) side-by-side alignment of nonhomologous chromosomes
E) side-by-side alignment of homologous chromosomes
- 38) Which if the following is not a source of genetic variation in meiosis? 38) _____
A) crossing over
B) the random lining up of chromosomes on the metaphase plate
C) tetrad formation
D) law of independent assortment
E) polar body formation
- 39) In an organism with 60 chromosomes, how many bivalents would be expected to form during meiosis? 39) _____
A) 240 B) 15 C) 120 D) 30 E) 60
- 40) *Drosophila melanogaster*, the fruit fly, has a 2n chromosome number of 8. Assuming that a somatic G2 nucleus from one of the individuals in this scenario contains about 8.0 picograms of DNA, how much nuclear DNA would you expect in a fly egg? 40) _____
A) 4 pg B) 8 pg C) 2 pg D) 16 pg E) 1 pg
- 41) 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? 41) _____
A) 12 B) 92 C) 24 D) 23 E) 16

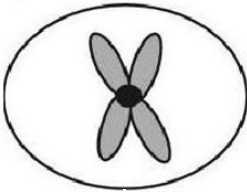
- 42) What significant genetic function occurs in the S phase of the cell cycle? 42) _____
 A) karyokinesis
 B) cytokinesis
 C) centromere division
 D) chromosome condensation
 E) DNA synthesis
- 43) An organism with a haploid number of 10 will produce _____ combinations of chromosomes at the end of meiosis. 43) _____
 A) 10,000 B) 10 C) 1024 D) 32 E) 100
- 44) What is the name of the membranous structure that compartmentalizes the cytoplasm of eukaryotic organisms? 44) _____
 A) nucleoid
 B) ribosome
 C) endoplasmic reticulum
 D) cytosol
 E) mitochondria
- 45) Which part of interphase does DNA duplication take place? 45) _____
 A) S B) G1 C) M D) G2 E) G0
- 46) A bivalent at prophase I contains _____ chromatids. 46) _____
 A) three B) eight C) one D) four E) two
- 47) The house fly, *Musca domestica*, has a haploid chromosome number of 6. How many chromatids should be present in a diploid, somatic, metaphase cell? 47) _____
 A) 6 B) 24 C) 3 D) 12 E) 18
- 48) 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? 48) _____
 A)



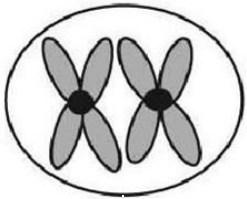
B)



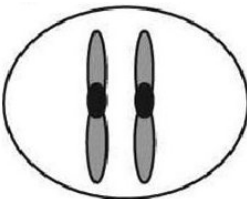
C)



D)



E)



49) In which stage of the cell cycle is G0 located?

A) anaphase

B) G1

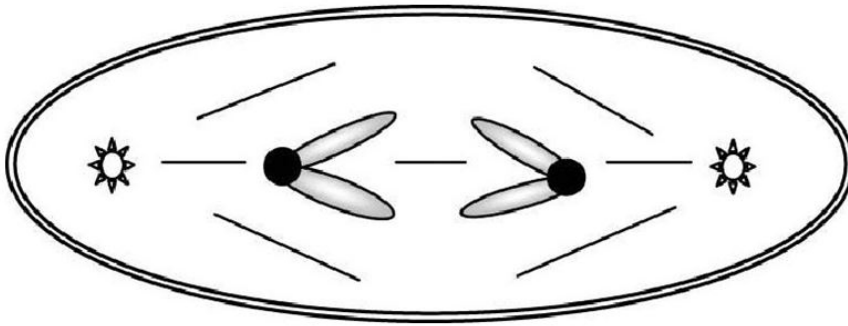
C) G2

D) M

E) S

49) _____

50) The accompanying sketch depicts a cell from an organism in which $2n = 2$ and each chromosome is metacentric. 50) _____



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

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

51) During the transition from interphase to metaphase chromosome, the DNA undergoes how much compaction? 51) _____

- A) 500 fold
- B) 50 fold
- C) 10 fold
- D) 2 fold
- E) 5000 fold

52) There is about as much nuclear DNA in a primary spermatocyte as in _____ spermatids. 52) _____

- A) 4
- B) 3
- C) 0.5
- D) 1
- E) 2

53) List, in order of appearance, all the cell types expected to be formed during oogenesis. 53) _____

- A) oogonium, primary oocyte, secondary oocyte and first polar body, ootid and second polar body
- B) primary oocyte, secondary oocyte and first polar body, ootid, second polar body, oogonium
- C) oogonium, primary oocyte, second polar body and ootid, secondary oocyte and first polar body
- D) primary oocyte, secondary oocyte and first polar body, second polar body, ootid, oogonium
- E) primary oocyte, secondary oocyte and first polar body, oogonium, second polar body and ootid

54) 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? 54) _____

- A) bacterium
- B) virus
- C) mitochondrial organism
- D) eukaryotic organism
- E) prokaryotic organism

Answer Key

Testname: CH2

- 1) B
- 2) B
- 3) B
- 4) A
- 5) A
- 6) A
- 7) B
- 8) E
- 9) D
- 10) D
- 11) A
- 12) E
- 13) A
- 14) D
- 15) C
- 16) C
- 17) B
- 18) B
- 19) C
- 20) B
- 21) C
- 22) C
- 23) E
- 24) D
- 25) C
- 26) A
- 27) E
- 28) A
- 29) C
- 30) E
- 31) C
- 32) E
- 33) B
- 34) E
- 35) C
- 36) B
- 37) E
- 38) E
- 39) D
- 40) A
- 41) D
- 42) E
- 43) C
- 44) C
- 45) A
- 46) D
- 47) B
- 48) D
- 49) B
- 50) E

Answer Key

Testname: CH2

- 51) E
- 52) A
- 53) A
- 54) D