

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

- 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? 1) \_\_\_\_\_
  - A) virus
  - B) eukaryotic organism
  - C) prokaryotic organism
  - D) mitochondrial organism
  - E) bacterium
  
- 2) What is the name of the membranous structure that compartmentalizes the cytoplasm of eukaryotic organisms? 2) \_\_\_\_\_
  - A) cytosol
  - B) ribosome
  - C) nucleoid
  - D) mitochondria
  - E) endoplasmic reticulum
  
- 3) 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? 3) \_\_\_\_\_
  - A) The cells would no longer be able to produce ATP.
  - B) The mitochondria would no longer work.
  - C) The cells would change shape.
  - D) The endoplasmic reticulum could still import polypeptides but could no longer synthesize lipids.
  - E) The sister chromatids would no longer be attached to each other.
  
- 4) Name two cellular organelles, each containing genetic material, which are involved in either photosynthesis or respiration. 4) \_\_\_\_\_
  - A) chloroplast and endoplasmic reticulum
  - B) chloroplasts and mitochondria
  - C) rough and smooth endoplasmic reticula
  - D) lysosome and chloroplast
  - E) peroxisomes and mitochondria
  
- 5) The nucleolus organizer region (NOR) is responsible for production of what type of cell structure? 5) \_\_\_\_\_
  - A) chromatids
  - B) mitochondria
  - C) endoplasmic reticulum
  - D) nucleolus
  - E) ribosome

- 6) 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? 6) \_\_\_\_\_  
A) 12                      B) 23                      C) 92                      D) 24                      E) 16
- 7) Which chromosome has a telomere but the p arm is much shorter than the q arm? 7) \_\_\_\_\_  
A) submetacentric  
B) telocentric  
C) metacentric  
D) acrocentric  
E) sex chromosome
- 8) Which of the following is true about sex-determining chromosomes? 8) \_\_\_\_\_  
A) They are independent during meiosis.  
B) They do not participate in meiosis.  
C) They are always metacentric.  
D) They have the same gene configuration and same loci.  
E) They act like homologous chromosomes during meiosis so each gamete will get one sex chromosome.
- 9) What significant genetic function occurs in the S phase of the cell cycle? 9) \_\_\_\_\_  
A) chromosome condensation  
B) cytokinesis  
C) DNA synthesis  
D) centromere division  
E) karyokinesis
- 10) During interphase of the cell cycle, \_\_\_\_\_. 10) \_\_\_\_\_  
A) RNA replicates  
B) DNA content essentially doubles  
  
C) sister chromatids move to opposite poles  
D) DNA recombines  
E) the nuclear membrane disappears
- 11) The house fly, *Musca domestica*, has a haploid chromosome number of 6. How many chromatids should be present in a diploid, somatic, metaphase cell? 11) \_\_\_\_\_  
A) 6                      B) 3                      C) 24                      D) 18                      E) 12
- 12) How many haploid sets of chromosomes are present in a diploid individual cell with a chromosome number of 32? 12) \_\_\_\_\_  
A) 2                      B) 32                      C) 16                      D) 8                      E) 1

- 13) How many haploid sets of chromosomes are present in an individual cell that is pentaploid ( $5n$ )? 13) \_\_\_\_\_  
A) 3  
B) 2  
C) 5  
D) 4  
E) It is impossible to tell with the information given.
- 14) 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? 14) \_\_\_\_\_  
A) 40                      B) 38                      C) 82                      D) 44                      E) 41
- 15) Which of the follow could occur if a cell cycle checkpoint was missed? 15) \_\_\_\_\_  
A) An unreplicated chromosome could be put through mitosis.  
B) DNA would mutate during G2.  
C) Cohesin could not function correctly.  
D) The cell cycle would be arrested until the error could be corrected.  
E) The spindle apparatus would not form.
- 16) In which stage of the cell cycle is G0 located? 16) \_\_\_\_\_  
A) S                      B) M                      C) G1                      D) G2                      E) anaphase
- 17) When cells withdraw from the continuous cell cycle and enter a "quiescent" phase, they are said to be in what stage? 17) \_\_\_\_\_  
A) M                      B) G0                      C) S                      D) G1                      E) G2
- 18) A typical G1 nucleus is  $2n$  and contains  $2C$  (two complements) of DNA. Which of the following is true? 18) \_\_\_\_\_  
A) A cell in prophase is  $2n$  and contains  $4C$  of DNA.  
B) A cell in prophase is  $2n$  and contains  $2n$  of DNA.  
C) A cell in G2 is  $4n$  and contains  $2C$  of DNA.  
D) A prophase cell is  $4n$  and contains  $4C$  of DNA.  
E) A cell in metaphase is  $2n$  and contains  $2C$  of DNA.
- 19) Which part of interphase does DNA duplication take place? 19) \_\_\_\_\_  
A) S                      B) M                      C) G2                      D) G1                      E) G0
- 20) The centromere of a chromosome separates during \_\_\_\_\_. 20) \_\_\_\_\_  
A) telophase  
B) interphase  
C) prometaphase  
D) prophase  
E) anaphase

21) 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  $3.0 \times 10^{-12}$  grams of DNA. 21) \_\_\_\_\_

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

22) If a typical somatic cell has 64 chromosomes, how many chromosomes are expected in each gamete of that organism? 22) \_\_\_\_\_

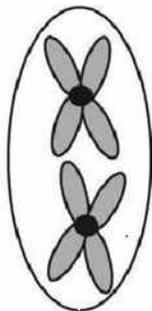
A) 64                      B) 16                      C) 32                      D) 8                      E) 128

23) In an organism with 60 chromosomes, how many bivalents would be expected to form during meiosis? 23) \_\_\_\_\_

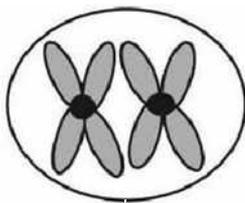
A) 240                      B) 15                      C) 30                      D) 120                      E) 60

24) 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? 24) \_\_\_\_\_

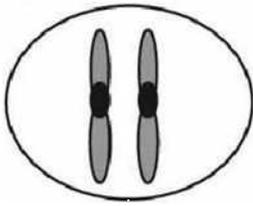
A)



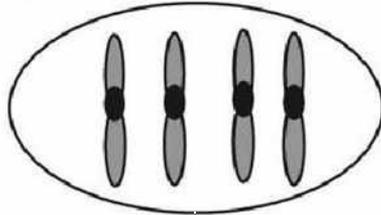
B)



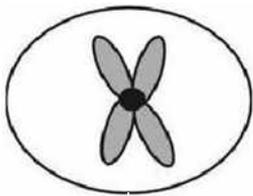
C)



D)



E)



- 25) 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? 25) \_\_\_\_\_
- A) 16 picograms
  - B) 32 picograms
  - C) 4 picograms
  - D) 8 picograms
  - E) Not enough information is provided to answer the question.
- 26) *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? 26) \_\_\_\_\_
- A) 4.5                      B) 9                      C) 32                      D) 41                      E) 25
- 27) What is the outcome of synapsis, a significant event in meiosis? 27) \_\_\_\_\_
- A) monad movement to opposite poles
  - B) chiasma segregation
  - C) dyad formation
  - D) side-by-side alignment of homologous chromosomes
  - E) side-by-side alignment of nonhomologous chromosomes

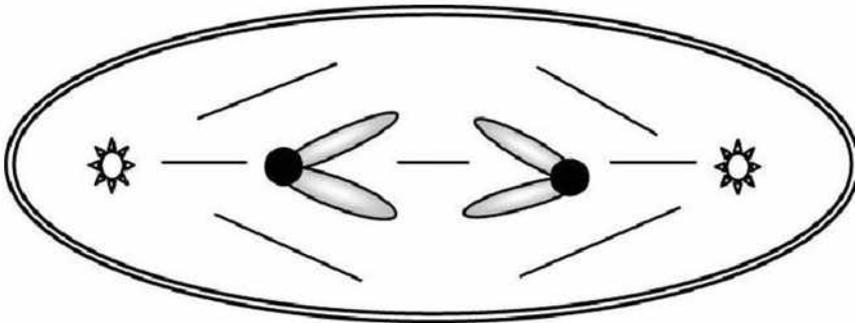
28) Which of the following is true about the second meiotic division? 28) \_\_\_\_\_

- A) Synapsis occurring in the second meiotic division.
- B) The products are four identical gametes.
- C) Homologous chromosomes are pulling apart.
- D) Nondisjunction would lead to extra bivalents forming.
- E) Sister chromatids are pulling apart.

29) Which if the following is not a source of genetic variation in meiosis? 29) \_\_\_\_\_

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

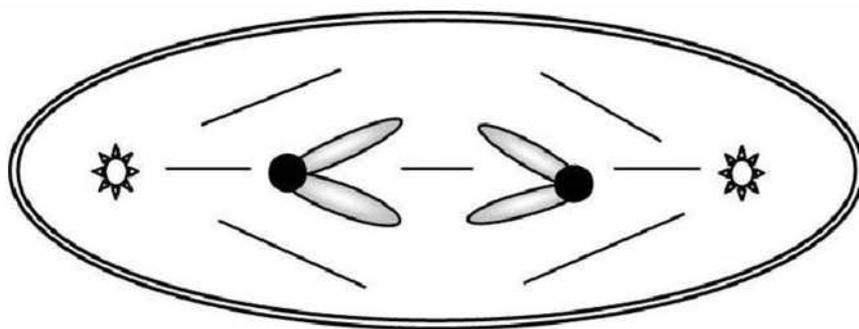
30) The accompanying sketch depicts a cell from an organism in which  $2n = 2$  and each chromosome is metacentric. 30) \_\_\_\_\_



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

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

31) 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? 31) \_\_\_\_\_



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

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? 32) \_\_\_\_\_

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

33) Which of the following are the areas where chromatids intertwine during meiosis? 33) \_\_\_\_\_

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

34) After meiosis II, \_\_\_\_\_ would be formed. 34) \_\_\_\_\_

- A) synapsis                      B) tetrads                      C) monads                      D) dyads                      E) chiasma

35) Which of the following would occur if there was no chiasma formation in prophase I? 35) \_\_\_\_\_

- A) In a heterozygote, there would only be a 2:2 formation after meiosis II, never a 1:1:1:1.
- B) All gametes would have the same genotype.
- C) All gametes would have the same phenotype.
- D) Mosaic chromosomes would form.
- E) In a heterozygote, there would only be a 1:1:1:1 formation after meiosis II, never a 2:2.

36) Which term describes meiosis I? 36) \_\_\_\_\_

- A) confrontational
- B) equinational
- C) middling
- D) multiplicative
- E) reeducational

- 37) Which if the following is true? 37) \_\_\_\_\_
- A) Cells are considered to be  $2n$  after meiosis I.
  - B) Sister chromatids in mitosis are not identical.
  - C) A chromosome may contain one or two chromatids in different phases of the mitotic or meiotic cell cycle.
  - D) A chromosome always contains the same number of chromatids, regardless of phase of the mitotic or meiotic cell cycle.
  - E) Cells are  $4n$  after S phase.
- 38) If a typical G1 nucleus contains  $2C$  (two complements) of DNA, a gamete that is haploid ( $n$ ) contains \_\_\_\_\_ of DNA. 38) \_\_\_\_\_
- A)  $4C$
  - B)  $1C$
  - C)  $3C$
  - D)  $0.5C$
  - E)  $2C$
- 39) During meiosis, chromosome number reduction takes place in \_\_\_\_\_. 39) \_\_\_\_\_
- A) anaphase I
  - B) prophase I
  - C) telophase II
  - D) metaphase I
  - E) anaphase II
- 40) A bivalent at prophase I contains \_\_\_\_\_ chromatids. 40) \_\_\_\_\_
- A) one
  - B) four
  - C) two
  - D) eight
  - E) three
- 41) The meiotic cell cycle involves \_\_\_\_\_ number of cell division(s) and \_\_\_\_\_ number of DNA replication(s). 41) \_\_\_\_\_
- A) two; one
  - B) one; two
  - C) two; two
  - D) one; one
  - E) two; zero
- 42) An organism with a haploid number of 10 will produce \_\_\_\_\_ combinations of chromosomes at the end of meiosis. 42) \_\_\_\_\_
- A) 1024
  - B) 10,000
  - C) 32
  - D) 10
  - E) 100
- 43) An organism with a diploid chromosome number of 46 will produce \_\_\_\_\_ combinations of chromosomes at the end of meiosis. 43) \_\_\_\_\_
- A) 23
  - B) 529
  - C)  $7.04 \times 10^{13}$
  - D) 46
  - E) 8388608

- 44) The stage at which "sister chromatids go to opposite poles" immediately follows which of the stages listed below? 44) \_\_\_\_\_
- A) mitotic metaphase
  - B) metaphase of meiosis I
  - C) metaphase of meiosis II
  - D) A and B
  - E) A and C
- 45) *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? 45) \_\_\_\_\_
- A) 2 pg
  - B) 16 pg
  - C) 4 pg
  - D) 8 pg
  - E) 1 pg
- 46) 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? 46) \_\_\_\_\_
- A) 100; 100
  - B) 100; 50
  - C) 50; 50
  - D) 200; 300
  - E) 200; 50
- 47) In a healthy male, how many sperm cells would be expected to be formed from (a) 400 primary spermatocytes? (b) 400 secondary spermatocytes? 47) \_\_\_\_\_
- A) (a) 400; (b) 400
  - B) (a) 1600; (b) 800
  - C) (a) 800; (b) 800
  - D) (a) 100; (b) 800
  - E) (a) 1600; (b) 1600
- 48) There is about as much nuclear DNA in a primary spermatocyte as in \_\_\_\_\_ spermatids. 48) \_\_\_\_\_
- A) 2
  - B) 1
  - C) 4
  - D) 0.5
  - E) 3
- 49) List, in order of appearance, all the cell types expected to be formed during spermatogenesis. 49) \_\_\_\_\_
- A) primary spermatocyte, secondary spermatocyte, spermatozoa, spermatid, spermatogonia
  - B) spermatogonia, spermatozoa, spermatid, primary spermatocyte, secondary spermatocyte
  - C) primary spermatocyte, secondary spermatocyte, spermatid, spermatozoa, spermatogonia
  - D) spermatogonia, primary spermatocyte, secondary spermatocyte, spermatid, spermatozoa
  - E) spermatozoa, spermatid, spermatogonia, primary spermatocyte, secondary spermatocyte
- 50) List, in order of appearance, all the cell types expected to be formed during oogenesis. 50) \_\_\_\_\_
- A) primary oocyte, secondary oocyte and first polar body, second polar body, ootid, oogonium
  - B) primary oocyte, secondary oocyte and first polar body, ootid, second polar body, oogonium
  - C) oogonium, primary oocyte, secondary oocyte and first polar body, ootid and second polar body
  - D) primary oocyte, secondary oocyte and first polar body, oogonium, second polar body and ootid
  - E) oogonium, primary oocyte, second polar body and ootid, secondary oocyte and first polar body

- 51) In plants, which stage is haploid? 51) \_\_\_\_\_  
A) germ cell  
B) spermatozoa  
C) polar body  
D) gametophyte  
E) sporophyte
- 52) Which of the following is diploid? 52) \_\_\_\_\_  
A) megaspore  
B) gametophyte  
C) egg  
D) zygote  
E) sperm
- 53) Electron microscopy of metaphase chromosomes demonstrated various degrees of coiling. What was the name of the model that depicted this process? 53) \_\_\_\_\_  
A) double-stranded  
B) folded-fiber  
C) chromatid folding  
D) packing  
E) condensation
- 54) During the transition from interphase to metaphase chromosome, the DNA undergoes how much compaction? 54) \_\_\_\_\_  
A) 5000 fold      B) 10 fold      C) 2 fold      D) 50 fold      E) 500 fold

Answer Key

Testname: UNTITLED2

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

Answer Key

Testname: UNTITLED2

43) E

44) E

45) C

46) A

47) B

48) C

49) D

50) C

51) D

52) D

53) B

54) A