

Circle the best single letter choice for each of the following questions before transferring your answers to your computer sheet.

1. When would a 0.1% frequency of recombination be observed?

- A. only in sex chromosomes.
- B. on genes on sister chromatids.
- C. on unlinked chromosomes.
- D. in any two genes on different chromosomes.
- E. in genes located very close to one another on the same chromosome.

2. In a series of experiments, the recombination frequencies for four different linked genes of *Drosophila* were determined as shown below.

B = black body; cn = cinnabar eyes; rb = reduced bristles; vg = vestigial wing.

vg – b = 19.0%	rb – b = 3.5%
vg – cn = 9.0%	rb – cn = 6.5%
vg – rb = 16.0%	cn – b = 9.0%

What is the order of these genes on the chromosome?

- A. rb – cn – vg - b
- B. vg – b – rb - cn
- C. cn – rb – b - vg
- D. b – rb – cn - vg
- E. vg – cn – b - rb

3. Cinnabar eyes is a X-linked recessive characteristic in fruit flies. If a female having cinnabar eyes is crossed with a wild-type male, what percentage of the F₁ males will have cinnabar eyes?

- A. 0%
- B. 25%
- C. 50%
- D. 75%
- E. 100%

4. Which of the following statements is true for cells of human individuals with three or more X chromosomes

- A. one X chromosome remains active and the rest are inactivated.
- B. all of the X chromosomes remain active.
- C. two X chromosomes remain active, and the rest are inactivated.
- D. two X chromosomes remain active in females and one remain active in males; the rest are inactivated.
- E. only one X chromosome is inactivated.

5. Anwar and Jane hypothesize that women have a faster reaction time than men when country music is being played. What would be the best null hypothesis for this group?

- A. There is no reaction time difference between men and women.
 - B. Women have a faster reaction time than men.
 - C. Women have a slower reaction time than men.
 - D. Women prefer country music more than men.
 - E. Women have a slower reaction time than men because they are easily distracted by country music.
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6. Given the following information, what would be the magnification achieved by the light microscope?

Ocular lens = 20x

Objective lens = 100x (oil immersion)

1 stage division = 10 μ m

diameter of the field = 3.5 mm

- A. 10x
 - B. 20x
 - C. 200x
 - D. 2000x
 - E. 3.5x
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7. Which of the following structures is common to **all** cells?

- A. chloroplast
 - B. mitochondria
 - C. cell membrane
 - D. cell wall
 - E. centrioles
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8. Which type of cell would probably provide the best opportunity to study lysosomes?

- A. muscle cell
 - B. nerve cell
 - C. leaf cell of maple tree
 - D. phagocytic white blood cell
 - E. prokaryotic cell
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9. Ribosomes are assembled in a specialized dense region that is **not** enclosed in a membrane. What is this structure called?

- A. nuclei
 - B. nucleolus
 - C. Golgi apparatus
 - D. nucleoid
 - E. centrosome
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10. If you discovered what you thought was a new species of bacterium and wanted to closely examine its surface structure, what type of microscopy would best suit your needs?

- A. transmission electron microscopy
 - B. compound light microscopy
 - C. scanning electron microscopy
 - D. dissecting (stereo) light microscope
 - E. nuclear magnetic resonance microscopy
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11. Which cellular structure is **not** surrounded by at least one membrane?

- A. chloroplast
 - B. nuclei
 - C. lysosome
 - D. ribosome
 - E. Golgi apparatus
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12. The working surfaces of mitochondria are membranes that are folded into the interior of the mitochondrion. What are these inner membranes called?
- A. tonoplasts.
 - B. cristae.
 - C. cisternae.
 - D. thylakoids.
 - E. grana.
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13. Suppose you are examining a cell from a crime scene using an electron microscope, and you find the cell contains ribosomes, DNA, a plasma membrane, mitochondria, and plasmodesmata. What type of cell is it?
- A. a lung cell
 - B. a virus infected skin cell
 - C. a prokaryotic cell
 - D. a sperm cell
 - E. an oak leaf cell
-
14. Why has the electron microscope been particularly useful in studying bacteria?
- A. Electrons can penetrate through bacterial walls but not through eukaryotic cell membranes.
 - B. Bacteria are too small to be resolved well by light.
 - C. Bacteria move so quickly they are hard to photograph.
 - D. Since they have fewer organelles present bacteria are distinguishable by differences in individual macromolecules.
 - E. Bacterial organelles are small and tightly packed together.
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15. Which of the following clues would tell you whether a cell is prokaryotic or eukaryotic?
- A. presence or absence of a cell wall
 - B. whether or not the cell is partitioned by internal membranes
 - C. the presence or absence of ribosomes
 - D. whether or not the cell is dividing
 - E. whether or not the cell contains one or more chromosomes
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16. Through what structures can small molecules travel directly from the cytoplasm of one animal cell to the cytoplasm of an adjacent cell?
- A. plasmodesmata
 - B. tight junctions
 - C. gap junctions
 - D. anchoring junctions
 - E. microtubules
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17. Cells can be described as having a cytoskeleton of internal structures that contribute to the shape, organization, and movement of the cell. Which of the following structures is **not** part of the cytoskeleton?
- A. chromatin.
 - B. microtubules.
 - C. microfilaments.
 - D. intermediate filaments.
 - E. tubulin
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18. Which of the following pairs is **mismatched**?
- A. nucleolus – ribosomal RNA
 - B. nucleus – DNA replication
 - C. lysosome – lytic enzymes
 - D. cytoskeleton - plasmodesmata
 - E. mitochondria – ATP production
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19. Which of the following organelles is **least** closely associated with the endomembrane system?

- A. nuclear envelope
- B. chloroplast
- C. Golgi apparatus
- D. plasma membrane
- E. endoplasmic reticulum

20. During cytokinesis in an animal cell, a constricting ring pinches the dividing cell into the two daughter cells. This contractile ring is formed by which of the following structures?

- A. centrioles
- B. microtubules
- C. the spindle apparatus
- D. myosin or dynein
- E. microfilaments

21. Honeybee eggs that are not fertilized develop into fertile, haploid males called drones. Fertilized eggs can develop into diploid females, one of which might become a queen (Fertilized eggs might also become males, but they are taken out and killed by the drones.). If the queen has 32 chromosomes in her body cells, how many chromatids will be present in a G₂ drone cell?

- A. 8
- B. 16
- C. 32
- D. 64
- E. 4

22. If there are 20 chromatids in a cell, how many centromeres are there?

- A. 10
- B. 20
- C. 30
- D. 40
- E. 1

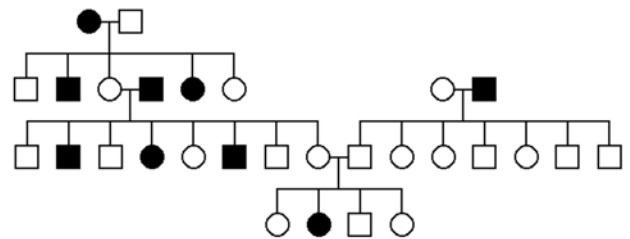
23. Taxol is an anticancer drug extracted from the Pacific yew tree. In animal cells, taxol disrupts microtubule formation by binding to microtubules and accelerating their assembly from the protein precursor tubulin. Surprisingly, this stops mitosis. What must taxol **specifically** affect?

- A. the fibres of the mitotic spindle.
- B. anaphase.
- C. cytokinesis.
- D. chromatid assembly.
- E. the S phase of the cell cycle.

24. A group of cells is assayed for DNA content immediately following mitosis and is found to have an average of 8 picograms of DNA per nucleus. Those cells would have ___ picograms at the end of the S phase and ___ picograms at the end of G₂.

- A. 8; 8
- B. 8; 16
- C. 16; 8
- D. 16; 16
- E. 12; 16

25. Which of the answers below **best** describes the inheritance of the affected allele in the pedigree below?



- A. autosomal dominant
- B. autosomal recessive
- C. X-linked dominant
- D. Y-linked
- E. Mitochondrial

26. What pattern of inheritance would lead a geneticist to suspect that an inherited disorder of cell metabolism is due to a defective mitochondrial gene?

- A. The disorder would always be inherited from the mother.
- B. The disorder would be X-linked.
- C. The disorder would always be lethal.
- D. The disorder would always be inherited from the father.
- E. The disorder would show a classic 9:3:3:1 genotypic ratio.

27. Which of the following statements about the number of chromosomes found in a eukaryotic cell is **true**?

- A. It indicates the phylogenetic position of the organism.
- B. It is constant during the life cycle.
- C. It is never $1n$.
- D. It is doubled by fertilization and cut in half by meiosis.
- E. It is dependent on the age of the tissue.

28. During which phase of the cell cycle are the chromosomes and genes actually replicated?

- A. anaphase.
- B. metaphase.
- C. interphase.
- D. prophase.
- E. None of the above is correct.

29. Which of the following is **true** of a species that has a chromosome number of $2n = 16$?

- A. The species is diploid with 32 chromosomes.
- B. The species has 16 sets of chromosomes.
- C. There are 16 homologous pairs.
- D. During the S phase of the cell cycle there will be 32 separate chromosomes.
- E. A gamete from this species has 8 chromosomes.

30. Eukaryotic sexual life cycles show tremendous variation. Of the following elements, which do **all** sexual life cycles have in common?

- I. Alternation of generations
- II. Meiosis
- III. Fertilization
- IV. Gametes
- V. Spores

- A. I, IV, and V
- B. I, II, and IV
- C. II, III, and IV
- D. II, IV, and V
- E. I, II, III, IV and V

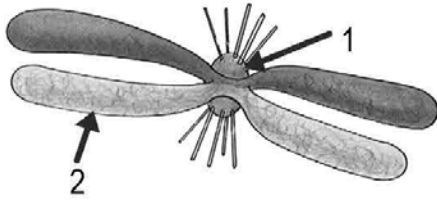
31. During which phase of Meiosis do synapsis and crossing over occur?

- A. anaphase I.
- B. metaphase II.
- C. interphase.
- D. prophase II.
- E. prophase I.

32. Which statement about homologous chromosomes is correct?

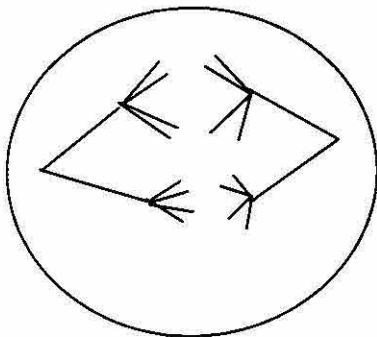
- A. They may exchange parts during meiosis.
- B. They have alleles for the same factor even though the alleles may not be the same.
- C. They are in pairs, one chromosome of each pair from the father and one from the mother.
- D. They pair up during meiosis.
- E. All of the above statements are correct.

33. Identify the structures labeled **1** and **2** in the following diagram.



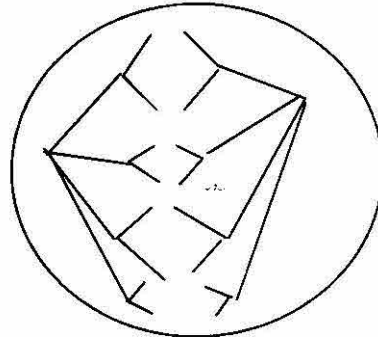
- A. 1 – centriole; 2 - chromosome
- B. 1 - centromere; 2 – chromatid
- C. 1 – chromatid; 2 - centromere
- D. 1 – kinetochore; 2 - chromatid
- E. 1 – centromere; 2 - chromatin

34. The cell illustrated below belongs to a species with a diploid chromosome number of **four**. The cell below is in which stage of mitosis or meiosis?



- A. meiosis I, metaphase
- B. meiosis I, anaphase
- C. mitosis, metaphase
- D. mitosis, anaphase
- E. meiosis II, anaphase

35. The cell illustrated below belongs to a species with a diploid chromosome number of **four**. The cell below is in which stage of mitosis or meiosis?



- A. meiosis II, metaphase
- B. meiosis II, anaphase
- C. mitosis, telophase
- D. mitosis, anaphase
- E. meiosis I, anaphase

36. There are 40 chromosomes in the somatic cells of the house mouse. This means that there are ____ autosomes in the somatic cells of the female and ____ sex chromosomes in the somatic cells of the male.

- A. 38; 2
- B. 40; 2
- C. 20; 1
- D. 20; 2
- E. 40; 0

37. Which law states that alleles separate during gamete formation.

- A. law of multiple alleles
- B. law of dominance and recessiveness
- C. law of independent assortment
- D. law of segregation
- E. law of co-dominance

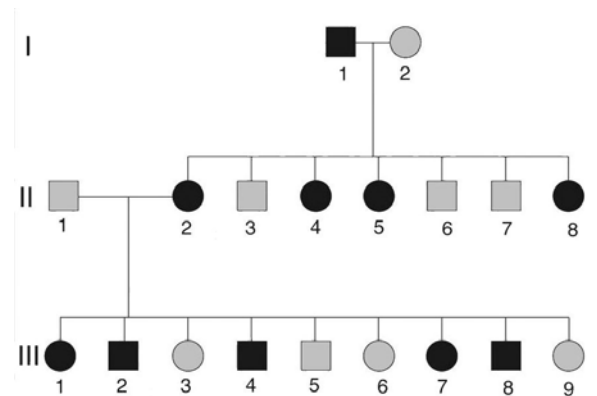
38. A dihybrid cross (**AaBb** x **AaBb**) will result in what offspring phenotypic ratio?

- A. 4 : 4 : 2 : 2
- B. 1 : 3 : 1
- C. 9 : 3 : 3 : 1
- D. 1 : 1 : 1 : 1
- E. 3 : 1

39. Sickle cell disease is the result of a mutation to the hemoglobin gene on chromosome 11 (recessive allele). Your father, who does not show the trait, is heterozygous for sickle cell disease. You know your mother has two "good" alleles. What is the probability that you will have the disorder?

- A. 0% but you will have a 50% chance of passing the "bad" gene on to your children
- B. 0% and you don't need to worry about passing the "bad" allele on to your children
- C. 25% for you and 25% for your children
- D. 50% for you and 50% for your children
- E. 50% for you and 25% that you will pass the "bad" allele to your children

40. What is the mode of inheritance of the affected allele in the pedigree below?



- A. autosomal dominant
- B. autosomal recessive
- C. X-linked dominant
- D Y-linked recessive
- E. Mitochondrial

41. What mode(s) of inheritance are human ABO blood types a demonstration of?

- A. incomplete dominance.
- B. epistasis.
- C. dominance and codominance.
- D. dominance and incomplete dominance.
- E. dominance, codominance, and epistasis.

42. A sexually reproducing animal has two unlinked genes, one for head shape (**H**) and one for tail length (**T**). Its genotype is **HhTt**. Which of the following genotypes is possible in a **gamete** from this organism?

- A. HT
- B. Hh
- C. HhTt
- D. T
- E. H

43. All seven of the pea plant traits studied by Mendel obeyed the principle of independent assortment. What does this fact mean?
- none of the traits obeyed the law of segregation.
 - the diploid number of chromosomes in the pea plants was 7.
 - all of the genes controlling the traits were located on the same chromosome.
 - all of the genes controlling the traits behaved as if they were on different chromosomes.
 - the formation of gametes in plants occurs by mitosis only.
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44. A couple has three children, all of whom have brown eyes and blond hair. Both parents are homozygous for brown eyes (**BB**), but one is a blond (**rr**) and the other is a redhead (**Rr**). What is the probability that their next child will be a brown-eyed redhead?
- 1
 - 1/2
 - 1/4
 - 1/8
 - 1/16
-
45. The genotype of F₁ individuals in a tetrahybrid cross is **Aa Bb Cc Dd**. Assuming independent assortment of these four genes, what is the probability that F₂ offspring will have the genotype **aa bb cc dd**?
- 1 / 128
 - 1 / 64
 - 1 / 16
 - 1 / 256
 - 1 / 2
-
46. A woman who belongs to blood group A and is Rh positive has a daughter who is O positive and a son who is B negative. Rh positive is a simple dominant over Rh negative. Which of the following is a possible genotype for the son?
- I^BI^B rr
 - I^BI^B RR
 - I^Bi Rr
 - I^Bi rr
 - I^BI^B Rr
-
47. In a cross between **Parent 1** whose genotype is **Aa Bb CC Dd ee Ff** and **Parent 2** whose genotype is **aa Bb Cc dd Ee Ff** what is the probability of getting an offspring phenotypically like Parent 1?
- 9 / 512
 - 9 / 256
 - 9 / 128
 - 1 / 64
 - 0
-
48. An X-linked recessive gene produces red-green colour blindness in humans. A woman with normal colour vision whose father was colour-blind marries a colour-blind man. What is the probability that their son will be colour-blind?
- 0 %
 - 25 %
 - 50 %
 - 75 %
 - 100 %
-

49. Assume that genes A and B are linked and are 50 map units apart. An animal heterozygous at both loci is crossed with one that is homozygous recessive at both loci. What percentage of the offspring will show phenotypes resulting from crossovers?

- A. 75%
 - B. 50%
 - C. 25%
 - D. 10%
 - E. 100%
-

50. A chromosome's gene sequence was **ABCDEFGH** before meiosis and **ABCDLMNOP** after meiosis. What is this an example of?

- A. inversion.
 - B. deletion.
 - C. duplication.
 - D. translocation.
 - E. aneuploidy.
-