1. A researcher treats cells with a chemical that prevents DNA synthesis from starting. This treatment would trap the cells in which part of the cell cycle?
   A. G1
   B. S
   C. G2
   D. Metaphase

2. It is difficult to observe individual chromosomes with a light microscope during prophase because
   A. The DNA has not been replicated yet.
   B. They are uncoiled in long, thin strands.
   C. They leave the nucleus and are dispersed to other parts of the cell.
   D. The spindle must move them to the metaphase plate before they become visible.

3. The word homologous literally means same location. How does this relate to homologous chromosomes?
   A. The chromosomes always move to the same location in the cell during division.
   B. The bands resulting from staining are found in the same location.
   C. The chromosomes have the same genes in the same location.
   D. Both B and C are correct.

4. In crossing a homozygous recessive with a heterozygote, what is the chance of getting an offspring with the homozygous recessive phenotype?
   A. 75%
   B. 25%
   C. 50%
   D. 0%

5. _____ explained genetic disorders such as alkaptonuria and albinism.
   A. Recessive inheritance has
   B. Dominant genes have
   C. X chromosomes
   D. XY chromosomes

6. The _____ is the set of observable characteristics and is the sum of genetic and environmental effects.
   A. Genotype
   B. Phenotype
   C. Dominance
   D. Karyotype

7. Of the following, which one will NOT necessarily carry the allele responsible for the mentioned trait?
   A. A woman in a family where an autosomal dominant trait is segregated, and her mother and son are affected.
   B. A daughter of a man who is affected by an X-linked dominant trait.
   C. A father of a child who is affected with an autosomal recessive trait.
   D. A father of a boy affected with X-linked recessive trait.

8. In meiosis, recombination occurs in
   A. Prophase I
   B. Metaphase I
   C. Anaphase I
   D. Prophase II

9. Non-disjunction can occur during
   A. Prophase I
   B. Metaphase I
   C. Anaphase I
   D. Prophase II

10. Which of the following is NOT a reason why Mendel used pea plants for his studies?
   A. The pea plants were easy to cultivate with relatively short life cycle.
   B. Has discontinuous characteristics such as flower color and pea texture.
   C. Were attractive phenotypically.
   D. Could easily be self-fertilized.

11. Portions of DNA molecules that do not contain the codes for proteins are called:
   A. introns
   B. exons
   C. mutagens
   D. Chromatids

12. A represents the dominant allele and a represents the recessive allele of a pair. If, in 1000 offspring, 500 are aa and 500 are of some other genotype, which of the following are most probably the genotypes of the parents?
   A. aa and aa
   B. Aa and aa
   C. AA and Aa
   D. AA and aa

13. A form of vitamin D-resistant rickets, known as hypophosphatemia, is inherited as an X-linked dominant trait. If a male with hypophosphatemia marries a normal female, which of the following predictions concerning their potential progeny would be true?
   A. All of their sons would inherit the disease
   B. All of their daughters would inherit the disease
   C. About 50% of their daughters would inherit the disease
   D. None of their daughters would inherit the disease.

14. Which of the following best describes the parents in a testcross?
   A. One individual has the dominant phenotype and the other has the recessive phenotype.
   B. Both individuals have the dominant phenotype.
   C. Both individuals have the recessive phenotype.
   D. Both individuals have an unknown phenotype.

15. A mouse has a diploid chromosome number of 40. Which row in the table shows the correct number of chromosomes in each cell?

	Number of chromosomes in a mouse egg cell	Number of chromosomes in a mouse eye cell
A	40	40
B	20	20
C	20	40
D	40	20

16. Which of the following is NOT a continuous trait in humans?
    A. Height
    B. Blood pressure
    C. Skin colour
    D. Blood group

17. All chromosomes exclusive of the sex chromosomes are called
    A. Gametes
    B. Non-disjunction
    C. Monosomes
    D. Autosomes

18. Any chromosome or chromatid whose centromere is positioned at its end, creating one chromosome arm is
    A. Metacentric
    B. Submetacentric
    C. Acrocentric
    D. Telocentric

19. A gene can be defined as:
    A. An inherited factor that determines a biological characteristic of an organism
    B. A linear array of amino acids
    C. The product of transcription
    D. The product of translation

20. What is the relationship among a DNA, a gene, and a chromosome?
    A. A chromosome contains hundreds of genes which are composed of proteins
    B. A chromosome contains hundreds of genes which are composed of DNA
    C. A gene contains hundreds of chromosomes which are composed of proteins
    D. A gene contains hundreds of chromosomes which are composed of DNA

21. A pure breeding strain refers to a group of organisms that:
    A. Are homozygous for a particular trait
    B. Are heterozygous for a particular trait
    C. Results from mating two heterozygotes
    D. Are homozygous for all their phenotypic traits

22. An eukaryotic chromosome is made of:
    A. DNA only
    B. Histones and nucleic acids
    C. Centromeres and centrioles
    D. DNA and RNA only

23. In sexually reproducing organisms, the source of chromosomes in the offspring is:
    A. Almost all from one parent, usually the father
    B. Almost all from one parent, usually the mother
    C. Half from the father and half from the mother
    D. A random mixing of chromosomes from both parents

24. How can one account for cells in the human body such as skeletal muscle cells that are multinucleate?
    A. No cell in the human body has more than one nucleus
    B. Cytokinesis occurs without mitosis
    C. Cytokinesis does not occur between cell cycles
    D. Cells divide but the nucleus does not

25. Which of these sequences correctly describes the cell cycle?
    A. → G_1 → G_2 → S → prophase → metaphase → anaphase → telophase →
    B. → S → G_2 → prophase → metaphase → anaphase → telophase → G_1 →
    C. → G_1 → S → G_2 → prophase → anaphase → metaphase → telophase →
    D. → G_1 → S → G_2 → metaphase → prophase → anaphase → telophase →

26. If there are 12 chromosomes in an animal cell in the G_1 stage of the cell cycle, what is the diploid number of chromosomes for this organism?
    A. 6
    B. 12
    C. 24
    D. 48

27. If there are 12 chromosomes in an animal cell in the G_2 stage of the cell cycle, what is the diploid number of chromosomes for this organism?
    A. 6
    B. 12
    C. 36
    D. 48

28. How do daughter cells at the end of mitosis and cytokinesis compare with their parent cell when it was in G_1 of the cell cycle?
    A. The daughter cells have half the amount of cytoplasm and half the amount of DNA
    B. The daughter cells have the same number of chromosomes and half the amount of DNA
    C. The daughter cells have the same number of chromosomes and the same amount of DNA
    D. The daughter cells may have new combinations of genes due to crossing over.

29. If a diploid (2n) animal cell is treated with colchicine, a drug that inhibits polymerization of microtubules, as it begins its cell cycle, the cell will:
    A. Divide normally, forming two diploid daughter cells
    B. Complete its cell cycle, forming two tetrapoid (4n) cells due to lack of a spindle apparatus
    C. Complete its cell cycle but remains as one tetraploid cell because the spindle and other microtubules necessary for cytokinesis are lacking
    D. None of the above outcomes is likely

30. Nuclear envelope is disintegrating, nucleolus is disappearing, progeny centrioles are moving apart and spindle fibres are forming. What kind of a cell is this?
    A. A plant cell in prophase
    B. A plant cell undergoing cytokinesis
    C. An animal cell in prophase
    D. An animal cell undergoing cytokinesis.

31. Reciprocal exchange of genetic materials between similar chromosomes is called:
    A. Segregation
    B. Translocation
    C. Tetrad formation
    D. Crossing over

32. The earliest event of meiosis among those below listed is:
    A. Chromosomes move to the equator of the spindle
    B. Spindle fibres are pulled to the opposite poles
    C. Homologous chromosomes pair up along their lengths
    D. Segregation occurs

33. The function of meiosis II is
    A. Separation of sister chromatids during anaphase
    B. Reduction of the number of gametes by half
    C. Reduction of the number of chromosomes by half
    D. Increase in the genetic variability by crossing over

34. Which of the following statements is FALSE?
    A. Individuals with the same phenotype might have different genotypes
    B. Mating between individuals with dominant phenotypes cannot produce offspring with recessive phenotypes
    C. Mating between individuals with recessive phenotypes usually do not produce offspring with dominant phenotypes.
    D. Individuals with the same genotype might have different phenotypes

35. A cross produced 915 offspring with normal pigment and 310 offspring with albinism. What conclusions can be drawn from this?
    A. One of the parents was homozygous for albinism
    B. Both parents were heterozygous
    C. One parent was homozygous for normal pigmentation
    D. Both parents were albinos

36. Mendel's law of segregation states that:
    A. Members of a pair of alleles move away from each other during gamete formation
    B. Each gamete receives a full complement of chromosomes
    C. There may be alternative forms of the same gene
    D. Genes end up in respective gametes by chance

37. The results of a testcross reveal that all the offspring resemble the parent being tested. This parent must be:
    A. Heterozygous
    B. Recessive
    C. Homozygous
    D. Haploid

38. Yellow-seeded pea plants may be homozygous or heterozygous. To find out which, we cross the plants with:
    A. True breeding yellow-seeded plants
    B. True breeding green-seeded plants
    C. Heterozygous green-seeded plants
    D. Heterozygous yellow-seeded plants

39. Independent assortment of chromosomes occurs during:
    A. Metaphase of meiosis I
    B. Metaphase of meiosis II
    C. Anaphase of meiosis I
    D. Anaphase of meiosis II

40. In guinea pigs, black hair (*B*) is dominant to brown hair (*b*). Short hair (*S*) is dominant to long hair (*s*). If you crossed *BBSS* with *bbss* to produce an F_1 generation, what phenotypic ratio would you obtain if you did a testcross of the F_1?
    A. 1:1
    B. 3:1
    C. 9:3:3:1
    D. 1:1:1:1

41. Let *W* = purple flowers and *w* = white and let *D* = tall plants and *d* = short. In a *WwDd* x *WwDd* cross, what proportion of the offspring would be tall with white flowers?
    A. 1/16
    B. 3/16
    C. 4/16
    D. 9/16

42. An organism heterozygous for four pairs of genes produces how many genetically distinct kinds of gametes?
    A. 2
    B. 4
    C. 16
    D. 64

43. Traits controlled by sex-linked recessive genes are expressed more often in males because:
    A. Males inherit these genes from their fathers
    B. Males are always homozygous for these genes
    C. All male offspring of a female carrier get the gene
    D. The male has only one gene for the trait

44. A recessive allele on the X chromosome causes color blindness. A non-color blind woman (whose father is color blind) marries a color blind man. What is the chance that their son will be color blind?
    A. 0 %
    B. 25 %
    C. 50 %
    D. 75 %

45. A man who carries a harmful sex-linked (on the X chromosome) gene will pass the gene on to
    A. All of his daughters
    B. Half of his daughters
    C. Half of his sons
    D. All of his sons

46. Mendel chose true breeding cultivars of the pea plant for an experiment. One had purple flowers and the other white. Later, when he had completed his experiment and was recording the results, these two cultivars would be called:
    A. The parental (P) generation
    B. The first filial (F_1) generation
    C. The second filial (F_2) generation
    D. Hybrids

47. Which of the following is a variant form of a gene, which has a different DNA sequence and therefore produces a different product?
    A. Gene
    B. Allele
    C. Locus
    D. Genotype

48. Which is the result of meiotic equational division?
    A. 46 chromosomes, 92 chromatids, 2 cells
    B. 46 chromosomes, 46 chromatids, 2 cells
    C. 23 chromosomes, 46 chromatids, 4 cells
    D. 23 chromosomes, 23 chromatids, 4 cells

49. Which of the following is true regarding Mendel's principle of segregation?
    A. Paired genes are transmitted together and hereditary factors are blended
    B. One member of a paired gene is transmitted and hereditary factors are blended
    C. Paired genes are transmitted together and hereditary factors are not blended
    D. One member of a paired gene is transmitted and hereditary factors are not blended

50. Using the punnet square, what are the genotype probabilities for offspring if the maternal genotype is homozygous dominant and the paternal genotype is heterozygous?
A. 100% homozygous dominant and 0% heterozygous, 0% homozygous recessive
B. 50% homozygous dominant and 50% heterozygous, 0% homozygous recessive
C. 25% homozygous dominant and 50% heterozygous, 25% homozygous recessive
D. 0% homozygous dominant and 0% heterozygous, 100% homozygous recessive

51. To determine the probability of having first a boy, then a girl, and finally a boy, we would use the
A. Sum rule
B. Product rule
C. Binomial theorem
D. The principle of segregation

52. Which definition is correct?
A. A dominant allele is expressed only in a heterozygous condition
B. A dominant allele is expressed only in a homozygous condition
C. A recessive allele is expressed only in a homozygous condition
D. A dominant allele is more likely to be passed to future generations than a recessive allele

53. If the haploid number of an organism is 8, how many chromatids are present at prophase I during meiosis?
A. 4
B. 8
C. 12
D. 32

54. In the chi-square test, the p-value refers to
A. The chance that the results could have been caused by a true null hypothesis
B. The chance that the results could have been caused by a false null hypothesis
C. The chance that the results could have been caused by a true alternative hypothesis.
D. The null hypothesis should be accepted

For the next question, assume that the ability to taste PTC (Phenylthiocarbamide) and to roll one's tongue are both dominant traits determined by genes on separate chromosomes.

55. What is the probability of a first born being able to roll its tongue and taste PTC if its parents have genotypes *RrTt* and *Rrtt*?
A. 3/8
B. 1/2
C. 5/8
D. 1/16

56. Cytokinesis usually, but not always, follows mitosis. If cells undergo mitosis and not cytokinesis, this would result in:
A. A cell with a single large nucleus
B. A cell with two nuclei
C. Cells with abnormally small nuclei
D. Feedback responses that prevent further mitosis

57. Bivalents are formed in
    A. Mitosis
    B. Meiosis I
    C. Meiosis II
    D. Interphase

58. What would happen if synthesis of interphase occurs before meiosis II
    A. Generation of daughter cells with haploid number of chromosomes
    B. Generation of daughter cells with n number of chromosomes
    C. Generation of daughter cells with diploid number of chromosomes
    D. Generation of daughter cells with half the number of chromosomes as parent cell

59. Chromosomes align on a metaphase plate or equatorial plane during
    A. Prophase
    B. Metaphase
    C. Anaphase
    D. Telophase

60. DNA replication occurs during which stage of the cell cycle?
    A. G1
    B. S
    C. G2
    D. Meiosis

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