

Question Type: Multiple Choice

1) Which of the following requirements must be met by a substance in order to be considered hereditary material?

1. The material must be able to replicate or be replicated
2. The material must encode information regarding the structure and function of the organism.
3. The material must be able to change over time.

- a) 1
- b) 2
- c) 3
- d) 1 and 2 only
- e) All of these

Answer: e

2) In 1953 the structure of _____ was determined, as well as its role as the hereditary material for various organisms.

- a) Amino acids
- b) DNA
- c) Protein
- d) Carbohydrates
- e) Lipids

Answer: b

3) Which of the following persons contributed greatly to the understanding of the field of modern genetics?

- a) Gregor Mendel
- b) James Watson
- c) Francis Crick
- d) B and C only
- e) All of these

Answer: e

4) Which of the following is considered a milestone in the field of genetics?

- a) The Human Genome Project
- b) The discovery of the rules of inheritance

- c) The discovery of the structure of DNA
- d) All of these
- e) None of these

Answer: d

5) The heritable factors that Mendel studied are now known as:

- a) Nucleic acids
- b) Amino acids
- c) Genes
- d) Unit factors
- e) Peptides

Answer: c

6) How did Mendel discover the rules of inheritance?

- a) He interbred plants that showed different traits
- b) He interbred animals that showed similar traits
- c) He crossbred protists that showed different traits
- d) All of these
- e) None of these

Answer: a

7) Different forms of the same gene are known as:

- a) Peptides
- b) Amino acids
- c) Proteins
- d) Alleles
- e) Gene differences

Answer: d

8) Mendel proposed that each individual organism (i.e. pea plants) carried how many alleles, or copies of a gene?

- a) 1
- b) 2
- c) 3

- d) 4
- e) 5

Answer: b

9) Which of the following is not a principle of inheritance discovered by Mendel's garden pea experiments?

1. Each individual organism carries 2 copies of a gene in its normal state
2. Each individual organism randomly passes down one copy of each gene in its gametes (egg or sperm cell)
3. Each gene is inherited independently of the others and is a discrete entity

- a) 1
- b) 2
- c) 3
- d) 2 and 3 only
- e) All of these

Answer: e

10) The building blocks of genes are:

- a) Proteins
- b) Amino acids
- c) Nucleic acids
- d) Lipids
- e) Carbohydrates

Answer: c

11) Nucleic acids are composed of a series of:

- a) Amino acids
- b) Nucleotides
- c) Nucleic chromosomes
- d) Peptide chains
- e) Sugars

Answer: b

12) Nucleotides are composed of which of the following?

- a) Pentose sugar, phosphate molecule, and a nitrogenous base
- b) Pentose sugar, nucleic acid, and a nitrogenous base
- c) Hexane molecule, muramic acid, and a phosphorylated base
- d) Amino acid, phosphate molecule, and a nitrogenous base
- e) DNA, RNA, and amino acid chain

Answer: a

13) Which of the following is the sugar found in RNA?

- a) Deoxyribose
- b) Ribose
- c) Sucrose
- d) Fructose
- e) Glucose

Answer: b

14) Which of the following is not a nitrogenous base found in DNA?

- a) Cytosine
- b) Adenine
- c) Guanine
- d) Uracil
- e) Thymine

Answer: d

15) Which of the following individuals are credited with the discovery of the structure of DNA?

- a) James Watson and Arthur Kornberg
- b) Francis Crick and Arthur Kornberg
- c) Paul Erlich and James Watson
- d) James Watson and Francis Crick
- e) Francis Crick and Paul Erlich

Answer: d

16) Which of the following correctly describes the structure of DNA as determined in 1953?

1. A phosphate backbone with sugars linked together by nitrogenous base bonds.
2. A sugar-phosphate backbone with nitrogenous bases linked together by weak bonds
3. A nitrogenous base backbone with sugars linked together by phosphate bonds.

- a) 1
- b) 2
- c) 3
- d) 1 and 3
- e) None of these

Answer: c

17) Which of the following is an example of a correct pairing of nitrogenous bases as is found in the structure of dsDNA?

- a) A pairs with C
- b) A pairs with T
- c) A pairs with G
- d) A pairs with A

Answer: b

18) Which of the following is different between RNA and DNA?

1. RNA is double stranded and DNA is single stranded
2. RNA is single stranded and DNA is double stranded
3. RNA contains the nitrogenous base Uracil and DNA contains the base Thymine

- a) 1
- b) 2
- c) 3
- d) 1 and 2
- e) 2 and 3

Answer: e

19) The collection of DNA molecules that is characteristic of an organism is known as its:

- a) Allelic makeup
- b) Genome
- c) Phenotype
- d) DNA array
- e) None of these

Answer: b

20) The Human Genome Project's purpose is/was:

- a) To determine the sequence of the nucleotide pairs in human beings
- b) To determine the cause of genetic diseases in human beings
- c) To determine the rate of mutation in the human population
- d) All of these
- e) None of these

Answer: a

21) This man ran a privately funded project that was similar to the federally funded Human Genome Project.

- a) Gregor Mendel
- b) James Watson
- c) Craig Venter
- d) Francis Crick
- e) Anton Van Leeuwenhoek

Answer: c

22) The study of genes on a molecular level is often referred to as:

- a) Proteomics
- b) Genomics
- c) Amino acid array technology
- d) Classical Genetics
- e) None of these

Answer: b

23) The National Center for Biotechnology (NCBI) is an organization that:

- a) Maintains updated databases regarding genome sequences
- b) Maintains updated databases regarding information about proteins
- c) Is a source to obtain publications regarding genomic research
- d) All of these
- e) None of these

Answer: d

24) Which of the following best describes the flow of information in a biological system?

- a) DNA → RNA → Protein
- b) Protein → RNA → DNA
- c) DNA → Protein → RNA
- d) RNA → DNA → Protein
- e) Protein → DNA → RNA

Answer: a

25) Why is DNA considered to be the genetic material in cellular organisms?

- a) It can replicate
- b) It can direct the function and behavior of an organism
- c) It can change over time
- d) It can replicate and it can direct the function and behavior of an organism
- e) All of these

Answer: e

26) Coding units composed of triplets of adjacent nucleotides are known as:

- a) Proteins
- b) peptides
- c) Codons
- d) Tripods
- e) None of these

Answer: c

27) The process in which DNA is used as a template to produce RNA is known as:

- a) Replication
- b) Transcription
- c) Translation
- d) Codon usage
- e) None of these

Answer: b

28) The process in which RNA is used as a template to produce a polypeptide chain is known as:

- a) Replication
- b) Transcription

- c) Translation
- d) Codon usage
- e) None of these

Answer: c

29) What substance is produced via the process of transcription?

- a) ssDNA
- b) dsDNA
- c) proteins
- d) mRNA
- e) enzymes

Answer: d

30) The collection of all the different proteins in an organism is known as:

- a) Genome
- b) Proteome
- c) Polypeptide sequence
- d) All of these
- e) None of these

Answer:

31) The study of all the proteins in cells is known as:

- a) Genomics
- b) Allelomics
- c) Proteomics
- d) Gene array technology
- e) None of these

Answer: b

32) If the flow of hereditary information follows the pathway RNA→DNA, the process of _____ must be involved.

- a) Congruent Transcription
- b) Inverse Replication
- c) Reverse Transcription

- d) Reverse Replication
- e) Reverse Translation

Answer: c

33) Changes that are introduced into the DNA strand during replication are known as:

- a) Codons
- b) Phenotypes
- c) Genotypes
- d) Mutations
- e) Errors

Answer: d

34) Which of the following proposed that variation makes it possible for a species to change over time?

- a) Alfred Wallace
- b) Charles Darwin
- c) Gregor Mendel
- d) Alfred Wallace and Charles Darwin
- e) All of these

Answer: d

35) Established historical relationships between organisms are known as a:

- a) Phylogeny
- b) Genealogy
- c) Genomics
- d) Proteomics
- e) None of these

Answer: a

36) If a geneticist pursues their science by analyzing the outcomes of crosses between different strains of an organism, he is practicing:

- a) Molecular genetics
- b) Classical genetics
- c) Population genetics
- d) Conservation genetics

e) Environmental genetics

Answer: b

37) By analyzing patterns of inheritance, geneticists can localize genes to specific chromosomes and sometimes localize genes to specific positions within chromosomes. This is known as:

- a) Chromosome counting
- b) Chromosome mapping
- c) Chromosome positioning
- d) Genome analysis
- e) Proteome analysis

Answer: b

38) Studies that emphasize the passing down of genes and chromosomes from one generation to another are known as studies in:

- a) Population genetics
- b) Hereditary genetics
- c) Transmission genetics
- d) Molecular genetics
- e) None of these

Answer: c

39) If a geneticist is studying how DNA replicates, is expressed and how mutations occur in the DNA strand, perhaps by studying a particular DNA sequence, he is practicing:

- a) Molecular genetics
- b) Classical genetics
- c) Transmission genetics
- d) Population genetics
- e) Conservation genetics

Answer: a

40) If a geneticist is studying the frequency of sickle cell anemia in a group of individuals, to see how often the sickle cell allele is present within the group as a whole, he is practicing:

- a) Molecular genetics
- b) Classical genetics

- c) Transmission genetics
- d) Population genetics
- e) Conservation genetics

Answer: d

41) An organism that has been altered by the introduction of a foreign gene is known as:

- a) GMO
- b) GMP
- c) FDA
- d) SOP
- e) PCR

Answer: a

42) An example of a commonly produced agricultural GMO is:

- a) Philodendron
- b) Corn
- c) *Bacillus thuringiensis*
- d) Canker worm
- e) Butterfly

43) A professional who is trained to advise individuals about their risks of inheriting or transmitting a genetic disease is known as:

- a) Molecular geneticist
- b) Population geneticist
- c) Genetic counselor
- d) Physician
- e) None of these

Answer: c

44) Which of the following is a disease whose treatment or diagnosis has been influenced by the field of genetics?

- a) Cystic Fibrosis
- b) Breast Cancer
- c) Heart Disease
- d) Diabetes

e) All of these

Answer: e

45) Which of the following is a way that the study of genetics influences society?

- a) The use of DNA evidence in a paternity suit
- b) The use of DNA to create new pharmaceutical drugs
- c) The use of DNA to create drought resistant and pest resistant crops
- d) All of these
- e) None of these

Answer: d

Question Type: Essay

46) Briefly describe the process of DNA replication.

Answer: The process of DNA replication is based on the complementary nature of the strands that make up duplex DNA molecules. These strands are held together by hydrogen bonds between specific base pairs—A paired with T, and G paired with C. When these bonds are broken, the separated strands can serve as templates for the synthesis of new partner strands. The new strands are assembled by the stepwise incorporation of nucleotides opposite to nucleotides in the template strands. This incorporation conforms to the base-pairing rules. Thus, the sequence of nucleotides in a strand being synthesized is dictated by the sequence of nucleotides in the template strand. At the end of the replication process, each template strand is paired with a newly synthesized partner strand. Thus, two identical DNA duplexes are created from one original duplex.

47) Briefly explain how genetic information is expressed.

Answer: The expression of genetic information to form a polypeptide is a two-stage process. First, the information contained in a gene's DNA is copied into a molecule of RNA. The RNA is assembled in stepwise fashion along one of the strands of the DNA duplex. During this assembly process, A in the RNA pairs with T in the DNA, G in the RNA pairs with C in the DNA, C in the RNA pairs with G in the DNA, and U in the RNA pairs with A in the DNA. Thus, the nucleotide sequence of the RNA is determined by the nucleotide sequence of a strand of DNA in the gene. The process that produces this RNA molecule is called **transcription**, and the RNA itself is called a **transcript**. The RNA transcript eventually separates from its DNA template and, in some organisms, is altered by the addition, deletion, or modification of nucleotides. The finished molecule, called the **messenger RNA** or simply **mRNA**, contains all the information needed for the synthesis of a polypeptide.

The second stage in the expression of a gene's information is called **translation**. At this stage, the gene's mRNA acts as a template for the synthesis of a polypeptide. Each of the gene's codons, now present within the sequence of the mRNA, specifies the incorporation of a particular amino acid into the polypeptide chain. One amino acid is added at a time. Thus, the polypeptide is synthesized stepwise by reading the codons in order. When the polypeptide is finished, it dissociates from the mRNA, folds into a precise three-dimensional shape, and then carries out its role in the cell. Some polypeptides are altered by the removal of the first amino acid, which is usually methionine, in the sequence.

48) Briefly explain two ways the study of genetics has influenced agriculture

Answer: Selective breeding programs—now informed by genetic theory—continue to play important roles in agriculture. High-yielding varieties of wheat, corn, rice, and many other plants have been developed by breeders to feed a growing human population. Selective breeding techniques have also been applied to animals such as beef and dairy cattle, swine, and sheep, and to horticultural plants such as shade trees, turf grass, and garden flowers. Plant and animal breeders are also employing the techniques of molecular genetics to introduce genes from other species into crop plants and livestock. This process of changing the genetic makeup of an organism was initially developed using test species such as fruit flies. Today it is widely used to augment the genetic material of many kinds of creatures. Plants and animals that have been altered by the introduction of foreign genes are called GMOs—genetically modified organisms

49) How have physicians benefited from the study of genetics?

Answer: Classical genetics has provided physicians with a long list of diseases that are caused by mutant genes. From this work, physicians have learned to diagnose genetic diseases, to trace them through families, and to predict the chances that particular individuals might inherit them, such as is the case with the BRCA1 gene which is diagnostic for breast cancer. Advances in molecular genetics are providing new ways of detecting mutant genes in individuals. Diagnostic tests based on analysis of DNA are now readily available. Molecular genetics is also providing new ways to treat diseases, such as with the advent of the production of human insulin being produced on a large scale by using the bacterium *E.coli*. Human gene therapy is another way in which molecular genetic technologies are used to treat diseases, such as Cystic fibrosis

50) How does the study of genetics impact society as a whole?

Answer: Discoveries from genetics raise deep, difficult, and sometimes disturbing existential questions. Modern societies rely on technology to provide food and health care. Discoveries from genetic research have initiated countless business ventures in the biotechnology industry. Companies that market pharmaceuticals and diagnostic tests, or that provide services such as DNA profiling, have contributed to worldwide economic growth. Another way is legal. DNA sequences differ among individuals, and by analyzing these differences, people can be identified uniquely. Such analyses are now routinely used in many situations—to test for paternity, to

convict the guilty and to exonerate the innocent of crimes for which they are accused, to authenticate claims to inheritances, and to identify the dead. Evidence based on analysis of DNA is now commonplace in courtrooms all over the world.