

Practice Multiple-Choice Questions on Genetics Chapters 16-20

- 1) For a couple of decades, biologists knew the nucleus contained DNA and proteins. The prevailing opinion was that the genetic material was proteins, and not DNA. The reason for this belief was that proteins are more complex than DNA. This is because
- A) proteins have a greater variety of three-dimensional forms than does DNA.
  - B) proteins have two different levels of structural organization; DNA has four.
  - C) proteins are made of 20 amino acids and DNA is made of four nucleotides.
  - D) Only A and C are correct.
  - E) A, B, and C are correct.
- 2) What does transformation involve in bacteria?
- A) the creation of a strand of DNA from an RNA molecule
  - B) the creation of a strand of RNA from a DNA molecule
  - C) the infection of cells by a phage DNA molecule
  - D) the type of semiconservative replication shown by DNA
  - E) assimilation of external DNA into a cell
- 3) In trying to determine whether DNA or protein is the genetic material, Hershey and Chase made use of which of the following facts?
- A) DNA does not contain sulfur, whereas protein does.
  - B) DNA contains phosphorus, but protein does not.
  - C) DNA contains nitrogen, whereas protein does not.
  - D) A and B only
  - E) A, B, and C
- 4) Cytosine makes up 38% of the nucleotides in a sample of DNA from an organism. Approximately, what percentage of the nucleotides in this sample will be thymine?
- A) 12
  - B) 24
  - C) 31
  - D) 38
  - E) It cannot be determined from the information provided.
- 5) All of the following can be determined directly from X-ray diffraction photographs of crystallized DNA *except* the
- A) diameter of the helix.
  - B) helical shape of DNA.
  - C) sequence of nucleotides.
  - D) spacing of the nitrogenous bases along the helix.
  - E) number of strands in a helix.
- 6) The DNA double helix has a uniform diameter because \_\_\_\_\_, which have two rings, always pair with \_\_\_\_\_, which have one ring.
- A) purines; pyrimidines
  - B) pyrimidines; purines
  - C) deoxyribose sugars; ribose sugars
  - D) ribose sugars; deoxyribose sugars
  - E) nucleotides; nucleoside triphosphates

- 7) What kind of chemical bond is found between paired bases of the DNA double helix?
- A) hydrogen
  - B) ionic
  - C) covalent
  - D) sulfhydryl
  - E) phosphate
- 8) The strands that make up DNA are antiparallel. This means that
- A) the twisting nature of DNA creates nonparallel strands.
  - B) the 5' to 3' direction of one strand runs counter to the 5' to 3' direction of the other strand.
  - C) base pairings create unequal spacing between the two DNA strands.
  - D) one strand is positively charged and the other is negatively charged.
  - E) one strand contains only purines and the other contains only pyrimidines.
- 9) Which enzyme catalyzes the elongation of a DNA strand in the 5' 3' direction?
- A) primase
  - B) DNA ligase
  - C) DNA polymerase
  - D) topoisomerase
  - E) helicase
- 10) The leading and the lagging strands differ in that
- A) the leading strand is synthesized in the same direction as the movement of the replication fork, and the lagging strand is synthesized in the opposite direction.
  - B) the leading strand is synthesized by adding nucleotides to the 3' end of the growing strand, and the lagging strand is synthesized by adding nucleotides to the 5' end.
  - C) the leading strand is synthesized continuously, whereas the lagging strand is synthesized in short fragments that are ultimately stitched together.
  - D) both A and B
  - E) both A and C
- 11) *E. coli* cells grown on  $^{15}\text{N}$  medium are transferred to  $^{14}\text{N}$  medium and allowed to grow for two more generations (two rounds of DNA replication). DNA extracted from these cells is centrifuged. What density distribution of DNA would you expect in this experiment?
- A) one high-density and one low-density band
  - B) one intermediate-density band
  - C) one high-density and one intermediate-density band
  - D) one low-density and one intermediate-density band
  - E) one low-density band
- 12) All of the following are functions of DNA polymerase in DNA replication *except*
- A) covalently adding nucleotides to the new strands.
  - B) proofreading each added nucleotide for correct base pairing.
  - C) replacing RNA primers with DNA.
  - D) initiating a polynucleotide strand.
  - E) none of the above
- 13) Which of the following represents a similarity between RNA and DNA?
- A) Both are double-stranded.
  - B) the presence of uracil
  - C) the presence of an OH group on the 2' carbon of the sugar

- D) nucleotides consisting of a phosphate, sugar, and nitrogenous base
- E) Both are found exclusively in the nucleus.

14) The nitrogenous base adenine is found in all members of which group?

- A) proteins, triglycerides, and testosterone
- B) proteins, ATP, and DNA
- C) ATP, RNA, and DNA
- D) alpha glucose, ATP, and DNA
- E) proteins, carbohydrates, and ATP

15) If proteins were composed of only 12 different kinds of amino acids, what would be the smallest possible codon size in a genetic system with four different nucleotides?

- A) 1
- B) 2
- C) 3
- D) 4
- E) 12

16) A codon

- A) consists of two nucleotides.
- B) may code for the same amino acid as another codon.
- C) consists of discrete amino acid regions.
- D) catalyzes RNA synthesis.
- E) is found in all eukaryotes, but not in prokaryotes.

17) If the triplet CCC codes for the amino acid proline in bacteria, then in plants CCC should code for

- A) leucine.
- B) valine.
- C) cystine.
- D) phenylalanine.
- E) proline.

18) Which of the following are transcribed from DNA?

- A) protein
- B) exons
- C) rRNA
- D) B and C only
- E) A, B, and C

19) Which of the following is *not* a part of the eukaryotic transcription initiation complex?

- A) promoter
- B) RNA polymerase
- C) transcription factors
- D) snRNP
- E) TATA box

20) All of the following are found in prokaryotic mRNA *except*

- A) the AUG codon.
- B) the UGA codon.
- C) introns.

- D) uracil.
- E) cytosine.

21) Alternative RNA splicing

- A) is a mechanism for increasing the rate of transcription.
- B) can allow the production of proteins of dramatically different sizes from a single mRNA.
- C) can allow the production of proteins of dramatically different amino acid sequences from a single mRNA.
- D) B and C only
- E) A, B, and C

22) Where is eukaryotic ribosomal RNA transcribed?

- A) the Golgi apparatus
- B) ribosomes
- C) the nucleolus
- D) X chromosomes
- E) prokaryotic cells only

23) During translation, chain elongation continues until what happens?

- A) No further amino acids are needed by the cell.
- B) All tRNAs are empty.
- C) The polypeptide is long enough.
- D) A stop codon is encountered.
- E) The ribosomes run off the end of mRNA.

24) What is one function of a signal peptide?

- A) to direct an mRNA molecule into the cisternal space of the ER
- B) to bind RNA polymerase to DNA and initiate transcription
- C) to terminate translation of the messenger RNA
- D) to translocate polypeptides across the ER membrane
- E) to signal the initiation of transcription

25) Which of the following statements are true about protein synthesis in prokaryotes?

- A) Translation can begin while transcription is still in progress.
- B) Extensive RNA processing is required before prokaryotic transcripts can be translated.
- C) Prokaryotic cells have complicated mechanisms for targeting proteins to the appropriate cellular organelles.
- D) Only A and B are true.
- E) A, B, and C are true.

26) A frameshift mutation could result from

- A) a base insertion only.
- B) a base deletion only.
- C) a base substitution only.
- D) deletion of three consecutive bases.
- E) either an insertion or a deletion of a base.

27) Which of the following is *not* true of a codon?

- A) It consists of three nucleotides.
- B) It may code for the same amino acid as another codon does.
- C) It never codes for more than one amino acid.

- D) It extends from one end of a tRNA molecule.
- E) It is the basic unit of the genetic code.

- 28) The anticodon of a particular tRNA molecule is
- A) complementary to the corresponding mRNA codon.
  - B) complementary to the corresponding triplet in rRNA.
  - C) the part of tRNA that bonds to a specific amino acid.
  - D) changeable, depending on the amino acid that attaches to the tRNA.
  - E) catalytic, making the tRNA a ribozyme.

- 29) Which of the following is *not true of RNA processing*?
- A) Exons are cut out before mRNA leaves the nucleus.
  - B) Nucleotides may be added at both ends of the RNA.
  - C) Ribozymes may function in RNA splicing.
  - D) RNA splicing is thought to be catalyzed by spliceosomes.
  - E) A primary transcript is often much longer than the final RNA molecule that leaves the nucleus.

- 30) What is the function of reverse transcriptase in retroviruses?
- A) It hydrolyzes the host cell's DNA.
  - B) It uses viral RNA as a template for DNA synthesis.
  - C) It converts host cell RNA into viral DNA.
  - D) It translates viral RNA into proteins.
  - E) It uses viral RNA as a template for making complementary RNA strands.

- 31) The process by which host cell DNA is accidentally packaged within a phage virus particle and transferred to another bacterial cell instead of the phage DNA is called
- A) translocation.
  - B) conjugation.
  - C) transposition.
  - D) transduction.
  - E) transformation.

- 32) An R plasmid can
- A) facilitate bacterial resistance to antibiotics.
  - B) adjust the rates of metabolic pathways.
  - C) repress gene expression.
  - D) convert an  $F^+$  to an  $F^-$  bacterium.
  - E) reverse the direction of transcription.

- 33) All of the following are made up of nucleic acid *except a*
- A) repressor.
  - B) structural gene.
  - C) promoter.
  - D) regulatory gene.
  - E) operator.

- 34) The tryptophan operon is a repressible operon that is
- A) permanently turned on.
  - B) turned on only when tryptophan is present in the growth medium.
  - C) turned off only when glucose is present in the growth medium.

- D) turned on only when glucose is present in the growth medium.
- E) turned off whenever tryptophan is added to the growth medium.

35) In a nucleosome, what is the DNA wrapped around?

- A) polymerase molecules
- B) ribosomes
- C) mRNA
- D) histones
- E) nucleolus protein

36) Which of the following statements concerning the eukaryotic chromosome is *false*?

- A) It is composed of DNA and protein.
- B) The nucleosome is the most basic structural subunit.
- C) The number of genes on each chromosome is different in different cell types.
- D) It consists of a single linear molecule of double-stranded DNA.
- E) Active transcription occurs on euchromatin.

37) Muscle cells and nerve cells in one species of animal owe their differences in structure to

- A) having different genes.
- B) having different chromosomes.
- C) using different genetic codes.
- D) differential gene expression.
- E) having unique ribosomes.

38) Which of the following mechanisms is (are) used to coordinately control the expression of multiple, related genes in eukaryotic cells?

- A) organization of the genes into clusters, with local chromatin structures influencing the expression of all the genes at once
- B) each of the genes sharing a common control element, allowing a single activator to turn on their transcription at once, regardless of their location in the genome
- C) organizing the genes into large operons, allowing them to be transcribed as a single unit
- D) A and B only
- E) A, B , and C

39) A eukaryotic gene typically has all of the following features *except*

- A) introns.
- B) a promoter.
- C) an operator.
- D) control elements.
- E) a terminator.

40) In both eukaryotes and prokaryotes, gene expression is primarily regulated at the level of

- A) transcription.
- B) translation.
- C) mRNA stability.
- D) mRNA splicing.
- E) protein stability.

41) The functioning of enhancers is an example of

- A) transcriptional control of gene expression.
- B) a post-transcriptional mechanism for editing mRNA.

- C) the stimulation of translation by initiation factors.
- D) post-translational control that activates certain proteins.
- E) a eukaryotic equivalent of prokaryotic promoter functioning.

- 42) Steroid hormones produce their effects in cells by
- A) activating key enzymes in metabolic pathways.
  - B) activating translation of certain mRNAs.
  - C) promoting the degradation of specific mRNAs.
  - D) binding to intracellular receptors and promoting transcription of specific genes.
  - E) promoting the formation of looped domains in certain regions of DNA.

- 43) Tumor suppressor genes
- A) are frequently overexpressed in cancerous cells.
  - B) are cancer-causing genes introduced into cells by viruses.
  - C) can encode proteins that promote DNA repair or cell-cell adhesion.
  - D) often encode proteins that stimulate the cell cycle.
  - E) all of the above

- 44) Which of the following statements about the DNA in one of your brain cells is *true*?
- A) Some DNA sequences are present in multiple copies.
  - B) Most of the DNA codes for protein.
  - C) The majority of genes are likely to be transcribed.
  - D) Each gene lies immediately adjacent to an enhancer.
  - E) Many genes are grouped into operon-like clusters.

- 45) Within a cell, the amount of protein made using a given mRNA molecule depends partly on
- A) the degree of DNA methylation.
  - B) the rate at which the mRNA is degraded.
  - C) the presence of certain transcription factors.
  - D) the number of introns present in the mRNA.
  - E) the types of ribosomes present in the cytoplasm.

- 46) Proto-oncogenes can change into oncogenes that cause cancer. Which of the following best explains the presence of these potential time bombs in eukaryotic cells?
- A) Proto-oncogenes first arose from viral infections.
  - B) Proto-oncogenes normally help regulate cell division.
  - C) Proto-oncogenes are genetic "junk."
  - D) Proto-oncogenes are mutant versions of normal genes.
  - E) Cells produce proto-oncogenes as they age.

- 47) Plasmids are important in biotechnology because they are
- A) a vehicle for the insertion of foreign genes into bacteria.
  - B) recognition sites on recombinant DNA strands.
  - C) surfaces for protein synthesis in eukaryotic recombinants.
  - D) surfaces for respiratory processes in bacteria.
  - E) proviruses incorporated into the host DNA.

- 48) A gene that contains introns can be made shorter (but remain functional) for genetic engineering purposes by using
- A) RNA polymerase to transcribe the gene.
  - B) a restriction enzyme to cut the gene into shorter pieces.

- C) reverse transcriptase to reconstruct the gene from its mRNA.
- D) DNA polymerase to reconstruct the gene from its polypeptide product.
- E) DNA ligase to put together fragments of the DNA that codes for a particular polypeptide.

49) The polymerase chain reaction is important because it allows us to

- A) insert eukaryotic genes into prokaryotic plasmids.
- B) incorporate genes into viruses.
- C) make DNA from RNA transcripts.
- D) make many copies of a targeted segment of DNA.
- E) insert regulatory sequences into eukaryotic genes.

50) After being digested with a restriction enzyme, genomic DNA fragments are separated by gel electrophoresis. Specific fragments can then be identified through the use of a

- A) plasmid.
- B) restriction enzyme.
- C) sticky end.
- D) nucleic acid probe.
- E) RFLP.

51) Which of the following sequences in double-stranded DNA is most likely to be recognized as a cutting site for a restriction enzyme?

- A) AAGG  
TTCC
- B) AGTC  
TCAG
- C) GGCC  
CCGG
- D) ACCA  
TGGT
- E) AAAA  
TTTT

52) In recombinant DNA methods, the term *vector* can refer to

- A) the enzyme that cuts DNA into restriction fragments.
- B) the sticky end of a DNA fragment.
- C) a RFLP marker.
- D) a plasmid used to transfer DNA into a living cell.
- E) a DNA probe used to identify a particular gene.

Key

- 1. D
- 2. E
- 3. D
- 4. A
- 5. C
- 6. A
- 7. A
- 8. B
- 9. C
- 10. E

11. D  
12. D  
13. D  
14. C  
15. B  
16. B  
17. E  
18. D  
19. D

20. C  
21. D  
22. C  
23. D  
24. D  
25. A  
26. E  
27. D  
28. A  
29. A

30. B  
31. D  
32. A  
33. A  
34. E  
35. D  
36. C  
37. D  
38. D  
39. C

40. A  
41. A  
42. D  
43. C  
44. A  
45. B  
46. B  
47. A  
48. C  
49. D  
50. D  
51. C  
52. D