

MULTIPLE CHOICE. This exam has 60 questions. All answers go on the SCANTRON provided. Choose the one alternative that best completes the statement or answers the question.

- 1) The genetic material of all living organisms is
A) DNA. B) RNA. C) protein. D) more than one answer is correct.

- 2) Who conducted experiments demonstrating that DNA is the genetic material of bacteriophages?
A) Hershey and Chase B) Griffith C) Pauling D) Franklin E) Watson and Crick

- 3) Credit for the discovery of the three dimensional structure of DNA goes to
A) Hershey and Chase B) Griffith C) Pauling D) Franklin E) Watson and Crick

- 4) Deoxyribose is a
A) nucleotide B) nucleic acid C) sugar D) nitrogen base E) phosphate

- 5) Which of the following statements regarding DNA is *false*?
A) DNA is a nucleic acid.
B) One DNA molecule can include four different nucleotides in its structure.
C) DNA molecules have a sugar-phosphate backbone.
D) DNA uses the nitrogenous base uracil.
E) DNA uses the sugar deoxyribose.

- 6) The monomers of DNA and RNA are
A) amino acids. B) nucleic acids. C) monosaccharides. D) fatty acids. E) nucleotides.

- 7) Which of the following can be found in a nucleotide of DNA?
A) deoxyribose B) phosphate C) nitrogen base D) all of the above

- 8) Which of the following is a nitrogen base found in DNA?
A) Adenine B) Thymine C) Guanine D) Cytosine E) all of the above

- 9) An understanding of DNA has important applications in understanding
A) the molecular genetic basis of life B) Genetically modified (GM) foods
C) cancer D) All of the above.

- 10) Using Chargaff's rule as a model, we could calculate the percent of Guanine in the DNA of an organism with 25% Adenine to be
A) 4% B) 25% C) 50% D) 75% E) 90%

- 11) Based on an understanding of the base composition observed in the DNA of different species, Chargaff concluded that the percent composition of adenine is the same for all species.
A) True B) False

- 12) As understood today, the DNA molecule
A) is a helix
B) has two polynucleotide chains, each with a sugar-phosphate backbone
C) has the sugar deoxyribose
D) has the nitrogen bases A, T, G & C
E) all of the above are correct

- 13) The word “complimentary” as applied to DNA means
A) sugars and phosphates in the DNA are paired one for one
B) nitrogen base A pairs with T and G with C
C) nitrogen base A pairs with G and T with C
D) more than one answer is correct
- 14) The process of DNA synthesis could be described as
A) winding, pairing, joining B) joining, winding, pairing C) pairing, joining, pairing
D) unwinding, pairing and joining E) joining, pairing, unwinding
- 15) The word “semiconservative” as it pertains to DNA synthesis means
A) each new daughter DNA molecule contains one-half the original parental DNA
B) the entire structure of the original parental DNA is conserved and not lost during DNA synthesis.
C) DNA synthesis occurs only when needed, so it is a semiconservative process.
D) DNA synthesis always recycles nucleotides so it is considered semiconservative.
E) all of these.
- 16) The flow of genetic information in all living organisms on Earth could be summarized as
A) Protein → RNA → DNA B) DNA → RNA → Protein C) RNA → DNA → Protein
D) RNA → Protein → DNA E) Protein → DNA → RNA
- 17) The flow of genetic information in all living organisms on Earth could be summarized as consisting of a set of instructions resulting in the synthesis of proteins.
A) True B) False
- 18) Translation is ___ using ___ as a coded information to determine the identity and arrangement of amino acids in a protein.
A) RNA synthesis:DNA B) DNA synthesis:RNA C) protein synthesis:mRNA
- 19) The presence and action of proteins determine the phenotype of an organism.
A) True B) False
- 20) The directions for the kind and location of each amino acid in a polypeptide are indicated by a codon consisting of ___ nucleotide(s) in an RNA molecule.
A) 4 B) 1 C) 2 D) 3 E) 5
- 21) We would expect that a 15-nucleotide sequence in a messenger RNA molecule could direct the production of a polypeptide that consists of _____ amino acids.
A) 2 B) 4 C) 5 D) 15 E) 64
- 22) The genetic code has ___ different codons.
A) 2 B) 4 C) 5 D) 16 E) 64
- 23) One feature of the genetic code is that it is
A) redundant B) unambiguous C) floppy D) universal (mostly) E) all of these

- 24) Which of the following occurs when RNA polymerase attaches to the promoter region of DNA?
A) RNA synthesis is started. B) RNA synthesis is ended. C) DNA synthesis is started.
D) Protein synthesis is started. E) More than one answer is correct.
- 25) Which of the following options most accurately gives the sequence of events in translation?
A) peptide bond formation → codon recognition → translocation → termination
B) codon recognition → translocation → peptide bond formation → termination
C) codon recognition → peptide bond formation → elongation → translocation → termination
D) peptide bond formation → translocation → codon recognition → termination
E) codon recognition → peptide bond formation → termination → translocation
- 26) If gene transcription consists of initiation, elongation and termination, what is being elongated?
A) DNA B) RNA C) protein D) all of these
- 27) An essential feature of protein synthesis using mRNA and tRNA is codon-anticodon pairing between these two types of RNA.
A) True B) False
- 28) What is the minimum number of codons required for a protein containing five amino acids? (Don't worry about start or stop codons.)
A) 4 B) 5 C) 8 D) 15 E) none
- 29) What is the minimum number of RNA nucleotides required for a protein containing five amino acids? (Don't worry about start or stop codons.)
A) 4 B) 5 C) 8 D) 15 E) none
- 30) What is the minimum number of DNA nucleotides required to make a messenger RNA molecule for a protein containing five amino acids? (Don't worry about start or stop codons.)
A) 4 B) 5 C) 8 D) 15 E) none
- 31) Let's say a molecule of messenger RNA was just synthesized from eukaryotic DNA. Let's also assume this mRNA primary transcript could be placed into a bacterial ribosome ready to do protein synthesis. What do you predict would happen?
A) a polypeptide would be produced, but it would not be a functional protein since introns were not removed.
B) the bacterial ribosome would first remove introns, then proceed to make a functional protein.
C) It is not possible for a bacterial ribosome to "read" eukaryotic mRNA under any circumstances.
D) a functional polypeptide/protein would be produced.
- 32) Let's say a molecule of messenger RNA was just synthesized from prokaryotic DNA. Let's also assume this mRNA transcript could be placed into a eukaryotic ribosome ready to do protein synthesis. What do you predict would happen?
A) a polypeptide would be produced, but it would not be a functional protein since introns were not removed.
B) the eukaryotic ribosome would first remove introns, then proceed to make a functional protein.
C) It is not possible for a eukaryotic ribosome to "read" prokaryotic mRNA under any circumstances.
D) A functional polypeptide/protein would be produced.

- 33) When DNA from two sources is combined into one single piece of DNA, it is known as
A) a DNA library. B) recombinant DNA. C) cloned DNA. D) a vector. E) a plasmid.
- 34) Two enzymes central to the success of genetic engineering are
A) DNA polymerase and RNA polymerase B) restriction endonucleases and ligase
C) protease and lipase D) exons and introns
- 35) Retroviruses such as HIV use _____ to convert information stored in their RNA to DNA.
A) a restriction enzyme B) a terminator enzyme C) RNA polymerase
D) DNA ligase E) reverse transcriptase
- 36) Gene therapy can currently be considered
A) established & reliable. B) impossible. C) far off in the future. D) promising. E) cheap & easy.
- 37) The polymerase chain reaction relies upon heat-resistant _____ isolated from bacteria living in hot springs.
A) plasmids B) DNA polymerase molecules C) mRNA D) phages E) restriction enzymes
- 38) Gel electrophoresis sorts DNA molecules on the basis of their
A) ability to bind to mRNA B) nucleotide sequence. C) solubility in the gel.
D) size. E) solubility in water.
- 39) Genetic engineering is to some extent the process of transferring DNA from one species to another using appropriate enzymes. (This is true.) In other words, genetic engineering is like
A) slash and burn B) show and tell C) give and take D) cut and paste
- 40) Approximately what percentage of human DNA is noncoding, i.e. not involved in RNA synthesis?
A) 37% B) 49% C) 99.9% D) 79% E) 98.5%
- 41) The coding regions of a gene (or mRNA molecule) in a eukaryotic cell (the portions that are expressed as polypeptide sequences) are called
A) proto-oncogenes. B) exons. C) introns. D) nucleosomes.
- 42) The development of colon cancer occurs slowly and is more prominent in the elderly than the young. This is most likely because
A) cancer cells have to wait until new blood vessels grow into the area, which takes much time.
B) cancer cells don't have mitochondria, so they grow slowly.
C) cancer cells suppress the growth of each other in a tissue.
D) most cancer mutations interfere with mitosis, so cell division occurs more slowly.
E) four or more somatic mutations must occur to give rise to the cancer and this takes time.
- 43) An application of genetic engineering in plant is
A) crops with enhanced nutritional value. B) pest-resistant crops
C) herbicide resistant crops D) all of these
- 44) A gene that has the potential to cause cancer when present in a single copy in a cell is called a(n)
A) enhancer gene. B) proto-oncogene. C) carcinogen. D) oncogene.

- 45) In order for cancer to occur DNA must first mutate. (This is true.) Mutation in DNA can occur because of exposure to many carcinogens (like benzopyrene) in
A) ultraviolet light. B) tobacco. C) alcohol. D) salt. E) plutonium.
- 46) HIV is a
A) bacterium B) virus C) prion D) protist
- 47) Which of the following is present in HIV?
A) RNA nucleic acid B) capsid C) membrane-like envelope D) all of these
- 48) Through integration, RNA of HIV can be inserted into the genomic DNA of the host cell.
A) True B) False
- 49) Many viruses are said to be emerging. What does "emerging" mean?
A) Viruses from other animals can spread to humans B) They can spread from isolated populations.
C) They can mutate rapidly. D) All of these
- 50) An example of an emerging virus is
A) HIV B) SARS C) West Nile D) All of these
- 51) A DNA "photocopying" process capable of making millions of copies of DNA in about an hour is
A) gel electrophoresis B) PCR C) gene duplication D) gene expression
- 52) Some bacteria (like Staphylococcus) have developed a remarkable resistance to antibiotics, thus making them especially harmful microorganisms. What feature of such bacteria give them the property of antibiotic resistance?
A) They contain a plasmid with genes for antibiotic resistance.
B) They have a thick cell wall protecting them from the immune system.
C) They harbor viruses that can attack antibiotic drugs used against bacteria.
D) All of these.
- 53) Which of the following is a cause for mutation?
A) mistakes made in cells during DNA replication or recombination. B) high energy radiation.
C) mutagenic chemicals. D) all of these
- 54) A mutation is any change in DNA.
A) True B) False
- 55) Mutations known as substitutions, and deletions will affect the arrangement or order of ___ in DNA.
A) nitrogen bases B) sugars C) phosphates D) all of these
- 56) A silent mutation will NOT affect
A) the nucleotide sequence in messenger RNA
B) the nucleotide sequence in DNA
C) the amino acid sequence translated from messenger RNA
D) none of these since a mutation will affect DNA, RNA and the protein amino acid sequence.

- 57) Which of the following permits a single gene to code for more than one polypeptide?
- A) alternative RNA splicing
 - B) genetic differentiation
 - C) protein degradation
 - D) retention of different introns in the final version of the different mRNA strands
 - E) addition of different types of caps and tails to the final version of the mRNA strands
- 58) Sequences of DNA called "jumping genes" that can move around to different positions within the genome of a single cell are also called
- A) inversions
 - B) jumpons
 - C) transposons
 - D) operons
- 59) Ultraviolet light causes damage to DNA and forms
- A) thymine-thymine dimers
 - B) adenine-guanine dimers
 - C) cytosine-thymine dimers
 - D) all of the above
- 60) Mutation in which type of gene can cause cancer?
- A) Proto-oncogene
 - B) Tumor-suppressor gene
 - C) Both A & B
 - D) None of these