Name: _____ Class: _____ Date: _____ ID: A

DNA & Molecular Genetics Exam)MYP)

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

____ 1. In his transformation experiments, Griffith observed that
   a. mutant mice were resistant to bacterial infections.
   b. mixing a heat-killed deadly kind of bacteria with a living non-deadly kind can convert some of the living cells into the deadly form.
   c. mixing a heat-killed non-deadly kind of bacteria with a living deadly kind makes the deadly kind non-deadly.
   d. infecting mice with non-deadly kinds of bacteria makes them resistant to deadly kinds.
   e. mice infected with a deadly kind of bacteria can spread the infection to other mice.

____ 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 viral DNA molecule
   d. the type of semiconservative replication shown by DNA
   e. taking up external DNA into a cell

____ 3. Avery and his colleagues purified various chemicals from pathogenic bacteria and showed that ____ was (were) the transforming agent.
   a. DNA
   b. protein
   c. lipids
   d. carbohydrates
   e. phage

____ 4. The following scientists made significant contributions to our understanding of the structure and function of DNA. Place the scientists' names in the correct chronological order, starting with the first scientist(s) to make a contribution.

   I. Avery, McCarty, and MacLeod
   II. Griffith
   III. Hershey and Chase
   IV. Meselson and Stahl
   V. Watson and Crick

   a. V, IV, II, I, III
   b. II, I, III, V, IV
   c. I, II, III, V, IV
   d. I, II, V, IV, III
   e. II, III, IV, V, I

Match the investigator(s) to the appropriate discovery of about the nature of genes.

A. Frederick Griffith
B. Alfred Hershey and Martha Chase
C. Oswald Avery, Maclyn McCarty, and Colin MacLeod
D. Erwin Chargaff
E. Matthew Meselson and Franklin Stahl

____ 5. Chemicals from heat-killed S cells were purified. The chemicals were tested for the ability to transform live R cells. The transforming agent was found to be DNA.
a. A
b. B
c. C
d. D
e. E

____ 6. Phage (viruses) with labeled proteins or DNA was allowed to infect bacteria. It was shown that the DNA, but not the protein, entered the bacterial cells, and was therefore the genetic material.
a. A
b. B
c. C
d. D
e. E

____ 7. In DNA from any species, varies in the amount of adenine, thymine, guanine and cytosine.
a. A
b. B
c. C
d. D
e. E

____ 8. 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.

____ 9. Watson and Crick determined directly from X-ray diffraction photographs of crystallized DNA and other evidence all of the following *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.

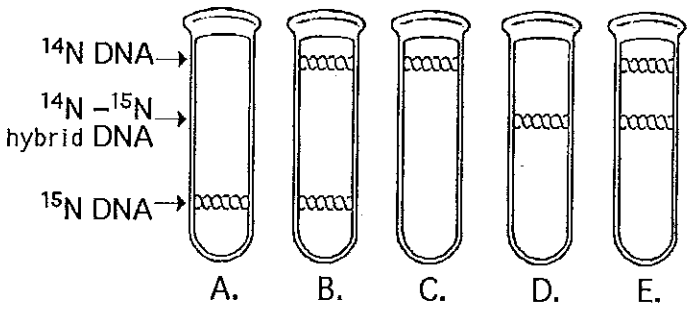
____ 10. The DNA double helix has a uniform (same) diameter because ____, which have two rings, always pair with ____, which have one ring.
a. purines; pyrimidines
b. pyrimidines; purines
c. deoxyribose sugars; ribose sugars
d. ribose sugars; deoxyribose sugars
e. nucleotides; nucleoside triphosphates

____ 11. 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

____ 12. It became apparent to Watson and Crick after completion of their model that the DNA molecule could carry a vast amount of hereditary information in its
a. sequence of bases.
b. phosphate-sugar backbones.
c. number of adenine bases.
d. side groups of nitrogenous bases.
e. different five-carbon sugars.

____ 13. In an analysis of the nucleotide composition of DNA, which of the following is *true*?
a. A = C
b. A = G and C = T
c. A + C = G + T
d. T + A = G + C
e. both C and D

Use the figure below to answer the following questions.



____ 14. In the late 1950s, Meselson and Stahl grew bacteria in a medium containing "heavy" nitrogen (15N) and then transferred them to a medium containing 14N. Which of the results in the figure above would be expected after one DNA replication in the presence of 14N?
a. A
b. B
c. C
d. D
e. E

____ 15. What is the function of DNA polymerase?
a. to unwind the DNA helix during replication
b. to seal together the broken ends of DNA strands
c. to add nucleotides to the end of a growing DNA strand
d. to degrade damaged DNA molecules
e. to rejoin the two DNA strands (one new and one old) after replication

Refer to the list of enzymes below to answer the following questions. The answers may be used once, more than once, or not at all.

A. helicase
B. nuclease
C. ligase
D. DNA polymerase I
E. primase

____ 16. separates the DNA strands during replication
a. A
b. B
c. C
d. D
e. E

____ 17. covalently connects segments of DNA, like Okazaki fragments.
a. A
b. B
c. C
d. D
e. E

____ 18. synthesizes and binds short segments of RNA to DNA.
a. A
b. B
c. C
d. D
e. E

____ 19. Which of the following help to hold the DNA strands apart while they are being replicated?
a. primase
b. ligase
c. DNA polymerase
d. single-strand binding proteins
e. exonuclease

____ 20. Which of these is a difference between a DNA and an RNA molecule?
a. DNA contains uracil, whereas RNA contains thymine.
b. DNA is a polymer (chain) composed of nucleotides, whereas RNA is a polymer composed of nucleic acids.
c. DNA is double-stranded, whereas RNA is single-stranded.
d. DNA contains five-carbon sugars, whereas RNA contains six-carbon sugars.
e. DNA contains nitrogenous bases, whereas RNA contains phosphate groups.

____ 21. After DNA replication is completed,
a. each new DNA double helix consists of one old DNA strand and one new DNA strand.
b. each new DNA double helix consists of two new strands.
c. one DNA double helix consists of two old strands and one DNA double helix consists of two new strands.
d. each of the four DNA strands consists of some old strand parts and some new strand parts.
e. there are four double helices.

____ 22. Translation occurs in
a. the cytoplasm.
b. a lysosome.
c. the nucleus.
d. a mitochondrion.
e. a nucleoplasm.

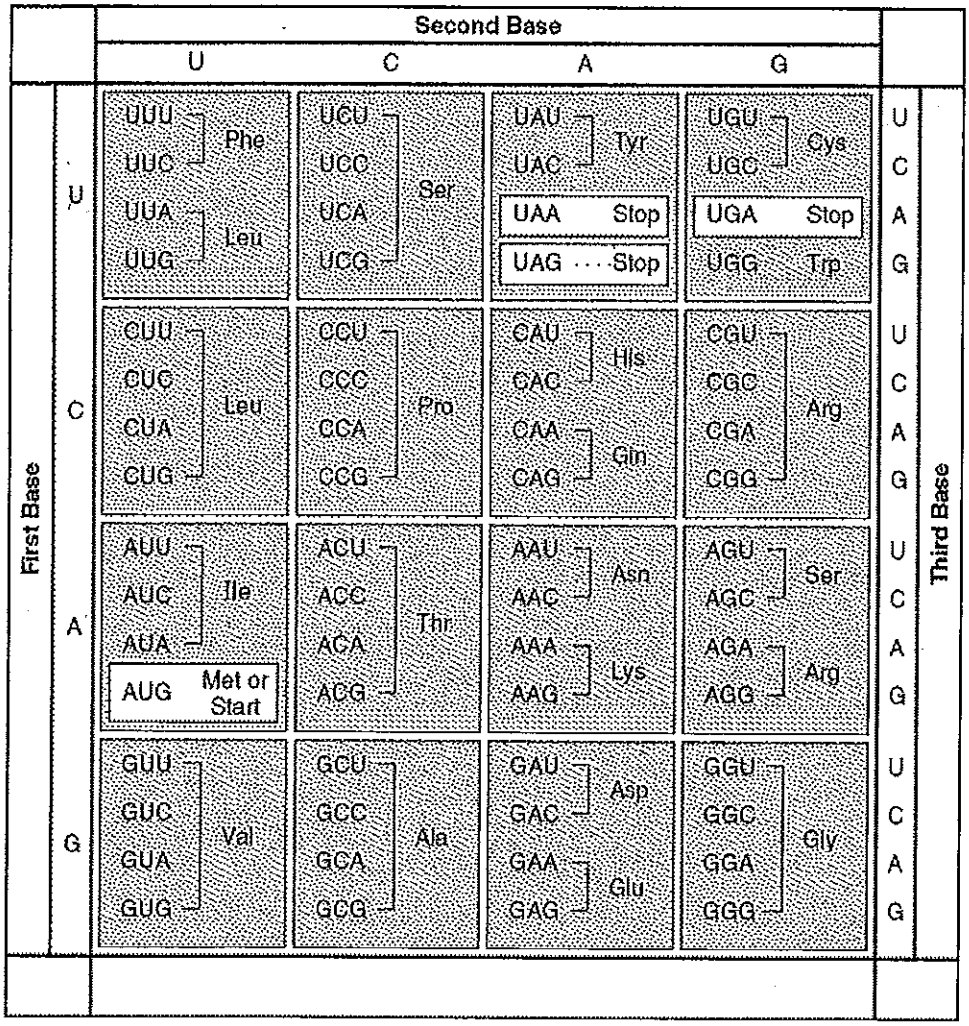
____ 23. Synthesis of a new DNA strand usually begins with
a. an RNA primer.
b. a DNA primer.
c. an Okazaki fragment.
d. DNA ligase.
e. a thymine dimer.

____ 24. Using RNA as a template for protein synthesis instead of translating proteins directly from the DNA is advantageous for the cell because
a. RNA is much more stable than DNA.
b. RNA acts as an expendable copy of the genetic material, allowing the DNA to serve as a permanent, pristine repository of the genetic material.
c. many mRNA molecules simply make better proteins than DNA
d. B and C only
e. A, B, and C

_____ 25. If proteins were composed (made) 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

____ 26. An extraterrestrial life form is discovered. It has a genetic code much like that of organisms on Earth except that there are five different DNA bases instead of four and the base sequences are translated as doublets instead of triplets. How many different amino acids could be accommodated by this genetic code?
a. 5
b. 10
c. 25
d. 64
e. 32

Use the table of condons below to answer the following questions.



____ 27. A possible sequence of nucleotides in the template strand of DNA that would code for the polypeptide sequence phe-leu-ile-val would be
a. 5' TTG-CTA-CAG-TAG 3'.
b. 3' AAC-GAC-GUC-AUA 5'.
c. 5' AUG-CTG-CAG-TAT 3'.
d. 3' AAA-AAT-ATA-ACA 5'.
e. 3' AAA-GAA-TAA-CAA 5'.

____ 28. What amino acid sequence will be generated, based on the following mRNA codon sequence?
5'AUG-UCU-UCG-UUA-UCC-UUG
a. met-arg-glu-arg-glu-arg
b. met-glu-arg-arg-gln-leu
c. met-ser-leu-ser-leu-ser
d. met-ser-ser-leu-ser-leu
e. met-leu-phe-arg-glu-glu

____ 29. What is the sequence of a peptide based on the mRNA sequence 5' UUUUCUUAUUGUCUU 3' ?
a. leu-cys-tyr-ser-phe
b. cyc-phe-tyr-cys-leu
c. phe-leu-ile-met-val
d. leu-pro-asp-lys-gly
e. phe-ser-tyr-cys-leu

____ 30. A codon
a. consists of two nucleotides.
b. may code for the same amino acid as another codon.
c. is made from amino acid.
d. catalyzes RNA synthesis.
e. floating in the cytosol.

____ 31. 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.

____ 32. The genetic code is essentially the same for all organisms. From this, one can logically assume all of the following *except*
a. a gene from an organism could theoretically be expressed by any other organism.
b. all organisms have a common ancestor.
c. DNA was the first genetic material.
d. the same codons in different organisms usually translate into the same amino acids.
e. different organisms have the same number of different types of amino acids.

____ 33. RNA polymerase moves along the template strand of DNA in the ____ direction, and adds nucleotides to the ____ end of the growing transcript.
a. 3' to 5'; 5'
b. 3' to 5'; 3'
c. 5' to 3'; 5'
d. 5' to 3'; 3'

____ 34. All of the following are directly involved in translation *except*
a. mRNA.
b. tRNA.
c. ribosomes.
d. DNA.
e. aminoacyl-tRNA synthetase enzymes.

____ 35. The anticodon on the tRNA that binds the mRNA codon AAA is
a. TTT.
b. UUA.
c. UUU.
d. AAA.
e. either UAA or TAA, depending on first base wobble.

____ 36. Accuracy in the translation of mRNA into the primary structure of a protein depends on specificity in the
a. binding of ribosomes to mRNA.
b. shape of the A and P sites of ribosomes.
c. bonding of the anticodon to the codon.
d. attachment of correct amino acids to certain tRNAs.
e. both C and D

____ 37. What molecule brings amino acids to the ribosomes during protein synthesis?
a. DNA
b. tRNA
c. mRNA
d. rRNA
e. a codon

____ 38. There are 61 mRNA codons that code for only 20 amino acids. This is best explained by the fact that the genetic code is
a. redundant, a single codon can code for multiple amino acids.
b. ambiguous, sometimes AGU codes for serine and other times it codes for alanine.
c. universal, every organism has its own unique genetic code.
d. A, B, and C
e. none of the above

____ 39. What are ribosomes composed of?
a. rRNA only
b. proteins only
c. both rRNA and protein
d. mRNA, rRNA, and protein
e. mRNA, tRNA, rRNA, and protein

____ 40. Choose the answer that has these events of protein synthesis in the proper sequence.
1. A tRNA binds to the A site.
2. A peptide bond forms between the new amino acid and a polypeptide (protein) chain.
3. tRNA leaves the P site, and the P site remains vacant.
4. A small ribosomal subunit binds with mRNA.
5. tRNA translocates (moves) to the P site.
a. 1,3,2,4,5
b. 4,1,2,5,3
c. 5,4,3,2,1
d. 4,1,3,2,5
e. 2,4,5,1,3

____ 41. During translation, protein 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.

____ 42. Which of the following does *not occur during the termination phase of translation?*
a. A termination codon causes the A site to accept a release factor.
b. The newly formed polypeptide is released.
c. A tRNA with the next amino acid enters the P site.
d. The two ribosomal subunits separate.
e. Translation stops.

____ 43. When does translation begin in prokaryotic cells?
a. after a transcription
b. during transcription
c. after mRNA leaves the nucleus
d. after all amino acids are assembled into a vesicle
e. as soon as the DNA has completed replication

____ 44. What is the effect of a nonsense mutation in a gene?
a. It changes one amino acid in the encoded protein.
b. It has no effect on the amino acid sequence of the encoded protein.
c. It introduces a stop codon into the mRNA before the normal stop codon.
d. It alters the reading frame of the mRNA.
e. It prevents the initiation of transcription.

Each of the following is a modification of the sentence THECATATETHERAT.

A.THERATATETHECAT
B. THETACATETHERAT
C. THECATARETHERAT
D. THECATATTHERAT
E. CATATETHERAT

____ 45. Which of the above is analogous to a frameshift mutation?
a. A
b. B
c. C
d. D
e. E

____ 46. Which of the above is analogous to a single substitution mutation?
a. A
b. B
c. C
d. D
e. E

____ 47. Translation occurs in
a. the cytosol.
b. a lysosome.
c. the nucleus.
d. a mitochondria.
e. a membrane bound organelle.

____ 48. What does the operon model attempt to explain?
a. the coordinated control of gene expression in bacteria
b. bacterial resistance to antibiotics
c. how genes move between homologous regions of DNA
d. the mechanism of viral attachment to a host cell
e. how bacteria pass genes to each.

____ 49. All of the following are made up of nucleic acid *except a*
a. repressor.
b. structural gene.
c. promoter.
d. regulatory gene.
e. operator.

____ 50. 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.

ID Number

mark only one bubble in each digit group

1st digit	0	1	2	3	4	
	5	6	7	8	9	
2nd digit	0	1	2	3	4	
	5	6	7	8	9	
3rd digit	0	1	2	3	4	
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4th digit	0	1	2	3	4	
	5	6	7	8	9	
5th digit	0	1	2	3	4	
	5	6	7	8	9	
6th digit	0	1	2	3	4	
	5	6	7	8	9	

1	A	B ●	C	D	E	F
2	A ●	B	C	D	E	F
3	A	B	C	D	E ●	F
4	A	B ●	C	D	E	F
5	A	B	C ●	D	E	F
6	A	B ●	C	D	E	F
7	A	B	C	D ●	E	F
8	A ●	B	C	D	E	F
9	A	B	C ●	D	E	F
10	A ●	B	C	D	E	F
11	A	B	C ●	D	E	F
12	A ●	B	C	D	E	F
13	A	B	C	D ●	E	F
14	A	B	C	D ●	E	F
15	A	B	C ●	D	E	F
16	A ●	B	C	D	E	F
17	A	B	C ●	D	E	F
18	A	B	C	D	E ●	F
19	A	B	C	D ●	E	F
20	A	B	C ●	D	E	F
21	A ●	B	C	D	E	F
22	A ●	B	C	D	E	F
23	A ●	B	C	D	E	F
24	A	B ●	C	D	E	F
25	A	B ●	C	D	E	F
26	A	B	C ●	D	E	F
27	A	B	C	D	E ●	F
28	A	B	C	D ●	E	F
29	A	B	C	D	E ●	F
30	A	B ●	C	D	E	F
31	A	B	C	D	E ●	F
32	A	B	C ●	D	E	F
33	A	B	C	D ●	E	F
34	A	B	C	D ●	E	F
35	A	B	C ●	D	E	F
36	A	B	C	D	E ●	F
37	A	B ●	C	D	E	F
38	A ●	B	C	D	E	F
39	A	B	C ●	D	E	F
40	A	B ●	C	D	E	F
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43	A	B ●	C	D	E	F
44	A	B	C ●	D	E	F
45	A	B	C	D ●	E	F
46	A	B	C ●	D	E	F
47	A ●	B	C	D	E	F
48	A ●	B	C	D	E	F
49	A ●	B	C	D	E	F
50	A	B	C	D	E ●	F

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