GENETICS PART 1 REVIEW

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Black fur in mice (*B*) is dominant to brown fur (*b*). Short tails (*T*) are dominant to long tails (*t*). What fraction of the progeny of crosses *BbTt* × *BBtt* will be expected to have black fur and long tails? 1) _____

A) 1/16 B) 1/2 C) 3/16 D) 9/16 E) 3/8

Refer to the following information to answer the questions below.

Gene *S* controls the sharpness of spines in a type of cactus. Cactuses with the dominant allele, *S*, have sharp spines, whereas homozygous recessive *ss* cactuses have dull spines. At the same time, a second gene, *N*, determines whether or not cactuses have spines. Homozygous recessive *nn* cactuses have no spines at all.

2) The relationship between genes *S* and *N* is an example of 2) _____

A) complete dominance.
B) pleiotropy.
C) codominance.
D) incomplete dominance.
E) epistasis.

Use the following information to answer the questions below.

Tallness (*T*) in snapdragons is dominant to dwarfness (*t*), while red (*R*) flower color is dominant to white (*r*). The heterozygous condition results in pink (*Rr*) flower color.

3) If snapdragons are heterozygous for height as well as for flower color, a mating between them will result in what ratio? 3) _____

A) 9:4:3
B) 9:3:3:1
C) 1:2:1
D) 27:9:9:9:3:3:3:1
E) 6:3:3:2:1:1

Use the following information to answer the questions below.

Labrador retrievers are black, brown, or yellow. In a cross of a black female with a brown male, results can be either all black puppies, 1/2 black to 1/2 brown puppies, or 3/4 black to 1/4 yellow puppies.

4) These results indicate which of the following? 4) _____

A) Black is dominant to brown and to yellow.
B) Brown is dominant to black.
C) Yellow is dominant to black.
D) There is incomplete dominance.
E) Epistasis is involved.

5) Which of the following provides an example of epistasis? 5) _____

A) In cacti, there are several genes for the type of spines.
B) The allele *b17* produces a dominant phenotype, although *b1* through *b16* do not.
C) In rabbits and many other mammals, one genotype (*cc*) prevents any fur color from developing.
D) In *Drosophila* (fruit flies), white eyes can be due to an X-linked gene or to a combination of other genes.
E) Recessive genotypes for each of two genes (*aabb*) results in an albino corn snake.

Use the following information to answer the questions below.

Tallness (*T*) in snapdragons is dominant to dwarfness (*t*), while red (*R*) flower color is dominant to white (*r*). The heterozygous condition results in pink (*Rr*) flower color.

6) A dwarf, red snapdragon is crossed with a plant homozygous for tallness and white flowers. What are the genotype and phenotype of the F_1 individuals? 6) _____

A) *TTRR*—tall and red
B) *ttRr*—dwarf and pink
C) *TtRr*—tall and pink
D) *TtRr*—tall and red
E) *ttrr*—dwarf and white

7) How could you best predict the maximum number of alleles for a single gene whose polypeptide product is known? 7) _____

A) Mate all known genotypes and collect all possible offspring different from the parents.
B) Count the number of amino acids in the polypeptide.
C) Search the population for all phenotypic variants of this polypeptide.
D) Count the number of DNA nucleotides that are in the code for the polypeptides.
E) Measure the rate of new mutations in the species and estimate the number since it first evolved.

8) In the cross *AaBbCc* × *AaBbCc*, what is the probability of producing the genotype *AABBCC*? 8) _____

A) 1/32 B) 1/4 C) 1/8 D) 1/16 E) 1/64

9) Which of the following describes the ability of a single gene to have multiple phenotypic effects? 9) _____

A) epistasis
B) incomplete dominance
C) pleiotropy
D) multiple alleles

Use the following pedigree (Figure 14.3) for a family in which dark-shaded symbols represent individuals with one of the two major types of colon cancer. Numbers under the symbols are the individual's age at the time of diagnosis.

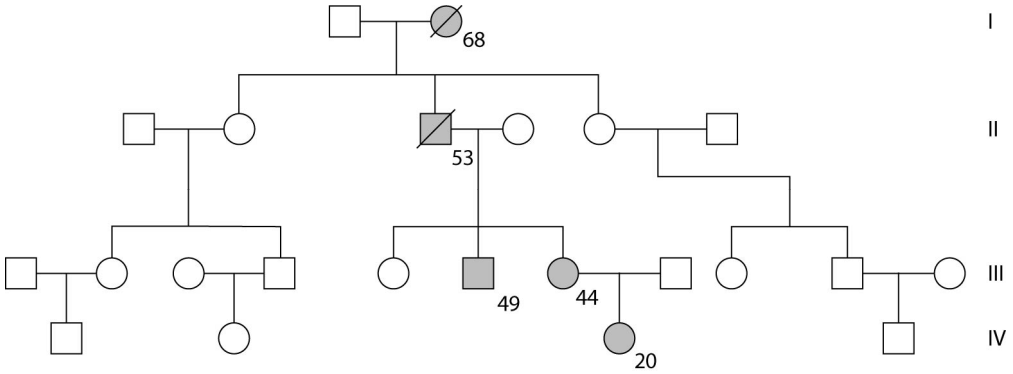


Figure 14.3

10) The affected woman in generation IV is thinking about her future and asks her oncologist (cancer specialist) whether she can know whether any or all of her children will have a high risk of the same cancer. The doctor would be expected to advise which of the following? 10) _____

I. genetic counseling
II. prenatal diagnosis when/if she becomes pregnant
III. testing to see whether she has the allele
IV. testing to see whether her future spouse or partner has the allele

A) I only
B) I and II only
C) II only
D) III and IV only
E) I, II, and III only

11) The frequency of heterozygosity for the sickle-cell anemia allele is unusually high, presumably because this reduces the frequency of malaria. Such a relationship is related to which of the following? 11) _____

A) Mendel's law of independent assortment
B) Mendel's law of segregation
C) Darwin's observations of competition
D) the malarial parasite changing the allele
E) Darwin's explanation of natural selection

12) Mendel's observation of the segregation of alleles in gamete formation has its basis in which of the following phases of cell division? 12) _____

A) anaphase of mitosis
B) prophase I of meiosis
C) metaphase I of meiosis
D) anaphase II of meiosis
E) anaphase I of meiosis

Use the following information to answer the questions below.

Radish flowers may be red, purple, or white. A cross between a red-flowered plant and a white-flowered plant yields all-purple offspring. The part of the radish we eat may be oval or long, with long being the dominant characteristic.

13) In the F_2 generation of the above cross, which of the following phenotypic ratios would be expected? 13) _____

A) 1:1:1:1
B) 9:3:3:1
C) 1:1:1:1:1:1
D) 6:3:3:2:1:1
E) 9:4:3

Use the following information to answer the questions below.

A woman who has blood type A positive has a daughter who is type O positive and a son who is type B negative. Rh positive is a trait that shows simple dominance over Rh negative and is designated by the alleles R and r, respectively. A third gene for the MN blood group has codominant alleles M and N.

14) Which of the following is a possible partial genotype for the son? 14) _____

A) $I^A I^A$ B) $I^B i$ C) $I^B I_A$ D) ii E) $I^B I^B$

15) Which of the following is a possible phenotype for the father? 15) _____

A) AB negative
B) A negative
C) O negative
D) B positive
E) impossible to determine

16) What was the most significant conclusion that Gregor Mendel drew from his experiments with pea plants? 16) _____

A) An organism that is homozygous for many recessive traits is at a disadvantage.
B) Traits are inherited in discrete units, and are not the results of "blending."
C) There is considerable genetic variation in garden peas.
D) Genes are composed of DNA.
E) Recessive genes occur more frequently in the F_1 generation than do dominant ones.

Use the following information to answer the questions below.

Skin color in a certain species of fish is inherited via a single gene with four different alleles.

17) One fish of this type has alleles 1 and 3 (S_1S_3) and its mate has alleles 2 and 4 (S_2S_4). If each allele confers a unit of color darkness such that S_1 has one unit, S_2 has two units, and so on, then what proportion of their offspring would be expected to have five units of color? 17) _____

A) 1/5 B) 0 C) 1/8 D) 1/2 E) 1/4

18) Mendel was able to draw his ideas of segregation and independent assortment because of the influence of which of the following? 18) _____

A) His reading and discussion of Darwin's *Origin of Species.*
B) The understanding of particulate inheritance he learned from renowned scientists of his time.
C) His reading of the scientific literature current in the field.
D) His discussions of heredity with his colleagues at major universities.
E) His experiments with the breeding of plants such as peas and fuchsia.

19) Hydrangea plants of the same genotype are planted in a large flower garden. Some of the plants produce blue flowers and others pink flowers. This can be best explained by which of the following? 19) _____

A) the alleles being codominant
B) the knowledge that multiple alleles are involved
C) environmental factors such as soil pH
D) the fact that a mutation has occurred
E) the allele for blue hydrangea being completely dominant

20) Which of the following calculations require that you utilize the addition rule? 20) _____

A) Calculate the probability of black offspring from the cross $AaBb \times AaBb$, when B is the symbol for black.
B) Calculate the probability of purple flower color in a plot of 50 plants seeded from a self–fertilizing heterozygous parent plant.
C) Calculate the probability of each of four children having cystic fibrosis if the parents are both heterozygous.
D) Calculate the probability of a child having either sickle–cell anemia or cystic fibrosis if parents are each heterozygous for both.
E) Calculate the probability of children with both cystic fibrosis and polydactyly when parents are each heterozygous for both genes.

21) You briefly expose bacteria undergoing DNA replication to radioactively labeled nucleotides. When you centrifuge the DNA isolated from the bacteria, the DNA separates into two classes. One class of labeled DNA includes very large molecules (thousands or even millions of nucleotides long), and the other includes short stretches of DNA (several hundred to a few thousand nucleotides in length). These two classes of DNA probably represent 21) _____

A) leading strands and Okazaki fragments.
B) RNA primers and mitochondrial DNA.
C) lagging strands and Okazaki fragments.
D) Okazaki fragments and RNA primers.
E) leading strands and RNA primers.

Use the following model of a eukaryotic transcript to answer the next few questions.

5' UTR E_1 I_1 E_2 I_2 E_3 I_3 E_4 UTR 3'

22) Suppose that an induced mutation removes most of the 5' end of the 5' UTR. What might result? 22) _____
A) The first exon will not be read because I_1 will now serve as the UTR.
B) Removal of the 5' UTR also removes the 5' cap and the mRNA will quickly degrade.
C) Removal of the 5' UTR has no effect because the exons are still maintained.
D) The 3' UTR will duplicate and one copy will replace the 5' end.
E) Removal of the 5' UTR will result in the strand not binding to tRNAs.

A researcher introduces double-stranded RNA into a culture of mammalian cells, and can identify its location or that of its smaller subsections experimentally, using a fluorescent probe.

23) Some time later, she finds that the introduced strand separates into single-stranded RNAs, one of which is degraded. What does this enable the remaining strand to do? 23) _____
A) bind to complementary regions of target mRNAs
B) bind to noncomplementary RNA sequences
C) attach to histones in the chromatin
D) activate other siRNAs in the cell
E) bind to Dicer enzymes to destroy other RNAs

24) The role of a metabolite that controls a repressible operon is to 24) _____
A) bind to the repressor protein and activate it.
B) bind to the promoter region and decrease the affinity of RNA polymerase for the promoter.
C) bind to the operator region and block the attachment of RNA polymerase to the promoter.
D) increase the production of inactive repressor proteins.
E) bind to the repressor protein and inactivate it.

A researcher introduces double-stranded RNA into a culture of mammalian cells, and can identify its location or that of its smaller subsections experimentally, using a fluorescent probe.

25) Within the first quarter hour, the researcher sees that the intact RNA is found in the cells. After 3 hours, she is not surprised to find that 25) _____
A) the RNA is degraded by 5' and 3' exonucleases.
B) the double-stranded RNA replicates itself.
C) Dicer enzyme has reduced it to smaller double-stranded pieces.
D) the double-stranded RNA binds to tRNAs to prevent translation.
E) the double-stranded RNA binds to mRNAs to prevent translation.

26) If you were to observe the activity of methylated DNA, you would expect it to 26) _____
A) be very actively transcribed and translated.
B) be replicating nearly continuously.
C) induce protein synthesis by not allowing repressors to bind to it.
D) be unwinding in preparation for protein synthesis.
E) have turned off or slowed down the process of transcription.

One hereditary disease in humans, called xeroderma pigmentosum (XP), makes homozygous individuals exceptionally susceptible to UV–induced mutation damage in the cells of exposed tissue, especially skin. Without extraordinary avoidance of sunlight exposure, patients soon succumb to numerous skin cancers.

27) Which of the following best describes this phenomenon? 27) _____
A) embryonic or fetal cancer
B) inherited predisposition to mutation
C) inherited cancer taking a few years to be expressed
D) inherited inability to repair UV–induced mutation
E) susceptibility to chemical carcinogens

A researcher found a method she could use to manipulate and quantify phosphorylation and methylation in embryonic cells in culture.

28) One of her colleagues suggested she try increased methylation of C nucleotides in a mammalian system. Which of the following results would she most likely see? 28) _____
A) inactivation of the selected genes
B) decreased chromatin condensation
C) increased chromatin condensation
D) decreased binding of transcription factors
E) abnormalities of mouse embryos

29) *BRCA1* and *BRCA2* are considered to be tumor–suppressor genes because 29) _____
A) they block penetration of breast cells by chemical carcinogens.
B) their normal products participate in repair of DNA damage.
C) they prevent infection by retroviruses that cause cancer.
D) the mutant forms of either one of these promote breast cancer.
E) the normal genes make estrogen receptors.

Suppose an experimenter becomes proficient with a technique that allows her to move DNA sequences within a prokaryotic genome.

30) If she moves the operator to the far end of the operon (past the *transacetylase* gene), which of the following would likely occur when the cell is exposed to lactose? 30) _____
A) The structural genes will be transcribed continuously.
B) The repressor will no longer bind to the operator.
C) The inducer will no longer bind to the repressor.
D) The operon will never be transcribed.
E) The repressor protein will no longer be produced.

A researcher has arrived at a method to prevent gene expression from *Drosophila* embryonic genes. The following questions assume that he is using this method.

31) The researcher in question measures the amount of new polypeptide production in embryos from 2—8 hours following fertilization and the results show a steady and significant rise in polypeptide concentration over that time. The researcher concludes that 31) _____
A) the new polypeptides were inactive and not measurable until fertilization.
B) the results are due to building new cell membranes to compartmentalize dividing nuclei.
C) his measurement skills must be faulty.
D) polypeptides were attached to egg membranes until this time.
E) the resulting new polypeptides are due to translation of maternal mRNAs.

32) Which of the following is most likely to have a small protein called ubiquitin attached to it? 32) _____

A) a cyclin that usually acts in G_1, now that the cell is in G_2
B) a cell surface protein that requires transport from the ER
C) a regulatory protein that requires sugar residues to be attached
D) an mRNA produced by an egg cell that will be retained until after fertilization
E) an mRNA that is leaving the nucleus to be translated

33) Which of the following, when taken up by the cell, binds to the repressor so that the repressor no longer binds to the operator? 33) _____

A) promoter
B) corepressor
C) ubiquitin
D) inducer
E) repressor

34) Gap genes and pair–rule genes fall into which of the following categories? 34) _____

A) morphogens
B) segmentation genes
C) homeotic genes
D) egg–polarity genes
E) inducers

35) Allolactose, an isomer of lactose, is formed in small amounts from lactose. An *E. coli* cell is presented for the first time with the sugar lactose (containing allolactose) as a potential food source. Which of the following occurs when the lactose enters the cell? 35) _____

A) Allolactose binds to the repressor protein.
B) The repressor protein and allolactose bind to RNA polymerase.
C) Allolactose binds to the regulator gene.
D) RNA polymerase attaches to the regulator.
E) The repressor protein attaches to the regulator.

36) During DNA replication, 36) _____

A) methylation of the DNA is maintained because methylation enzymes act at DNA sites where one strand is already methylated and thus correctly methylates daughter strands after replication.
B) DNA polymerase is blocked by methyl groups, and methylated regions of the genome are therefore left uncopied.
C) methylated DNA is copied in the cytoplasm, and unmethylated DNA is copied in the nucleus.
D) all methylation of the DNA is lost at the first round of replication.
E) methylation of the DNA is maintained because DNA polymerase directly incorporates methylated nucleotides into the new strand opposite any methylated nucleotides in the template.

37) Which of the following is a protein produced by a regulatory gene? 37) _____

A) repressor
B) operon
C) promoter
D) corepressor
E) inducer

38) In prophase I of meiosis in female *Drosophila*, studies have shown that there is phosphorylation of an amino acid in the tails of histones of gametes. A mutation in flies that interferes with this process results in sterility. Which of the following is the most likely hypothesis? 38) _____

A) These oocytes have no histones.
B) All proteins in the cell must be phosphorylated.
C) Histone tails must be removed from the rest of the histones.
D) Histone tail phosphorylation prohibits chromosome condensation.
E) Any mutation during oogenesis results in sterility.

39) You are given an experimental problem involving control of a gene's expression in the embryo of a particular species. One of your first questions is whether the gene's expression is controlled at the level of transcription or translation. Which of the following might best give you an answer? 39) _____

A) You assess the position and sequence of the promoter and enhancer for this gene.
B) You explore whether there has been alternative splicing by examining amino acid sequences of very similar proteins.
C) You use an antibiotic known to prevent translation.
D) You measure the quantity of the appropriate pre–mRNA in various cell types and find they are all the same.
E) An analysis of amino acid production by the cell shows you that there is an increase at this stage of embryonic life.

40) In response to chemical signals, prokaryotes can do which of the following? 40) _____

A) turn off translation of their mRNA
B) inactivate their mRNA molecules
C) alter the sequence of amino acids in certain proteins
D) alter the level of production of various enzymes
E) increase the number and responsiveness of their ribosomes

41) Which of the following mechanisms is (are) used to coordinate the expression of multiple, related genes in eukaryotic cells? 41) _____

A) Genes are organized into clusters, with local chromatin structures influencing the expression of all the genes at once.
B) The genes share a common intragenic sequence, and allow several activators to turn on their transcription, regardless of location.
C) The genes are organized into large operons, allowing them to be transcribed as a single unit.
D) Environmental signals enter the cell and bind directly to promoters.
E) A single repressor is able to turn off several related genes.

42) Altering patterns of gene expression in prokaryotes would most likely serve the organism's survival in which of the following ways? 42) _____

A) allowing the organism to adjust to changes in environmental conditions
B) allowing environmental changes to alter the prokaryote's genome
C) allowing each gene to be expressed an equal number of times
D) organizing gene expression so that genes are expressed in a given order
E) allowing young organisms to respond differently from more mature organisms

43) Which of the following is a function of a poly–A signal sequence? 43) _____

A) It adds a 7–methylguanosine cap to the 3' end of the mRNA.
B) It is a sequence that codes for the hydrolysis of the RNA polymerase.
C) It allows the 3' end of the mRNA to attach to the ribosome.
D) It adds the poly–A tail to the 3' end of the mRNA.
E) It codes for a sequence in eukaryotic transcripts that signals enzymatic cleavage ~10—35 nucleotides away.

44) What is a ribozyme? 44) _____

A) an enzyme that catalyzes the association between the large and small ribosomal subunits
B) an enzyme that synthesizes RNA as part of the transcription process
C) an RNA with enzymatic activity
D) an enzyme that synthesizes RNA primers during DNA replication
E) an enzyme that uses RNA as a substrate

45) Garrod hypothesized that "inborn errors of metabolism" such as alkaptonuria occur because 45) _____

A) metabolic enzymes require vitamin cofactors, and affected individuals have significant nutritional deficiencies.
B) certain metabolic reactions are carried out by ribozymes, and affected individuals lack key splicing factors.
C) enzymes are made of DNA, and affected individuals lack DNA polymerase.
D) many metabolic enzymes use DNA as a cofactor, and affected individuals have mutations that prevent their enzymes from interacting efficiently with DNA.
E) genes dictate the production of specific enzymes, and affected individuals have genetic defects that cause them to lack certain enzymes.

46) What is the function of GTP in translation? 46) _____

A) GTP hydrolyzes to provide energy for making peptide bonds.
B) GTP separates the small and large subunits of the ribosome at the stop codon.
C) GTP supplies phosphates and energy to make ATP from ADP.
D) GTP hydrolyzes to provide phosphate groups for tRNA binding.
E) GTP energizes the formation of the initiation complex, using initiation factors.

47) Which of the following does not occur in prokaryotic eukaryotic gene expression, but does in eukaryotic gene expression? 47) _____

A) RNA polymerase binds to the promoter.
B) A poly–A tail is added to the 3' end of an mRNA and a cap is added to the 5' end.
C) RNA polymerase requires a primer to elongate the molecule.
D) Transcription can begin as soon as translation has begun even a little.
E) mRNA, tRNA, and rRNA are transcribed.

48) The "universal" genetic code is now known to have exceptions. Evidence for this can be found if which of the following is true? 48) _____

A) If a single mRNA molecule is found to translate to more than one polypeptide when there are two or more AUG sites.
B) If UGA, usually a stop codon, is found to code for an amino acid such as tryptophan (usually coded for by UGG only).
C) If prokaryotic organisms are able to translate a eukaryotic mRNA and produce the same polypeptide.
D) If several codons are found to translate to the same amino acid, such as serine.
E) If one stop codon, such as UGA, is found to have a different effect on translation than another stop codon, such as UAA.

49) Which of the following is *not* true of a codon? 49) _____

A) It is the basic unit of the genetic code.
B) It never codes for more than one amino acid.
C) It extends from one end of a tRNA molecule.
D) It may code for the same amino acid as another codon.
E) It consists of three nucleotides.

50) Which of the following is a function of a signal peptide? 50) _____

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

51) Which of the following provides some evidence that RNA probably evolved before DNA? 51) _____

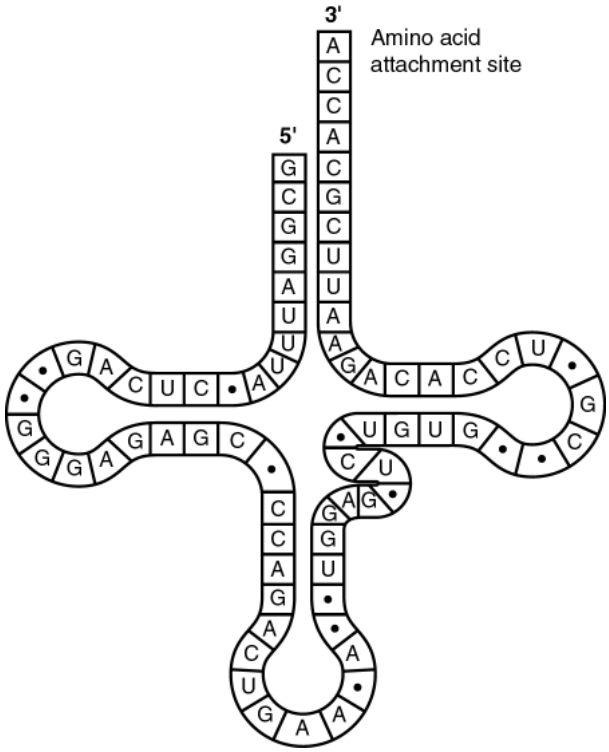
A) DNA polymerase has proofreading function.
B) RNA polymerase uses DNA as a template.
C) RNA polymerase makes a single–stranded molecule.
D) RNA polymerase does not require localized unwinding of the DNA.
E) DNA polymerase uses primer, usually made of RNA.

52) A mutant bacterial cell has a defective aminoacyl synthetase that attaches a lysine to tRNAs with the anticodon AAA instead of the normal phenylalanine. The consequence of this for the cell will be that 52) _____

A) the ribosome will skip a codon every time a UUU is encountered.
B) the cell will compensate for the defect by attaching phenylalanine to tRNAs with lysine–specifying anticodons.
C) proteins in the cell will include lysine instead of phenylalanine at amino acid positions specified by the codon UUU.
D) none of the options will occur; the cell will recognize the error and destroy the tRNA.
E) none of the proteins in the cell will contain phenylalanine.

53) There are 61 mRNA codons that specify an amino acid, but only 45 tRNAs. This is best explained by the fact that 53) _____

A) many codons are never used, so the tRNAs that recognize them are dispensable.
B) the rules for base pairing between the third base of a codon and tRNA are flexible.
C) competitive exclusion forces some tRNAs to be destroyed by nucleases.
D) the DNA codes for all 61 tRNAs but some are then destroyed.
E) some tRNAs have anticodons that recognize four or more different codons.



54) The figure represents tRNA that recognizes and binds a particular amino acid (in this instance, phenylalanine). Which codon on the mRNA strand codes for this amino acid? 54) _____

A) CAU B) GUG C) UUC D) UGG E) GUA

55) Which component is *not* directly involved in translation? 55) _____

A) DNA
B) tRNA
C) ribosomes
D) mRNA
E) GTP

56) Gene expression in the domain Archaea in part resembles that of bacteria and in part that of the domain Eukarya. In which way is it most like the domain Eukarya? 56) _____

A) Domain Archaea have numerous transcription factors.
B) There is only one RNA polymerase.
C) Initiation of translation is like that of domain Eukarya.
D) Post–transcriptional splicing is like that of Eukarya.
E) Transcription termination often involves attenuation.

57) In the structural organization of many eukaryotic genes, individual exons may be related to which of the following? 57) _____

A) the number of start sites for transcription
B) the sequence of the intron that immediately precedes each exon
C) the various domains of the polypeptide product
D) the number of restriction enzyme cutting sites
E) the number of polypeptides making up the functional protein

58) Which of the following is the first event to take place in translation in eukaryotes? 58) _____

A) elongation of the polypeptide
B) base pairing of activated methionine–tRNA to AUG of the messenger RNA
C) binding of the larger ribosomal subunit to smaller ribosomal subunits
D) the small subunit of the ribosome recognizes and attaches to the 5' cap of mRNA
E) covalent bonding between the first two amino acids

59) What is the effect of a nonsense mutation in a gene? 59) _____

A) It has no effect on the amino acid sequence of the encoded protein.
B) It introduces a premature stop codon into the mRNA.
C) It alters the reading frame of the mRNA.
D) It prevents introns from being excised.
E) It changes an amino acid in the encoded protein.

The following questions refer to this table of codons.

First Base	Second Base: U	Second Base: C	Second Base: A	Second Base: G	Third Base
U	UUU, UUC — Phe UUA, UUG — Leu	UCU, UCC, UCA, UCG — Ser	UAU, UAC — Tyr UAA — Stop UAG — Stop	UGU, UGC — Cys UGA — Stop UGG — Trp	U C A G
C	CUU, CUC, CUA, CUG — Leu	CCU, CCC, CCA, CCG — Pro	CAU, CAC — His CAA, CAG — Gln	CGU, CGC, CGA, CGG — Arg	U C A G
A	AUU, AUC, AUA — Ile AUG — Met or Start	ACU, ACC, ACA, ACG — Thr	AAU, AAC — Asn AAA, AAG — Lys	AGU, AGC — Ser AGA, AGG — Arg	U C A G
G	GUU, GUC, GUA, GUG — Val	GCU, GCC, GCA, GCG — Ala	GAU, GAC — Asp GAA, GAG — Glu	GGU, GGC, GGA, GGG — Gly	U C A G

60) A possible sequence of nucleotides in the template strand of DNA that would code for the polypeptide sequence phe–leu–ile–val would be 60) _____

A) 3' AAA–AAT–ATA–ACA 5'.
B) 3' AAA–GAA–TAA–CAA 5'.
C) 3' AAC–GAC–GUC–AUA 5'.
D) 5' AUG–CTG–CAG–TAT 3'.
E) 5' TTG–CTA–CAG–TAG 3'.

61) RNA polymerase in a prokaryote is composed of several subunits. Most of these subunits are the same for the transcription of any gene, but one, known as sigma, varies considerably. Which of the following is the most probable advantage for the organism of such sigma switching? 61) _____

A) It could alter the rate of translation and of exon splicing.
B) It might allow the polymerase to recognize different promoters under certain environmental conditions.
C) It could allow ribosomal subunits to assemble at faster rates.
D) It could allow the polymerase to react differently to each stop codon.
E) It might allow the transcription process to vary from one cell to another.

62) In his transformation experiments, what did Griffith observe? 62) _____

A) Mixing a heat–killed nonpathogenic strain of bacteria with a living pathogenic strain makes the pathogenic strain nonpathogenic.
B) Mice infected with a pathogenic strain of bacteria can spread the infection to other mice.
C) Infecting mice with nonpathogenic strains of bacteria makes them resistant to pathogenic strains.
D) Mixing a heat–killed pathogenic strain of bacteria with a living nonpathogenic strain can convert some of the living cells into the pathogenic form.
E) Mutant mice were resistant to bacterial infections.

63) 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 which of the following? 63) _____

A) side groups of nitrogenous bases
B) phosphate–sugar backbones
C) sequence of bases
D) different five–carbon sugars
E) complementary pairing of bases

64) The leading and the lagging strands differ in that 64) _____

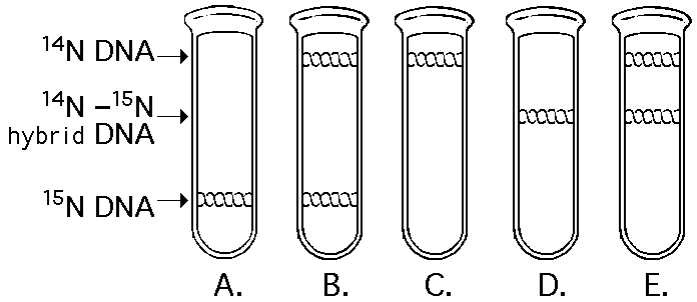
A) the leading strand is synthesized in the same direction as the movement of the replication fork, and the lagging strand is synthesized in the opposite direction.
B) the lagging strand is synthesized continuously, whereas the leading strand is synthesized in short fragments that are ultimately stitched together.
C) 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.
D) the leading strand is synthesized at twice the rate of the lagging strand.

65) What is meant by the description "antiparallel" regarding the strands that make up DNA? 65) _____

A) Base pairings create unequal spacing between the two DNA strands.
B) One strand is positively charged and the other is negatively charged.
C) The 5' to 3' direction of one strand runs counter to the 5' to 3' direction of the other strand.
D) One strand contains only purines and the other contains only pyrimidines.
E) The twisting nature of DNA creates nonparallel strands.

66) Which of the following would you expect of a eukaryote lacking telomerase? 66) _____

A) a reduction in chromosome length in gametes
B) a high probability of somatic cells becoming cancerous
C) inability to repair thymine dimers
D) high sensitivity to sunlight
E) production of Okazaki fragments



67) In the late 1950s, Meselson and Stahl grew bacteria in a medium containing "heavy" nitrogen (^{15}N) and then transferred them to a medium containing ^{14}N. Which of the results in the figure above would be expected after one round of DNA replication in the presence of ^{14}N? 67) _____

A) A B) B C) C D) D E) E

68) Which of the following help(s) to hold the DNA strands apart while they are being replicated? 68) _____

A) single–strand binding proteins
B) DNA polymerase
C) ligase
D) primase
E) exonuclease

69) Suppose you are provided with an actively dividing culture of *E. coli* bacteria to which radioactive thymine has been added. What would happen if a cell replicates once in the presence of this radioactive base? 69) _____

A) Neither of the two daughter cells would be radioactive.
B) DNA in both daughter cells would be radioactive.
C) Radioactive thymine would pair with nonradioactive guanine.
D) One of the daughter cells, but not the other, would have radioactive DNA.
E) All four bases of the DNA would be radioactive.

70) *E. coli* cells grown on ^{15}N medium are transferred to ^{14}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? 70) _____

A) one low–density band
B) one high–density and one low–density band
C) one intermediate–density band
D) one low–density and one intermediate–density band
E) one high–density and one intermediate–density band

71) In analyzing the number of different bases in a DNA sample, which result would be consistent with the base–pairing rules? 71) _____

A) $A = C$
B) $A + G = C + T$
C) $G = T$
D) $A = G$
E) $A + T = G + T$

72) Which of the following sets of materials are required by both eukaryotes and prokaryotes for replication? 72) _____

A) topoisomerases, telomerases, polymerases
B) ligase, primers, nucleases
C) G–C rich regions, polymerases, chromosome nicks
D) nucleosome loosening, four dNTPs, four rNTPs
E) double–stranded DNA, four kinds of dNTPs, primers, origins

73) Which of the following statements is true of histones? 73) _____

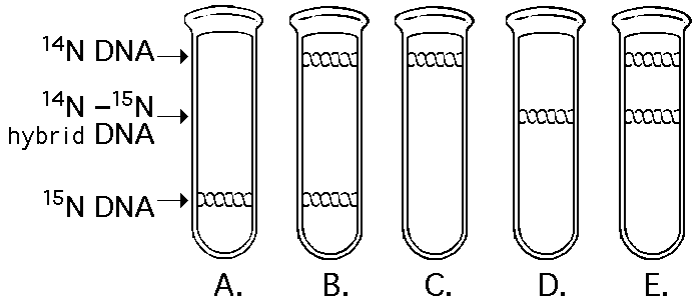
A) Histone H1 is not present in the nucleosome bead; instead, it draws the nucleosomes together.
B) The carboxyl end of each histone extends outward from the nucleosome and is called a "histone tail."
C) Each nucleosome consists of two molecules of histone H1.
D) The mass of histone in chromatin is approximately nine times the mass of DNA.
E) Histones are found in mammals, but not in other animals or in plants or fungi.

74) What is the function of DNA polymerase III? 74) _____

A) to seal together the broken ends of DNA strands
B) to rejoin the two DNA strands (one new and one old) after replication
C) to add nucleotides to the 3' end of a growing DNA strand
D) to unwind the DNA helix during replication
E) to degrade damaged DNA molecules

75) For a science fair project, two students decided to repeat the Hershey and Chase experiment, with modifications. They decided to label the nitrogen of the DNA, rather than the phosphate. They reasoned that each nucleotide has only one phosphate and two to five nitrogens. Thus, labeling the nitrogens would provide a stronger signal than labeling the phosphates. Why won't this experiment work? 75) _____

A) There is no radioactive isotope of nitrogen.
B) Radioactive nitrogen has a half–life of 100,000 years, and the material would be too dangerous for too long.
C) Amino acids (and thus proteins) also have nitrogen atoms; thus, the radioactivity would not distinguish between DNA and proteins.
D) Although there are more nitrogens in a nucleotide, labeled phosphates actually have 16 extra neutrons; therefore, they are more radioactive.
E) Avery et al. have already concluded that this experiment showed inconclusive results.



76) A space probe returns with a culture of a microorganism found on a distant planet. Analysis shows that it is a carbon–based life–form that has DNA. You grow the cells in ^{15}N medium for several generations and then transfer them to ^{14}N medium. Which pattern in the figure above would you expect if the DNA was replicated in a conservative manner? 76) _____

A) A B) B C) C D) D E) E

Use the following list of choices for the following questions:

I. helicase
II. DNA polymerase III
III. ligase
IV. DNA polymerase I
V. primase

77) Which of the enzymes synthesizes short segments of RNA? 77) _____

A) I B) II C) III D) IV E) V

78) After mixing a heat–killed, phosphorescent strain of bacteria with a living nonphosphorescent strain, you discover that some of the living cells are now phosphorescent. Which observations would provide the best evidence that the ability to fluoresce is a heritable trait? 78) _____

A) The phosphorescence in the living strain is especially bright.
B) Descendants of the living cells are also phosphorescent.
C) Protein passed from the heat–killed strain to the living strain.
D) Both DNA and protein passed from the heat–killed strain to the living strain.
E) DNA passed from the heat–killed strain to the living strain.

79) What is the basis for the difference in how the leading and lagging strands of DNA molecules are synthesized? 79) _____

A) Polymerase can work on only one strand at a time.
B) Helicases and single–strand binding proteins work at the 5' end.
C) The origins of replication occur only at the 5' end.
D) DNA polymerase can join new nucleotides only to the 3' end of a growing strand.
E) DNA ligase works only in the 3' → 5' direction.

80) In an analysis of the nucleotide composition of DNA, which of the following will be found? 80) _____

A) A = G and C = T B) A = C
C) G + C = T + A D) A + C = G + T

Answer Key
Testname: UNTITLED1

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

50) B
51) E
52) C
53) B
54) C
55) A
56) A
57) C
58) D
59) B
60) B
61) B
62) D
63) C
64) A
65) C
66) A
67) D
68) A
69) B
70) D
71) B
72) E
73) A
74) C
75) C
76) B
77) E
78) B
79) D
80) D