

Big Idea 3: Multiple Choice

1. You are studying an organism and discovered that its genetic information is stored in a circular chromosome. This indicates
 - a. It is a transgenic organism
 - b. It uses RNA to store genetic material
 - c. It is a prokaryote
 - d. Its chromosome is single-stranded

2. More enzymes are involved in the replication of the lagging strand of DNA than the leading strand of DNA because
 - a. DNA can only be synthesized from the 5' end to the 3' end
 - b. Initiation of replication occurs on the lagging DNA strand, requiring additional transcription enzymes
 - c. The lagging strand contains uracil bases which must be converted to thymine bases
 - d. The lagging strand adds new nucleotides to the phosphate end of the DNA backbone

3. Cytosine and guanine always pair in DNA because
 - a. They are both purines, having a double-ring structure
 - b. They form disulfide bonds, unlike adenine – thymine pairs
 - c. They are only present in DNA, not RNA
 - d. They form 3 hydrogen bonds, while adenine – thymine form 2 hydrogen bonds

4. Which of the following is not a shared characteristic of both DNA and RNA?
 - a. Uracil bases
 - b. Sugar – phosphate backbones
 - c. Purine – pyrimidine base pairing
 - d. 5' to 3' synthesis

5. A toxin is introduced into an organism which affects the three-dimensional configuration of primase. Which of the following would still occur?
 - a. Replication of the leading DNA strand
 - b. Replication of the lagging DNA strand
 - c. Incorporation of RNA primers into DNA
 - d. Mitosis

6. In the Hershey-Chase experiment, DNA was labeled with
 - a. Radioactive sulfur
 - b. Radioactive phosphorus
 - c. Radioactive deoxyribose
 - d. Radioactive thymine

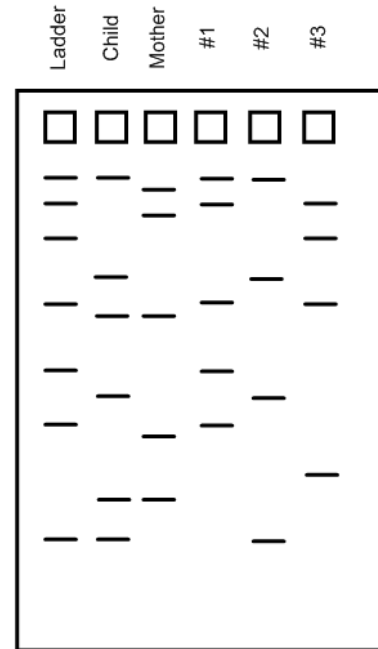
7. All of the following statements are true regarding prokaryotic and eukaryotic chromosomes except
- Both prokaryotic and eukaryotic chromosomes are double-stranded
 - Eukaryotic chromosomes are located in the nucleus of the cell, while prokaryotic chromosomes are located in the nucleoid region of the cell
 - Prokaryotic chromosomes undergo replication prior to cell division, eukaryotic chromosomes undergo replication during the mitotic phase
 - Both prokaryotic and eukaryotic organisms utilize DNA polymerase to replicate their chromosomes
8. Genetic information always flows from DNA to RNA to protein except in which case?
- In archaea which need to adapt quickly to extreme environments
 - In retroviruses, such as influenza
 - In embryonic stem cells
 - In cells undergoing meiosis
9. Which of the following statements regarding transcription in prokaryotes is accurate?
- Transcription occurs in the cytoplasm of the cell
 - Both strands of DNA are transcribed simultaneously
 - RNA primase is the enzyme responsible for transcription
 - During transcription, DNA is read from 5' end to 3' end
10. Which of the following statements regarding translation in prokaryotes is false?
- Translation occurs in the cytoplasm of the cell
 - The start codon codes for the amino acid methionine
 - The anticodons of tRNA base pair with the codons of mRNA at the ribosome
 - Codons are pairs of nucleotides in a RNA strand
11. Which of the following statements regarding transcription in eukaryotes is false?
- Transcription occurs in the nucleus of the cell
 - Transcription of the gene is initiated by transcription factors at the promoter region
 - Transcription stops when RNA polymerase reaches the stop codon on the DNA strand
 - Transcription is followed by the addition of a poly-A tail and a modified guanine cap

12. Which of the following statements regarding translation in eukaryotes is accurate?
- Ribosomes translate rRNA into protein
 - Only the exons of the gene are translated into protein
 - Most translation occurs in the smooth endoplasmic reticulum
 - Additional translation factors are required to initiate translation of RNA
13. Which of the following is not a shared feature of gene expression in all living organisms?
- mRNA splicing occurs prior to translation
 - Transcription of genes is initiated by transcription factors produced as a result of signal-transduction pathways
 - Errors in transcription of DNA have no effect on the stored genetic information
 - Ribosomes catalyze the reaction necessary to create peptide bonds between amino acids
14. Which of the following mutations would be most likely to have a harmful effect on an organism?
- A base-pair substitution mutation
 - A single base deletion near the middle of an intron
 - A single base insertion near the middle of an exon
 - A deletion of three bases near the end of a gene
15. The phenotype of a hemophiliac is the direct result of
- A single base pair mutation in a gene on the X chromosome
 - Competitive inhibition of RNA polymerase during transcription
 - A lack of coagulation (clotting) factors in the blood
 - Transcription of coagulation factors with a mutated tertiary structure
16. Lactose intolerance is the direct result of
- Evolutionary pressure to wean offspring early
 - The inability of the digestive system to diffuse lactose into the cells
 - A noncompetitive inhibitor affecting the enzymes responsible for lactose breakdown
 - A decrease in production of the enzyme lactase after weaning
17. A small amount of DNA is found at a crime scene. To increase the availability of this DNA for testing technicians will use

- a. Gel electrophoresis
- b. Polymerase chain reaction
- c. Restriction enzymes
- d. Bioengineering

18. A gel is run using the DNA of a child, his mother, and three potential fathers. Using the results to the right, determine who is the father of the child.

- a. Man #1
- b. Man #2
- c. Man #3
- d. None of the above



19. Bacteria can be used to synthesize human insulin for diabetic patients. Which of the following correctly illustrates the steps necessary to produce this medication?

- a. Cut the gene from the human genome using restriction enzymes, amplify the amount of DNA using gel electrophoresis, insert the gene on a plasmid, transform bacteria using the plasmid
- b. Cut the gene from the human genome using restriction enzymes, amplify the amount of DNA using polymerase chain reaction, insert the gene into bacteria, incubate the bacteria at 37°C
- c. Locate the gene using a DNA sequencer, remove the gene from the genome, amplify the amount of DNA using polymerase chain reaction, insert the gene onto a plasmid, transform bacteria using the plasmid
- d. Locate the gene using a DNA sequencer, remove the gene from the genome, amplify the amount of DNA using polymerase chain reaction, insert the gene onto a plasmid, insert the plasmid into human cell

20. Zebra fish, known as GloFish, have genes for fluorescence extracted from jellyfish and inserted into their genomes. Which of the following statements is true regarding these fish?

- a. For successful fluorescence, the jellyfish DNA must be inserted into the zebra fish in its embryonic stage.
- b. Plasmids, located in the cytoplasm of the fish cells, are transcribed by the native RNA polymerase
- c. The process of creating GloFish is an example of synthetic biology
- d. All cells of the GloFish express the jellyfish gene

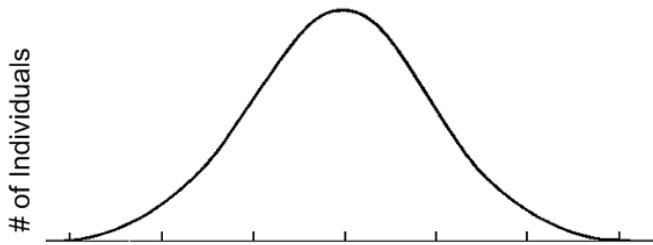
21. One difference between a cancer cell and normal cell is that

- a. Cancer cells do not successfully complete cytokinesis
- b. Cancer cells do not exhibit contact inhibition
- c. Cancer cells are totipotent
- d. Cancer cells are pluripotent

22. A particular cell has half the amount of DNA as other cells in mitotically active tissue. This cell is likely in which phase?
- Gap 1
 - Gap 2
 - Prophase
 - Metaphase
23. Increased Cdk (cyclin-dependent kinase) activity in the cell will likely result in
- Increased DNA polymerase activity
 - Increased RNA polymerase activity
 - Decreased concentration of maturation promotion factor (MPF)
 - Decreased mitotic activity
24. If a cell were to undergo mitosis without first passing through the S phase, what would likely result?
- An increase in the duration of Gap 2
 - Four gametes
 - Two haploid daughter cells
 - Cancer cells
25. In some organisms, mitosis occurs without cytokinesis occurring. This will result in
- Cells with more than one nucleus
 - Cells that are lacking nuclei
 - Cells with an abnormal number of chromosomes
 - Cells that are unusually large
26. Germ cells in women undergo meiosis and create eggs. Which of the following statements is false regarding a woman's eggs?
- Independent assortment and crossing over during meiosis create genetically unique egg cells
 - Egg cells contain half the number of chromosomes when compared to body cells of the woman
 - Each meiotic division creates four eggs cells in the woman
 - Egg cells are much larger in size than sperm cells
27. Which of the following does not increase the genetic variation in a population?
- Crossing over
 - Independent assortment
 - Metaphase
 - Mitosis

28. Which of the following is true regarding genes on the X chromosome?
- Genes on the X chromosome control expression of sexual characteristics
 - Recessive disorders located on the X chromosomes are more commonly expressed in men
 - The X chromosome contains the genes for mitochondria
 - The X chromosome determines femaleness in all species
29. Five genes, A B C D and E, are located on the same chromosome and linked in the order given. Crossing over would occur most frequently between the loci of
- A and B
 - B and C
 - D and E
 - A and E
30. Fertilization results in all of the following except
- Fusion of the endosymbiotic organelles
 - The creation of diploid totipotent cells
 - A genetically unique zygote
 - Rapid mitosis in the fused cell
31. Which of the following correctly distinguishes between mitosis and meiosis?
- DNA replication occurs prior to mitosis but not meiosis
 - Cytokinesis divides the nucleus of mitosis but not meiosis
 - Sister chromatids are separated during anaphase of mitosis but they are separated during anaphase II of meiosis
 - The nuclear envelope breaks down during prophase of mitosis but during metaphase of meiosis
32. Nondisjunction is the failure of chromosomes or sister chromatids to separate during meiosis. Which of the following statements is false regarding nondisjunction?
- Nondisjunction results in gametes with abnormal numbers of chromosomes
 - Nondisjunction occurs during anaphase I or II
 - In many instances, nondisjunction results in the spontaneous abortion when the gamete undergoes fertilization
 - Nondisjunction occurs in females and incidence increases with age

33. The graph below depicts the distribution of a particular trait. The most likely inheritance pattern for this particular trait is



- a. Polygenic
- b. Codominance
- c. Incomplete dominance
- d. Sex-linked

34. The mitochondrial DNA (mtDNA) of children has been found to be identical to the mtDNA of their mothers. The best explanation for this is
- a. The mtDNA of men is recessive to the mtDNA of women
 - b. The mtDNA of sperm is destroyed after fertilization of the egg
 - c. Only eggs contain mtDNA
 - d. The genes coding for mitochondria are located on the X chromosome

35. Mitochondrial diseases are a group of disorders caused by malfunctioning mitochondria. Which of the following statements is true regarding these disorders?
- a. These disorders are more common in women than men
 - b. These disorder can only be passed from mother to child
 - c. Disorders of the mitochondria will affect RNA polymerase activity in the cell
 - d. Mitochondrial disorders result from faulty meiosis

36. Some mutations cause an overexpression of bicoid protein. What would likely occur as a result of this type of mutation?
- a. Growth of ventral structures on the dorsal surface of the organism
 - b. Decreased expression of homeotic genes
 - c. Lack of brain development
 - d. Lack of development of posterior structures

37. Silent mutations do not affect the structure of the resulting protein. This is best explained by
- a. Redundancy in the genetic code
 - b. Exons mutate at a much greater rate than introns
 - c. Transcription factors repair DNA mutations prior to transcription
 - d. These mutations only occur in "junk DNA"

38. In an *eyeless* mutant fruit fly, an eye grows ectopically on the leg of the fly. The *eyeless* gene is an example of which type of gene?
- a. Homeotic genes
 - b. Maternal effect genes
 - c. Mitochondrial genes
 - d. Segmentation genes

Template strand: TACAAAGGCTTAATT

Non-Template strand: ATGTTTCCGAATTAA

39. The primary sequence of the protein which results from the above strand of DNA is

- a. Tyrosine – Lysine – Glycine – Leucine – Isoleucine
- b. Methionine – Phenylalanine – Proline – Asparagine – Stop
- c. Methionine – Tyrosine – Lysine – Glycine – Leucine
- d. Methionine – Phenylalanine – Proline – Asparagine

40. The lac operon is an inducible operon. This means

- a. The protein coded for by the lac operon is consistently transcribed
- b. Lactose initiates a signal transduction pathway leading to transcription of the lac operon
- c. The lac operon is an example of a positive feedback loop
- d. In the absence of lactose the lac operon switches on to increase sugar concentration

Answers

1. C
2. A
3. D
4. A
5. A
6. B
7. C
8. B
9. A
10. D
11. C
12. B
13. B
14. C
15. C
16. D
17. B
18. B
19. C
20. A
21. B
22. A
23. A
24. C
25. A
26. C
27. D
28. B
29. D
30. A
31. C
32. C
33. A
34. B
35. B
36. D
37. A
38. A
39. D
40. B