Student name:\_\_\_\_\_\_\_\_\_\_

**TRUE/FALSE - Write 'T' if the statement is true and 'F' if the statement is false.  
1)** If cells are damaged, they are destroyed and removed from the body. These cells are then replaced with new cells.

⊚ true  
 ⊚ false

**2)** The only way a physician can diagnose cancer is to detect cancer cells in the blood.

⊚ true  
 ⊚ false

**3)** All cells are specialized to have the same function.

⊚ true  
 ⊚ false

**4)** DNA is the only nucleic acid found in cells.

⊚ true  
 ⊚ false

**5)** In the human genome, there is an equal ratio of genes to proteins expressed.

⊚ true  
 ⊚ false

**6)** After transcription, the entire mRNA is translated into a polypeptide.

⊚ true  
 ⊚ false

**7)** If a mutation occurs that results in the change of an amino acid, this will not alter the shape of the protein, and the protein will function the same.

⊚ true  
 ⊚ false

**8)** The daughter cells produced through mitosis are genetically unique from the parent cell.

⊚ true  
 ⊚ false

**9)** Mutations in DNA can result in cancerous cells. These cells are structurally altered but their functions remain normal.

⊚ true  
 ⊚ false

**10)** Each time the cell divides, the telomerase enzyme shortens the length of the chromosome.

⊚ true  
 ⊚ false

**11)** In cancerous cells, checkpoints still operate as normal and cell division is monitored.

⊚ true  
 ⊚ false

**12)** The BRCA1 gene is involved in producing a protein that activates DNA repair enzymes, stopping the cell cycle, and putting the cell in G 0 phase.

⊚ true  
 ⊚ false

**13)** Growth factors, in the form of hormones, bind to receptor proteins which decreases the expression of proto-oncogenes and decreases cell division.

⊚ true  
 ⊚ false

**14)** In breast cancer patients, there may be overexpression in the ERBB2 gene. This overexpression results in the disregard of damaged DNA.

⊚ true  
 ⊚ false

**15)** The life span of normal cells and cancerous cells is the same.

⊚ true  
 ⊚ false

**16)** Malignant tumors can spread through tissues by digesting proteins with the enzyme lipase.

⊚ true  
 ⊚ false

**17)** The main difference between Stage 1A and 1B is the size of the tumor. In Stage 1B, the tumor has grown much larger than observed in Stage 1A.

⊚ true  
 ⊚ false

**18)** In breast cancer patients, lymph nodes are biopsied to determine the size of the tumor.

⊚ true  
 ⊚ false

**19)** Negative feedback works to maintain homeostasis within the body.

⊚ true  
 ⊚ false

**20)** If an individual has only one mutated copy of the *BRCA1* tumor-suppressor gene, the other copy of the *BRCA1* gene cannot act as a regulator of the cell cycle.

⊚ true  
 ⊚ false

**CHECK ALL THE APPLY. Choose all options that best completes the statement or answers the question.  
21)** From the list provided, what would be helpful to differentiate eukaryotes from prokaryotes? (Check all that apply.)

A) The size of the ribosomes   
 B) The size of the cell  
 C) The plasma membrane  
 D) Organelles

**22)** From the following list, select those that are characteristics of life. (Check all that apply.)

A) The ability to move   
 B) The ability to reproduce  
 C) The ability to communicate  
 D) The ability to acquire materials and energy  
 E) The ability to respond to the environment

**23)** DNA nucleotides consist of several parts. From the list below, select the parts that would be found in DNA nucleotides. (Check all that apply.)

A) Phosphate group   
 B) Ribose  
 C) Adenine  
 D) Uracil  
 E) Deoxyribose

**24)** Gene expression occurs through transcription and then translation. From the provided list, select all that pertain to transcription. (Check all that apply.)

A) Creation of mRNA   
 B) Linking together amino acids  
 C) Using RNA polymerase  
 D) Using DNA as a template  
 E) Reading codons

**25)** From the list provided, select the two obstacles of gene expression.

A) DNA is in the nucleus.   
 B) DNA and RNA are two different types of molecules.  
 C) Proteins are composed of amino acids.  
 D) Ribosomes are required for protein expression.  
 E) RNA polymerase is not efficient.

**26)** From the following list, select all that can apply to cancerous cells. (Check all that apply.)

A) Damaged DNA   
 B) Directed apoptosis  
 C) Uncontrolled cell division  
 D) Monitoring with checkpoints  
 E) Daughter cells with correct genetic information

**27)** From the list, select the most common mutagens. (Check all that apply.)

A) Bacteria   
 B) Viruses  
 C) Radiation  
 D) Animals  
 E) Chemicals

**28)** From the list, select all of the following that pertain to this state. (Check all that apply.)  
 If a patient is screened for cancerous cells, a doctor is looking for cells that are \_\_\_\_\_\_\_\_\_\_.

A) less specialized   
 B) functioning as part of an organ  
 C) not in their original location  
 D) dividing uncontrollably  
 E) undergoing apoptosis

**29)** From the following list, select all that define the functions of enzymes. (Check all that apply.)

A) A narrow pH range   
 B) A wide temperature range  
 C) A narrow temperature range  
 D) A narrow salt concentration range  
 E) A high salt concentration range

**30)** From the list of organ systems, select the ones that play a major role in homeostasis. (Check all that apply.)

A) Endocrine system   
 B) Cardiovascular system  
 C) Urinary system  
 D) Immune system  
 E) Digestive system

**31)** Some antimetabolites are called antibiotics. From the list below, select all statements that characterize these compounds. (Check all that apply.)

A) They are designed to kill bacteria.   
 B) They interfere with specific enzyme functions.  
 C) They interfere with RNA formation during gene expression.  
 D) They interfere with DNA replication.  
 E) They can be used to treat any infection.

**32)** From the classes of chemotherapeutic drugs listed below, select those that would interfere with DNA synthesis. (Check all that apply.)

A) Alkaloids   
 B) Taxanes  
 C) Antimetabolites  
 D) Alkylating agents  
 E) Topoisomerase inhibitors

**33)** CRISPR is a genetic editing process. From the list provided, select all that are required for this process to be successful. (Check all that apply.)

A) A Cas9 enzyme to identify the correct DNA sequence   
 B) A complementary guide DNA molecule to assist the Cas9 enzyme  
 C) A regulatory region called a PAM sequence  
 D) A single-stranded break of DNA  
 E) A target DNA sequence

**MULTIPLE CHOICE - Choose the one alternative that best completes the statement or answers the question.  
34)** Tumor suppressor genes

A) halt cell division if an error is found in the DNA.   
 B) cause an increase in cell division if an error is found in DNA.  
 C) slow the rate of cell division.  
 D) allow cells to remain at a constant cell division.

**35)** You are reading an article about a person being diagosed with a type of sarcoma. This type of cancer affects \_\_\_\_\_\_\_\_\_\_.

A) the skin   
 B) white blood cells  
 C) connective tissue  
 D) cells related to the immune system

**36)** A research oncologist is one who studies the causes and treatments of cancer. What area(s) would a research oncologist study to understand the formation of a new cancer?

A) Genetic factors   
 B) Environmental factors  
 C) Prevalence in males versus females  
 D) All of the answer choices are correct.

**37)** Thinking about the hierarchy of biological organization, which of the following includes the others?

A) Cells   
 B) Organs  
 C) Organ systems  
 D) Tissues  
 E) Organelles

**38)** Lung cancer was the leading cause of cancer-related deaths during the mid-1990s. Which group was most impacted?

A) Males   
 B) Females

**39)** If a person has a cancer that interferes with organs of the urinary system, that person may have trouble

A) getting oxygen to tissues.   
 B) with regulating the water-salt balance of the blood.  
 C) getting nutrients and water to tissues.  
 D) fighting off other diseases.

**40)** Cancer begins when

A) a tumor forms.   
 B) there is an abnormal function of an organ system.  
 C) cells divide uncontrollably.  
 D) an organ stops functioning.  
 E) All of the answer choices are correct.

**41)** Which of the following statements describes DNA?

A) DNA encodes for proteins that are involved in cellular regulation.   
 B) DNA is the genetic material called the genome.  
 C) Sections of DNA are called genes.  
 D) All of the answer choices are correct.

**42)** The shape of the active site

A) determines the substrate that is broken down.   
 B) changes to fit all substrates.  
 C) can be modified by cell signals.  
 D) changes after breaking down its first substrate.

**43)** Ribosomes

A) convert energy in food into usable energy for the cell.   
 B) use genetic information to synthesize proteins.  
 C) digest incoming nutrients.  
 D) allow for passage of materials in and out of the cell.

**44)** What cell organelle converts the energy found in food into a form usable by cells?

A) Mitochondrion   
 B) Lysosome  
 C) Centriole  
 D) Golgi apparatus

**45)** During the division of eukaryotic cells, the \_\_\_\_\_\_ assists by dividing the genetic material and cell contents into the two resulting cells.

A) nucleus   
 B) centrioles  
 C) ribosomes  
 D) lysosome  
 E) mitochondria

**46)** Cells are specialized to form tissues and organs through the control of gene expression. Gene expression is regulated (turning on and off genetic instructions) by

A) nearby cell signals.   
 B) environmental factors.  
 C) nearby cell signals and environmental factors.  
 D) rapid cell divisions.  
 E) nearby cell signals and rapid cell divisions.

**47)** Cancer cells \_\_\_\_\_\_\_\_\_\_.

A) are less specialized   
 B) no longer function with neighboring cells  
 C) divide rapidly  
 D) ignore the genetic information  
 E) All of the answer choices are correct.

**48)** At the cellular level, enzymes work by

A) using more energy to assist the reaction.   
 B) lowering the activation energy of the reaction.  
 C) maintaining a constant breakdown of the substrate.  
 D) being consumed in the reaction.

**49)** In a biochemical pathway consisting of three enzymes,

A) the first enzyme releases a product that is a substrate for the second enzyme.   
 B) the first enzyme provides energy for the second enzyme.  
 C) the first enzyme releases a product that is a substrate for the last enzyme.  
 D) the second enzyme provides energy for the first enzyme.  
 E) the first enzyme releases a product that is a substrate for the second enzyme, then the second enzyme releases a product for the third enzyme.

**50)** DNA is a

A) single strand of nucleotides arranged in helical structure.   
 B) double strand of nucleotides arranged in a linear structure.  
 C) double strand of nucleotides arranged in a helical structure.  
 D) single strand of nucleotides arranged in either a linear or helical structure.  
 E) double strand of nucleotides arranged in either a linear or helical structure.

**51)** The two strands of DNA are held together by hydrogen bonds between complementary nucleotides. Which of the following correctly matches the complementary nucleotides of DNA?

A) Adenine:thymine and cytosine:guanine   
 B) Adenine:cytosine and guanine:thymine  
 C) Thymine:cytosine and adenine:guanine  
 D) Uracil:adenine and cytosine:guanine  
 E) Uracil:cytosine and adenine:guanine

**52)** In animal cells, DNA is located in the \_\_\_\_\_\_\_\_\_\_.

A) cytoplasm   
 B) nucleus  
 C) ribosomes  
 D) lysozymes  
 E) golgi apparatus

**53)** Ribosomes are located on the \_\_\_\_\_\_\_\_\_\_.

A) nucleus   
 B) lysosomes  
 C) smooth endoplasmic reticulum  
 D) rough endoplasmic reticulum  
 E) plasma membrane

**54)** The purpose of transcription is to

A) make mRNA that will carry the instructions for making proteins outside of the nucleus.   
 B) replicate DNA to provide a new copy for cellular division.  
 C) link together amino acids to form a polypeptide chain.  
 D) provide a code that will be read by DNA polymerase.  
 E) All of the answer choices are correct.

**55)** The purpose of translation is to

A) make mRNA that will carry the instructions for proteins outside of the nucleus.   
 B) replicate DNA to provide a new copy for cellular division.  
 C) use mRNA codons to link together amino acids to form a polypeptide chain.  
 D) provide a code that will be read by DNA polymerase.  
 E) All of the answer choices are correct.

**56)** In eukaryotic cells, translation occurs with the use of free floating ribosomes in the cyptoplasm or ribosomes that are \_\_\_\_\_\_\_\_\_\_.

A) on the mitochondria   
 B) in the nucleus  
 C) on the smooth endoplasmic reticulum  
 D) on the rough endoplasmic reticulum

**57)** During translation, the \_\_\_\_\_\_ reads the codon on the mRNA and brings in the cooresponding amino acid.

A) rRNA   
 B) tRNA  
 C) RNA polymerase  
 D) ribosome  
 E) protein

**58)** At the end of gene expression, the amino acids are in a \_\_\_\_\_\_ structure. This is also the \_\_\_\_\_\_ structure of a protein.

A) linear; primary   
 B) alpha helix; secondary  
 C) globular; tertiary  
 D) grouping; quarternary  
 E) beta sheets; secondary

**59)** Nucleic acids serve as a

A) genetic code.   
 B) means of energy production.  
 C) genetic code and a method of cellular control.  
 D) genetic code and a means of energy production.

**60)** Which of the following statements best describes the relationships between the genome, genes, and proteins?

A) There is one genome; it consists of many genes that encode for multiple proteins.   
 B) There is one genome; it consists of one gene that encodes for multiple proteins.  
 C) There are multiple genomes; they consist of one single gene that encodes for multiple proteins.  
 D) There is one genome; it consists of one gene that encodes for one protein.  
 E) There are multiple genomes; they consist of many genes that encode for multiple proteins.

**61)** In eukaryotic cell division, what are the two major parts of the cell cycle?

A) Interphase and mitosis   
 B) Mitosis and cytokinesis  
 C) Interphase and cytokinesis  
 D) Interphase and prophase  
 E) Prophase and cytokinesis

**62)** In a normal cell, G1 phase is the checkpoint for DNA damage. If the damage is too extensive, the cell will undergo \_\_\_\_\_\_\_\_\_\_.

A) division   
 B) apoptosis  
 C) alignment of chromosomes  
 D) separation of the cytoplasm

**63)** The DNA is compacted into multiple \_\_\_\_\_\_ that condense and organize the genetic information before cells divide.

A) genomes   
 B) chromosomes  
 C) ribosomes  
 D) sister chromatids

**64)** Your instructor is showing you a model of prophase in mitosis. There is an arrow pointing to a structure holding the two sister chromatids together. What structure is your instructor asking you to identify?

A) Centrosome   
 B) Mitotic spindle  
 C) Centromere  
 D) Chromatin

**65)** Chromosomes are copied

A) during mitosis.   
 B) in the growth phase of interphase (G 1).  
 C) immediately before cell division (G 2).  
 D) between the growth phase (G 1) and preparation cell division (G 2).

**66)** In which stage does the cell spend most of its time?

A) Interphase   
 B) Cytokinesis  
 C) Anaphase  
 D) Prophase  
 E) Telophase

**67)** Normal cell division is highly regulated by proteins to prevent mutations from occuring. If the cell division is stalled due to excessive DNA damage, the cell is placed in \_\_\_\_\_\_ phase in an attempt to repair the DNA.

A) S   
 B) G 1  
 C) G 2  
 D) G 0  
 E) Interphase

**68)** There are multiple steps in interphase that prepare the cells for cell division. Select the correct order of steps that prepare cells for division.

A) G 1, G 2, S   
 B) G 1, S, G 2  
 C) S, G 1, G 2  
 D) S, G 2, G 1  
 E) G 2, G 1, S

**69)** Cell division occurs in \_\_\_\_\_\_ phase.

A) M   
 B) S  
 C) G 1  
 D) G 2  
 E) G 0

**70)** Cells have checkpoints to regulate cell division. The G1 checkpoint

A) allows the cell to move into S phase.   
 B) may delay division.  
 C) may cause the cell to enter a resting phase.  
 D) is regulated by growth hormones.  
 E) All of the answer choices are correct.

**71)** At which checkpoint is DNA assessed for accuracy before cell division?

A) S   
 B) G 1  
 C) G 2  
 D) G 0  
 E) M

**72)** Telomere length can change with age and the type of cell. Which of the following correctly describes telomere length?

A) Telomeres increase as a person ages.   
 B) Telomeres remain constant throughout a person's life.  
 C) Telomeres are the longest in stem cells.  
 D) Telomeres are the shortest in stem cells.  
 E) Telomeres shorten in cancer cells.

**73)** A base substitution can result in

A) a change in DNA nucleotide sequence.   
 B) adenine binding with cytosine.  
 C) a misfolded protein.  
 D) a different codon sequence.  
 E) All of the answer choices are correct.

**74)** If a gene mutation occurs that results in a premature stop codon in the mRNA sequence, the protein will \_\_\_\_\_\_\_\_\_\_.

A) misfold   
 B) be incomplete  
 C) be normal  
 D) cause other proteins to misfold  
 E) be larger in size

**75)** In normal cells, tumor suppressor genes

A) decrease the likelihood of damaged DNA being passed onto the daughter cells.   
 B) decrease the likelihood of damaged DNA staying in parent cells.  
 C) increase the rate of cell division.  
 D) decrease the rate of cell division.  
 E) monitor the rate of cell division and check newly synthesized DNA for damage before being passedon to daughter cells.

**76)** A mutation in a tumor suppressor gene can lead to cancer because these genes are involved in

A) checking the DNA for damage during the cell cycle.   
 B) aligning chromosomes during mitotic division.  
 C) creating the cleavage furrow.  
 D) synthesizing mRNA during transcription.  
 E) incorporating amino acids during translation.

**77)** A mutation in the \_\_\_\_\_\_ results in uncontrolled cell division. This mutation can lead to cancer.

A) ERBB-2   
 B) p53 genes  
 C) BRCA1 genes  
 D) TP53 genes

**78)** Proto-oncogenes expression depends on external cell signaling. Under normal conditions, what molecules regulate the expression of proto-oncogenes?

A) Insulin   
 B) Growth factors  
 C) p53  
 D) HER-2  
 E) All of the answer choices are correct.

**79)** Mutations in tumor-suppressor genes and in proto-oncogenes can result in cancer. If both are mutated,

A) damaged DNA will be unrecognized by the cell.   
 B) cell division will increase.  
 C) the cell will undergo apoptosis.  
 D) DNA damage will go unrecognized and cell division will increase.  
 E) DNA damage will be repaired but cell division will increase.

**80)** A breast cancer patient may be diagnosed with being hormone receptor positive. This receptor protein is known as the \_\_\_\_\_\_ protein.

A) HER-2   
 B) p53  
 C) BRCA1  
 D) HER-1  
 E) TP53

**81)** The appearance of cancerous cells differs from normal cells. If you were to view cancerous cells under the microscope, you would notice enlarged \_\_\_\_\_\_\_\_\_\_.

A) nuclei   
 B) plasma membranes  
 C) mitochondria  
 D) ribosomes  
 E) vacuoles

**82)** As cancerous cells accumulate mutations, the cells will continue to divide rapidly. This uncontrolled division results in

A) a change in cellular appearance.   
 B) cells becoming less specialized  
 C) cells growing in blood vessels.  
 D) cells moving to different parts of the body.  
 E) All of the answer choices are correct.

**83)** Benign tumors are not considered a threat because they

A) do not have mutations.   
 B) have controlled cell division.  
 C) do not spread or cause more tumors.  
 D) maintain their original function.  
 E) All of the answer choices are correct.

**84)** Malignant tumors need nutrients and oxygen to grow. From what structures do they obtain nutrients and oxygen?

A) Capillaries   
 B) Lymphatic vessels  
 C) Lungs  
 D) Kidneys  
 E) Arteries

**85)** Cells within the inside of a tumor secrete growth factors, which cause capillaries to grow toward the tumor. This process is called \_\_\_\_\_\_, and contributes to the growth and spread of the tumor.

A) metastasis   
 B) angiogenesis  
 C) biogenesis  
 D) abiogenesis

**86)** The main difference between Stage 0 and Stage 1 cancer is that in Stage 1, the cancer cells have

A) begun to spread to a few lymph nodes.   
 B) formed a larger tumor.  
 C) spread to all lymph nodes.  
 D) spread extensively throughout body.  
 E) spread to neighboring organs.

**87)** The main difference between Stages 2A and 2B breast cancer, is that in Stage 2B the tumors in nearby lymph nodes are \_\_\_\_\_\_\_\_\_\_.

A) less that 2 cm   
 B) between 2-5 cm  
 C) between 5-10 cm  
 D) greater than 10 cm

**88)** Stage 3 breast cancer is divided into levels based on the size of the tumor and the degree to which it has spread to nearby tissues and lymph nodes. In which level has the tumor spread to the collar bone or more than ten lymph nodes?

A) 3A   
 B) 3B  
 C) 3C

**89)** If a breast cancer patient has not responded to treatment and the cancer has spread to the brain, the patient is classified as having Stage \_\_\_\_\_\_ cancer.

A) 4   
 B) 1  
 C) 2  
 D) 3  
 E) TNM

**90)** If cancer invades the \_\_\_\_\_\_, this can cause an accumulation of blood calcium and may lead to a coma.

A) brain   
 B) bone  
 C) liver  
 D) stomach  
 E) kidneys

**91)** Which of the following blood cells would be measured to evaluate a patient for cancer?

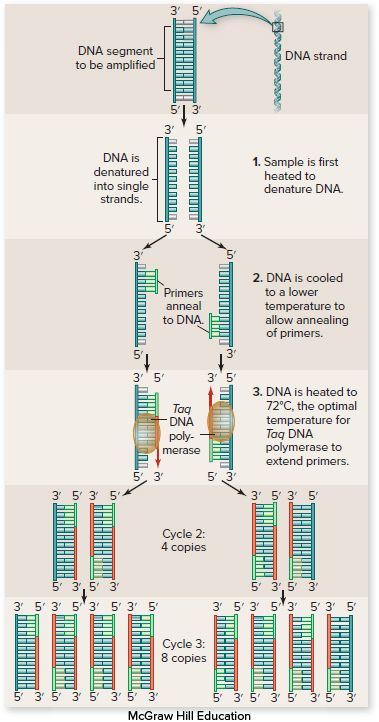
A) Red blood cells   
 B) Osteocytes  
 C) White blood cells  
 D) Platelets  
 E) All the answer choices are correct.

**92)** Which of the following scanning tools is used to look for abnormalities in the breast that could be associated with cancer?

A) Screening mammogram   
 B) Diagnostic mammogram  
 C) CT scan  
 D) PET scan  
 E) MRI

**93)** Which of the following scanning tools is a special type of X-ray that is used to determine if the cancer has spread?

A) Screening mammogram   
 B) Diagnositic mammogram  
 C) CT scan  
 D) PET scan  
 E) MRI

**94)** There are several ways a person can be tested to assess their risk of cancer. One is genetic testing. What genetic testing technique is shown in the image provided?  


A) PCR   
 B) MRI  
 C) Microarray  
 D) CBC  
 E) DNA sequencing

**95)** There are multiple mutations in the BRCA1 gene that physicians use to determine cancer treatments. Which of the following mutations would indicate the patient has breast cancer and treatment should be explored?

A) Deleterious   
 B) Benign polymorphism  
 C) Variant, favor polymorphism  
 D) Suspected deleterious  
 E) Variation of uncertain significance

**96)** A CBC is conducted to look for changes in the blood associated with cancer. Which of the following is/are measured to detect cancer in the blood?

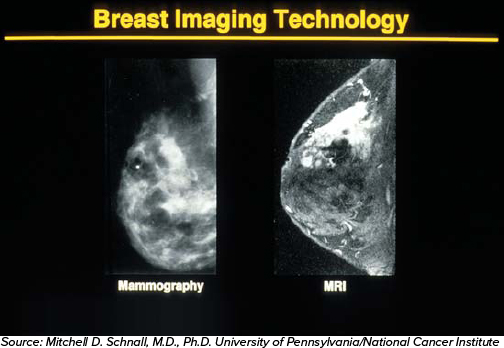
A) The number of normal cells   
 B) The number of tumor cells  
 C) Abnormal proteins  
 D) Antibodies  
 E) All of the answer choices are correct.

**97)** Physicians will request an analysis of proteins in the blood of possible cancer patients because

A) proteins from cancer cells are different from normal cells.   
 B) normal cells will produce more proteins in the blood.  
 C) normal cells will produce less proteins in the blood.  
 D) proteins from cancer cells inhibit the growth of normal cells.  
 E) All of the answer choices are correct.

**98)** Which of the following would be detected in a blood test that would indicate the immune system is responding to cancer?

A) Calcium   
 B) Enzymes  
 C) Ion elevation  
 D) Antibodies  
 E) Red blood cells

**99)** There are several scanning techniques physicians use to determine the extent of tumors. What type of scan, shown here, can be used to determine the extent of the tumor in the breast?  


A) MRI   
 B) Screening mammogram  
 C) Diagnostic mammogram  
 D) CAT scan  
 E) PET scan

**100)** Chemotherapy can interact with different phases of the cell cycle. What are the main phases that these drugs target?

A) S, G 2, and M   
 B) G 2, M, and G 1  
 C) M, G 1, and G 0  
 D) G 1, G 0, and S  
 E) G 0, S, and G 2

**101)** Alkylating agents work by

A) breaking the DNA and introducing mutations.   
 B) interfering with the spindle fibers that separate the sister chromatids.  
 C) mimicking nucleotides, which results in an incorrectly developed DNA molecule.  
 D) interfering with the cell's ability to unwind DNA during DNA replication.  
 E) placing the cell in G 0 phase.

**102)** Antimetabolites work by

A) breaking the DNA and introducing mutations.   
 B) interfering with the spindle fibers that separate the sister chromatids.  
 C) mimicking nucleotides, which results in an incorrectly developed DNA molecule.  
 D) interfering with the cell's ability to unwind DNA during DNA replication.  
 E) placing the cell in G 0 phase.

**103)** Topoisomerase inhibitors work by

A) breaking the DNA and introducing mutations.   
 B) interfering with the spindle fibers that separate the sister chromatids.  
 C) mimicking nucleotides, which results in an incorrectly developed DNA molecule.  
 D) interfering with the cell's ability to unwind DNA during DNA replication.  
 E) placing the cell in G 0 phase.

**104)** There are different drugs that interfere with the M phase of the cell cycle. \_\_\_\_\_\_ interfere with the formation of the spindle fibers and \_\_\_\_\_\_ prevent the breakdown of the microtubles.

A) Alkaloids; taxanes   
 B) Taxanes; antimetabolites  
 C) Taxanes; alkylating agents  
 D) Taxanes; alkaloids  
 E) Alkylating agents; topoisomerase inhibitors

**105)** In a normal cell, topoisomerase

A) helps unwind DNA during DNA replication.   
 B) adds in amino acids during protein synthesis.  
 C) separates sister chromatids during cell division.  
 D) adds in complementary nucleotides during DNA replication.  
 E) aligns sister chromatids in the middle of the cell before dividing.

**106)** Radiation is targeted cancer therapy that works by

A) breaking the DNA and introducing mutations.   
 B) interfering with the spindle fibers that separate the sister chromatids.  
 C) mimicking nucleotides, which results in an incorrectly developed DNA molecule.  
 D) interfering with the cell's ability to unwind DNA during DNA replication.  
 E) placing the cell in G 0 phase.

**107)** One benefit of radiation over chemotherapy is that radiation

A) only targets cancer cells.   
 B) only mutates DNA in cancer cells.  
 C) limits the number of healthy cells affected.  
 D) relies on chemicals being injected into the body.  
 E) All of the answer choices are correct.

**108)** In which stage of breast cancer would a physician most likely use radiation and chemotherapy to treat a cancer patient?

A) Stage 1   
 B) Stage 2  
 C) Stage 3  
 D) Stage 4

**109)** There are several types of radiation. What type of radiation is being administered in the provided image?  


A) External   
 B) High-dose seed  
 C) Low-dose seed  
 D) Internal radiation

**110)** There are two types of brachytherapy. \_\_\_\_\_\_ brachytherapy is when the "seed" is placed in the tumor, and \_\_\_\_\_\_ brachytherapy is when the "seed" is placed near the tumor.

A) Interstitial; intracavitary   
 B) Intracavitary; interstitial  
 C) Internal; external  
 D) Internal; intracavitary  
 E) External; intracavitary

**111)** Internal radiation that requires the seeds to remain in the body is referred to as \_\_\_\_\_\_ treatment.

A) high-dose   
 B) low-dose  
 C) extended  
 D) permanent  
 E) systemic

**112)** I-131 is a radioactive form of iodine that is used to aid in systemic radiation of thyroid cancer. Why is I-131 used in this treatment?

A) Iodine is used by the thyroid; therefore, the radioactive form would also travel to that area.   
 B) Radioactive iodine will interfere with cancer cells in the thyroid and throughout the body.  
 C) Radioactive iodine is harmless to the patient.  
 D) Iodine is required for DNA replication; therefore, it would be attracted to DNA of cancerous cells.  
 E) Iodine is required for all cancerous cells to continue to divide; therefore, it would travel to those cells.

**113)** Which of the following would be the first step in treating a patient with a form of internal radiation?

A) Marking the patient for treatment   
 B) Placing a radioactive material in the patient  
 C) Emitting radiation to the treatment area  
 D) Treating the patient with chemotherapy  
 E) Removing the radioactive material

**114)** Chemotherapy works by

A) targeting points during cell division.   
 B) producing hormones to slow the growth rate of the tumor.  
 C) forcing the cell into G 0 phase.  
 D) targeting a specific area of cancerous cells.

**115)** Immunotherapy is a new method of treatment that

A) uses monoclonal antibodies to target specific antigens on the surface of cancer cells.   
 B) involves genetically-engineered white blood cells that activate the action of cytotoxic T cells.  
 C) uses chemicals such as interferons and interleukins to stimulate white blood cell activity.  
 D) helps the immune system identify cancerous cells and target them for destruction.  
 E) All of the answer choices are correct.

**116)** Normally, cancer cells can evade an immune response because the immune system

A) has a difficult time identifying cancerous cells.   
 B) does not have the ability to kill cancerous cells.  
 C) does not have the ability to create antigens against it.  
 D) is surveying different parts of the body that do not involve cancerous cells.  
 E) All of the answer choices are correct.

**117)** The role of the immune system is to

A) continuously scan, recognize foreign agents, and destroy them.   
 B) identify self versus non-self cells.  
 C) create antibodies for future attacks by the same infectious agent.  
 D) signal the body of infection.  
 E) All of the answer choices are correct.

**118)** There are three checkpoints during cell division. Which checks for DNA damage?

A) M   
 B) G2  
 C) G1

**119)** There are three checkpoints during cell division. Which checks for proper alignment of chromosomes?

A) M   
 B) G2  
 C) G1

**120)** There are three checkpoints during cell division. Which checks for DNA replication?

A) M   
 B) G2  
 C) G1

**121)** Prophase is a step of mitosis. What key event happens during prophase?

A) Chromosomes condense   
 B) Sister chromatids align on the spindle equator  
 C) Sister chromatids are pulled apart  
 D) Nuclear envelopes form and a cleavage furrow forms

**122)** Anaphase is a step of mitosis. What key event happens during anaphase?

A) Chromosomes condense   
 B) Sister chromatids align on the spindle equator  
 C) Sister chromatids are pulled apart  
 D) Nuclear envelopes form and a cleavage furrow forms

**123)** Telophase and cytokinesis is a step of mitosis. What key event happens during telophase and cytokinesis?

A) Chromosomes condense   
 B) Sister chromatids align on the spindle equator  
 C) Sister chromatids are pulled apart  
 D) Nuclear envelopes form and a cleavage furrow forms

**124)** Metaphase is a step of mitosis. What key event happens during metaphase?

A) Chromosomes condense   
 B) Sister chromatids align on the spindle equator  
 C) Sister chromatids are pulled apart  
 D) Nuclear envelopes form and a cleavage furrow forms

**125)** Which characteristic corresponds with Stage 0 of breast cancer?

A) Cancer begins invading more lymph nodes and tissue   
 B) Cancer is localized and less than 2 cm  
 C) Cancer extensively spreads to nearby tissue  
 D) Cancer spreads to other organs  
 E) Cancer is found in a few lymph nodes

**126)** Which characteristic corresponds with Stage 1 of breast cancer?

A) Cancer begins invading more lymph nodes and tissue   
 B) Cancer is localized and less than 2 cm  
 C) Cancer extensively spreads to nearby tissue  
 D) Cancer spreads to other organs  
 E) Cancer is found in a few lymph nodes

**127)** Which characteristic corresponds with Stage 2 of breast cancer?

A) Cancer begins invading more lymph nodes and tissue   
 B) Cancer is localized and less than 2 cm  
 C) Cancer extensively spreads to nearby tissue  
 D) Cancer spreads to other organs  
 E) Cancer is found in a few lymph nodes

**128)** Which characteristic corresponds with Stage 3 of breast cancer?

A) Cancer begins invading more lymph nodes and tissue   
 B) Cancer is localized and less than 2 cm  
 C) Cancer extensively spreads to nearby tissue  
 D) Cancer spreads to other organs  
 E) Cancer is found in a few lymph nodes

**129)** Which characteristic corresponds with Stage 4 of breast cancer?

A) Cancer begins invading more lymph nodes and tissue   
 B) Cancer is localized and less than 2 cm  
 C) Cancer extensively spreads to nearby tissue  
 D) Cancer spreads to other organs  
 E) Cancer is found in a few lymph nodes

**FILL IN THE BLANK. Write the word or phrase that best completes each statement or answers the question.  
130)** The role of the \_\_\_\_\_\_ system is to respond quickly to internal and external stimuli.

**131)** The two different classes of cells are \_\_\_\_\_\_ and \_\_\_\_\_\_.

**132)** In eukaryotes, the \_\_\_\_\_\_ is the site of the genetic information of the cell.

**133)** Some medications bind to the active site of enzymes. This blocks the \_\_\_\_\_\_ from binding.

**134)** The monomers that link together to form DNA are called \_\_\_\_\_\_.

**135)** There are two stages of gene expression. The first stage, \_\_\_\_\_\_, produces mRNA that is used in the second step.

**136)** There are two main steps in gene expression. This first step produces mRNA, and the second step, \_\_\_\_\_\_, converts the mRNA into a protein.

**137)** In eukaryotic cells, transcription occurs in the \_\_\_\_\_\_.

**138)** RNA polymerase copies a gene to provide a transcript of mRNA. What would be the transcript from the following DNA nucleotide sequence?  
 TACCCGGTAGATATC

**139)** The three nucleotide segments found on mRNA, which code for amino acids, are called \_\_\_\_\_\_.

**140)** A \_\_\_\_\_\_ is a short segment of DNA that encodes a functional protein.

**141)** In mitosis, the division of the cytoplasm occurs in \_\_\_\_\_\_.

**142)** Individuals receive \_\_\_\_\_\_ (how many) chromosomes from their mother?

**143)** In cellular division, the two parts of M phase are mitosis and \_\_\_\_\_\_.

**144)** Short sections of DNA, called \_\_\_\_\_\_, are located on chromosomes.

**145)** Chemicals, radiation, and viruses can cause \_\_\_\_\_\_ to occur in genes. This may lead to the cell becoming cancerous.

**146)** \_\_\_\_\_\_ is the mutagen responsible for structurally changing the DNA molecule during DNA replication.

**147)** When referring to cancer, the two most associated tumor-suppressor genes are BRCA1 and \_\_\_\_\_\_.

**148)** The main role of the \_\_\_\_\_\_ gene is to check for breaks in the DNA.

**149)** In breast cancer patients, there is over expression of the proto-oncogene ERBB-2. This causes an increase production in the \_\_\_\_\_\_ protein.

**150)** The \_\_\_\_\_\_ enzyme allows for continuous cell division of cancerous cells.

**151)** In \_\_\_\_\_\_ tumors, the cells move into local capillaries or lymphatic vessels and spread throughout the body.

**152)** The \_\_\_\_\_\_ vessels can contribute to metastasis as they try to remove the excess fluid from the tumor tissue.

**153)** In Stage \_\_\_\_\_\_ cancer, the cancer has spread extensively to nearby tissues and lymph nodes but has not yet spread to organs.

**154)** \_\_\_\_\_\_ are doctors who use the TNM classification system to define the stages of cancer.

**155)** Cancer affects the normal operation of the body and the response to the external environment. The normal operation is maintained by a process called \_\_\_\_\_\_.

**156)** Physicians rely on two different genetic tests to determine if someone is susceptible to cancer. A DNA microarray will determine the rate of expression of a gene, while DNA \_\_\_\_\_\_ will precisely determine if a mutation is actually present in the gene.

**157)** A \_\_\_\_\_\_ procedure is used to remove a small piece of tissue to test for the presence of cancer cells.

**158)** In \_\_\_\_\_\_ radiation, a radioactive substance is either ingested or injected into the blood. It can then be targeted for therapy.

**159)** Alkylating agents target DNA of all cells. If mutations are introduced into the bone marrow cells, the patient may develop \_\_\_\_\_\_, which is cancer of the blood.

**160)** Cancer \_\_\_\_\_\_ are used to protect against some forms of cancer and can be used to warn the body of existing cancers.

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.  
161)** List the five characteristics that define cells.

**162)** Cancer begins with a series of events. One of these events is becoming immortal. Explain how these cells become immortal.

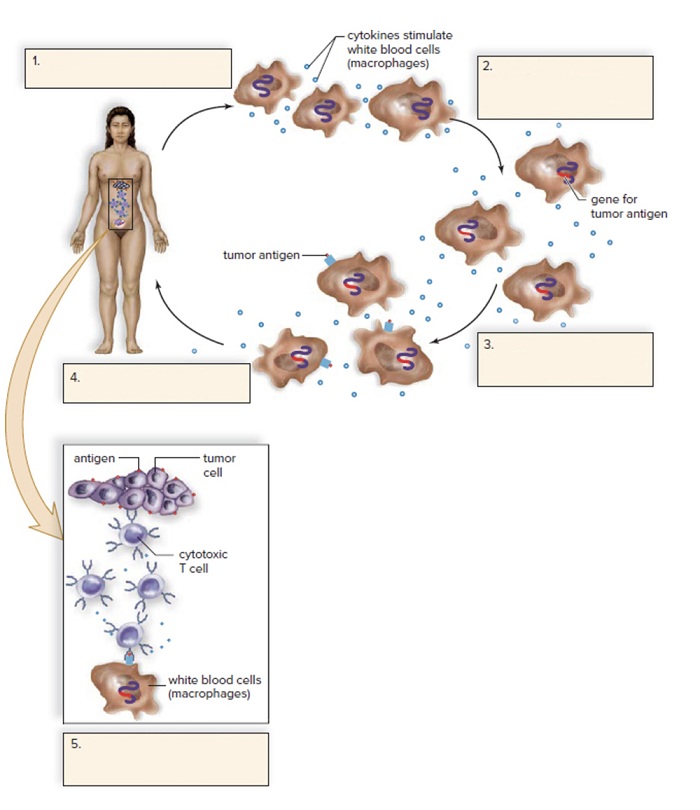
**ESSAY. Write your answer in the space provided or on a separate sheet of paper.  
163)** List the nucleotides that are found in DNA.

**164)** The stages of breast cancer are determined by an oncologist by addressing four questions. Provide three of the four questions.

**165)** Each stage of cancer has defining characteristics. State the characteristics of Stage 2 cancer.

**166)** If a patient has Stage 4 cancer that has spread to a major organ, how might this disrupt the function of the organ?

**167)** There are two main types of radiation: external and internal. Provide a description of both processes.

**168)** The image shown outlines the immune response to a cancer vaccine, a type of immunotherapy treatment. Provide the missing information in the boxes to describe the steps of response.  


**Answer Key**Test name: Cancer Unit Test Bank

1) TRUE

Damaged cells are replaced with new cells. See section 1.1 for more information.

2) FALSE

Cancer cells can present in the blood or in the form of a tumor. See section 1.1 for more information.

3) FALSE

Cells are specialized to have different functions, which contributes to unique properties of tissues and organs. See section 1.2 for more information.

4) FALSE

RNA is also a form of nucleic acid found in cells. See section 1.2 for more information.

5) FALSE

There are 19,000 genes that produce several hundred thousand different types of proteins. See section 1.2 for more information.

6) FALSE

The mRNA is modified by removing non-coding regions before translation can take place. See section 1.2 for more information.

7) FALSE

The shape of the protein determines its function. See section 1.2 for more information.

8) FALSE

Mitosis results in two identical daughter cells. See section 1.3 for more information.

9) FALSE

Cancerous cells have abnormal structure and function. See section 1.2 for more information.

10) FALSE

In certain cells, telomerase protects the chromosomes from shortening. See section 1.3 for more information.

11) FALSE

Cancerous cells divide continuously with no regard to checkpoints. See section 1.3 for more information.

12) FALSE

These are the roles of the p53 gene. See section 1.4 for more information.

13) FALSE

The binding of growth factors increases the expression of proto-oncogenes and cell division. See section 1.4 for more information.

14) FALSE

The over expression of the ERBB2 gene results in an increase in cell growth. See section 1.4 for more information.

15) FALSE

Cancerous cells are "immortal." See section 2.1 for more information.

16) FALSE

Malignant tumors often release the enzyme proteinase to move through the body. See section 2.1 for more information.

17) FALSE

The tumor size in Stage 1A and 1B are the same. The difference is, in Stage 1B, the cells have started to spread to surrounding lymph nodes. See section 2.2 for more information.

18) FALSE

Lymph nodes are biopsied to determine if the cancer has spread from its orginal location. See section 2.1 for more information.

19) TRUE

Negative feedback is used to maintain homeostasis. See section 2.3 for more information.

20) FALSE

An individual needs only one copy of the *BRCA1* tumor-suppressor gene for it to act as a regulator of the cell cycle. However, an individual with one mutated copy of *BRCA1* may be susceptible to breast cancer if a second mutation inactivates the other copy of *BRCA1*. See section 3.1 for more information.

21) [A, B, D]

Eukaryotes are larger, have a different size ribosome, and have linear DNA versus circular DNA. See section 1.2 for more information.

22) [B, D, E]

There are five characteristics of life. There are three in this list: the ability to respond to the environment, reproduce, and acquire materials and energy. See section 1.2 for more information.

23) [A, C, E]

Uracil and ribose are found in RNA. See section 1.2 for more information.

24) [A, C, D]

Transcription involves using a gene, or section of DNA, and RNA polymerase to make mRNA. See section 1.2 for more information.

25) [A, C]

The two main obstacles in gene expression are getting the code out of the nucleus and providing a code that results in amino acids. See section 1.2 for more information.

26) [A, C]

Cancerous cells are defined as having damaged DNA and uncontrollable cell division. See section 1.3 for more information,

27) [B, C, E]

Chemicals, radiation, and viruses can cause DNA mutations. See section 1.4 for more information.

28) [A, C, D]

Tumors, from extensive cell growth, unspecialized cells, and cells that are no longer functioning properly are signs of cancer. See section 2.1 for more information.

29) [A, C]

Enzymes rely on a narrow pH and temperature range. See section 2.3 for more information.

30) [B, C, E]

As you will learn, the endocrine and immune systems play small roles in homeostasis but are not major players. See section 2.3 for more information.

31) [B, C, D]

They interfere with enzymes involved in DNA replication and in transcription. See section 3.2 for more information.

32) [C, D]

Alkaloids and taxanes interfere with M phase. See section 3.2 for more information.

33) [A, C, E]

CRISPR uses a guide RNA and causes a double-stranded DNA break. See section 3.4 for more information.

34) A

Tumor suppressor genes shut down cell division in hopes to repair errors that have occurred. See sections 1.1 and 1.4 for more information.

35) C

Sarcomas affect connective tissues. See section 1.1 for more information.

36) D

All of these affect cancer formations at the cellular level. See section 1.1 for more information.

37) C

Organ systems are organized of organs, organs are made of tissues, tissues are made of cells, and cells have organelles. See section 1.1 for more information.

38) A

While cancer-related deaths have decreased, males were more impacted by lung cancer than females. See section 1.1 for more information.

39) B

The urinary system regulates water-salt balance in the blood. It also regulates acid-base balance in the blood. See section 1.1 for more information.

40) C

While all of these can be effects of cancer, cancer actually begins when cell division is uncontrolled. See section 1.1 for more information.

41) D

DNA regulates cellular functions. DNA is organized in genes and the genetic expression is highly regulated. See section 1.2 for more information.

42) A

Enzymes are substrate specific. See section 1.2 for more information.

43) B

Ribosomes are used to manufacture proteins during translation. See section 1.2 for more information.

44) A

The mitochondria are involved in converting the energy found in nutrients into a usable form. See section 1.2 for more information.

45) B

The centrioles arrange and separate the cellular contents during cell division. See section 1.2 for more information.

46) C

Gene expression is controlled by nearby cell signals and other environmental factors. See section 1.2 for more information.

47) E

Cancer cells are less specialized because they ignore the genetic code. This results in rapid cell division and a disregard to neighboring cell functions. See section 1.2 for more information.

48) B

Enzymes are substrate specific and assist reactions by decreasing the required amount of energy. See section 1.2 for more information.

49) E

Each enzyme releases a product that is further broken down by the next enzyme. See section 1.2 for more information.

50) C

DNA is a double strand of nucleotides arranged in a helical structure. See section 1.2 for more information.

51) A

Between the double strands of DNA, adenine binds with thymine and cytosine binds with guanine. See section 1.2 for more information.

52) B

The nucleus is sometimes referred to as the control center of the cell because this is the location of its DNA. See section 1.2 for more information.

53) D

Ribosomes are located on the rough endoplasmic reticulum. See section 1.2 for more information.

54) A

Transciption provides mRNA that is read during translation. See section 1.2 for more information.

55) C

Translation is the process of reading codons to bring in complementary amino acids. See section 1.2 for more information.

56) D

The rough endoplasmic reticulum contains ribosomes used in translation. See section 1.2 for more information.

57) B

The role of the tRNA is to bring in complementary amino acids. See section 1.2 for more information.

58) A

Amino acids in a linear structure are also referred to as the primary structure of a protein.

59) A

Nucleic acids function in gene expression and regulation. See section 1.2 for more information.

60) A

In a cell, there is one genome; it consists of many genes that encode for multiple proteins. See section 1.2 for more information.

61) A

Interphase and mitosis are the two major parts of the cell cycle. See section 1.3 for more information.

62) B

Cell fragmentation is also known as apoptosis. See section 1.3 for more information.

63) B

Humans have 23 pairs of chromosomes that are organized before cell division. See section 1.3 for more information.

64) C

The centromere holds sister chromatids together. See section 1.3 for more information.

65) D

Chromosomes are copied in the S phase. See section 1.3 for more information.

66) A

Cells spend most of their time in interphase. See section 1.3 for more information.

67) D

G 0 phase is a pause in cell division to repair damaged DNA. See section 1.2 for more information.

68) B

Interphase consists of cellular growth (G 1), DNA synthesis (S), and final steps to enter into mitosis (G 2). See section 1.3 for more information.

69) A

Cell division occurs during M phase. See section 1.3 for more information

70) E

The G 1 checkpoint monitors cell growth before DNA synthesis occurs. For more information see section 1.3.

71) C

The G 2 checkpoint checks for DNA replication accuracy before the cell can enter into the M phase. See section 1.3 for more information.

72) C

Telomeres are the longest in stem cells and in cancer cells because both cell types have telomerase. See section 1.3 for more information.

73) E

Base substitutions can change the DNA sequence, which can ultimately change the protein structure. See section 1.4 for more information.

74) B

A premature stop codon results in a smaller, incomplete protein. See section 1.4 for more information.

75) E

The main role of tumor suppressor genes is to check newly synthesized DNA before it is passed on to the daughter cells. See section 1.4 for more information.

76) A

Tumor suppressor genes examine the DNA for damage before the cell divides. See section 1.4 for more information.

77) A

ERBB-2 is a proto-oncogene. See section 1.4 for more information.

78) B

Growth hormones regulate the expression of proto-oncogenes. See section 1.4 for more information.

79) D

Mutations in tumor-suppressor genes and in proto-oncogenes will result in mutated DNA and uncontrolled cell division. See section 1.4 for more information.

80) A

An increase in the production of the ERBB2 gene results in more HER-2 recepter proteins in some breast cancer patients. See section 1.4 for more information.

81) A

Nuclei of cancerous cells appear larger than normal cells. See section 2.1 for more information.

82) E

Mutations result in uncontrolled cellular division that results in overgrowth of the cells along with other problems. See section 2.1 for more information.

83) C

While benign tumors still have mutations, they do not spread or cause more tumors. See section 2.1 for more information.

84) A

Capillaries "feed" growing malignant tumors. See section 2.1 for more information.

85) B

Angiogenesis assists in "feeding" malignant tumors. This, in turn, allows the tumor to grow and enter into the bloodstream. See section 2.1 for more information.

86) A

The main difference between Stage 0 and Stage 1 is that the cancers cells have begun to move from their original location to a few lymph nodes. See section 2.2 for more information.

87) B

In Stage 2B cancer, the size of the tumor is between 2-5 cm and has been detected in nearby lymph nodes. See section 2.2 for more information.

88) C

Stage 3C is defined by the cancer spreading to the collar bone and many lymph nodes. See section 2.2 for more information.

89) A

A patient is in Stage 4 breast cancer when the cancer has spread to other organs. See section 2.2 for more information.

90) B

Bone cancer can cause disruption in calcium homeostasis. See section 2.3 for more information.

91) C

An elevation in white blood cells could indicate cancer. See section 3.1 for more information.

92) A

Screening mammograms are used for early detection and base-line screening. See section 3.1 for more information.

93) C

CT scans are less invasive than other scans and are used to determine the extent of the cancer. See section 3.1 for more information.

94) A

PCR is used to provide multiple copies of a gene. Cancer genes can be targeted. See section 3.1 for more information.

95) A

If a patient is deleterious is the BRCA1 gene, treatment should be recommended. See section 3.1 for more information.

96) E

Cancer patients may have a decrease or increase in normal blood cells, tumor cells may be present, and abnormal proteins and antibodies may also be detected in the blood. See section 3.1 for more information.

97) A

Cancer cells are unspecialized and produce proteins thatare different from normal cells. See section 3.1 for more information.

98) D

Antibodies are produced by cells in the immune system in response to infections and cancers. See section 3.1 for more information.

99) A

This MRI scan can show the extent of the cancer in the breast. See section 3.1 for more information.

100) A

The S, G2, and M phases are targeted by different types of chemotherapy agents. See section 3.2 for more information.

101) A

Alkylating agents work by damaging the DNA. See section 3.2 for more information.

102) C

Antimetabolites incorporate incorrect nucleotides. See section 3.2 for more information.

103) D

Topoisomerase inhibitors prevent the seperation of DNA. See section 3.2 for more information.

104) A

Alkaloids and taxanes interfere with the M phase. See section 3.2 for more information.

105) A

Topoisomerase is essential in separating DNA during DNA replication. See section 3.2 for more information.

106) A

Radiation can damage healthy cells and cancer cells within the range of treatment. See section 3.3 for more information.

107) C

Radiation is localized treatment that reduces the number of healthy cells being affected. See section 3.3 for more information.

108) D

Radiation and chemotherapy would most likely be used in a stage 4 breast cancer patient. In stage 4 the cancer has spread throughout the body. See section 3.3 for more information.

109) A

This is an image of external radiation. It is the most common form. See section 3.3 for more information.

110) A

Inter- is within and intra- is between. See section 3.3 for more information.

111) B

Low-dose is used for long-term treatment. See section 3.3 for more information.

112) A

Iodine travels to the thyroid. See section 3.3 for more information.

113) B

The radioactive material is placed first. It will then emit radiation and damage cells. See section 3.3 for more information.

114) A

Chemotherapy slows the rate of cell division of cells. See section 3.2 for more information.

115) E

Immunotherapy helps the body recognize cancerous cells as non-self. See section 3.4.

116) A

The main problem the immune system has is that it cannot differentiate cancerous from non-cancerous cells. See section 3.4 for more information.

117) E

The immune system not only scans, recognizes, and kills infectious agents, but it also builds a memory for future infections. See section 3.4 for more information.

118) C

There are three checkpoints that check for DNA damage, completed replication, and alignment. See section 1.3 for more information.

119) A

There are three checkpoints that check for DNA damage, completed replication, and alignment. See section 1.3 for more information.

120) B

There are three checkpoints that check for DNA damage, completed replication, and alignment. See section 1.3 for more information.

121) A

The goal of cell division is strategic in the steps: condensing of chromosomes, alignment of sister chromatids, separation, and then cell division. See section 1.3 for more information.

122) C

The goal of cell division is strategic in the steps: condensing of chromosomes, alignment of sister chromatids, separation, and then cell division. See section 1.3 for more information.

123) D

The goal of cell division is strategic in the steps: condensing of chromosomes, alignment of sister chromatids, separation, and then cell division. See section 1.3 for more information.

124) B

The goal of cell division is strategic in the steps: condensing of chromosomes, alignment of sister chromatids, separation, and then cell division. See section 1.3 for more information.

125) B

The stages of breast cancer change by the growth and migration away from the original location. See section 2.2 for more information.

126) E

The stages of breast cancer change by the growth and migration away from the original location. See section 2.2 for more information.

127) A

The stages of breast cancer change by the growth and migration away from the original location. See section 2.2 for more information.

128) C

The stages of breast cancer change by the growth and migration away from the original location. See section 2.2 for more information.

129) D

The stages of breast cancer change by the growth and migration away from the original location. See section 2.2 for more information.

130) nervous

The path of nerves to and from the brain results in a quick response to stimuli. See section 1.1 for more information.

131) [eukaryotes, prokaryotes]

Eukaryotes and prokaryotes are the two classes of cells. See section 1.2 for more information.

132) nucleus

The nucleus is the location of DNA in eukaryotic cells. See section 1.2 for more information.

133) substrate

Many drugs block chemical pathways by inhibiting the substrate from entering the active site of enzymes. See section 1.2 for more information.

134) nucleotides

There are four nucleotides that form DNA. See section 1.2 for more information.

135) transcription

Transcription is proceeded by translation. See section 1.2 for more information.

136) translation

Transcription provides the product that is read during translation. See section 1.2 for more information.

137) nucleus

The nucleus is the location of the genome. See section 1.2 for more information.

138) AUGGGCCAUCUAUAG

The nucleotides in mRNA contain uracil instead of thymine. See section 1.2 for more information.

139) codons

Codons provide direction to the incoming tRNAs that carry amino acids. See section 1.2 for more information.

140) gene

Genes are units of DNA that provide the code for a functional protein. See section 1.2 for more information.

141) cytokinesis

Cytokinesis is the last step in cell division. See section 1.3 for more information.

142) 23

Humans have 2 sets of chromosomes, one from their mother and one from their father. See section 1.3 for more information.

143) cytokinesis

Mitosis is the division of the sister chromatids and cytokinesis is the division of the cytoplasm. See section 1.3 for more information.

144) genes

Genes are found on chromosomes. See section 1.3 for more information.

145) mutations

Mutations interfere with normal DNA activities. See section 1.4 for more information.

146) Radiation

Radiation can cleave or cause different types of bond formations during DNA replication. See section 1.4 for more information.

147) p53

The two tumor-suppressor genes related to cancer are p53 and BRCA1. See section 1.4 for more information.

148) BRCA1

BRCA1 gene works with the p53 gene by checking for undamaged DNA. See section 1.4 for more information.

149) HER-2

The ERBB2 gene is expressed to give the HER-2 gene. See section 1.4 for more information.

150) telomerase

The telomerase enzyme allows for continous cell division as it attempts to repair telomeres. See section 2.1 for more information.

151) malignant

The main difference between benign and malignant is that malignant tumors spread. See section 2.1 for more information.

152) lymphatic

The lymphatic vessels are part of the immune system and inadvertently move tumor cells from one area of the body to another. See section 2.1 for more information.

153) 3

Stage 3 cancer is the spread to neighboring tissue and lymph nodes. See section 2.2 for more information.

154) Pathologists

Pathologists study diseases based on lab results. See section 2.2 for more information.

155) homeostasis

Homeostasis maintains set conditions of the body. See section 2.3 for more information.

156) sequencing

DNA sequencing is used over microarray because it is more precise. See section 3.1 for more information.

157) biopsy

A biopsy only looks at a small piece of tissue. Used with a scanning tool, it in very efficient in determining the extent of the cancer. See section 3.1 for more information.

158) systemic

Systemic radiation helps target the cancer. See section 3.3 for more information.

159) leukemia

Leukemia affects the production of healthy blood cells. See section 3.2 for more information.

160) vaccines

Vaccines are used to make antibody responses before and after cancer cells have formed. See section 3.4 for more information.

161) The five characteristics of all cells include the ability to acquire materials and energy, respond to their environment, reproduce, maintain an internal environment, and adapt to their environment. See section 1.2 for more information.

162) In cancerous cells, the telomerase enzyme is active, which allows cells to continously divide and repair the telomeres at the end of the chromosomes. However, these cells may have an increase in mutations.

163) The four nucleotides in DNA are adenine, thymine, cytosine, and guanine. See section 1.2 for more information.

164) The four questions are:  
 How large is the tumor? Has the tumor invaded nearby tissue? Is the cancer close to lymph nodes? Has the cancer moved to other organs?  
 See section 2.2 for more information.

165) In Stage 2 cancer, the tumor has begun spreading to other nearby tissues and lymph nodes. See section 2.2 for more information.

166) A tumor can take over an organ and block ducts, blood vessels, and/or lymphatic vessels. This stops or slows the function of the organ. See section 2.3 for more information.

167) External radiation uses targeted external x-rays for treatment. Internal radiation requires the patient to have a radioactive particle placed, ingested, or injected into their body, which then emits radiation inside the body. See section 3.3 for more information.

168) Creating a cancer vaccine involves removing macrophages, exposing the macrophages to tumor antigens or engineering the macrophages to have genes for tumor antigens, allowing the macrophages to display tumor antigens on their surface, returning the genetically engineered macrophages to the patient, and having the reintroduced macrophages activate cytotoxic T cells to attack tumor cells. See section 3.4 and figure 3.15 for more information.