1 Which of the following is the “Central Dogma” of cell biology?

- A DNA – Nucleic Acid – Protein – Amino Acid
- B Prokaryote – bacteria – eukaryote
- C Atom – molecule – organelle
- D DNA – RNA – Protein
2 A gene is

- A A sequence of DNA that codes for a protein
- B A sequence of amino acids that codes for a protein
- C A sequence of codons that code for nucleic acids
- D The end product of transcription and translation
3 In eukaryotic organisms, gene expression is complex and highly regulated because

- **A** Eukaryotic organisms contain many different types of specialized cells that perform a variety of functions
- **B** Different types of cells have to work together and must be able to respond to intercellular chemical signals
- **C** Eukaryotes have more complex chromosomes that require multiple levels of regulation
- **D** All of the above
4 Transcription and Translation occur in?

- A Prokaryotes only
- B Eukaryotes only
- C Both Prokaryotes and Eukaryotes
- D Bacteria only
5 In eukaryotes, RNA transcription takes place in the

- A Nucleus
- B cytoplasm
- C ribosome
- D Golgi Apparatus
6. In prokaryotes and eukaryotes where does translation take place?

- A  Nucleus
- B  Chloroplast
- C  Ribosomes
- D  Golgi Apparatus
7 In order for RNA transcription to occur in eukaryotic cells

- A  5' caps and 3' poly A tails must be added to the molecule
- B  a repressor must be removed from the operator sequence
- C  the gene that is being transcribed must be unpacked from the chromatin
- D  the entire genome must be exposed to DNA polymerase
8 Transcription factors

- A Are proteins that bind to a DNA sequence near the promoter region
- B help regulate which genes are expressed
- C are involved in post-transcriptional gene regulation
- D all of the above
- E a and b only
9. The noncoding regions of genes are called

A. chromatin
B. exons
C. introns
D. extrons
10 RNA splicing

- A Removes exons and joins introns
- B Removes introns and joins exons
- C Removes 3’ poly A tails and 5’ caps
- D Removes codons and joins noncoding regions
11 The nuclear pore helps regulates gene expression by

- A Ensuring only mRNA’s with 5’ caps and 3’ poly-A tails enter the cytoplasm
- B Allowing unmodified preRNA to exit the nucleus
- C Preventing genetic information from leaving the nucleus
- D Regulating the transcription of DNA
12. A permanent change in the DNA sequence of a gene is called a?

- A  replication
- B  transformation
- C  mutation
- D  perforation
13 An insertion or deletion of a nucleotide base in a gene sequence can cause a

- A frameshift mutation
- B substitution mutation
- C transformational mutation
- D subliminal mutation
14 Almost 90% of the DNA in humans?

☐ A  Codes for proteins

☐ B  Contains exons

☐ C  Is termed junk DNA because it does not code for proteins

☐ D  Is altered by pre-mRNA processing
15 Which of the following would most likely result in a silent mutation?

- A mutation that changes the codon but does not alter the amino acid sequence
- A mutation in junk DNA
- A mutation in an exon
- A and B only
16 The process of cell division results in?

- A Half the number of cells
- B Uncontrolled growth
- C Mitosis
- D Two daughter cells
17 The two main phases of the cell cycle are

- A Interphase and mitotic phase
- B Mitosis and cytokinesis
- C DNA duplication and cell division
- D Mitosis and meiosis
18 A typical cell spends more than 90% of its life in

- A S phase
- B Interphase
- C Mitotic phase
- D Prometaphase
If a cell has 46 chromosomes, how many chromosomes will each of its daughter cells have after mitosis?

- A 23
- B 46
- C 92
- D $2n$ where $n=23$
Although the chromosomes do not become visible until the beginning of the Mitotic phase, it is useful to think of each chromosome as doubling, forming two identical sister chromatids during the S-phase of interphase. However, during the S-phase DNA is actually not condensed, but unpacked into a loose fiber so that replication can occur. This fibrous structure is called

- A Chromatin
- B Chromosome
- C Centromere
- D Gelatin
21. During which phase of the cell cycle are gene mutations most likely to occur?

- A. G1
- B. S phase
- C. G2
- D. Mitotic Phase
22 The two sub-phases of the mitotic phase are

○ A  Mitosis and cytokinesis
○ B  Prophase and metaphase
○ C  Interphase and cytokinesis
○ D  Anaphase and telophase
23 Which of the following represents the phases of mitosis in proper sequence?

- A  Prophase, metaphase, anaphase, telophase, and cytokinesis
- B  Interphase, prophase, anaphase, metaphase, telophase
- C  Interphase, prophase, metaphase, anaphase, and telophase
- D  Prophase, prometaphase, metaphase, anaphase, and telophase
During prophase

- A  The mitotic spindle starts to form from the centrosomes
- B  The nucleus breaks down
- C  The centrosomes move towards opposite ends of the cell
- D  All of the above
25 What phase of mitosis is shown?

- A Prometaphase
- B Metaphase
- C Anaphase
- D Telophase
26 What happens during telophase

- A The cell elongates
- B The nuclear envelope reforms around each set of chromosomes
- C The nucleoli reappear
- D All of the above
27 How does cytokinesis differ in plant cells and animal cells?

○ A  The process is the same in all eukaryotes

    In animal cells, a cell plate forms between the two nuclei; in plant cells, a cleavage furrow forms and the cytoplasm is “pinched” in half

○ B  In plant cells, a cell plate forms between the two nuclei; in animal cells, a cleavage furrow forms and the cytoplasm is “pinched” in half

○ C  A cell membrane forms around animal cells only
28 Which disease is the result of uncontrolled cell division?

- A Sickle-cell anemia
- B Alzheimer’s
- C Chicken Pox
- D Cancer
29 The process of meiosis results in the formation of?

○ A Body cells
○ B Somatic cells
○ C Sex cells with a haploid number of chromosomes
○ D Sex cells with homologous chromosomes
30 During metaphase I the way homologous chromosomes line up in the middle can vary. Therefore, during anaphase I, maternally and paternally inherited genes on the homologues move to one pole or the other, independent of the other genes. This process is referred to as

- A Crossing-over
- B Independent Assortment
- C Lateral gene transfer
- D Chromosome reduction
31 Independent assortment of chromosomes results in

- A Cells with unique combinations of genes
- B Cells with identical arrangements of genes
- C Cells with different numbers of chromosomes
- D Cells with a haploid number chromosomes
32 What is the end product of Meiosis II?

- A 2 genetically different diploid daughter cells
- B 2 genetically identical diploid daughter cells
- C 4 genetically different haploid cells
- D 4 genetically identical haploid cells
Which of the following is an example of nondisjunction?

- A  Trisomy
- B  Substitution
- C  Insertion
- D  Deletion
Organisms that have two identical alleles for a trait are

- A  Heterozygous
- B  Homozygous
- C  Hybrid
- D  Recessive
35 Which scientist(s) is best known as the “Father of Genetics”?

- A Stanley Miller
- B Frederick Griffith
- C Francis Crick & James Watson
- D Gregor Mendel
36 The Law of Segregation states that

- A  Allele pairs separate during meiosis
- B  Alleles are dominant or recessive
- C  Alleles come in pairs
- D  An individual can be homozygous or heterozygous
37 If a plant with white flowers is allowed to self-pollinate and generation after generation it produces plants with white flowers, this is an example of

○ A  Incomplete dominance
○ B  The Law of Segregation
○ C  True breeding
○ D  hybridization
38  Recessive traits appear only when an organism is
________________________.

☐ A  Fully grown
☐ B  Different from its parents
☐ C  Heterozygous
☐ D  Homozygous
39  What color pod would the F1 plants be if a yellow pod pea plant (Yy) was crossed with a green pod pea plant (yy)?

- A  All Green
- B  All Yellow
- C  Half Green, half yellow
- D  $\frac{3}{4}$ green, $\frac{1}{4}$ yellow
40 What are the chances that a red (RR) flowering plant and a white (rr) flowering plant will produce red offspring?

- A 0%
- B 25%
- C 75%
- D 100%
41 If a pea plant with white flowers and yellow pods (WwYY) is crossed with a pea plant with white flowers and green pods (WWyy), what is the probability the offspring will have white flowers and yellow pods?

☐ A 1/16

☐ B 1/4

☐ C 1/2

☐ D 1
42 When a gene has more than two alleles this is known as

- A Codominance
- B Polygenic dominance
- C Complete dominance
- D Multiple alleles
43 If a man with Type A blood marries a woman with Type B blood, which of the following is not a possible genotype for their offspring?

- A AO
- B AA
- C BO
- D OO
44  ABO blood groups are an example of

- A  Incomplete dominance
- B  Codominance
- C  Polygenic Inheritance
- D  Pleiotropy
If a trait is X-linked, males pass the X-linked allele to ________________ of their daughters.

- A  None
- B  ¼
- C  ½
- D  All
46 Which of the following does not involve preparation of a karyotype?

- A  Genetic testing of parents
- B  Fetoscopy
- C  Chronic villus sampling
- D  Amniocentesis
Using the pedigree, assuming the shaded individuals are affected, the allele causing the disorder can best be described as:

- A. Autosomal dominant
- B. Autosomal recessive
- C. X-linked dominant
- D. X-linked recessive
48 Using the pedigree above, what was the genotype of individual 4 from generation II?

- A  XX
- B  XAXA
- C  XXA
- D  XAY
49 Using the above pedigree, if individual 2 from generation III marries an individual that is heterozygous for this trait, what is the probability that their male offspring would be affected?

- A 0
- B ¼
- C ½
- D 1
50 Biological evolution refers to

- **A** Change over time
- **B** The process by which one organism evolves into another
- **C** The process by which modern organisms have descended from ancient organisms over time
- **D** The acquisition of beneficial traits that are passed down from parent to offspring
An inherited characteristic that enables a living organism to better survive and reproduce in its environment is known as a(n)

A. Phenotype
B. Adaptation
C. Trait
D. Mutation
52 Lamarck’s “use it or lose it” theory of inheritance was incorrect because he proposed that

- A Traits that were not beneficial would disappear over time
- B Traits that were beneficial would remain over time
- C Traits that were acquired during an organism’s lifetime could be passed on to the next generation
- D All of the above
Human, whale, and bat forelimbs are examples of

- A  Vestigial organs
- B  Homologous structures
- C  Comparative embryology
- D  All of the above
54 Structures that have lost function and shrunk over time are known as

○ A Homologous structures
○ B Comparative embryology
○ C Vestigial structures
○ D Convergent evolution
Natural selection results in:

- A. Changes in inherited characteristics of a population over time.
- B. Adaptations that enhance an organism’s ability to survive and reproduce in its environment.
- C. Survival of organisms that can out-compete other organisms for food, water, and shelter.
- D. All of the above
What mode of natural selection favors one extreme phenotype in a population?

- A  Stabilizing selection
- B  Disruptive selection
- C  Directional selection
- D  Diagonal selection
Disruptional selection

- A. Favors extreme variations in the population
- B. Leads to increased variation within a population
- C. Is a step toward divergent evolution
- D. All of the above
58 Which of the following is molecular evidence for descent from a common ancestor?

- A Conservation of rRNA across different species
- B Gene conservation
- C A universal genetic code shared by all living things
- D All of the above
The Hardy-Weinberg equilibrium equation is used to measure:

A. Whether or not a population is evolving
B. Genotypic frequencies within a population
C. Phenotypic frequencies within a population
D. All of the above
60  In the Hardy-Weinberg equation: $p^2 + 2pq + q^2 = 1$

- A  $p$ represents the frequency of the dominant allele
- B  $2pq$ represents the frequency of the heterozygous genotype
- C  $q$ represents the frequency of the recessive allele
- D  All of the above
61 It is impossible for a real population to maintain H-W equilibrium because

○ A  Natural selection is always occurring
○ B  Gene flow and mutations cannot be prevented
○ C  Most organisms choose their mates; it’s not random
○ D  All of the above
62 Genetic drift refers to

- A Random changes in allele frequencies within a population
- B Random mutations within a population
- C Non-random selection of mates within a population
- D All of the above
The bottleneck effect

- A  Occurs when most of a population dies off due to a natural disaster
- B  Results in overall loss of heterozygosity
- C  Results in increased genetic variability
- D  A and B only
64 A change in allele frequency that results from the migration of a small subgroup of a population is called

☐ A  Natural selection
☐ B  The H-W principle
☐ C  The founder effect
☐ D  Genetic equilibrium
65  Extinction can be caused by which of the following factors

- A  Reduced genetic variation within a population
- B  Disease
- C  Natural disaster
- D  All of the above
Darwin’s finches on the Galapagos Islands likely emerged from a common ancestor on the mainland. This pattern of macroevolution is known as

- A Convergent evolution
- B Adaptive radiation
- C Divergent evolution
- D Punctuated equilibrium
The sudden appearance or disappearance of species in the fossil record has led some scientists to conclude that macroevolution does not always occur gradually, but follows a pattern of relative stability followed by rapid bursts of change. This theory is known as

- A Punctuated equilibrium
- B Divergent evolution
- C Adaptive radiation
- D Coevolution
Why is the study of evolution important?

- **A** It helps us understand and interpret events in the living world
- **B** It helps us predict how living organisms will respond to human activity in the environment
- **C** It helps us understand how populations of bacteria and viruses change, which can inform medical decisions
- **D** All of the above
69 In order for speciation to occur

- **A** Members of a population must become reproductively isolated from one another.
- **B** Members of different species must interbreed and produce viable offspring.
- **C** Members of a population must be geographically isolated from one another without losing their ability to interbreed.
- **D** None of the above.
Two populations of frogs are separated from one another by a body of water. Thousands of years later, the two groups of frogs can no longer mate with each other because each group has changed so much genetically. This is an example of speciation by what mechanism

- A Behavioral isolation
- B Temporal isolation
- C Geographic isolation
- D Mechanical isolation
71 Which of the following is an example of behavioral isolation?

- **A** A small population of fruit flies is separated from the rest of the population by a storm that sweeps them away.

- **B** Two closely related organisms of different species mate and reproduce, but the offspring is sterile.

- **C** Different types of warblers (a type of bird) have different mating songs, which prevents some warblers from breeding with others.

- **D** All of the above
Based on their names, you know that the fish Oncorhynchus gorbuscha and Oncorhynchus nerka DO NOT belong to the same

- A  phylum
- B  family
- C  genus
- D  species
73 Prokaryotes make up which of the following domains?

- A  Bacteria
- B  Archea
- C  Eukarya
- D  a and b only
- E  all of the above
74 Organisms made up of cells containing membrane-bound nuclei and organelles are characteristic of which Domain?

- A  Bacteria
- B  Archea
- C  Eukarya
- D  a and b only
- E  all of the above
75 Which of the following are traits that define different phyla within the kingdom Animalia?

☐ A  vertebrae

☐ B  body plan symmetry

☐ C  body cavity development

☐ D  all of the above
A trait that is present in an organism, but was absent in the last common ancestor of the group being considered is known as

- [ ] A An adaptation
- [x] B A derived character
- [ ] C An ancestor
- [ ] D None of the above
Cladistic analysis is used to show

- A. The importance of each derived character
- B. The order in which derived characters evolved
- C. All traits an organisms possesses
- D. A family tree based on molecular similarities
The principles of parsimony and maximum likelihood ensure that phylogenetic trees

- Are constructed based on the simplest and most likely sequence of evolutionary events
- Are constructed based on the most complex and likely sequence of evolutionary events
- Are constructed based on molecular evidence only
- Reflect possible evolutionary events in non-specific order
All of Earth's water, land, and atmosphere within which life exists is known as a

- A Population
- B Community
- C Biome
- D Biosphere
80 All the plants, animals, fungi living in a pond make up a

- A Population
- B Community
- C Biome
- D Biosphere
81 Which of the following is a biotic factor in an ecosystem?

- A  The amount of oxygen in the atmosphere
- B  The climate of the region
- C  The amount of annual precipitation
- D  The types of carnivores
82 Which pair of organisms would most likely compete for the same ecological niche?

- A  Bacteria and fungi
- B  Deer and wolf
- C  Tree and fungi
- D  Deer and bacteria
83 Which of the following is an example of mutualism?

○ A  A tick living on the scalp of a human
○ B  Nitrogen fixing bacteria living in the roots of legumes
○ C  A barnacle living on a whale
○ D  A wolf preying on cattle
84 Which set of terms best identifies the letters in the above diagram?

- A Photosynthesis, inorganic molecules, decomposition
- B Respiration, organic molecules, digestion
- C Photosynthesis, organic molecules, respiration
- D Respiration, inorganic molecules, photosynthesis
85  Autotrophs convert radiant energy into

- A  Lipids
- B  Proteins
- C  Carbohydrates
- D  Nucleic acids
A scorpion stalks, kills, and then eats a spider. Based on its behavior, which ecological terms describe the scorpion?

- A Producer, herbivore, decomposer
- B Producer, carnivore, heterotroph
- C Predator, autotroph, herbivore
- D Predator, carnivore, consumer
Removing all predators from an ecosystem would most likely result in

- A. An increase in the number of higher order consumers
- B. A decrease in the number of new predators moving
- C. An increase in the amount of organic waste generated
- D. An increase in the number of herbivores
88 How is carbon stored in the biosphere?

- A In the atmosphere as carbon dioxide
- B Underground as fossil fuels and calcium carbonate rock
- C In plant and animal tissues
- D All of the above
A rocky island appears as ocean waters recede. Which forms of vegetation would likely appear first on the bare rock?

- A  Lichens
- B  Weeds
- C  Shrubs
- D  Trees
90  A biome is characterized by its particular set of abiotic factors and

- A  Average temperatures and precipitation
- B  Specific geographic location
- C  Distance from the equator
- D  Characteristic ecological community
All of the following are factors that influence the climate within a biome EXCEPT

- A  Latitude
- B  Altitude
- C  Distance from the Sun
- D  The greenhouse effect
92 Which two biomes experience the least amount of precipitation?

- A  Tropical rain forest and temperate grassland
- B  Tropical savanna and tropical dry forest
- C  Tundra and desert
- D  Boreal forest and tundra
93 Which organism would most likely be found in the biome characterized by permafrost, cold temperatures, and little vegetation?

- A  Polar bear
- B  Moose
- C  Iguana
- D  Whitetail deer
Which statement is a valid inference if the human population continues to grow at current rates?

A. Future ecosystems will be distressed and many animal habitats will be destroyed.

B. Global warming will decrease as a result of lower demand for fossil fuels.

C. Over one hundred years after resources are used up the human population will level off.

D. The human population can continue to grow at this rate indefinitely.
95 Biological magnification refers to

A. The higher concentrations of toxins in the tissues of higher order consumers exposed to toxic waste.
B. The higher concentrations of toxins in the tissues of primary producers exposed to toxic waste.
C. The intensification of the effects of pollution in an ecosystem.
D. Increased levels of carbon dioxide in the Earth’s atmosphere.
Scientists think an increase in the amount of carbon dioxide released into the atmosphere may be causing

- A  Average temperatures to increase
- B  A blanket of greenhouse gases to surround the Earth
- C  A hole in the O-zone layer
- D  Global cooling
97 The goals of conservation biologist include all of the following EXCEPT

- A  Wise management of natural resources
- B  Introduction of non-native species into ecosystems
- C  Preservation of habitats and wildlife
- D  Protection of biodiversity
Using renewable resources while ensuring that they are not depleted is a practice called

A. Monoculture
B. Subsistence hunting
C. Sustainable development
D. Ecological succession
99 A dicot has

- A Two embryos
- B Two seed coats
- C Two sepals
- D Two cotyledons
100 Which of the following is a characteristic of a monocot?

- A Branched leaf veins
- B Complex vascular bundles
- C Petals in multiples of 4 or 5
- D One taproot
101 Which of the following is not unique to a plant cell?

- A Chloroplast
- B Cell wall
- C Lysosome
- D Central vacuole
102 Which of the following is not a function of the root system of plants

- A  Anchor the plant
- B  Absorb minerals
- C  Store food
- D  Contain reproductive structures
Organisms that maintain a constant internal body temperature regardless of external temperatures are known as

- A Heliotherms
- B Endotherms
- C Ectotherms
- D Mesoderms
104 Which of the following is NOT a primary function of the integumentary system

- A  Vitamin D production
- B  Body temperature regulation
- C  Structure and support
- D  Sensation
Sensory input, integration, and motor output are the main functions of the

- A   Endocrine System
- B   Nervous System
- C   Muscular System
- D   Digestive System
106 Which body system acts as a transport system for nutrients and oxygen?

- A Circulatory System
- B Digestive System
- C Respiratory System
- D Endocrine System
107 The tonsils, appendix, bone marrow, and thymus gland are all components of the

- A Circulatory System
- B Respiratory System
- C Lymphatic System
- D Endocrine System
108 Which of the following lists the processes of the excretory system in the correct order

- A  Filtration, reabsorption, secretion, excretion
- B  Reabsorption, filtration, secretion, excretion
- C  Excretion, filtration, reabsorption, secretion
- D  Filtration, secretion, reabsorption, excretion
Identify the two starting products for nuclear transfer cloning.

- A Egg Cell & donor nucleus
- B Embryo & donor nucleus
- C Embryo & Egg Cell
- D Two donor nuclei
110 Where are embryonic stem cells found?

- A  In blood
- B  In blastocysts
- C  In all major organs
- D  In egg cells
111 Which of the following best represents the steps of Recombinant DNA Technology in order?

○ A Isolate the gene of interest, make more of the gene of interest, cut the gene of interest from the genome, put the recombined piece of DNA into the host

Collect the protein product, cut the gene of interest from the genome, make more of the gene of interest, put the recombined piece into the host genome

○ B Make more of the gene of interest, cut the gene of interest from the genome, paste the gene into the host genome, collect the protein product

○ C Cut the gene of interest from the genome, make more of the gene of interest, insert the gene of interest into the host organism, collect the protein product
112 What is used to cut the gene of interest from the genome?

- A  Restriction Enzymes
- B  DNA sequencer
- C  Gel Electrophoresis
- D  Proteins