LexSciBowl

Biology Test

Part A:

Every correct answer is worth 1 point. There is no penalty for incorrect answers.

1) Which of the following is TRUE of water?
    a) It exhibits hydrogen bonding
    b) It has low surface tension
    c) It is densest in the solid phase
    d) It is nonpolar

2) Which of the following choices does NOT describe a way in which prokaryotes differ from eukaryotes?
    a) Prokaryotes have a plasma membrane
    b) Prokaryotes lack membrane-bound organelle
    c) Prokaryotes have circular DNA
    d) Prokaryotes have peptidoglycan cell walls

3) Which organelle is involved in cellular digestion and has an internal pH of about 4.8?
    a) Mitochondria
    b) Nucleus
    c) lysosome
    d) endoplasmic reticulum

4) mRNA, tRNA, and rRNA are all involved in the synthesis of what macromolecule?
    a) nucleic acids
    b) proteins
    c) Lipids
    d) carbohydrates

5) What are the sex chromosomes for male and female humans, respectively?
    a) XX and XY
    b) XY and XX
    c) X0 and XX
    d) YY and XY

6) If a cell starts out with 10 chromosomes in G1, how many chromosomes will each daughter cell have after undergoing two rounds of meiosis?
    a) 5
    b) 10
    c) 15
    d) 20

7) A red flower and a white flower are cross pollinated, and all the offspring are pink. What genetic phenomenon does this describe?
    a) cross-dominance
    b) sex-linked inheritance
    c) codominance
    d) incomplete dominance

8) In DNA, base-pairing between nucleotides occurs due to what kind of bonding?
    a) hydrophobic interactions
    b) ionic bonding
    c) hydrogen bonding
    d) covalent bonding

9) In plants, starch is stored in what organelle?
    a) glyoxysome
    b) central vacuole
    c) chloroplast
    d) amyloplast

10) Which of the following characteristics is unique to eudicots?
    a) floral organs in multiples of three
    b) parallel leaf venation
    c) active vascular cambium
    d) fibrous root system

11) In flowers, the anther carries out what function?
    a) catches pollen and delivers it to ovules
    b) produces pollen
    c) protects seeds
    d) provides structural support for flower

12) Mammals possess which of the following?
    a) mammary glands
    b) feathers
    c) nucleated red blood cells
    d) two-chambered heart

13) What is the largest bone in the human body?
    a) Tibia
    b) humerus
    c) Scapula
    d) femur

14) Which of the following diseases is caused by a bacteria?
    a) bubonic plague
    b) Malaria
    c) AIDS
    d) chicken pox

15) Birds are adapted for flying in all of the following ways EXCEPT:
    a) large air sacs in the body
    b) efficient one-way ventilation of the lungs
    c) light, porous bones
    d) absence of liver to reduce weight

16) Digestion begins in what organ?
    a) esophagus
    b) stomach
    c) mouth
    d) small intestine

17) Catherine rings a bell every time she feeds her blobfish. After a month of doing this, her blobfish salivates upon hearing the bell even without food. This is an example of what kind of learning?
    a) operant conditioning
    b) classical conditioning
    c) nonassociative learning
    d) fixed action pattern

18) Which of the following is an example of a producer?
    a) Grasshopper
    b) field mouse
    c) Sunflower
    d) fungus

19) What biome is characterized by coniferous forests, grizzly bears, and cold temperatures?
    a) temperate forest
    b) tundra
    c) taiga
    d) chaparral

20) What are the three domains of life?
    a) Eukarya, Prokarya, Archaea
    b) Eukarya, Monera, Archaea
    c) Protista, Animalia, Plantae
    d) Chordata, Porifera, Bilateria

21) The phospholipids in a cell membrane have both hydrophobic and hydrophilic regions. What term best describes this?
    a) Soluble
    b) Amphoteric
    c) Selectively permeable
    d) Amphipathic

22) What process during protein synthesis converts mRNA into a sequence of amino acids?
    a) Transcription
    b) Replication
    c) Senescence
    d) Translation

23) Which of the following organelles possesses a single membrane?
    a) Peroxisome
    b) Endoplasmic Reticulum
    c) Mitochondria
    d) Nucleus

24) What amino acid always forms the start codon of all reading frames?
    a) Lysine
    b) Phenylalanine
    c) Methionine
    d) Proline

25) How many essential amino acids are there?
    a) 6
    b) 9
    c) 12
    d) 15

26) What are the respiratory organs of arachnids?
    a) Spiracles
    b) Skin
    c) Tracheal system
    d) Book Lungs

27) All of the following are conditions that satisfy Hardy Weinberg Equilibrium EXCEPT
   a) Large populations
   b) No natural selection
   c) No mutations
   d) Small populations

28) Which of the following hormones are produced by the posterior pituitary gland?
   a) GH (growth hormone)
   b) MSH (melanocyte stimulating hormone)
   c) LH (luteinizing hormone)
   d) ADH (antidiuretic hormone)

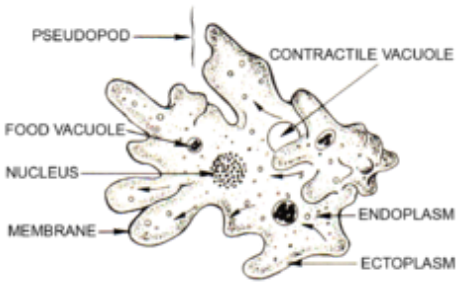
29) What element is central to the chlorophyll molecule?
   a) Sodium
   b) Magnesium
   c) Manganese
   d) Aluminum

30) What is the pigment that gives human skin, hair color, and eyes a darker color?
   a) Phycoerythrin
   b) Chlorophyll
   c) Melanin
   d) Carotenoids

Part B :

Every correct answer is worth 1 point. There is no penalty for incorrect answers.

31) Bharat decides to go swimming and contracts a brain-eating amoeba, shown below. Which of the following is FALSE regarding this organism?
   a) It belongs in the Kingdom Animalia
   b) It most likely lives in salt water
   c) It engulfs its prey using phagocytosis
   d) It is a heterotroph



32) Karen collects a sample of Eric's cheek cells and observes them under a microscope. What kind of microscope would be most suitable if she wants to view the interior of the cell at a nanomolecular scale?
   a) phase-contrast microscope
   b) confocal fluorescent microscope
   c) scanning electron microscope
   d) transmission electron microscope

33) Based on the following descriptions, which brain regions are correctly matched with their function?

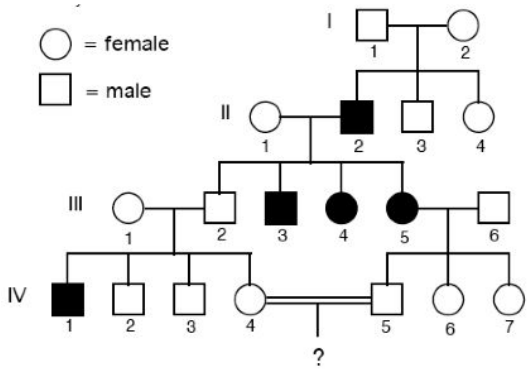
I. Cerebellum — motor learning
II. Prefrontal cortex — personality and decision making
III. Occipital lobe — hearing

a) I only
b) II only
c) I and II
d) I, II, and II

34) Aiyappa just ate a lot of fries and has developed high blood sodium. Which of the following physiological responses would you expect to see as a result?
a) increased urine output
b) increased blood pressure
c) decreased blood osmolarity
d) decreased urine osmolarity

35) Andrew is unable to match colors with his date at prom because he is unfortunately colorblind. What cells in his eye are defective?
a) Rods
b) Cones
c) Chromocytes
d) Horizontal cells

36) Clive has a rare genetic disease called *Ijustmadethisup* and comes to you for genetic counseling. Based on his family pedigree (below), what mode of inheritance does this disease exhibit?

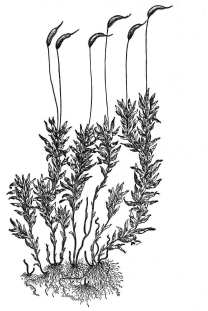


a) autosomal recessive
b) autosomal dominant
c) sex-linked recessive
d) mitochondrial inheritance

37) Malignant cancer cells are nearly impossible to get rid of because they can persist indefinitely without showing signs of normal aging. What enzyme is directly responsible for the increased longevity of cancer cells?
a) DNA ligase
b) reverse transcriptase
c) aminoacyl tRNA synthetase
d) telomerase

38) Which of the following vitamins is water soluble?
a) Vitamin D
b) Vitamin A
c) Vitamin E
d) Vitamin C

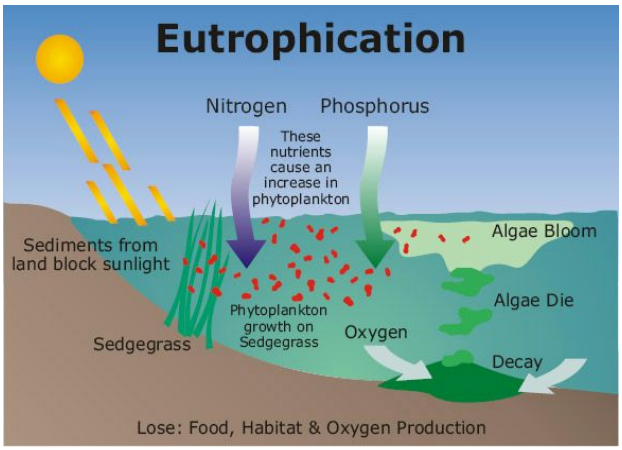
39) Roshan and Vivek were walking through the woods one day when they came across small plant that looked like the one below. To what phylum does this plant most likely belong to?



a) Angiospermae
b) Coniferophyta
c) Bryophyta
d) Hepatophyta

40) Consider the process shown in the diagram on the left. Which of the following statements is FALSE regarding this process?

a) bacteria digest the algae anaerobically, resulting in oxygen depletion in the water
b) nitrogen and phosphorus are limiting nutrients in this ecosystem
c) this process can be caused by fertilizer runoff into bodies of water
d) the biodiversity of this ecosystem decreases as a result of this process



41) The species *Gouldilocks* was once very common. However, its habitat was brutally destroyed and replaced by manmade modular classrooms. Only a small random handful of the original population survived. Which of the following statements is true about this small population of survivors?

a) it has undergone genetic drift
b) it has undergone balancing selection
c) it has undergone natural selection
d) it has undergone speciation

42) Snigdha is a last-minute procrastinator who has been sent home after falling asleep in all of her high-school classes. What hormone is responsible for regulating her sleep cycle?

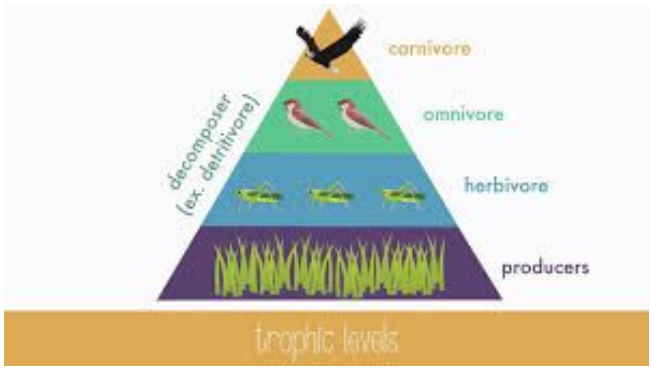
a) Melatonin
b) Thyroxine
c) Erythropoietin
d) Inhibin

43) As Cathy went traveling through a shallow pond, she notices a strange animal that looks like the following picture. What excretory organs might this animal possess?

a) Metanephridia
b) Protonephridia
c) Malpighian Tubules
d) Kidneys

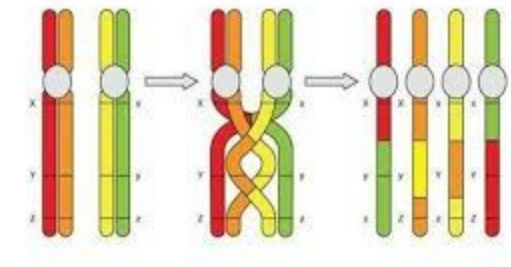
44) Who is considered to be the father of taxonomy?
a) Gregor Mendel
b) G.N. Lewis
c) Charles Darwin
d) Carolus Linnaeus

45) What level of the following trophic pyramid has the least amount of energy available?



a) Producers
b) Herbivores
c) Omnivores
d) Carnivores

46) The following process shown in the diagram occurs during what stage of meiosis?



a) Prophase I
b) Prophase II
c) Metaphase I
d) Telophase I

47) Jason finds an organism in the woods and decides to examine it. He determines that the animal has chitin present in its cell wall. Which of the following kingdoms in the domain Eukarya fits this description?

a) Animalia
b) Plantae
c) Protista
d) Fungi

48) What lobe in the brain is responsible for vision?

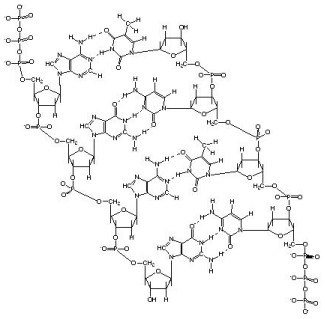
a) Occipital
b) Parietal
c) Temporal
d) Frontal

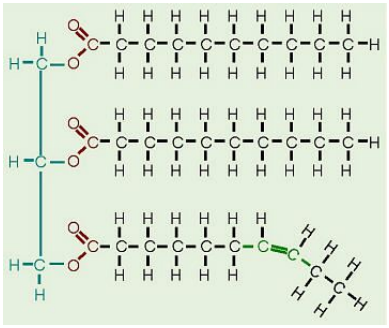
49) In what part of the chloroplast does the Calvin Cycle occur in?

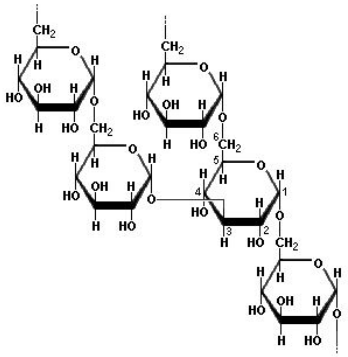
a) Thylakoids
b) Granum
c) Inner Membrane
d) Stroma

50) Match the following macromolecule options to their diagrams:

a) Triglycerides
b) Carbohydrates
c) Protein
d) DNA

i) 

ii) 

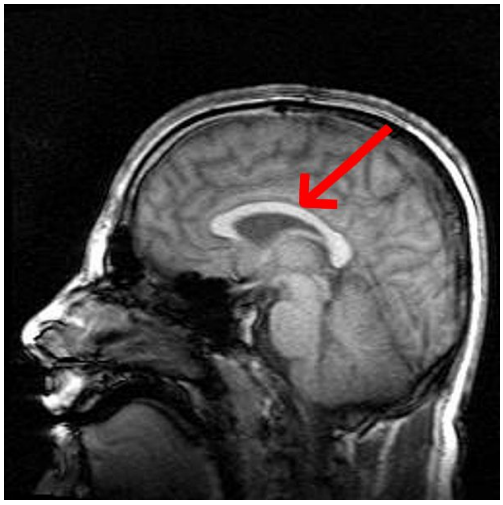
iii) 

iv) 

Part C:

This section is worth 10 points in total.

You are a neurologist (congratulations!). Have a brain scan:



1) What imaging method was used to produce this image?

2) What brain structure is indicated by the arrow in the image?

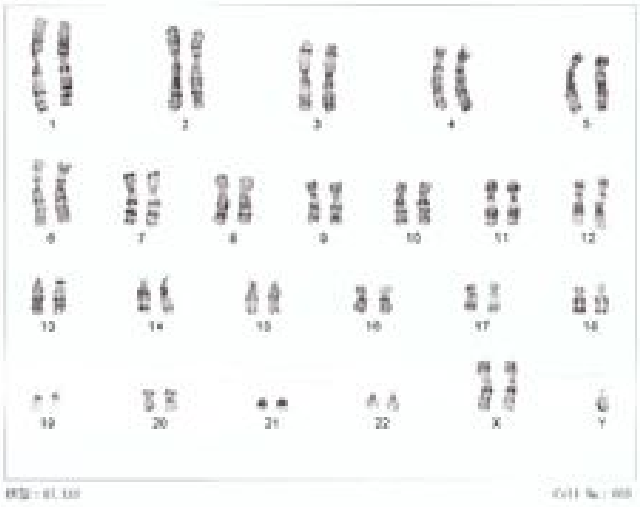
3) A 65-year-old patient presents with a resting tremor, muscular rigidity, and difficulty initiating movement. What disorder does this patient most likely have?

4) To treat the patient above, you prescribe a drug that mimics the action of a certain neurotransmitter which is missing in her brain. What neurotransmitter is this?

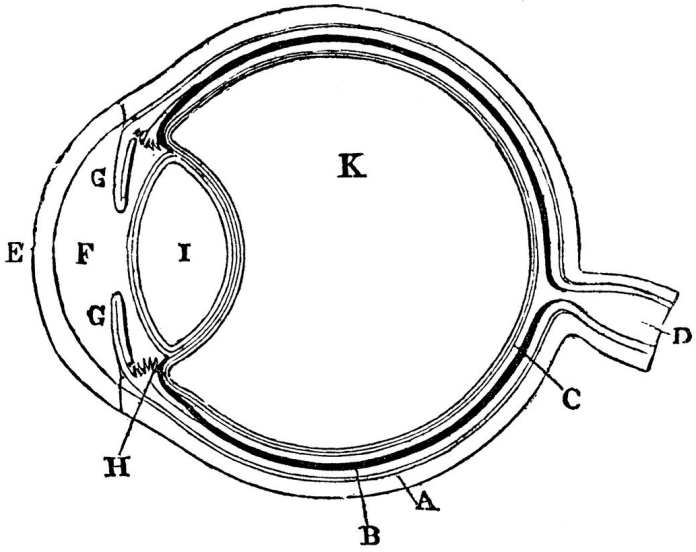
5) What specific part of the patient's brain has degenerated as a result of this disease?

6) On the distant planet of Rainbowphilia, a heterozygous cross between two F1 generation pink and short pea plants is performed. On the planet, the pink peas are dominant to purple peas and round peas are dominant to wrinkled peas. Phenotypically, how many of the peas will end up being wrinkled and purple if a total of 2,000 peas are produced?

7) Regard the diagram below. You are a geneticist who is trying to diagnose a prenatal baby. After performing various biochemical tests, the following karyotype is produced. What genetic disorder will this child end up having?



Questions 8-10 are related to the following diagram:



8) What organ is shown by this diagram?
9) What is the structure represented by letter E?
10) What is the function of letter E?

You're done :D

Note: This exam is modeled after the USA Biology Olympiad, the nation's premiere biology competition for high school students. If you are interested in biology, this is definitely something you should get involved in at your high school!