Evolution

1. Which pair of bases is NOT a complementary base pair?
   A. thymine, adenine.
   B. adenine, guanine.
   C. guanine, cytosine.
   D. cytosine, guanine.

2. The strands of DNA molecules are held together by H-bonds between
   A. sugars.
   B. phosphates.
   C. complementary bases.
   D. pairs of purines and pairs of pyrimidines.

3. Meiosis results in
   A. 2 diploid daughter cells.
   B. 4 diploid daughter cells.
   C. 2 haploid daughter cells.
   D. 4 haploid daughter cells.

4. Replication provides daughter cells formed by mitosis with exact copies of
   A. chromosomes without any mutations.
   B. all the genetic information of the organism.
   C. the genes to be used by those particular cells.
   D. suitable segments of DNA required for the survival.

5. Variations of a specific gene are
   A. alleles.
   B. recessive.
   C. mutations.
   D. genotypes.

6. The MOST ACCURATE way to identify evolution is
   A. observing mutations.
   B. finding genotypes that don't change over time.
   C. documenting changes in physical features over time.
   D. recording changes in gene frequencies in a gene pool.

7. The ability of an organism to pass on its genes to its offspring is part of
   A. fitness.
   B. radiation.
   C. evolution.
   D. adaptation.

8. Darwin is noted for the
   A. Gradual Change Model.
   B. Theory of Natural Selection.
   C. Discovery of DNA structure.
   D. Punctuate Equilibrium Model.

9. Individuals lacking specializations required for survival in a changing environment
   A. die.
   B. adapt.
   C. evolve.
   D. mutate.

10. Natural selection does NOT involve
    A. selective pressures.
    B. reproductive success.
    C. phenotypic variations.
    D. individuals adapting to an environment.

11. A bimodal distribution of phenotypes could naturally result from
    A. artificial selection.
    B. disruptive selection.
    C. stabilizing selection.
    D. directional selection.

Google it!

12. Evolution of Viceroy Moths illustrates
    A. disruptive selection.
    B. accidental selection.
    C. stabilizing selection.
    D. directional selection.

13. The evolutionary changes called industrial melanism
    A. may become reversed.
    B. have stopped completely
    C. are continuing at a rapid rate.
    D. are examples of genetic drift.

14. Industrial melanism is an example of
    A. artificial selection.
    B. disruptive selection.
    C. accidental selection.
    D. stabilizing selection.

15. Which is NOT an example of artificial selection?
    A. Bird watching.
    B. Breeding racehorses.
    C. Raising purebred dogs.
    D. Protecting endangered species.

16. The accumulation of toxins in the tissues of organisms is known as
    A. extinction.
    B. natural selection.
    C. disruptive selection.
    D. biological magnification.

17. Many predatory birds suffered due to human use of pesticides because
    A. all of the following.
    B. their food sources were dying off.
    C. the pesticides accumulated in their tissues.
    D. the pesticides affected their successful reproduction.

18. Genetic drift is MOST LIKELY to occur in a
    A. large population due to selective pressures.
    B. small population due to selective pressures.
    C. large population without the influence of selective pressures.
    D. small population without the influence of selective pressures.

19. A rare allele in a small population may become more common relatively quickly due to
    A. genetic drift.
    B. adaptive radiation.
    C. divergent evolution.
    D. convergent evolution.

20. A species is BEST defined as a set of organisms that
    A. live in the same area.
    B. is part of a population.
    C. successfully interbreed.
    D. has the same physical features.

Taxonomy

The first FOUR questions refer to the following name for a vine maple tree:

Acer circinatum

1. The name as it is written is
   A. correct.
   B. incorrect; it should be underlined.
   C. incorrect; both words should be capitalized.
   D. incorrect; neither word should be capitalized.

2. The biological name of vine maple is
   A. *Acer*.
   B. *circinatum*.
   C. *Acer circinatum*.
   D. none of the above.

3. The genus name for vine maple is
   A. *Acer*.
   B. *circinatum*.
   C. *Acer circinatum*.
   D. none of the above.

4. The species name for vine maple is
   A. *Acer*.
   B. *circinatum*.
   C. *Acer circinatum*.
   D. none of the above.

5. The two-word naming system used in biology is called
   A. taxonomy.
   B. dichotomy.
   C. binomial taxonomy.
   D. binomial nomenclature.

6. Biologists who classify organisms are
   A. taxologists.
   B. taxonomists.
   C. taxidermists.
   D. taxorganists.

7. All taxons more general than "species" are
   A. written in italics.
   B. based on structure.
   C. biologically useless.
   D. determined by biologists.

8. Horses and zebras are not members of the same species because they
   A. do not interbreed.
   B. are different sizes.
   C. eat different foods
   D. have different markings.

9. Members of the same species
   A. are in the same genus.
   B. live in the same location.
   C. have equal survival chances.
   D. are all the same colour and shape.

10. To determine if two populations of birds living on different islands are members of the same species, one must consider
    A. physical similarity.
    B. embryological similarity.
    C. environmental requirement.
    D. mutual reproductive capability.

11. Which sequence of taxa is correct?
    A. species, genus, family, class, order, phylum, kingdom
    B. genus, class, order, kingdom, phylum, species, family
    C. class, genus, family, species, order, phylum, kingdom
    D. species, genus, family, order, class, phylum, kingdom

12. The taxon most clearly defined by natural biological barriers is
    A. class.
    B. genus.
    C. species.
    D. phylum.

13. The third smallest taxon is
    A. class.
    B. order.
    C. family.
    D. phylum.

14. The taxon that includes the others listed is
    A. class.
    B. order.
    C. genus.
    D. phylum.

15. Homologous structures have
    A. the same type of tissues and the same functions.
    B. different types of tissues and may have different functions.
    C. different types of tissues but may have the same functions.
    D. the same types of tissues, but may have different functions.

16. Embryos of different animals appear similar during various stages of their development. This suggests they are
    A. evolving.
    B. mutating.
    C. genetically related.
    D. analogous to each other.

17. A mushroom is a fungus. What do you know to be true of mushrooms?
    A. unicellular and eukaryotic.
    B. unicellular and prokaryotic.
    C. multicellular and eukaryotic.
    D. multicellular and prokaryotic.

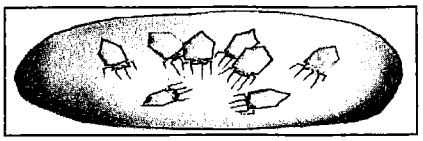
18. Unlike a plant, a photosynthetic protist
    A. is unicellular.
    B. has a nucleus.
    C. uses mitochondria.
    D does not contain chloroplasts.

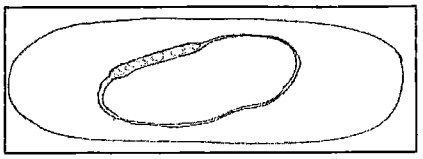
19. Nucleated unicellular organisms with cilia are probably
    A. ingestive protists.
    B. absorptive protists.
    C. prokaryotic protists.
    D. photosynthetic protists.

20. Which set of criteria is generally used to classify organisms into kingdoms?
    A. size and colouration.
    B. habitat and adaptations.
    C. structures and mode of nutrition.
    D. social and reproductive behaviours.

Microbiology

CHECK YOUR KNOWLEDGE OF DIAGRAMS:





1. The first structure illustrated to the right represents one stage in the lytic cycle.
   a. Describe what is being illustrated.
   b. Describe the events that occurred just before the stage illustrated as well as the events that will happen next.

2. The second structure illustrated to the right represents one stage in the lysogenic cycle.
   a. Describe what is being illustrated.
   b. Describe the events that occurred just before the stage illustrated as well as the events that will happen next.

1. What did Jenner inject into people to vaccinate them against small pox?
   A. Fluid from a cowpox blister.
   B. Blood from an infected cow.
   C. Pus from an infected person.
   D. Antibiotics he developed against small pox.

2. *E. coli* lives in
   A. water.
   B. bacteria.
   C. blood cells.
   D. intestines of mammals.

3. Structurally, Bacteriophage T4 is an arrangement of
   A. proteins around a DNA chromosome.
   B. proteins around an RNA chromosome.
   C. a DNA chromosome around a protein core.
   D. an RNA chromosome around a protein core.

4. The sequence that BEST describes the lytic cycle is
   A. infection – replication – self-assembly – lysis.
   B. replication – infection – self-assembly – lysis.
   C. infection – self assembly – replication – lysis.
   D. replication – self-assembly – infection - lysis.

5. The genetic material of a retrovirus will organize the synthesis of
   A. DNA from its RNA structure.
   B. DNA from its DNA structure.
   C. RNA from its RNA structure.
   D. RNA from its DNA structure.

6. Retroviruses are medically significant because they inject
   A. cancer-causing genes.
   B. cancer preventing genes.
   C. genetic material that produces cancer-causing genes.
   D. genetic material that produces cancer-preventing genes.

7. Which of these is NOT a difference between RNA and DNA?
   A. RNA contains uracil, where DNA doesn't contain uracil.
   B. RNA is single-stranded, where DNA is double-stranded.
   C. RNA contains ribose, where DNA contains deoxyribose.
   D. RNA is found in bacteria, where DNA is found in humans.

8. A pathogen is BEST described as a
   A. toxic chemical.
   B. virus or bacterium.
   C. carrier of a disease.
   D. disease-causing microbe.

9. What proteins are released by white blood cells to deactivate foreign cells?
   A. Interferon.
   B. Pathogens.
   C. Antibodies.
   D. Antibiotics.

10. Passive immunity typically
    A. is relatively short-lived.
    B. causes antibody production.
    C. is induced by injecting weakened pathogens.
    D. comes and goes depending on a person's health.

11. Interleukins, proteins released by certain white blood cells, function to
    A. absorb pathogens in the blood stream.
    B. activate other white blood cells during an infection.
    C. deactivate the immune system after an infection has passed.
    D. warn body cells that there are pathogens in the blood stream.

12. Which of these would NOT be found in a bacterial cell?
    A. Ribosome.
    B. Lysosome.
    C. Chromosome.
    D. Cell membrane.

13. Pili, on the surface of bacterial cells, function for
    A. Defense.
    B. Movement.
    C. Attachment.
    D. Detecting stimuli.

14. Which is MOST characteristic of bacteria?
    A. Anaerobic.
    B. Simple and rare.
    C. Common and abundant.
    D. Live in harsh environments.

15. Organisms that generally use oxygen, but can survive without it are called
    A. obligate aerobes.
    B. facultative aerobes.
    C. obligate anaerobes.
    D. facultative anaerobes.

16. Which of these is a correct match?
    A. Aerobic – plants – alcohol.
    B. Aerobic – animals – alcohol.
    C. Anaerobic – plants – lactic acid.
    D. Anaerobic – animals – lactic acid.

17. A bacterium that makes its food using chemical energy is a
    A. photosynthetic autotroph.
    B. chemosynthetic autotroph.
    C. photosynthetic heterotroph.
    D. chemosynthetic heterotroph.

18. During binary fission, bacteria will
    A. divide by mitosis and double their number.
    B. produce gametes that fuse to form a zygote.
    C. divide by meiosis and quadruple their number.
    D. combine, exchange genetic material, then divide.

19. In one hour, given ideal growing conditions, a small colony of 10 bacterial cells could grow to include
A. 13 cells.
B. 40 cells.
C. 80 cells.
D. 100's of cells.

20. Which sequence describes conjugation?
1. DNA replication
2. genetic recombination
3. genetic transfer between cells
A. 1, 2, 3
B. 2, 3, 1
C. 3, 1, 2
D. 1, 3, 2

21. Which is TRUE for endospore production?
A. Sexual; during poor conditions.
B. Sexual; during good conditions.
C. Asexual; during poor conditions.
D. Asexual; during good conditions.

22. The cell walls of Gram positive bacteria contain
A. lipids that absorb safranine.
B. lipids that absorb crystal violet.
C. carbohydrates that absorb safranine.
D. carbohydrates that absorb crystal violet.

23. Agar is prepared from
A. fruit.
B. seaweed.
C. grain crops.
D. animal tissues.

24. Macroscopically, bacteria colonies CANNOT be distinguished from each other by
A. Color.
B. Sheen.
C. Cell shape.
D. Surface texture.

25. Which is NOT a sterile technique?
A. Exposure to air.
B. Using disinfectants.
C. Avoiding direct contact.
D. Heating equipment to sterilize it.

26. Antiseptics are used to kill bacteria
A. in food.
B. in a cut.
C. internally.
D. on non-living surfaces.

27. Which of these is NOT done by bacteria?
A. Oil metabolism.
B. Food production.
C. Protein digestion.
D. Oxygen production.

28. Biotechnology is NOT currently used to produce
A. viruses.
B. certain medicines.
C. protein hormones.
D. genetically altered food.

29. Which combination is MOST correct?
A. Parasite – *E. coli* – intestines.
B. Symbiont – *E. coli* – stomach.
C. Pathogen – *H. pylori* – stomach.
D. Decomposer – *H. pylori* – intestines.

30. Nitrifying bacteria convert
A. N_2 into NH_3
B. N_2 into NO_3^{-1}
C. NO_3^{-1} into N_2
D. NH_3 into NO_3^{-1}

Seedless Plants

1. Which is NOT a correct match?
   A. Float – buoyancy.
   B. Holdfast – anchorage.
   C. Stipe – conduct water.
   D. Blade – photosynthesis.

2. The seaweeds of the Pacific West Coast are
   A. chlorophytes and phaeophytes.
   B. phaeophytes and rhodophytes.
   C. chlorophytes and rhodophytes.
   D. phaeophytes, chlorophytes, and rhodophytes.

3. Pigments other than chlorophyll-a capture light energy and
   A. store it to make glucose later.
   B. make products other than glucose.
   C. pass it along to chlorophyll-a for making glucose.
   D. make glucose, but not as efficiently than chlorophyll-a.

4. Green algae is similar to land plants because it
   A. has vascular tissue, which other algae lacks.
   B. stores glucose as starch, rather than oils, or other carbohydrates.
   C. is equipped with guard cells and stomata to control gas exchange.
   D. is predominantly a sporophyte, where other algae are gametophytes.

5. Which phylum of algae is believed to be the most related to terrestrial plants?
   A. Phylum Bryophyta.
   B. Phylum Phaeophyta.
   C. Phylum Rhodophyta.
   D. Phylum Chlorophyta

6. Which of these is NOT a feature of *Chlamydomonas*?
   A. Flagella.
   B. Eyespots.
   C. Pyrenoid body.
   D. Communication among cells.

7. Which of these ideas does NOT support the notion that *Volvox* is a multicellular colony?
   A. It has simple tissues and organs.
   B. Most of the component cells are very similar to each other.
   C. There is some communication between the component cells.
   D. If broken apart, it can reassemble or replace the missing parts.

8. The holdfasts of *Spirogyra* are an advantage and a disadvantage because they
   A. anchor the plant and absorb chemicals from the soil.
   B. anchor the plant and make it an easier target for herbivores.
   C. enable it to grow long increasing the chance of fragmentation.
   D. enable it to absorb chemicals from the soil, which may be toxic.

9. The biologically significance of *Ulva* is that it
   A. is eaten as dulse.
   B. has a similar life cycle to moss.
   C. can grow on land and in water.
   D. is harvested for agar production.

10. Which of these is the LEAST problematic for moss growing on land?
    A. Drying out in the sun.
    B. Getting soaked in the rain.
    C. Obtaining water through its roots.
    D. Obtaining enough light for photosynthesis.

11. Moss is a member of
    A. Phylum Bryophyta.
    B. Phylum Phaeophyta.
    C. Phylum Chlorophyta.
    D. Phylum Tracheophyta.

12. Which statement is TRUE about moss?
    A. The gametophyte gets some nutrition from the sporophyte.
    B. The sporophyte gets some nutrition from the gametophyte.
    C. The gametophyte and sporophyte equally support each other.
    D. The sporophyte and gametophyte live independently from each other.

13. Meiosis in moss occurs in the
    A. spore capsule.
    B. spores before germination.
    C. gametes before fertilization.
    D. male and female gametophyte.

14. Which of these is present in ferns but NOT in moss?
    A. Chlorophyll-a.
    B. Guard cells and stomata.
    C. Structures that produce spores.
    D. Structures that produce gametes.

15. Finish this sentence to make a TRUE statement about alternation of generations: Sporophytes produce...
    A. gametes that grow into sporophytes, which produce spores.
    B. spores that grow into sporophytes, which produce gametes.
    C. spores that grow into gametophytes, which produce gametes.
    D. gametes that grow into gametophytes, which produce spores.

16. Correctly complete this sentence: Stomata open to let...
    A. CO_2 in and O_2 and H_2O out.
    B. O_2 in and CO_2 and H_2O out.
    C. CO_2 and H_2O in and O_2 out.
    D. O_2 and H_2O in and CO_2 out.

17. Finish this sentence to make the BEST TRUE statement about the roles of vascular tissues: H_2O and dissolved minerals are conducted up to leaves by...
    A. xylem, where phloem transports the products of photosynthesis down a stem.
    B. phloem, where xylem transports the products of photosynthesis down a stem.
    C. xylem, where phloem transports the products of photosynthesis away from leaves.
    D. phloem, where xylem transports the products of photosynthesis away from leaves.

18. A fiddlehead is an immature
    A. sporophyte frond.
    B. gametophyte frond.
    C. sporophyte prothallium.
    D. gametophyte prothallium.

19. Sori are specializations found on
    A. fronds. They release spores.
    B. fronds. They release gametes.
    C. gametophytes. They release spores.
    D. gametophytes. They release gametes.

20. Which is the LEAST LOGICAL sequence during succession?
    A. Lichen – trees – grass – moss.
    B. Moss – grass – shrubs – trees.
    C. Ferns – grass – shrubs – trees.
    D. Algae – moss – grass – shrubs.

Seed Plants

Which BEST distinguishes gymnosperms from angiosperms?
A. Gymnosperms have needles, angiosperms don't.
B. Angiosperms have broad, flat leaves; gymnosperms never do.
C. Gymnosperms produce cones for reproduction, angiosperms don't.
D. Angiosperms produce flowers for reproduction, gymnosperms don't.

Which BEST describes a tissue?
A. Part of an organ.
B. A cluster of cells in the same place.
C. A set of cells that function together.
D. A set of identical cells that have a unified function.

Plants grow by mitosis in their
A. parenchyma tissue.
B. collenchyma tissue.
C. meristematic tissue.
D. sclerenchyma tissue.

4. Where on a plant is an apex?
A. In a flower.
B. Along the stem.
C. Under the leaves.
D. At the tip of a branch.

5. In which growing conditions would you find xerophytes, hydrophytes, and halophytes (respectively)?
A. Mineral rich, aquatic, dry.
B. Aquatic, dry, mineral rich.
C. Dry, aquatic, mineral rich.
D. Dry, mineral rich, aquatic.

6. A boring tool is used to drill a hole into a tree. Which sequence of tissues would it encounter?
A. Phloem – xylem – vascular cambium.
B. Phloem – vascular cambium – xylem.
C. Xylem – vascular cambium – phloem.
D. Xylem – phloem – vascular cambium.

7. Which process accounts for the movement of water into a root hair and on to the xylem?
A. Pressure exerted on the roots by the surrounding soil.
B. Diffusion due to the difference in concentration of minerals.
C. Active transport of minerals, which creates osmotic pressure.
D. Osmosis due to the osmotic pressure created by the surrounding ground.

8. The Casparian strip is a
A. tissue that conducts water from root xylem to stem xylem.
B. waxy layer around the xylem preventing water from leaving.
C. set of cells allowing water to move into the xylem from the root hairs.
D. protein-rich layer controlling water movement within a vascular bundle.

9. Under which conditions would the chance of transpiration be the greatest?
A. Hot and dry.
B. Cold and dry.
C. Hot and humid.
D. Cold and humid.

10. The dark lines forming the annular rings of a tree are made out of dense
A. xylem cells that form in poor growing conditions.
B. xylem cells that form in good growing conditions.
C. phloem cells that form in poor growing conditions.
D. phloem cells that form in good growing conditions.

11. A seed cone of a gymnosperm is a
A. 2N structure in which 1N structures develop.
B. 2N structure in which 2N structures develop.
C. 1N structure in which 1N structures develop.
D. 1N structure in which 2N structures develop.

12. Which of these is the BEST description of pollen?
A. Multicellular and male.
B. Multinucleate and male.
C. Multicellular and female.
D. Multinucleate and female.

13. During angiosperm fertilization, pollen nuclei do NOT
A. get released on a stigma.
B. cause ovules to develop into fruit.
C. fertilize polar bodies to produce endosperms.
D. cause the growth and elongation of pollen tubes.

14. What is the location and function of endosperm?
A. In a flower to attract pollen.
B. In a seed to feed the embryo.
C. In fruit to protect the embryo.
D. In pollen required for fertilization.

15. What is the function of a cotyledon?
A. Promote downward root growth and upward shoot growth.
B. Facilitate gas exchange for both photosynthesis and respiration.
C. Store water absorbed by root hairs to use when water is less available.
D. Provide nutrients to a plant embryo until it can conduct photosynthesis to make its own.

16. Which statement about flowers is CORRECT?
A. Sepals are photosynthetic.
B. The female parts surround the central male part.
C. Pistils are male parts, where stamens are female parts.
D. The style is the source of energy and fragrance for the flower.

17. What features are associated with both a maple and an oak leaf?
A. Parallel vein pattern and a petiole.
B. Parallel vein pattern, but no petiole.
C. Branching vein pattern and a petiole.
D. Branching vein pattern, but no petiole.

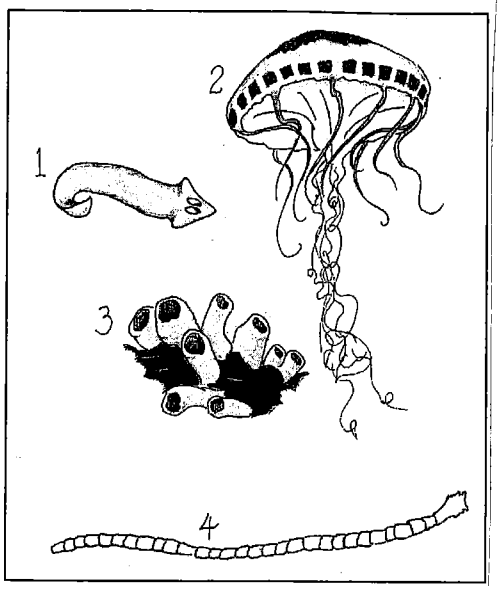
18. Leaves change colour and fall from trees because of
A. Increased photosynthesis and cell division.
B. Decreased photosynthesis and cell division.
C. Increased photosynthesis and cell deterioration.
D. Decreased photosynthesis and cell deterioration.

19. Which plant produces a seed with only one cotyledon?
A. Pea.
B. Corn.
C. Peanut.
D. Sunflower.

20. Which of these BEST describes a monocotyledon?
A. Six petals per flower with parallel veins in leaves.
B. Six petals per flower with branching veins in leaves.
C. Twelve petals per flower growing on very short stems.
D. Twelve petals per flower with leaves modified into thorns.

Lower Invertebrates

CHECK YOUR KNOWLEDGE OF DIAGRAMS:



1. Refer to Diagram 1 to answer these questions:
   a. What is the Phylum, Class, and common name of this animal?
   b. What type of symmetry and body cavity does it have?
   c. Describe the level of development of its digestive, nervous and excretory systems.
2. Refer to Diagram 2 to answer these questions:
   a. What is the Phylum, Class, and common name of this animal?
   b. What type of symmetry and body cavity does it have?
   c. What is this body form called?
   d. Explain how this animal gets its nutrients.
3. Refer to Diagram 3 to answer these questions:
   a. What is the Phylum and common name of these animals?
   b. What type of symmetry and body cavity do they have?
   c. Explain how animals like these get their nutrients and get rid of wastes.
4. Refer to Diagram 4 to answer these questions:
   a. What is the Phylum, Class, and common name of this animal?
   b. What type of symmetry and body cavity does it have?
   c. Describe how the body systems of this animal are specialized for its lifestyle.

1. Which combination contains only radially symmetrical animals?
   A. Jellyfish, sponges, roundworms.
   B. Roundworms, hydra, sea anemones.
   C. Sponges, Portuguese man-o-war, jellyfish.
   D. Portuguese man-o-war, flukes, roundworms.

2. Cephalization CORRECTLY refers to the development of
   A. a head.
   B. a brain.
   C. a scolex.
   D. an anterior end.

3. Which pattern of digestive system allows the greatest organ development?
   A. Sac-like pattern.
   B. Tube-like system.
   C. Gastrovascular cavity.
   D. Intracellularly by lysosomes.

4. Animals are diploid and produce gametes that are haploid. This statement is
   A. never true.
   B. always true.
   C. usually true.
   D. sometimes true.

5. Which is the MOST LIKELY description of sessile aquatic animals?
   A. Radial symmetry, separate sexes, reproduce by mating.
   B. Bilateral symmetry, separate sexes, reproduce by mating.
   C. Radial symmetry, hermaphroditic, reproduce by broadcasting.
   D. Bilateral symmetry, hermaphroditic, reproduce by broadcasting.

6. Which of these correctly describes the water flow through a sponge?
   A. In and out the osculum.
   B. In and out the porocytes.
   C. In porocytes and out the osculum.
   D. In the osculum and out the porocytes.

7. Which of these is TRUE about stinging cells and collar cells?
   A. Both types of cells are specializations of the ectoderm.
   B. Both types of cells are specializations of the endoderm.
   C. Collar cells are specializations of the ectoderm; stinging cells are specializations of endoderm.
   D. Stinging cells are specializations of the ectoderm; collar cells are specializations of endoderm.

8. Which of the following is NOT TRUE of amoebocytes?
   A. motile.
   B. produce spicules.
   C. specialize to produce sperm.
   D. secrete protective chemicals.

9. Nematocysts function for
   A. reproduction.
   B. capturing food.
   C. communication.
   D. absorbing nutrients.

10. The MOST COMPLETE list of functions occurring by diffusion in jellyfish is
    A. excretion and circulation.
    B. respiration and excretion.
    C. respiration and circulation.
    D. respiration, excretion, circulation.

11. The MOST COMPLETE list of functions of a gastrovascular cavity is
    A. digestion and excretion.
    B. excretion and circulation.
    C. digestion and circulation.
    D. digestion, excretion, circulation.

12. Which animal has a nerve net?
    A. Sponge.
    B. Jellyfish.
    C. Planaria.
    D. Tapeworm.

13. Which combination contains only sessile animals?
    A. Flukes and tapeworms.
    B. Flukes, tapeworms, planarians.
    C. Sponges, hydras, sea anemones.
    D. Jellyfish, planarians, tapeworms.

14. Which animal is a scyphozoan?
    A. Hydra.
    B. Planaria.
    C. Jellyfish.
    D. Sea anemone.

15. Planaria ingest through a
    A. mouth on their head.
    B. pharynx on their head.
    C. mouth on their ventral surface.
    D. pharynx on their ventral surface.

16. The ganglia in a planaria
    A. allow vision.
    B. form eyespots that contribute to a primitive brain.
    C. form a ladder-like structure along the length of the worm.
    D. are responsible for the movement of fluids in nephridiophores.

17. What system do flame cells and nephridiopores belong to?
    A. Excretory system of planaria.
    B. Circulatory system of planaria
    C. Excretory system of roundworms.
    D. Circulatory system of roundworms.

18. Which correctly identifies the number of tissue layers in these animals?
    A. Jellyfish (2); tapeworm (3); roundworm (3).
    B. Jellyfish (2); tapeworm (3); roundworm (4).
    C. Jellyfish (2); tapeworm (2); roundworm (3).
    D. Jellyfish (3); tapeworm (3); roundworm (4).

19. A parasitic worm that has a dormant stage in a mammal can often be found in a
    A. cyst.
    B. snail.
    C. scolex.
    D. proglottid.

20. The primary host is BEST described as the host
    A. where the adult parasite lives.
    B. in which most of the eggs are laid.
    C. that provides most of the nutrients.
    D. that larvae infest first after hatching.

21. Which is NOT TRUE of a scolex?
    A. produces proglottids.
    B. lacks an oral opening.
    C. contains a primitive brain.
    D. has specializations for attachment.

22. Humans that have tapeworms MOST LIKELY got them by consuming
    A. raw snails.
    B. unsanitary water.
    C. poorly cooked meat.
    D. unwashed leafy vegetables.

23. A pin poked into a nematode from the outside to its intestine would pierce
    A. ectoderm, mesoderm, pseudocoelom, and then endoderm.
    B. ectoderm, pseudocoelom, mesoderm, and then endoderm.
    C. ectoderm, mesoderm, pseudocoelom, mesoderm, and then endoderm.
    D. ectoderm, mesoderm, endoderm, pseudocoelom, mesoderm, and then endoderm.

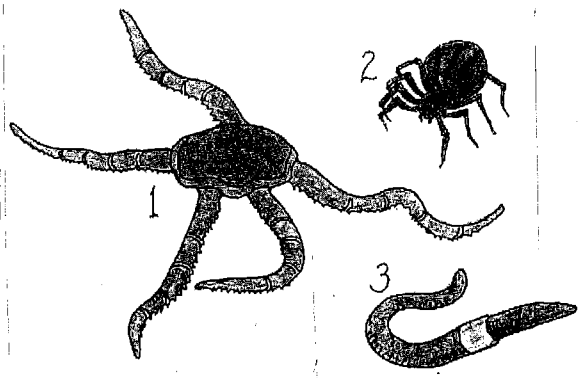
24. Which is the BEST description of nematode movement?
    A. Crawling.
    B. Swimming.
    C. Ciliated gliding.
    D. Whipping back and forth.

25. Why is it advantageous for a parasitic worm to have multiple hosts during its life cycle?
    A. Finding a mate.
    B. Distributing their young.
    C. Using a wider range of nutrients.
    D. Infecting a wider range of animals.

26. Coelom development is coupled with the earliest specialization of a
    A. nervous system.
    B. excretory system.
    C. circulatory system.
    D. respiratory system.

CHECK YOUR KNOWLEDGE OF DIAGRAMS:

1. Refer to Diagram 1 to answer these questions:
   a. What is the Phylum name and common names of this animal?
   b. Describe the locomotory and digestive systems of a sea star (a close relative of this animal).
2. Refer to Diagram 2 to answer these questions:
   a. What is the Phylum, Subphylum and Class name of this animal?
   b. Describe its respiratory and excretory systems.
3. Refer to Diagram 3 to answer these questions:
   a. What is the Phylum and Class name of this animal?
   b. Describe its digestive and reproductive systems.



1. The reproductive structures of an earthworm are located
   A. under the clitellum.
   B. mid-way along the worm.
   C. closer to the anterior of the worm.
   D. closer to the posterior of the worm.

2. An earthworm's setae function for
   A. feeling.
   B. traction.
   C. excretion.
   D. subdividing the coelom.

3. To elongate, an earthworm has to
   A. relax both circular and longitudinal muscles.
   B. contract both circular and longitudinal muscles.
   C. contract its circular muscles while relaxing its longitudinal muscles.
   D. relax its circular muscles while contracting its longitudinal muscles.

4. Which of these is the BEST description of "detritus"?
   A. Fertilizer.
   B. Soil debris.
   C. A type of fungus.
   D. Undigested wastes.

5. The aortic arches of an earthworm are located around the
   A. pharynx.
   B. intestine.
   C. esophagus.
   D. ventral nerve cord.

6. Which pair MOST CORRECTLY matches structures with functions?
   A. Crop – storage; gizzard – grinding.
   B. Crop – grinding; gizzard – storage.
   C. Crop – chemical digestion; gizzard – physical digestion.
   D. Crop – physical digestion; gizzard – chemical digestion.

7. Which of these MOST CORRECTLY describes an earthworm's lifestyle?
   A. Parasitic.
   B. Free-living.
   C. Carnivorous.
   D. Herbivorous.

9. The lifestyle of a polychaete is BEST described as
   A. prey.
   B. parasite.
   C. predator.
   D. producer.

10. Which of these systems is the MOST developed in a leech?
   A. Digestive.
   B. Excretory.
   C. Circulatory.
   D. Reproductive.

11. Secretions of a leech are medically significant because they prevent
   A. infection.
   B. blood clotting.
   C. tissue rejection.
   D. skin deterioration.

15. Which of the following pairs is mismatched?
   A. Hirudinea – suckers
   B. Gastropoda – mantle
   C. Oligochaeta – segments
   D. Bivalvia – water vascular system

16. Which part of the water vascular system of a sea star is connected directly to a tube foot?
   A. Ring canal.
   B. Radial canal.
   C. Madreporite.
   D. Lateral canal.

17. Which system of echinoderms is LEAST specialized?
   A. Digestive system.
   B. Circulatory system.
   C. Respiratory system.
   D. Locomotory system.

18. Which of these is the key identifying feature of the arthropods?
   A. Exoskeleton.
   B. Metamorphosis.
   C. Body segmentation.
   D. Jointed appendages.

19. Centipedes are members of
   A. Class Insecta.
   B. Class Arachnida.
   C. Class Chilopoda.
   D. Class Diplopoda.

20. Millipedes are known for their
   A. one pair of legs per segment; herbivorous lifestyle.
   B. one pair of legs per segment; carnivorous lifestyle.
   C. two pair of legs per segment; carnivorous lifestyle.
   D. two pairs of legs per segment; herbivorous lifestyle.

21. The major locomotory structures of an insect are attached to its
   A. head.
   B. thorax.
   C. abdomen.
   D. cephalothorax.

22. The circulatory system of a typical arthropod is BEST described as
   A. open with a dorsal pumping vessel.
   B. open with a ventral pumping vessel.
   C. closed with a dorsal pumping vessel.
   D. closed with a ventral pumping vessel.

23. Which of these lists a grasshopper's mouthparts in an anterior to posterior sequence?
    A. Labium – mandibles – maxillae – labrum
    B. Labrum – maxillae – mandibles – labium
    C. Labrum – mandibles – maxillae – labium
    D. Labrum – maxillae – mandibles – labium

24. To which body system do ocelli belong?
    A. Nervous
    B. Excretory
    C. Respiratory
    D. Reproductive

25. Which of the following BEST describes the life cycle of a moth?
    A. Egg – pupa – adult
    B. Egg – nymph – adult
    C. Egg – larva – pupa – adult
    D. Egg – larva – nymph – adult

26. How many stages are there in complete metamorphosis?
    A. Two
    B. Three
    C. Four
    D. Five

27. Which of these has a nymph stage in its life cycle?
    A. Fly
    B. Moth
    C. Mosquito
    D. Grasshopper

28. Malpighian tubules conduct metabolic wastes from
    A. kidneys to spiracles.
    B. tissue spaces to kidneys.
    C. tissue spaces to intestine.
    D. kidneys to excretory openings.

29. A grasshopper's tracheal tubes are attached to its
    A. gills.
    B. lungs.
    C. spiracles.
    D. book lungs.

30. Spiders obtain oxygen through their
    A. gills.
    B. cuticles.
    C. book lungs.
    D. tracheal tubes.

31. The "fangs" of a spider are MORE technically known as
    A. chelipeds.
    B. pedipalps.
    C. carapaces.
    D. chelicerae.

32. Which class of arthropods has branching appendages?
    A. Insecta
    B. Crustacea
    C. Chilopoda
    D. Diplopoda

33. Which system does the green gland of a crayfish belong to?
    A. Digestive
    B. Excretory
    C. Circulatory
    D. Reproductive

34. What is the function of uropods and a telson?
    A. Digestion
    B. Excretion
    C. Locomotion
    D. Reproduction

35. People who enjoy eating lobster are actually eating muscles of the
    A. uropods and telson.
    B. carapace and abdomen.
    C. chelipeds and abdomen.
    D. cephalothorax and chelipeds.

36. Insects that transmit diseases are
    A. vectors.
    B. virulent.
    C. parasites.
    D. pathogens.

1. Phylum Chordata is unified by all of the following except one. Which one?
   A. notochord
   B. vertebrate skeleton
   C. pharyngeal gill slits
   D. dorsal tubular nerve cord

Tunicates

2 Sea squirts are simple chordates that pump water
   A. for defense.
   B. for movement.
   C. to communicate.
   D. to ventilate their gills and get food.

8. Where are a vertebrate's nerve cord and major blood vessels located?
   A. Both are dorsal.
   B. Both are ventral.
   C. Dorsal nerve cord and ventral blood vessels.
   D. Ventral nerve cord and dorsal blood vessels.

13. Which of these animals has a heart with one ventricle? (3 chambers)
   A. Horses.
   B. Chickens.
   C. Alligators.
   D. Salamanders.

15. Which of these is a correct match?
   A. Scaly legs – frog
   B. Boneless – shark
   C. Free living – lamprey
   D. Crop and gizzard – alligator

20. Which system is NOT present in any vertebrate?
   A. Excretory.
   B. Endocrine.
   C. Respiratory.
   D. Water vascular.

cold blooded

23. Ectothermic chordates are characterized by the
   A. relatively constant nature of their body temperature.
   B. presence of hair or feathers to prevent heat loss or gain.
   C. dependency on the environment for their body temperature.
   D. development of internal fat storage tissue and high vascularization of their skin.

26. Birds and reptiles share all of the following EXCEPT
   A. Scales.
   B. Amniotic egg.
   C. Beaks and claws.
   D. Lightweight bones.

28. The advantage of laying amniotic eggs is the
   A. females never get pregnant.
   B. eggs contain their own yolk (food) and waste sac.
   C. eggs can be many colours, which provides camouflage
   D. animals do not have to return to an aquatic environment to lay them.

35. Which feature LEAST defines a mammal?
   A. hair
   B. live birth
   C. scaled tails
   D. milk-producing glands

43. Which of these is a correct sequence of digestive organs through which materials pass in a mammal?
   A. Mouth – stomach – rectum – large intestine – anus.
   B. Mouth – trachea – stomach – small intestine – anus.
   C. Mouth – esophagus – stomach – small intestine – anus.
   D. Mouth – stomach – caecum – small intestine – large intestine

Taxonomy

CHECK YOUR UNDERSTANDING OF CONCEPTS:

1. A	5. D	9. A	13. C	17. C
2. C	6. B	10. D	14. D	18. A
3. A	7. D	11. D	15. D	19. A
4. B	8. A	12. C	16. C	20. C

Evolution

CHECK YOUR UNDERSTANDING OF CONCEPTS:

1. B	5. A	9. A	13. A	17. A
2. C	6. D	10. D	14. C	18. D
3. D	7. A	11. B	15. A	19. A
4. B	8. B	12. D	16. D	20. C

Microbiology

CHECK YOUR KNOWLEDGE OF DIAGRAMS:

1. a. New phages have self-assembled in a host bacterium.
   b. Before – A bacteriophage inserted its genetic material into the bacterium. The viral genetic material took over the normal metabolism of the cell and re-organized it so that the bacterial cell began to manufacture viral components, which self assemble into new viruses.
   After – The bacterial cell will burst open (a process called lysis) and the new bacteriophages will be released.
2. a. The plasmid of the bacterium (circular piece of DNA) has a section of viral DNA (a prophage) inserted into it.
   b. Before – A bacteriophage inserted its genetic material into the bacterium. The viral genetic material (prophage) became incorporated into the plasmid and remains inactive.

CHECK YOUR UNDERSTANDING OF CONCEPTS:

1. A	7. D	13. C	19. C	25. A
2. D	8. D	14. C	20. D	26. B
3. A	9. C	15. D	21. C	27. C
4. A	10. A	16. D	22. D	28. A
5. A	11. B	17. B	23. B	29. C
6. C	12. B	18. A	24. C	30. B

Lower Invertebrates

CHECK YOUR KNOWLEDGE OF DIAGRAMS:

1. a. Phylum Platyhelminthes, Class Turbellaria. The common name is planarian (sing.) planaria (pl.)
   b. Planaria have bilateral symmetry. They have a sac-like body cavity, called a gastrovascular cavity (gvc).
   c. Digestive System – They have a ventral pharynx that they use to suck up nutrients into their gastrovascular cavity where they are digested following the release of enzymes. The gvc extends throughout the worm's interior and distributes the nutrients to the tissues (hence, it doubles as a circulatory system, which explains the term "gastrovascular"). There is no anus; indigestible materials are released back out the pharynx.
   Nervous System – These worms have a "ladder-like" nervous system comprised of a pair of ventral nerve cords that extend in a posterior direction from the eyespots. Nerves branching laterally from these nerve cords service all body regions. The eyespots are light sensitive regions that mark the location of the ganglia (sometimes called a primitive brain). The eyespots do not allow vision.
   Excretory System – These worms have flame cells, which are ciliated cells located at the blind ends of tiny tubes called nephridiophores located throughout its tissues. The openings of these tubes at the surface are called nephridiopores. The flame cells create a current in the fluid, which draws wastes (like ammonia) away from their tissues to the outside.
2. a. Phylum Cnidaria, Class Scyphozoa. The common name is jellyfish.
   b. Jellyfish have radial symmetry. Their sac-like body cavity is called a gastrovascular cavity (gvc).
   c. The body form of a jellyfish is a medusa.
   d. The long trailing tentacles have stinging cells (cnidoblasts) on them. These cells release a protein thread with a chemically equipped barb at the end, which it uses to capture prey. The tentacles then direct the victim (food) into the mouth, which is located in the middle of the tentacles on its oral surface. Nutrients are extracted from the food by the secretion of enzymes and circulated to the tissues by the gvc.

3. a. Phylum Porifera. These animals are sponges.
   b. Sponges have radial symmetry. Their body cavity (spongocoel) is sac-like.
   c. Microscopic nutrients are drawn into the interior with the inflow of water through the pore cells. The nutrient particles are absorbed by cells lining the body cavity on an individual basis and digestion occurs within each cell. Undigested material as well as metabolic wastes are released by each cell and from the body cavity through the osculum.
4. a. Phylum Platyhelminthes, Class Cestoda. The common name is a tapeworm.
   b. Tapeworms have bilateral symmetry. They do not have a body cavity.
   c. Being parasites, tapeworms have specific specializations to support this lifestyle. They have specializations for attachment (hooks and suckers on the scolex), reproduction (complex life cycles; repeating sets of sex organs in each proglottid), and obtaining nutrients (absorbent cuticle). Other systems are minimally developed or absent.

CHECK YOUR UNDERSTANDING OF CONCEPTS:

1. C	7. D	13. C	19. A	25. B
2. A	8. D	14. C	20. A	26. C
3. B	9. B	15. D	21. C	
4. C	10. D	16. B	22. C	
5. C	11. C	17. A	23. A	
6. C	12. B	18. A	24. D	

Higher Invertebrates

CHECK YOUR KNOWLEDGE OF DIAGRAMS:

1. a. Phylum Echinodermata. This is a brittle star (closely related to a sea star)
   b. Locomotory – A sea star moves using its rays (arms), which it anchors with suction cup endings on its tube feet. Tube feet are the terminal ends of the water vascular system. This set of tiny water filled tubes uses hydraulics to move the tube feet.
   Digestive – Sea stars feed mostly on the soft tissues of mollusks. They pry bivalves open, and while overtop of the soft tissues of the interiors, they lower their evertable stomach out of their mouths on their oral surfaces and envelop the food. They draw their stomachs and the food back into their body cavities and proceed to digest it by secreting enzymes into it. They have a reduced anus on their aboral surface.
2. a. Phylum Arthropoda, Subphylum Chelicerata, Class Arachnida

   b. Respiratory – Spiders have gas exchange structures known as book lungs located behind a ventral spiracle (opening) at the anterior ends of their abdomens. These moist tissues direct oxygen into the blood and carbon dioxide out of the blood.
   Excretory – Spiders (as with insects) have Malpighian tubules located throughout their coeloms. These tiny tubules drain metabolic wastes from the body fluids and conduct them to the intestine for excretion along with undigested food material.
3. a. Phylum Annelida, Class Oligochaeta
   b. Digestive – An earthworm has a complete digestive system consisting of the following structures or organs (anterior to posterior): prostomium (lip), pharynx, esophagus, crop, gizzard, intestine (equipped with digestive glands) and anus. Of note, the crop is a storage organ holding food material (detritus) until the gizzard can grind it up. This physical digestion increases the surface area of the material therefore making its chemical digestion by enzymes in the intestine more efficient.
   Reproductive – Earthworms are hermaphroditic. Their internal gonads are ventrally located roughly midway between the clitellum and the mouth with openings on the ventral surface. When they are ready to reproduce, two worms will lie next to each other in order to exchange sperm. Their clitellums secrete slime to facilitate this process. Each worm, having gained sperm from the other goes its own way. Afterwards, when the ova are mature, the worms release ova and the stored sperm. Fertilization occurs (again in a slime wad from the clitellum) and a trochophore larva develops. This is a feeding stage before it metamorphoses into a worm.

CHECK YOUR UNDERSTANDING OF CONCEPTS:

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

Chordates

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

Seedless Plants

1. C
2. D
3. C
4. B
5. D
6. D
7. A
8. B
9. B
10. B
11. A
12. B
13. A
14. B
15. C
16. A
17. C
18. A
19. A
20. A

Seed Plants

1. D
2. C
3. C
4. D
5. C
6. B
7. C
8. B
9. A
10. A
11. A
12. A
13. A
14. B
15. D
16. A
17. C
18. D
19. B
20. A

Higher Invertebrates → Diagrams.

4. a. Phylum Mollusca, Class Cephalopoda
   b. Nervous – Octopi have well developed nervous systems to complement their predatory lifestyles. They can see quite well with their lens-equipped eyes. Their relatively well developed brains are located in their heads protected by a bony plate (their only skeletal feature). They have major nerves in their tentacles.
   Respiratory – Octopi rely on gills for gas exchange, as with other oceanic members of this phylum.
5. a. Phylum Arthropoda, Subphylum Uniramia, Class Insecta, Order Diptera
   b. Respiratory – Flies (like grasshoppers) rely on a set of spiracles and tracheal tubes. Their abdomens show evidence of segmentation and each segment has a pair of spiracles, one on each side. These minute openings lead to tracheal tubes, which are tiny branching networks of tubules that conduct the air deep into the fluids in their body cavity where gas exchange occurs.
   Nervous – Flies have a fairly well developed nervous system equipped with compound eyes, a small brain and a paired ventral nerve cord.
6. a. Phylum Mollusca, Class Gastropoda
   b. Digestive – Snails have complete digestive systems. They are herbivores and scrape off bits of vegetation with their radula.
   Nervous – Snails have a small brain and a ventral nerve cord. They have fleshy sensory antenna.
7. a. Phylum Mollusca, Class Bivalvia (or Pelecypoda)
   b. Respiratory – Oysters, like clams rely the flow of water over their gills for gas exchange. Because oysters live in the water as opposed to buried in the sand, they have no need for a long siphon to draw water into their interiors.
   Digestive – An oyster has a complete digestive system. It is part of their fleshy visceral mass. They have labial palps, which are fleshy extensions around their oral opening. They use these to extract food materials transported by the water.