MULTIPLE CHOICE:

1. Which of the following groups of arthropods is NOT in the subphylum Labiatae?
   a. Arachnids  
   b. Insects  
   c. Millipedes  
   d. Centipedes  
   e. hexapods

2. Why are insects put together with some other classes in the subphylum Labiatae?
   a. They have one pair of antennae.  
   b. Mouthparts with “lips” (labrum and labium), mandibles, and maxillae  
   c. Excretory system with Malpighian tubules  
   d. Tergites, pleurites and sternites on each thoracic and abdominal segment  
   e. All of the above

3. Which of the following groups of labiates has two pairs (4) of legs per segment?
   a. millipedes  
   b. centipedes  
   c. insects  
   d. beetles  
   e. hexapods

4. What hormone is directly responsible for stimulating each molt?
   a. ecydysone  
   b. juvenile hormone  
   c. brain hormone  
   d. stretch receptors  
   e. prothoracic tropic hormone

5. A naiad is
   a. the larva of a holometabolous insect  
   b. the nymph of a terrestrial hemimetabolous insect  
   c. the nymph of an aquatic hemimetabolous insect  
   d. the nymph of an ametabolous insect  
   e. an immature centipede

6. Each larval stage between molts is called a(n)
   a. instar  
   b. pupa  
   c. imago  
   d. eclosion  
   e. molt

7. The unique winged stage just before the adult found in Ephemeroptera is the
   a. subimago  
   b. preimago  
   c. insta  
   d. pupa  
   e. naiad
8. Which part of the exoskeleton is completely shed (and not retained or partially recycled) during molting?
   a. epidermis  d. cocoon
   b. procuticle  e. ocelli
   c. epicuticle

9. Which of the following is a characteristic that differentiates between the insects and the other hexapods (the Parainsecta and Entognatha)?
   a. All insects have wings
   b. The insects have antennae and the other hexapods do not
   c. The insects have three body parts and the other hexapods do not
   d. The insects have external mandibles & maxillae (they are ectognathous)
   e. The insects have six legs and the other hexapods do not

10. How do the members of the Ensifera (katydids, crickets) make their sounds?
    a. by rubbing the head against special rough edges of the prothorax
    b. by rubbing the forewings against the hindwings
    c. by rubbing the hind legs against the top surface of the forewings
    d. by drumming the abdomen on the ground
    e. by whacking the head against branches of trees

11. The termite soldier type that has the head extended into a nozzle through which it can squirt smelly, sticky fluids to deter predators is called
    a. mandibulate  d. nozzle
    b. squirt gun  e. nasute
    c. king

12. The Diplurans (Entognatha) are considered in some ways like the Parainsecta and in other ways like insects. Which of the following best describes diplurans?
    a. Antennae entirely musc late, but abdomen with 10-11 segments.
    b. Mandibles with two attachment points (like insects), but diplurans add segments with molts.
    c. No eyes or antennae, but have wings.
    d. Typically live in the soil, but may also infest wood in houses.
    e. Can spring into the air, then use wings to fly away from predators.

13. Female mantids secrete some protective material around the eggs when laid. The protective covering is called a
    a. spermatoaphore  d. nest
    b. ootheca  e. egg carton
    c. cercus
14. The nitrogen containing carbohydrate of the procuticle in part responsible for darkening and toughening the exoskeleton is.
   a. chitin  d. naiad
   b. ecdysone  e. cuticul
   c. cocoon

15. Holometabolous insects are characterized by going through which of the following stages in their development?
   a. eggs, immatures like the adults, adults that continue to molt
   b. eggs, nymphs, adults
   c. eggs, naiads, adults
   d. eggs, larvae, pupae, adults
   e. eggs, larvae, adults

16. In the immatures, there are weakened lines in the exoskeleton that allow the cuticle to split during molting. These lines are called
   a. juvenile lines  d. shedding lines
   b. larval lines  e. adult lines
   c. ecdysial lines

17. The top of the thoracic segments is called the
   a. pleurite  d. notum
   b. sternite  e. leg
   c. wing

18. The suborder of odonates that hold their wings horizontally and have 360° vision is the
   a. Caelifera  d. Zygoptera
   b. Ensifera  e. Blattodea
   c. Anisoptera

19. Wood digesting symbiotes in the intestines are characteristic of
   a. Termites and some roaches  d. Thysanurans (silverfish)
   b. Walkingsticks  e. Grasshoppers
   c. Rockcrawlers

20. Which of the following orders has some species that exhibit a bit of maternal care to newly hatched young?
   a. Orthoptera (grasshoppers, etc.)  d. Mantodea
   b. Dermaptera (earwigs)  e. Stick Insects
   c. Thysanurans
21. The male reproductive organ (penis) in insects is called the
   a. spermatophore d. ootheca
   b. aedeagus e. abdomen
   c. ovipositor

22. Gills are found in a remarkably wide variety of places on the naiads of this order.
   a. Plecoptera (stoneflies) d. Jumping Bristletails
   b. Odonates (dragon/damselflies) e. Mantids
   c. Ephemeropterans (mayflies)

23. Insects which have specialized structures in the larvae that turn into wings inside
    the pupal stage are called
   a. Apterygotes d. the Endopterygotes
   b. the Parainsecta e. the Paleoptera
   c. the Exopterygotes

24. The insects which do not exhibit wing folding are classified as the ____________,
    and include the orders ____________ and ____________.
   a. Paleoptera; Odonata and Ephemeroptera
   b. Paleoptera; Odonata and Blattodea
   c. Neoptera; Ephemeroptera and Orthoptera
   d. Neoptera; Blattodea and Orthoptera
   e. Neoptera; Isoptera and Blattodea

25. Which of the following is a characteristic of the Isoptera (Termites)?
   a. Only the reproductives have wings
   b. The reproductives shed their wings not long after a dispersal flight
   c. Many could be considered useful as decomposers of dead plant materials
   d. a & b
   e. All of the above

**TRUE - FALSE:**

26. The orthopteroid orders typically have chewing mouthparts and long lived adults.

27. Dragonflies and damselflies can walk.

28. Dragonflies and damselflies can flap forewings and hindwings independently of
    one another.

29. The most primitive hexapods are capable of direct mating, like the insects.

30. Juvenile hormone turns a juvenile into an adult.
31. For many adult insects, the wing surfaces are shed when molting into the next adult stage.
32. The exoskeleton is very impermeable to water, which is important to prevent water loss in the terrestrial environment.
33. The adult stage is the stage in which the individual is able to reproduce.

MATCHING: Answers may be used more than once or not at all.

**Primitive Hexapod groups:**

34. Naiads with huge labium for catching prey  
35. Minute hexapods with 6-segmented abdomen  
36. No eyes or antennae  
37. Humped thorax; smack body on ground to jump  
38. Have some species that are pests inside houses  
39. The males have paired reproductive structures; adults fly but can’t eat

**Orthopteroid Orders:**

40. Raptorial forelegs for catching prey  
41. Social with distinct castes (workers, soldiers)  
42. Naiads prefer cool water; adults of some species fly in any month  
43. All legs can come off easily as a predator avoidance mechanism  
44. Social; have enlarged foretarsi with silk glands  
45. Very short elytra (forewings), hindwings fold accordion style up under elytra  
46. Some are indoor pests; females carry eggs (in an ootheca) with them; body flattened

a. Protura  
b. Collembola  
c. Diplura  
d. Archaeognatha  
e. Thysanura  
a. Ephemeroptera  
b. Odonata  
a. Blattodea (roaches)  
b. Mantodea (mantids)  
c. Isoptera (termites)  
d. Orthoptera  
e. Dermaptera (earwigs)  
a. Phasmatodea (sticks)  
b. Plecoptera (stoneflies)  
c. Embioptera (webspinners)
**FILL-IN-THE-BLANK:**

47. Extensions off of the end of the abdomen, such as the pinchers in earwigs, are called ________________.

48. Another name for the adult stage is the ________________.

49. The first antennal segment is called the ________________.

50. The sclerites on the underside of the segments are called ________________.

**SHORT ANSWER:** Answer any three (3) of the following.

A. Give two reasons why it is likely that insects have become so successful on the planet. (2 pts.)

B. Explain one of the two theories for the evolutionary origin of wings in insects. (2 pts.)

C. Describe how the indirect flight mechanism works; you must mention both the dorsoventral and longitudinal muscles. (2 pts.)

D. Explain why the Ensifera (katydids, crickets) typically have longer antennae than the Caelifera (grasshoppers). (2 pts.)
E. Define/describe the following: anamorphic development, eclosion. (2 pts.)

F. Give the scientific name of the one orthopteroid order which has no species in GA, and indicate where in the U.S. they do occur and what kind of habitat they typically live in. (2 pts.)

G. Name two classes of arthropods besides the labiates that include some terrestrial species. (2 pts.)

H. Define/describe the following: ocelli, gena (2 pts.)