PHYLUM ARTHROPODA

1. **Meaning:** 'jointed feet'

2. **Habitat:** marine, freshwater, terrestrial, air

3. **Examples:** lobsters, crayfish, prawns, crabs, shrimp, barnacles, spiders, insects, millipedes, centipedes

4. **Unique Characteristics**:
   - Chitin exoskeleton that also contains protein
   - Jointed appendages
   - Have the ability to molt (shed their exoskeleton)

5. **Characteristics:**
   - Bilateral symmetry
   - True coelom (body cavity)
   - Ventral nerve cord

6. **Classification:**
   - Class Crustacea
   - Class Arachnida
   - Class Insecta
   - Class Chilopoda (centipedes)
   - Class Diplopoda (millipedes)

CLASS CRUSTACEA

1. **Examples:** crayfish, crab, barnacle, wood bur

2. **Features:**
   - Body is divided into an abdomen and cephalothorax
   - Have gills
   - 2 pairs of antennae and many special appendages
   - Have an exoskeleton that contains $CaCO_3$

3. **Crayfish Appendages:**
   - Have a pair of appendages attached to each segment that are specialized for different functions

   a) Antennules – sensory appendages for taste, touch, and equilibrium
   b) Antennae – sensory appendages for taste and touch
   c) Mandibles – move up and down to crush food
   d) Maxillae – move side to side to tear food; also act as 'gill bailers' that pass water over gills
   e) Maxillipeds – hold the prey

f) Chelipeds – defend crayfish and capture prey
g) Walking Legs – locomotion (slow)
h) Swimmerets – create H_2O currents for the attached fertilized eggs to get O_2 (in females). In males one of these attached swimmerets is used to deposit sperm in the female
i) Uropod & Telson – propel the crayfish through the H_2O with the help of abdominal muscles, allow the crayfish to move backwards quickly

4. **Ingestion, Digestion, and Elimination:**
- Chelipeds capture food
- Food is held and torn by maxillae and maxillipeds
- Food is chewed by mandibles
- Food passes into the mouth and enters the esophagus
- Food enters the stomach and is ground up by teeth
- Digestive glands secrete enzymes that digest food
- Nutrients are absorbed in the intestine into the blood
- Undigested food exits the anus

5. **Excretion:**
Green glands (head region) remove N-wastes from the blood; N-wastes exit the opening at the base

CLASS ARACHNIDA

- **Examples:** spiders, scorpions, ticks

- **Features**: - air tubes / book lungs
  - 2 body parts: cephalothorax and abdomen
  - 4 pairs of legs

CLASS INSECTA

1. **Examples:** mosquito, fly, beetle, grasshopper

2. **Features:**
   - 3 body parts: head, thorax, and abdomen
   - 3 pairs of legs on the thorax
   - 2 pairs of wings on the thorax
   - 1 pair of antennae
   - Complete / incomplete metamorphosis

3. **Ingestion, Digestion, and Elimination of Grasshoppers:**

- Labrum and Labium hold grass, Mandible and Maxilla cut grass
- Food enters mouth and is moistened by saliva (salivary glands)
- Food passes into the esophagus
- Food enters the crop for storage
- Food enters the gizzard where sharp teeth shred the food
- Food enter stomach where gastric ceca secrete enzymes to break down food, nutrients pass into the coelom
- Wastes pass into the intestine and into the rectum
- Solid wastes exit the anus

4. **Excretion:**

- N-wastes enter the coelom and are picked up by the blood
- Malpighian tubules remove, concentrate, and deposit N-wastes into the rectum then they exit through the anus

5. **Circulation:**

- Blood contains nutrients, N-wastes
- Heart pumps blood forward through the aorta into the coelom carrying nutrients to organs
- Blood also transfers N-wastes to Malpighian tubules & the blood returns to the aorta

6. **Respiration:**

- Body muscles expand and O_2 flows through spiracles and into the trachea
- O_2 diffuses into tissues, CO_2 exits through the spiracles.
- Valves control the opening of the spiracles

7. **Locomotion:**

- Two pairs of walking legs, 1 pair of jumping legs
- Legs have hooks for grip and protection
- 2 pairs of wings
- Forewings protect the hind wings
- Hind wings enable flight
- Muscles attach to the exoskeleton and allow movement

8. **Nervous System:**

- Composed of a brain connected to a ventral nerve cord

9. **Sensory System:**

- 3 simple eyes – detect light
- 2 compound eyes – detect images and movement
- 2 tympanum – membrane to detect sound (located on the first abdominal segment)
- sensory appendages – detect taste and touch
- antennae – detect taste and touch

10. **Life Cycle (included metamorphosis):**

- Metamorphosis means undergoing many stages / shapes of development
- 2 types: - complete metamorphosis: most insects (88%)
  - butterflies, moths
  - incomplete metamorphosis: other insects (12%)
  - grasshoppers, mayflies, mantids
- Complete metamorphosis: egg → larva → pupa → adult
- Incomplete metamorphosis: egg → nymph → adult (nymph = baby adult)

Exoskeleton in Arthropods

ADVANTAGES	DISADVANTAGES
- protection and support	- limits flexibility
- muscles can be attached inside	- they must molt in order to grow
	- weight problem

Ecological Importance of Arthropods

- Pollinators of 2/3 of the worlds flowering plants
- Direct source of food for carnivores
- Insects and spiders are predators / parasites on other organisms