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 CaCO₃

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$_2$O 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$_2$O 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

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**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 O₂ flows through spiracles and into the trachea
   - O₂ diffuses into tissues, CO₂ 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**

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
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<tr>
<td>- protection and support</td>
<td>- limits flexibility</td>
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<tr>
<td>- muscles can be attached inside</td>
<td>- they must molt in order to grow</td>
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<td>- weight problem</td>
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**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