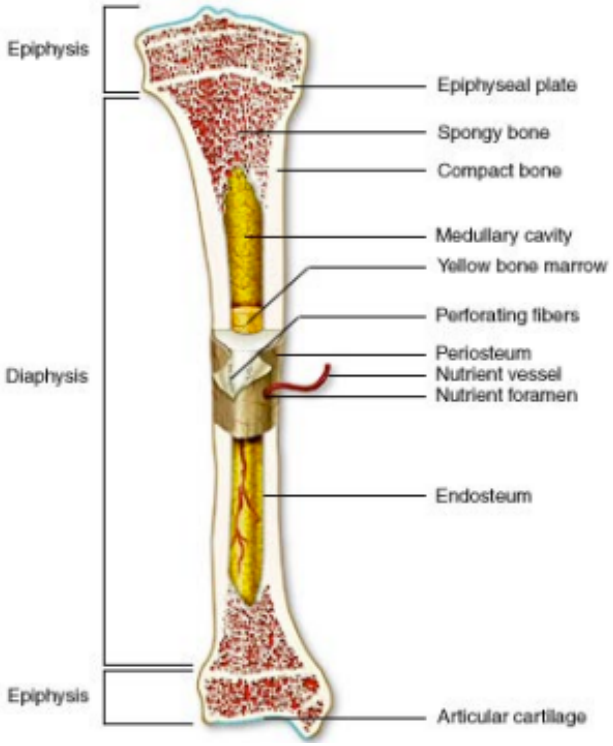
Locomotion	

Know the characteristics of skeletal systems	• Hydrostatic skeleton
	  ○ Pressure generated
	  ○ Contract against incompressible fluid
	  ○ Muscular hydrostats
	• Exoskeletons
	  ○ Rigid
	  ○ Invertebrates only
	  ○ Shells, plates
	  ○ Strong but light
	  ○ Not suitable for large mobile animals
	• Endoskeletons
	  ○ Supports body muscles and organs
	  ○ Flexibility and leverage for movement (e.g. breathing)
	  ○ Protection of softer tissues
	  ○ Blood formation in red bone marrow
	  ○ Dynamic growth responds to needs (can grow, respond to injury, and adjust to stress)
	  ○ Mineral store (stores calcium and phosphorous)
	  ○ Acid-base balance through mineral salts
	  ○ Supports larger, more mobile animals

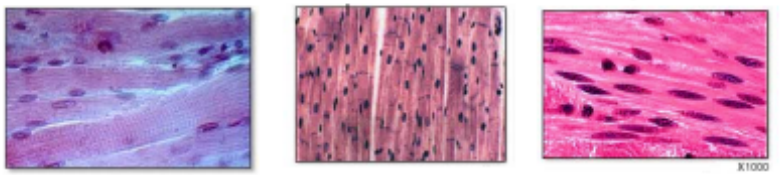
Be able to describe the roles of vertebrate skeletal components	• Cartilage
	  ○ Cells surrounded by gel matrix
	  ○ Few blood vessels
	  ○ Helps joints slide
	  ○ Provides a more flexible structure
	• Bone
	  ○ Dynamic tissue that continually remodels itself
	  ○ Connective tissue hardened by calcium phosphate
	  ○ Individual bones made up of bone tissue, marrow, cartilage and periosteum

Describe the relationship between bone structure and function	 • Diaphysis is the cylinder of compact bone • Endosteum cells resorb and deposit

	• Epiphyses are spongy bone covered with compact bone and cartilage
	• Growth occurs at epiphyseal plate towards diaphysis
	• Rest of the bone is covered with periosteum
	• Tendons penetrate the bone matrix
	• Nutrient foramina allows blood vessels to access the bone – bigger foramina indicates more pressure being put on the bone
	• Compact bone
	  o Cylinders of tissue around blood vessel
	  o Perforating canals connect osteons
	  o Dense and heavy
	• Spongy bone
	  o Formed by trabeculae
	  o Spaces filled with red bone marrow
	  o Few osteons or haversian canals (doesn't get remodelled like compact bone does)
	  o Strong but light
	• Bone marrow
	  o Occupies space in bone
	  o Red marrow mesh of fibres that produces blood cells
	  o Fatty yellow marrow in adult long bones

Identify types and functions of joints	• Fibrous
	  o Collagen between bones
	  o Immoveable and usually strong
	  o Strongest joints are those which have the most surface area for attachment (serrate is the strongest, lap is moderate and plane is weaker)
	• Cartilagenous
	  o Bound by cartilage
	  o Bones joined by hyaline or ligament cartilage
	  o Most flexible joint
	• Bony
	  o Bones fused by osseous tissue
	  o Strongest
	  o Bone fused with bone
	• Synovial
	  o Bones separated by a joint cavity
	  o Articular capsule lined by synovial membrane
	  o Synovial fluid viscous slippery fluid
	  o Articular hyaline cartilage covers bone surfaces
	  o Menuscus is a pad of fibrocartilage
	  o Tendon attaches muscle to bone
	  o Ligament attaches bone to bone
	  o Include
	  ▪ <u>Ball and socket</u> – smooth, multiaxial joint with a hemispherical head that fits wthin a cup (e.g. shoulder)
	  ▪ <u>Hinge</u> – monoaxial (flexion and extension) joint in which a convex surface fits into a concave depression (e.g. elbow and knee)
	  ▪ <u>Pivot</u> – monoaxial (rotation) joint in which one bone has a projection that fits into ring-like ligament of the other (e.g. radius and ulna)
	  ▪ <u>Saddle</u> – two planes of movement with a small amount of rotation (e.g. base of thumb)

	▪ Condyloid/ellipsoid – biaxial joint in which oval convex surface fits into a similarly shaped depression on the next (e.g. fingers) ▪ Gliding – two surfaces that can move past one another (e.g. wrist)

Describe features of vertebrates and invertebrate muscles	• Cilia and flagella movement
	  ○ Cilia are minute and hair like (found in all animals except nematodes) and beat asymmetrically
	  ○ Flagella are longer and beat symmetrically
	• Invertebrate muscles – graded contraction
	  ○ Smooth
	  ○ Striated
	  ○ Fibrillar (e.g. insect flight muscles – super fast)
	• Vertebrate muscle – sum of all fibres
	  ○ Striated (skeletal and cardiac)
	  ○ Smooth
	Comparison of vertebrate muscle types
	Skeletal / Cardiac / Smooth
	Location: skeleton / walls of heart / walls of hollow viscera
	Function: movement, posture / pumping of heart / movement, peristalsis
	Histology: striated, many nuclei, transverse tubules / striated, uninuclear, transverse tubules, intercalated discs / not striated, uninuclear, no transverse tubules
	Control: voluntary / involuntary / involuntary
	Contraction: contracts, relaxes & tires quickly / contracts as unit self-exciting, rhythmic / contracts & relaxes slowly, self-exciting, rhythmic
	 

Describe application of force to levers	• 1st class lever
	  ○ Fulcrum in the middle
	  ○ E.g. atlanto-occipital joint
	• 2nd class lever
	  ○ Resistance in the middle
	  ○ E.g. Achilles
	• 3rd class lever
	  ○ Effort in the middle
	  ○ E.g. biceps

Discuss how muscle structure affects types of contraction	• Muscle contracts when filaments (actin and myosin) in the sarcomere slide towards each other
	• This requires energy (ATP) ad calcium
	• Relaxation is passive
	• Lactic acid is a by-product when anaerobic respiration is used to produce ATP
	• Force of contraction correlates with the number of motor units activated
	• Slow twitch fibres
	  ○ Fatigue slowly
	  ○ Well vascularised