# 1) INTRODUCTION TO ANATOMY & OSETOLOGY

- Osteology: The study of the structure and function of the skeleton and bony structures.

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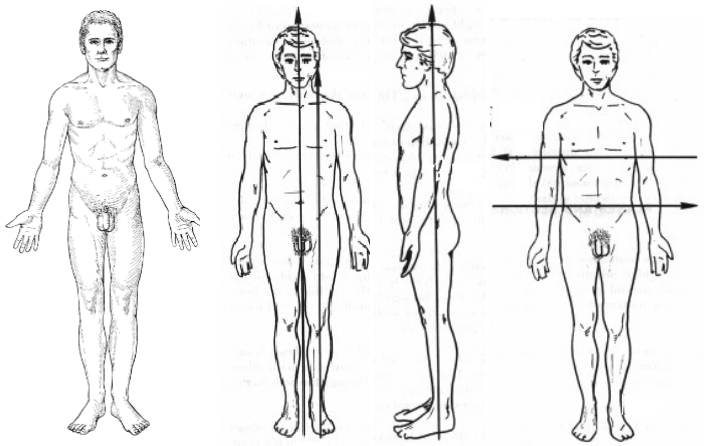
| *1.1 Define the anatomical position* | ▫ Standardised position (A)<br>➢ Body upright<br>➢ Eyes+ toes level & pointing forward<br>➢ Arms by side, palms forward |
| *1.2 Define the following terms of position & direction which are related to the standardise anatomical position* | ▫ Sagital plane: separate left & right<br>▫ Median (midsagittal) plane: median running top to bottom dividing body in 2 symmetrical halves<br>▫ Coronal (frontal) plane: perpendicular to sagittal, running down the side, dividing front and back<br>▫ Horizontal (transverse) plane: across the body to separate top & bottom<br>▫ Anterior (ventral): front *stomach is anterior to the back*<br>▫ Posterior (dorsal): back *ear is posterior to the nose*<br>▫ Superior (cephalic): higher/above *nose is superior to mouth*<br>▫ Inferior (caudal): lower/below *stomach is inferior to head*<br>▫ Proximal: closer to trunk *shoulder is proximal to elbow*<br>▫ Distal: further from trunk *hand is distal to shoulder*<br>▫ Superficial: on surface *skin is superficial to muscle*<br>▫ Deep: further from surface<br>▫ Lateral: further from median<br>▫ Medial: closer to median<br>▫ Unilateral: one side<br>▫ Bilateral: both sides<br>▫ Ipsilateral: same side<br>▫ Contralateral: opposite sides *oblique muscle(right) of stomach causes contralateral rotation of trunk(to left)* |



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| *1.3 List the major bones* | 1. Appendicular: |

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| *comprising the two divisions of the skeleton:* | ▫ Lower limb<br>▫ Lower limb girdle = pelvis<br>▫ Upper limb<br>▫ Upper limb girdle = scapula/clavicle<br><br>2. <u>Axial</u><br>▫ Bones of skull<br>▫ Vertebral column<br>▫ Thorax<br>▫ Pelvis |
| *1.4 List the five functions of skeletons* | 1. Protection vital organs *ribs = lungs, skull = brain*<br>2. Provide a basis for movement *attachment*<br>3. Produce blood cells *white & red*<br>4. Store minerals *calcium*<br>5. Support muscles *attachment* |
| *1.5 & 1.6 & 1.7*<br>*Refer to prac notes* | |

## 2) INTRODUCTION TO TISSUE (HISTOLOGY) & IMAGING ANATOMY

- **<u>Histology:</u>** The study of the microscopic structure of tissues.

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| *2.1 Define The terms tissue and organ* | ▫ <u>Tissue:</u> cells grouped or organised together for specific, limited functions<br>▫ <u>Organ:</u> mixture of cellular tissues and their associated extracellular matrix |
| *2.2 Briefly describe the main histological characteristics and general functions of the **four basic tissues** of the body* | 1. <u>Epithelial tissue:</u> layers of cells covering internal or external surfaces<br>▫ Forms **glands** which produce secretions – endocrine & exocrine<br>▫ Lines internal passageways<br>▫ Function:<br>➢ Physical protection<br>➢ Provide sensation<br>➢ Produced specialised secretions (endocrine & exocrine)<br>➢ Control permeability (skin is impermeable)<br>2. <u>Connective tissue:</u> most abundant and widely distributed out of all tissue types<br>▫ Totally internal (deep) - no contact with environment<br>▫ Loose (aerolar) – dermis<br>▫ Dense (regular) – ligaments & tendon |
| | ▫ Functions:<br>➢ Connect epithelium to rest of body (fills internal spaces)<br>➢ Protection (immune cells)<br>➢ Structure & support<br>➢ Store energy |

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| | ➢ Transport materials (blood)<br>▫ Fasciae:<br>➢ Support or surround organs<br>➢ Maintain position of internal organs<br>➢ Provide routes for blood vessels, lymphatic vessels & nerves<br>▫ Membranes:<br>➢ Physical barriers<br>➢ Lines or covers portions of the body<br>➢ Consists of epithelium supported by connective tissues<br>➢ Permeable and impermeable<br>➢ Limited places due to presence of epithelium<br>3. Muscle tissue:<br>▫ Functions:<br>➢ Contractions<br>➢ Body movement<br>▫ Three types:<br>➢ Skeletal: muscles<br>➢ Cardiac: heart<br>➢ Smooth: walls of hollow organs<br>4. Neural tissue:<br>▫ Two types: neurons & neuroglia<br>▫ Functions:<br>➢ Conducting electrical impulses<br>➢ Rapidly senses internal/external environment<br>➢ Processes info + decision making & control responses to 5 senses<br>➢ Maintain body $^{o}$C |

*2.3 Describe how the following techniques may be used for imaging basic tissues*

| 1. Radiography (X-ray) | 2. Fluoroscopy | 3. Computed tomography (CT) | 4. Magnetic resonance imagine (MRI) | 5. Bone scans | 6. Ultrasound |
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| **Uses** | **X-ray: form of radiant energy which can penetrate the body** | Injection of contrast material *barium & iodide* | **X rays** | **Magnetic field + radiowaves** | Local blood flow & rate of bone metabolic activity | High frequency sound waves |
| **Image** | **2D Image, superimposed structures** | Real time | **2D 'slices' used to reconstruct 3D image** | **3mm 2D 'slices" used to reconstruct 3D** | Skeleton | Real time image |
| **Body part** | **Hard tissue: broken bones (compact/spongy tissue)** | **Anthrogram Internal body parts *bowel/intestines*** | **Joint space, cartilage, labrum & tendons** | **Soft tissue; brain Structures around joints & tumours** | Cancer<br>Trauma<br>Degenerative disease<br>Osteomyelitis (infection of the bone)<br>Metabolic disease<br>Prosthetic joints<br>Sporting injuries | Non-invasive for internal tissues and organs |
| **Other advantages** | Produced on photographic film, TV, monitor<br>Radiolucent: dark *air*<br>Radiopaque: white *bone* | Surgery | Better than radiography for soft tissue & joint spaces | Direct image without use of contrast media | | Very clear of complex joints *shoulder* |
| **Disadvantages** | Poor discrimination for soft tissue<br>Cannot differentiate anterior/posterior, only left & right | | | **Expensive** | | Damage foetus |

## 3) BONES OF THE SHOULDER REGION (REFER TO PRAC NOTES)

# 4) INTRODUCTORY ARTHROLOGY

Arthrology: related to joints

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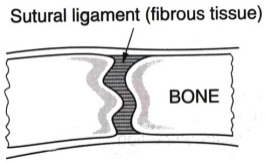
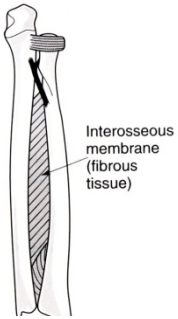
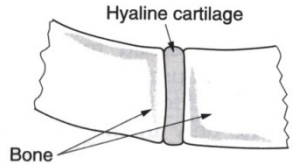
| *4.1 Define a joint (articulation)*<br><br>*4.2 Describe main functions of a joint* | ▫ Joint: a union between two or more parts of the skeleton.<br>▫ The classification of a joint depends on its **direction of movement** & **how much movement**<br>▫ Function: allow movement and provide stability |
| *4.3 Describe the general structure of, and relative amount of movement available at:*<br>*(i) fibrous; suture & syndesmosis*<br>*(ii) cartilaginous; primary (synchondrosis), secondary( (symphysis)*<br>*(iii) synovial*<br><br>*4.7 List and identify examples of each type of joint* | ▫ Movement: immovable, slightly movable, freely movable<br>▫ Structure: fibrous, cartilaginous, synovial<br><br>▫ Fibrous: fibrous material joins the bone ends together; the longer these fibres, the greater the movement<br>➢ Suture(fissures): **(hyaline cartilage)** immovable *e.g. bone sutures*<br>- Edges of bone are highly serrated<br>➢ Syndesmosis: **(fibrocartilage)** slightly movable + controlled *e.g. interosseous membrane b/w tibia & fibula, b/w radius & ulna. This is where bending/twisting occurs*<br>- More fibrous tissue > suture<br><br>▫ Cartilaginous: where cartilage tissue is involved in joint<br>➢ Primary cartilaginous (synchondrosis): immovable *e.g. costochondrial joint in ribs i.e, rib → bone → costochondrial cartilage → sternum*<br>- Hyaline cartilage = very rigid (immovable)<br>➢ Secondary cartilaginous (symphysis): slightly movable *e.g. intervertebral disc, front of pelvis is a disc known is pubic symphysis*<br>- Occurs in midline of body<br>- Hyaline cartilage covers articular surfaces of bones<br><br>▫ Synovial: freely movable i.e. can move in all planes *i.e. sagittal, coronal & transverse* and most common |


(i) Fibrous joint capsule:
unites bones, creating synovial joint cavity

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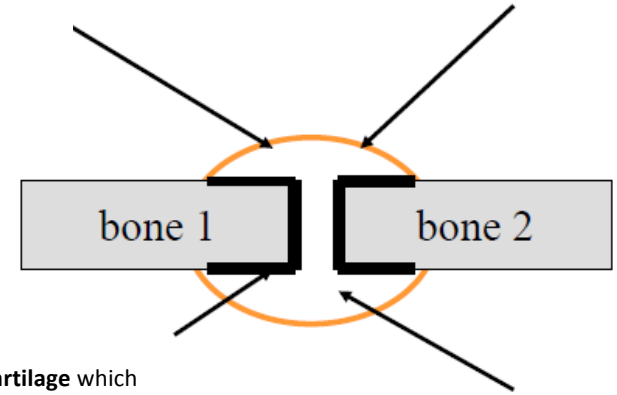
| | (iii) Synovial membrane: (inner layer):<br>lines joint capsule & produces synovial fluid<br>  <br><br>(ii) Bone ends: covered with **articular cartilage** which allows bones to slide on one another without friction |
| *4.4 Describe the factors which determine the amount of friction occurring between articular surfaces during movement at synovial joints.* | ▫ Friction depends on:<br>➢ Compressive load<br>➢ Surfaces involved *e.g. articular cartilage*<br>➢ Lubricant *e.g. synovial fluid*<br>▫ Synovial joints have very little friction<br>▫ Tyre rubber has a coefficient of friction (CF) of 1.0; ice skating CF of 0.03 ; cartilage on cartilage CF of **0.02-0.001 (very slippery)** |
| *4.5 Describe the 3 principal axes of movement about synovial joints.*<br><br>*4.10 Relate active movements about joints to the anatomical planes and axes for movement* | ▫ Transverse axis: sagittal plane<br>➢ Flexion, extension<br>▫ Longitudinal axis: transverse plane<br>➢ Rotation<br>▫ Anteroposterior: coronal plane<br>➢ Abduction, adduction |

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| *4.6 Classify synovial joints according to:*<br>*(i) degrees of freedom*<br>*(ii) structure*<br><br>*4.7 List and identify examples of each type of joint* | ▫ Degree of freedom: classified according to number of axes about which movement occurs<br>➢ AP, transverse and longitudinal axes<br>- Uniaxial, biaxial, multiaxial (below for examples) ($1^{o}$,$2^{o}$,$3^{o}$)<br>▫ Structure:<br>➢ Uniaxial:<br>- Hinge: flexion/extension *elbow*<br>- Pivot: rotation *radius, ulna, C1/C2 in neck*<br>➢ Biaxial:<br>- Ellipsoid: (oval shape) like ball and socket but in oval form *wrist*<br>- Condyloid: *metacarpals, knees*<br>- Saddle: concave + convex pair *base of thumb*<br>➢ Multilaxial:<br>- Ball & socket: *glenohumeral (shoulder), hip*<br>- Plane: gliding action *acromioclavicular (AC joint), sternoclavicular (S.C joint)* |

*In summary:*

| Joint | Example |
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| Fibrous – suture | **Skull** |
| Fibrous – syndesmosis | **Between radial and ulna** |
| Cartilaginous – primary (synchondrosis) | **First sternocostal joint** |
| Cartilaginous – secondary (symphasis) | **Intervertebral joint** |
| Synovial | **Shoulder joint** |
| Hinge | **Elbow joint** |
| Pivot | **C1 and C2 of neck** |
| Ellipsoid | **Radioulnar joint (proximal and distal)** |
| Condyloid | **Mcp joint in knee** |
| Saddle | **Carpometacarpal joint on base of thumb** |
| Ball and Socket | **Shoulder joint** |
| Plane (gliding) | **Acromioclavicular and sternoclavicular joint** |

*Table from Sarah Brown's notes*

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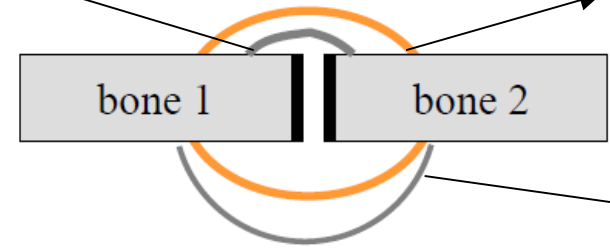
| *4.8 Define & demonstrate the following types of movement abut synovial joints* | ▫ Active: movement produced by voluntary muscle contraction *lifting arm up*<br>➢ Angular:<br>- Flexion/extension about transverse axis *biceps*<br>- Abduction/ adduction about AP *arm out and in*<br>➢ Rotational: *rolling ankle inwards and outwards*<br>- Internal (medial) rotation about vertical axis<br>- External<br>➢ Active assisted: when an active movement is assisted by an external force (physiotherapist) *right arm assisting left in raising*<br>▫ Passive:<br>➢ Physiological: can be produced actively but using an external force *relax arm completely and assisted*<br>➢ Accessory: rolling and gliding which is produced by articular surfaces within joint capsule. Not produced actively *individual cannot perform this movement alone i.e. demonstrate of gliding, sliding and rolling of knuckle joint* |
| *4.9 Define and demonstrate terms used to describe active movement above joints* | ▫ Flexion: bending of adjacent body segments in sagittal plane (on transverse axis) *e.g. bending elbow*<br>▫ Extension: Moving a part of adjacent body segments in sagittal plane (on transverse axis*) e.g. straightening flexed elbow and knee.* Also in reference to the movement beyond neutral position that is opposite to flexion<br>▫ Abduction: Movement of body segment in coronal plane (anteroposterior axis) so that it moves away from body's midline. *e.g. movement of upper limb away from trunk*<br>▫ Adduction: Movement of body segment in coronal plane (anteroposterior axis) so that it moves towards the body's midline<br>▫ Medial Rotation: Rotation of a limb segment about its longitudinal axis (transverse plane) so that anterior surface comes to face the midline. *e.g. turning the lower limb so toes face midline*<br>▫ Lateral Rotation: rotation of a limb segment about its longitudinal axis (transverse plane) so that the anterior surface faces away from the midline. *E.g. turning the lower limb so toes point away from midline*<br>▫ **Note:** different type of active movements can occur simultaneously *hand reaching behind back is a combination of medial rotation, adduction and extension* |
| *4.12 Define and give an example of each of the following types of ligament:*<br>*- capsular*<br>*- extracapsular*<br>*- intracapsular*<br><br>*4.15 Identify examples* | ▫ Ligaments: are bands of fibrous tissue connecting bone to muscle to stablisie joint<br>Intracapsular: inside *ACL*<br>Capsular: part of capsule *glenoid humeral*<br>  <br><br>Extracapsular: outside; *coracoacromial* |

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| *4. 11Explain the functions of ligaments:* | ▫ Mechanical restraints: *dislocating shoulder example*<br>➢ **Prevent unwanted movements** around joint: ligaments connects tightly between articulating joints and acts as an immovable barrier → |

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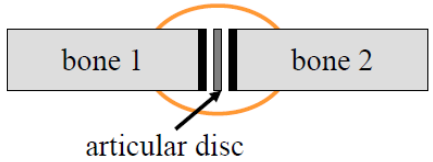
| *(i) mechanical*<br>***(ii) sensory*** | unwanted movements<br>➢ **Limit wanted** movements: ligaments tighten during movement so an endpoint to movement is created; avoiding bone to bone friction and muscle tear<br>▫ Sensory: (proprioceptive)<br>➢ Perception of joint position and movement enhancing kinaesthetic sense *sprain results in decreased ability to process movement = more sprains* |
| *4.13 Define 5 possible functions of articular discs*<br><br>*4.15 Identify examples* | ▫ Articular discs: fibrocartilaginous structure found in some synovial joints *acromioclavicular/sternoclavicular joint*<br>▫ Functions:<br>1. Shock absorbers *in knee*<br>2. Aid mechanical fit between articular surfaces *congruency*<br>3. Restrain movement<br>4. Assist in lubrication by spreading synovial fluid around joint<br>5. Permit different movements occurring simultaneously at joint *around sternoclavicular joint*<br>  |
| *4.14 Define & list functions of bursae* | ▫ Bursae: sac like dilations which may communicate directly with an adjacent joint cavity or exist independently<br>▫ Contains a fluid similar to synovial fluid<br>▫ When a muscle or tendon passes over or around edge of bone, it is usually separate from the bone by a bursa<br>▫ Not just around joints, can be found in places under unusual pressure or friction<br>▫ Function: reduce friction during movement |

## 5) JOINTS OF THE SHOULDER REGION

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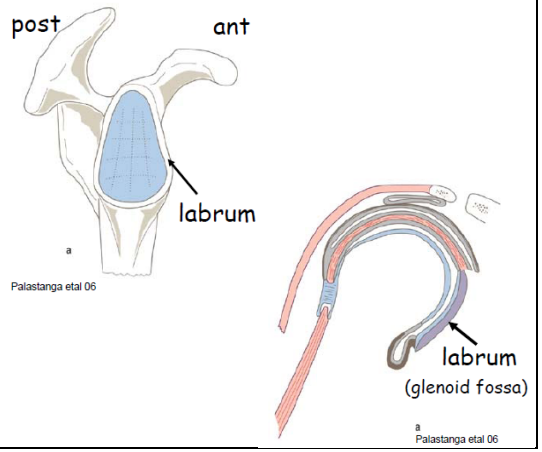
| *5.1 Classify the shoulder (glenohumeral) joint and identify and/or describe its:*<br><br>*5.2 Identify and state the functions of the glenoid labrum* | ▫ Glenohumeral joint: ball and socket, multi axial, synovial<br>▫ Articular surfaces: provides contact between the humerus and scapula and provide a basis for movement of the shoulder joint<br>➢ Humeral head:<br>- ½ sphere<br>- 3x size of glenoid fossa<br>- Greater surface area for mobility<br>- 25-30% contact b/w articular surfaces<br>▫ Glenoid labrum: fibrous structure around glenoid fossa about 4mm wide (very shallow)<br>➢ Facilitate mobility<br>➢ Increase glenoid cavity = more stability<br>➢ Attachment for joint capsule, muscle, ligaments<br>➢ *Dislocated shoulder = tear labrum*<br>  |

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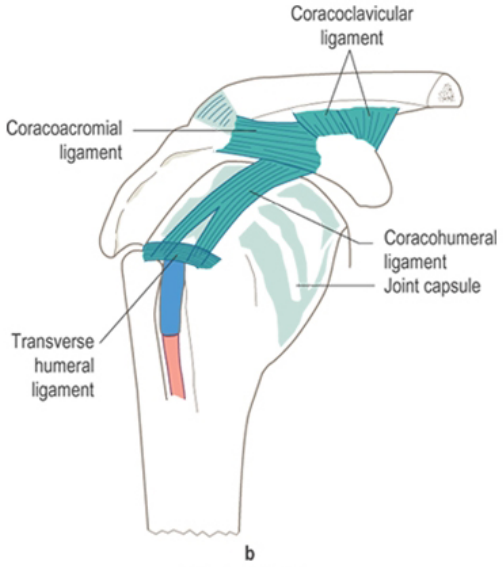
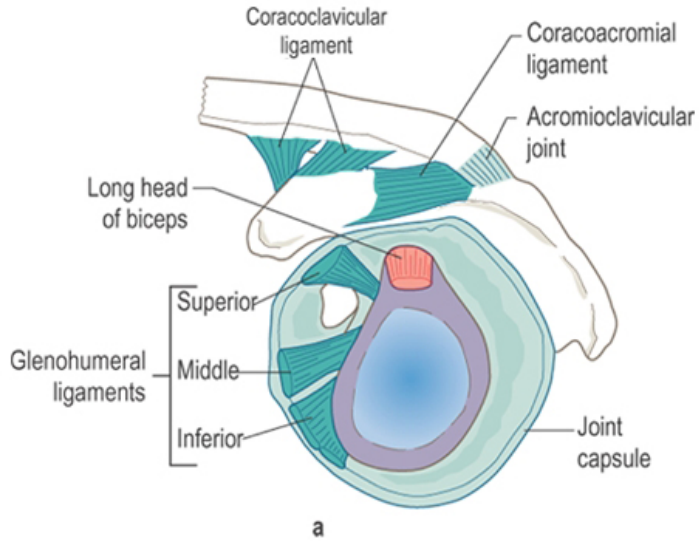
| *5.12 List the ligaments which attach to the*<br>*(i) coracoid process of scapula*<br>*(ii) acromion process of scapula*<br>*(iii) glenoid labrum*<br>*(iv) greater tubercle of humerus* | ▫ Joint capsule: encloses articular surfaces<br>➢ Very thin and lax (loose)<br>➢ Attaches to glenoid labrum & anatomical neck of humerus<br>➢ Reflected inferiorly onto medial shaft<br>➢ Reinforced by: rotator cuff tendons and glenohumeral, coracohumeral ligaments<br>▫ Synovial membrane: secretes synovial fluid into cavity to allow lubrication between bones<br>➢ lines joint capsule and bony surfaces inside joint capsule which are not covered by articular cartilage<br>▫ Ligaments:<br>➢ Coracoacromial: (extracapsular) **coracoids process** prevents superior dislocation of humerus<br>➢ Coracohumeral: (capsular & extracapsular) **acromion process** in upper limb pendant position, glenoid fossa is slightly superior & lateral to prevent lateral and inferior dislocation of humerus<br>➢ Glenohumeral: (capsular) **glenoid labrum** inconsistent<br>- Superior: like coracohumeral; prevents dislocation, limits external rotation<br>- Middle: limits external rotation<br>- inferior: prevents anterior dislocation of humerus when fully flexed/ abducted<br>➢ Transverse humeral: **greater tubercle of humerus** keeps long head of biceps brachii in Intertubercular groove but is not a real movement as it doesn't restrict movement<br>  <br><br>  <br><br>**Diagrams are from anterior view** |