Year 1 - Practical Notes

Human Anatomy and Physiology

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Human Anatomy and Physiology

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Study of Compound Microscopes

Experiment 1 - Practical Notes

Aim

To identify the parts of a compound light microscope, explain their functions and use a prepared slide to compare low- and higher-power views.

Apparatus

- Compound brightfield microscope.
- Instructor-provided prepared slide.
- Manufacturer-approved optical-cleaning materials.
- Notebook and pencil.

Learning Outcomes

- Identify the main parts and state their functions.
- Focus a prepared slide at low and higher power.
- Calculate total magnification.
- Explain the difference between magnification and resolution.

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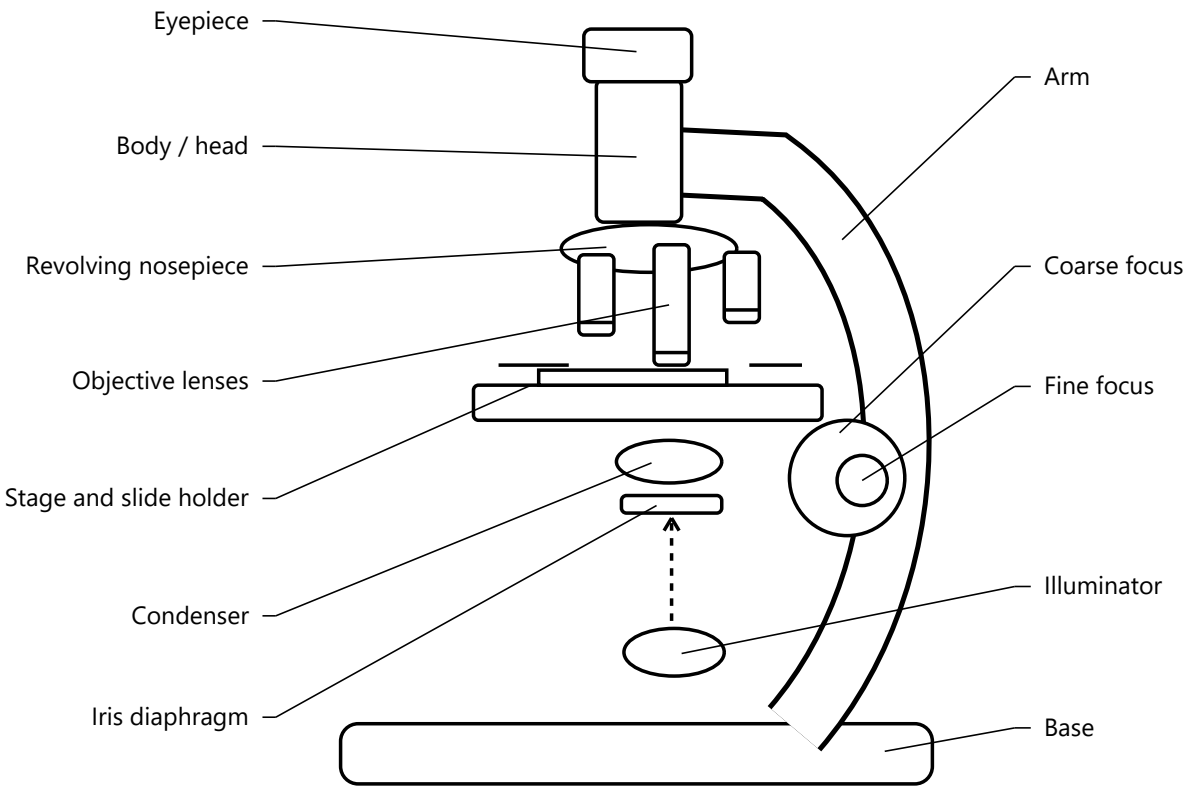
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Parts and Functions

Identify these parts on the microscope in your laboratory. Positions differ by model.



Simplified schematic; not to scale.

Part / group	Main function
Eyepiece and objective	Provide two stages of image magnification.
Revolving nosepiece	Selects an objective and holds it in the optical path.
Stage and slide holder	Support and position the prepared slide.
Condenser and iris diaphragm	Shape the illumination reaching the specimen.
Coarse and fine focus	Make large and small focusing adjustments.
Arm, base and illuminator	Support the instrument and supply transmitted light.

Quick check: Point to each part and state one function.

Principle and Magnification

Principle

- A compound microscope uses an objective and an eyepiece together.
- The objective collects light from the specimen and contributes to a magnified, inverted intermediate image.
- The eyepiece enlarges the intermediate image for visual observation.

Simplified Light Path

Illuminator → Condenser → Specimen → Objective → Eyepiece

Total Magnification

Total magnification = Objective magnification × Eyepiece magnification

Example: 40x objective × 10x eyepiece = **400x** total magnification.

Common Teaching Configuration

Objective	Eyepiece	Total magnification
4x	10x	40x
10x	10x	100x
40x (dry)	10x	400x

Confirm the markings on your own lenses. This table assumes visual observation with no extra magnification factor.

Magnification and Resolution

- **Magnification:** How large the image appears. A larger image alone does not guarantee more visible detail.
- **Resolution:** The ability to separate nearby details. It depends on the optics and illumination, not magnification alone.

Procedure and Precautions

Use the instructor-provided prepared slide and the operating manual for your microscope model.

Procedure

1. Set up

Place the microscope on a stable bench. Identify the controls and inspect the supplied slide before switching on the illuminator.

2. Select low power

Engage the lowest-power objective, commonly 4x. Check clearance between the objective and slide from the side.

3. Position the slide

Secure the prepared slide on the stage. Bring the region of interest over the stage opening.

4. Focus at low power

Use coarse focus cautiously at low power, then fine focus. Keep the objective clear of the slide and avoid forcing any control.

5. Increase magnification

Centre the feature first. Move through 10x to 40x dry objectives when available; refine with fine focus and adjust illumination as instructed.

6. Observe and record

Record lens markings and calculate total magnification. Describe image appearance and sketch what you actually observe.

7. Finish and store

Return to low power and remove the slide with adequate clearance. Switch off, clean accessible optics as instructed and cover after the lamp has cooled.

Precautions

- Use fine focus at 40x; coarse movement can strike the slide.
- Keep fingerprints off lenses. Use manufacturer-approved optical-cleaning materials.
- Use the correct dry objective. Use immersion oil only with a specified immersion objective.
- Carry and store the instrument as directed by its manufacturer.

Observations, Calculations and Result

Fill in your own observations. Numerical examples below are not laboratory results.

Name: _____ Date: _____ Roll no.: _____

Microscope model: _____ Prepared slide: _____

Observation Table

View	Objective	Eyepiece	Total	Appearance / feature
1	____ x	____ x	____ x	_____
2	____ x	____ x	____ x	_____
3	____ x	____ x	____ x	_____

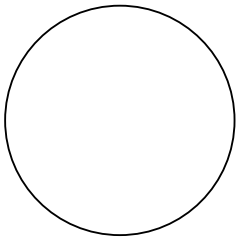
Worked Example: Field of View

Field diameter = Eyepiece field number (FN) ÷ Objective magnification.

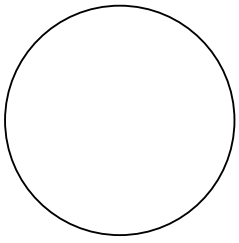
- Example only: assume FN = 18 mm.
- With a 10x objective: 18 ÷ 10 = **1.8 mm**.
- With a 40x objective: 18 ÷ 40 = **0.45 mm**.

Assumes no additional lens factor. Use your own instrument specifications.

Your Labelled Sketches



Low-power view



Higher-power view

Result - Complete After Observation

I identified _____ and observed the prepared slide at _____ x total magnification. On increasing objective power, I noted _____.

Viva Questions

Questions and Answers

1. Why is it called a compound microscope?

The objective and eyepiece provide two successive stages of magnification.

2. What is the total magnification for 10x × 40x?

400x, assuming no other lens factor.

3. Does a larger image always show more detail?

No. Magnification enlarges the image; resolution separates close details.

4. Why start at low power?

It helps you find and centre a feature before observing a smaller field at higher power.

5. Which focusing control should you use at 40x?

Fine focus. Large coarse movements risk contact between the objective and slide.

6. Why does the field of view become smaller?

For a fixed field number, increasing objective magnification reduces specimen field diameter.

Blood Collection Techniques and Specimen Handling

Experiment 2 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify safe blood-collection workflows and their pre-analytical controls.

Principle

Patient identification, correct tube choice, aseptic technique, specimen quality and timely labelling determine whether a blood-test result is reliable.

Key Points

- Venous, capillary and arterial collection have different indications and skill requirements.
- The ordered test determines tube and anticoagulant; serum and plasma are different materials.
- Identity is verified using the institution's required identifiers before collection.
- Use a trainer or supervised demonstration; arterial puncture is a specialist activity.

Activity Procedure

1. Prepare

Review the request, explain the procedure, obtain required consent and identify the person or mannequin.

2. Select equipment

Choose the ordered tube and collection device; check expiry and prepare sharps disposal.

3. Observe collection

On the trainer, demonstrate hand hygiene, site preparation and the institution-approved collection sequence.

4. Handle correctly

Apply pressure as appropriate; place sharps directly in the designated container without recapping.

5. Label and transfer

Label beside the person according to protocol; document time and test, inspect specimen quality and transport as ordered.

Record and Observations

Check	Activity record
Identity / request	_____
Method / tube / additive	_____
Asepsis / sharps handling	_____
Label / collection time	_____
Haemolysis / clot / transport check	_____

Result

The collection workflow was demonstrated on _____. Identity, tube, asepsis, label and transport checks were _____.

Precautions

- Invasive collection is performed only by trained personnel under the institution's supervision.
- Use simulated material for the student exercise where appropriate.
- Follow local exposure and specimen-disposal protocols.

Viva Questions and Answers

1. How does plasma differ from serum?

Plasma is obtained from anticoagulated blood and contains clotting proteins; serum is separated after clotting.

2. Why label at collection?

Delayed labelling increases the risk of misidentification.

3. Why can haemolysis matter?

Cell contents can alter some measured analytes and invalidate interpretation.

Microscopic Study of Epithelial Tissue

Experiment 3 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To recognise epithelial tissue in prepared histological sections.

Principle

Tissue identification links cell form and tissue arrangement to function. Closely packed cells arranged in sheets on a basement membrane with relatively little extracellular matrix.

Requirements

- Authenticated prepared slides
- Compound microscope and labelled drawing sheet

Procedure

1. Survey

Focus at low power and identify a representative intact region.

2. Examine

Identify simple squamous, cuboidal and columnar examples, and a stratified epithelium on the supplied slides.

3. Compare

Compare the assigned section with another tissue type and note the differences.

4. Draw

Draw a representative field and label: Cell shape, number of layers, free surface and basement-membrane boundary.

5. Interpret

Relate the observed structure to a lining or covering function; thickness and specialised surfaces fit local function.

Observations and Record

Feature	Observation
Slide / stain / magnification	_____
Cell shape / nuclei	_____
Tissue arrangement / matrix	_____
Diagnostic feature	_____
Structure-function link	_____

Result

The section was recognised as _____ because _____. Magnification: _____.

Precautions

- Start at low power before using higher magnification.
- Do not confuse folds, tears or stain deposits with cell structures.
- Record what is visible rather than copying an atlas drawing as an observation.

Viva Questions and Answers

1. What is the main identifying pattern?

Closely packed cells arranged in sheets on a basement membrane with relatively little extracellular matrix.

2. How does structure relate to function?

A lining or covering function; thickness and specialised surfaces fit local function.

3. Why compare slides?

Comparison reveals which features distinguish one tissue from another.

Microscopic Study of Cardiac Muscle

Experiment 4 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To recognise cardiac muscle in prepared histological sections.

Principle

Tissue identification links cell form and tissue arrangement to function. Striated, branching muscle fibres with usually central nuclei and intercalated-disc connections.

Requirements

- Authenticated prepared slides
- Compound microscope and labelled drawing sheet

Procedure

1. Survey

Focus at low power and identify a representative intact region.

2. Examine

Locate branching fibres, striations where visible and intercalated discs on a suitable cardiac slide.

3. Compare

Compare the assigned section with another tissue type and note the differences.

4. Draw

Draw a representative field and label: Branching fibres, central nuclei, striations and intercalated discs.

5. Interpret

Relate the observed structure to coordinated contraction of the heart; structural coupling supports synchronised activity.

Observations and Record

Feature	Observation
Slide / stain / magnification	_____
Cell shape / nuclei	_____
Tissue arrangement / matrix	_____
Diagnostic feature	_____
Structure-function link	_____

Result

The section was recognised as _____ because _____. Magnification: _____.

Precautions

- Start at low power before using higher magnification.
- Do not confuse folds, tears or stain deposits with cell structures.
- Record what is visible rather than copying an atlas drawing as an observation.

Viva Questions and Answers

1. What is the main identifying pattern?

Striated, branching muscle fibres with usually central nuclei and intercalated-disc connections.

2. How does structure relate to function?

Coordinated contraction of the heart; structural coupling supports synchronised activity.

3. Why compare slides?

Comparison reveals which features distinguish one tissue from another.

Microscopic Study of Smooth Muscle

Experiment 5 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To recognise smooth muscle in prepared histological sections.

Principle

Tissue identification links cell form and tissue arrangement to function. Non-striated spindle-shaped cells with a central elongated nucleus.

Requirements

- Authenticated prepared slides
- Compound microscope and labelled drawing sheet

Procedure

1. Survey

Focus at low power and identify a representative intact region.

2. Examine

Compare longitudinal and cross-sectional views; note that not every cut cell shows its nucleus.

3. Compare

Compare the assigned section with another tissue type and note the differences.

4. Draw

Draw a representative field and label: Spindle cells, central nuclei and absence of cross-striations.

5. Interpret

Relate the observed structure to involuntary movement in vessel and hollow-organ walls.

Observations and Record

Feature	Observation
Slide / stain / magnification	_____
Cell shape / nuclei	_____
Tissue arrangement / matrix	_____
Diagnostic feature	_____
Structure-function link	_____

Result

The section was recognised as _____ because _____. Magnification: _____.

Precautions

- Start at low power before using higher magnification.
- Do not confuse folds, tears or stain deposits with cell structures.
- Record what is visible rather than copying an atlas drawing as an observation.

Viva Questions and Answers

1. What is the main identifying pattern?

Non-striated spindle-shaped cells with a central elongated nucleus.

2. How does structure relate to function?

Involuntary movement in vessel and hollow-organ walls.

3. Why compare slides?

Comparison reveals which features distinguish one tissue from another.

Microscopic Study of Skeletal Muscle

Experiment 6 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To recognise skeletal muscle in prepared histological sections.

Principle

Tissue identification links cell form and tissue arrangement to function. Long multinucleated fibres with cross-striations and mainly peripheral nuclei.

Requirements

- Authenticated prepared slides
- Compound microscope and labelled drawing sheet

Procedure

1. Survey

Focus at low power and identify a representative intact region.

2. Examine

Locate parallel fibres and transverse striations; compare longitudinal and transverse sections.

3. Compare

Compare the assigned section with another tissue type and note the differences.

4. Draw

Draw a representative field and label: Parallel fibres, peripheral nuclei and striations.

5. Interpret

Relate the observed structure to movement and posture; fibres are activated through somatic motor control.

Observations and Record

Feature	Observation
Slide / stain / magnification	_____
Cell shape / nuclei	_____
Tissue arrangement / matrix	_____
Diagnostic feature	_____
Structure-function link	_____

Result

The section was recognised as _____ because _____. Magnification: _____.

Precautions

- Start at low power before using higher magnification.
- Do not confuse folds, tears or stain deposits with cell structures.
- Record what is visible rather than copying an atlas drawing as an observation.

Viva Questions and Answers

1. What is the main identifying pattern?

Long multinucleated fibres with cross-striations and mainly peripheral nuclei.

2. How does structure relate to function?

Movement and posture; fibres are activated through somatic motor control.

3. Why compare slides?

Comparison reveals which features distinguish one tissue from another.

Microscopic Study of Connective Tissue

Experiment 7 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To recognise connective tissue in prepared histological sections.

Principle

Tissue identification links cell form and tissue arrangement to function. Cells are distributed in an extracellular matrix containing fibres and ground substance.

Requirements

- Authenticated prepared slides
- Compound microscope and labelled drawing sheet

Procedure

1. Survey

Focus at low power and identify a representative intact region.

2. Examine

Compare loose connective tissue with one assigned dense, adipose, cartilage or bone section.

3. Compare

Compare the assigned section with another tissue type and note the differences.

4. Draw

Draw a representative field and label: Cells, collagen or elastic fibres, matrix and the assigned specialised feature.

5. Interpret

Relate the observed structure to support, connection, storage or mechanical protection depending on the type.

Observations and Record

Feature	Observation
Slide / stain / magnification	_____
Cell shape / nuclei	_____
Tissue arrangement / matrix	_____
Diagnostic feature	_____
Structure-function link	_____

Result

The section was recognised as _____ because _____. Magnification: _____.

Precautions

- Start at low power before using higher magnification.
- Do not confuse folds, tears or stain deposits with cell structures.
- Record what is visible rather than copying an atlas drawing as an observation.

Viva Questions and Answers

1. What is the main identifying pattern?

Cells are distributed in an extracellular matrix containing fibres and ground substance.

2. How does structure relate to function?

Support, connection, storage or mechanical protection depending on the type.

3. Why compare slides?

Comparison reveals which features distinguish one tissue from another.

Microscopic Study of Nervous Tissue

Experiment 8 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To recognise nervous tissue in prepared histological sections.

Principle

Tissue identification links cell form and tissue arrangement to function. Neurons have a cell body and processes; glial cells support neuronal structure and activity.

Requirements

- Authenticated prepared slides
- Compound microscope and labelled drawing sheet

Procedure

1. Survey

Focus at low power and identify a representative intact region.

2. Examine

Locate neuron cell bodies, nuclei and visible processes in a prepared section; distinguish smaller glial nuclei where possible.

3. Compare

Compare the assigned section with another tissue type and note the differences.

4. Draw

Draw a representative field and label: Neuron soma, nucleus, visible processes and surrounding glial nuclei.

5. Interpret

Relate the observed structure to reception, processing and transmission of information.

Observations and Record

Feature	Observation
Slide / stain / magnification	_____
Cell shape / nuclei	_____
Tissue arrangement / matrix	_____
Diagnostic feature	_____
Structure-function link	_____

Result

The section was recognised as _____ because _____. Magnification: _____.

Precautions

- Start at low power before using higher magnification.
- Do not confuse folds, tears or stain deposits with cell structures.
- Record what is visible rather than copying an atlas drawing as an observation.

Viva Questions and Answers

1. What is the main identifying pattern?

Neurons have a cell body and processes; glial cells support neuronal structure and activity.

2. How does structure relate to function?

Reception, processing and transmission of information.

3. Why compare slides?

Comparison reveals which features distinguish one tissue from another.

Identification of Axial Bones

Experiment 9 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the adult axial skeleton and state the location and main features of representative bones.

Principle

The adult axial skeleton forms the central framework: skull, auditory ossicles, hyoid, vertebral column and thoracic cage. Its usual count is 80 bones. Counts depend on adult fusion and exclude variable accessory bones.

Requirements

- Articulated skeleton or labelled models, isolated teaching bones and anatomical charts.
- Notebook and an identification checklist.

Procedure

1. Orient the skeleton

Identify anterior, posterior, superior and inferior views. Locate the skull, vertebral column and thorax.

2. Study the skull

Identify the eight cranial bones and fourteen facial bones. Locate major sutures, orbit and mandible on the model.

3. Study vertebrae

Compare cervical, thoracic and lumbar vertebrae. Identify the atlas, axis, sacrum and coccyx; relate their appearance to position.

4. Study the thoracic cage

Identify sternum and ribs. Distinguish true ribs 1-7, false ribs 8-12 and floating ribs 11-12.

5. Record a spot identification

For each bone, state its name, location, one landmark and one function; do not rely only on size.

Skull Bone Checklist

Group	Bones	Count
Cranial	Frontal 1; parietal 2; temporal 2; occipital 1; sphenoid 1; ethmoid 1	8
Facial	Mandible 1; vomer 1; maxillae 2; zygomatic 2; nasal 2; lacrimal 2; palatine 2; inferior nasal conchae 2	14
Associated	Malleus, incus and stapes on each side; hyoid	6 + 1

Regional Features

- Cervical vertebrae generally show transverse foramina; atlas and axis have specialised forms.
- Thoracic vertebrae articulate with ribs. Lumbar vertebrae have substantial bodies for load bearing.
- The sternum has manubrium, body and xiphoid process. Identify these parts rather than counting them as separate adult bones.

Observations and Record

Bone / model	Landmark observed	Location / function
Skull bone	_____	_____
Vertebra	_____	_____
Rib / sternum	_____	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Usual adult count: skull 22 + ossicles 6 + hyoid 1 + vertebral column 26 + ribs 24 + sternum 1 = 80.
- Vertebral column count: 7 cervical + 12 thoracic + 5 lumbar + fused sacrum 1 + fused coccyx 1 = 26 adult bones.

Result

I identified ____ axial bones and recorded a diagnostic landmark for each. The usual adult axial bone count is 80.

Precautions

- Handle isolated bones and models as directed; fragile projections may break.
- Count the fused sacrum as one adult bone, not as five separate adult bones.
- Not every model includes the auditory ossicles or hyoid.

Viva Questions and Answers

1. What distinguishes a thoracic vertebra?

It has articular facets associated with ribs.

2. Which vertebra has the dens?

The axis, or second cervical vertebra.

3. Why are ribs 11 and 12 called floating?

They have no anterior attachment to the sternum.

Identification of Appendicular Bones

Experiment 10 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the limb and girdle bones and distinguish the usual adult appendicular count from the axial count.

Principle

The appendicular skeleton includes the upper and lower limbs and their girdles. Its usual adult count is 126. Girdles connect the limbs to the central skeleton; limb arrangements reflect upper-limb mobility and lower-limb weight bearing.

Requirements

- Articulated skeleton, isolated bone models and upper- and lower-limb charts.
- Notebook and identification record.

Procedure

1. Identify girdles

Locate the clavicle and scapula on each side and the two hip bones. Identify the acetabulum and scapular glenoid cavity.

2. Identify upper limb

Locate humerus, radius and ulna. Use anatomical position: the radius is lateral on the thumb side, and the ulna is medial.

3. Identify the hand

Locate carpals, metacarpals and phalanges. The thumb has two phalanges; each other digit has three.

4. Identify lower limb

Locate femur, patella, tibia and fibula. Tibia is the main medial weight-bearing leg bone; fibula is lateral.

5. Identify foot and record

Identify the tarsal group, metatarsals and phalanges. Record name, side where determinable, landmark and joint relationship.

Hand and Foot Checklist

Group	Names to identify	Count per side
Carpals	Scaphoid, lunate, triquetrum, pisiform, trapezium, trapezoid, capitate, hamate	8
Tarsals	Talus, calcaneus, navicular, cuboid, medial/intermediate/lateral cuneiforms	7
Long bones of digits	Metacarpals / metatarsals; phalanges	5 + 14 in each hand or foot

Observations and Record

Bone	Side / identifying landmark	Joint relationship
Upper limb	_____	_____
Lower limb	_____	_____
Girdle bone	_____	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Each upper limb plus its girdle: 2 girdle bones + humerus 1 + radius/ulna 2 + carpals 8 + metacarpals 5 + phalanges 14 = 32; both sides = 64.
- Each lower limb plus hip bone: 1 + femur 1 + patella 1 + tibia/fibula 2 + tarsals 7 + metatarsals 5 + phalanges 14 = 31; both sides = 62.
- Total appendicular bones = 64 + 62 = 126. Together with 80 axial bones, the usual adult total is 206.

Result

I identified ____ appendicular bones, correctly stated their location and recorded representative landmarks.

Precautions

- Use anatomical position when naming medial and lateral structures.
- Do not count the ilium, ischium and pubis as three separate adult hip bones after fusion.
- Confirm landmarks before assigning right or left to an isolated bone.

Viva Questions and Answers

1. Which forearm bone is on the thumb side?

Radius in anatomical position.

2. What forms the hip bone?

Ilium, ischium and pubis fuse to form one hip bone on each side.

3. How many carpals and tarsals are on one side?

Eight carpals in the wrist and seven tarsals in the foot.

Determination of Blood Group

Experiment 11 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To interpret a supervised ABO and RhD grouping demonstration using reagent reactions and controls.

Principle

In forward grouping, specific antibodies detect red-cell antigens through agglutination. Reverse ABO grouping checks plasma reactions with known reagent cells when applicable. RhD testing uses the specified anti-D method and controls. Classroom grouping is not a substitute for a transfusion laboratory work-up.

Requirements

- Instructor-prepared simulated grouping kit or authorised laboratory demonstration.
- Anti-A, anti-B and anti-D reagents, relevant controls and approved method instructions.
- Labelled reaction record; no unsupervised blood collection.

Procedure

1. Confirm identification

Check the demonstration material and reagent identity, expiry and quality-control status.

2. Set up reactions

The instructor follows the validated slide, tube or other method. Maintain separate reaction areas and avoid reagent carryover.

3. Read within the method

Record agglutination only within the specified time and conditions. Distinguish a true reaction from drying artefact or an invalid control.

4. Interpret forward ABO

Use the pattern in the table. Confirm that controls and any required reverse grouping agree; unresolved discrepancies need laboratory investigation.

5. Interpret RhD

A valid anti-D reaction supports D antigen detection under the method. A non-reactive result is interpreted by the laboratory's algorithm; do not invent a weak-D conclusion.

6. Record limitations

State that clinical transfusion decisions require authorised testing, compatibility assessment and the complete patient context.

Forward ABO Pattern

Anti-A	Anti-B	Forward ABO interpretation
+	–	A
–	+	B
+	+	AB
–	–	O

Reverse Grouping Check

In a suitable adult demonstration, group A plasma reacts with B reagent cells, group B plasma with A reagent cells, group O plasma with both, and group AB plasma with neither. Special age groups and discrepant reactions require the laboratory's procedure.

Observations and Record

Reagent	Reaction + / –	Control status
Anti-A	____	_____
Anti-B	____	_____
Anti-D	____	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Fictional valid forward grouping: anti-A positive, anti-B negative. The forward ABO pattern supports group A.
- If anti-D is positive with a valid control, the teaching interpretation is RhD positive.
- If a control is invalid or forward and reverse ABO results disagree, record "unresolved" rather than assigning a definitive group.

Result

Forward ABO pattern: ____. Control validity: ____. Teaching ABO / RhD interpretation: ____ / ____, subject to the complete laboratory method.

Precautions

- Do not use a classroom or home grouping result for transfusion or pregnancy care.
- Read at the specified time; dried mixtures may mimic agglutination.
- Do not assume ABO and RhD cover every clinically relevant blood-group antigen.

Viva Questions and Answers

1. What does anti-A detect?

A antigen on red cells in a valid forward-grouping test.

2. Why use reverse ABO grouping?

It provides a complementary plasma-reaction check when appropriate.

3. Does group matching alone prove transfusion compatibility?

No; other antigens and antibodies and compatibility procedures matter.

Determination of Erythrocyte Sedimentation Rate

Experiment 12 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To observe a Westergren-type ESR demonstration and report sedimentation with method, time and units.

Principle

ESR describes red-cell settling under standardised conditions and is commonly expressed in mm at one hour. Increased plasma proteins can promote red-cell aggregation, but anaemia, cell shape and other factors also affect sedimentation. ESR is a non-specific finding and does not identify one disease by itself.

Requirements

- Westergren-type system and its instructions, vertical stand and timer.
- Instructor-provided anticoagulated material or a simulated reading.
- Temperature and observation record.

Procedure

1. Confirm method

Record the tube or instrument type, required anticoagulant and any prescribed dilution. Use the method-specific preparation rather than assuming one dilution for every system.

2. Observe filling

The instructor fills to the stated mark without bubbles or clot. Note that a correct initial level is required.

3. Set vertically

Place the tube upright in a stable stand, protected from vibration and unsuitable temperature conditions. Start timing as prescribed.

4. Read

At the stated endpoint, usually one hour for the classical method, read the clear-plasma column above the red cells in millimetres.

5. Interpret

Report method and interval and compare with the supplied laboratory range. Discuss non-specificity and confounding factors.

Observations and Record

Item	Required record	Observation
Method / temperature	System and room condition	_____
Start / reading time	____ / ____	_____
Sedimentation	Clear-plasma column	____ mm at 1 h

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Illustrative classical reading: clear-plasma column 18 mm after one hour. Report ESR = 18 mm at 1 h under the stated method.
- Do not divide a 30-minute observation into a guessed one-hour result: sedimentation is not assumed to be a simple linear process.

Result

ESR by ____ method = ____ mm at ____ h. The measurement conditions and interpretive limitations are recorded.

Precautions

- Keep the tube vertical and the timing consistent.
- Clots, bubbles, vibration or an incorrect fill level can invalidate the reading.
- Do not use ESR alone to diagnose infection, autoimmune disease or malignancy.

Viva Questions and Answers

1. What is read in the classical test?

The height of clear plasma above the settled red cells at the stated time.

2. Why can tube tilt matter?

It changes the sedimentation conditions and can distort the measurement.

3. Why is ESR non-specific?

Many inflammatory and non-inflammatory factors can change it.

Estimation of Haemoglobin

Experiment 13 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To observe a prescribed haemoglobin estimation method, calculate a teaching result and interpret it with the supplied laboratory interval.

Principle

Haemoglobin concentration describes the oxygen-carrying pigment in a volume of blood. Modern analysers may use validated non-cyanide photometric methods. A visual acid-haematin teaching method, where used, has different limitations. The named method, calibration and control status must accompany the result.

Requirements

- Instructor-selected analyser or photometer and its specified reagent system.
- Appropriate control, calibrator and supplied specimen or demonstration material.
- Method instructions and observation sheet.

Procedure

1. Identify the method

Record the instrument or teaching method and the reporting unit. Do not combine reagents or procedures from different methods.

2. Check readiness

Observe the instrument blank or zero, calibrator and control checks as prescribed.

3. Observe preparation

The instructor prepares and measures the supplied material using the method-specific quantities and reaction time.

4. Read the result

Record the reported Hb or blank-corrected absorbance. Apply the calibration calculation only if it is the validated calculation for that method.

5. Interpret

Compare with the supplied age- and context-appropriate interval. Consider CBC indices and clinical assessment; a low Hb finding does not itself establish the cause.

Observations and Record

Item	Value / description	Record
Method and unit	Instrument / g/dL or g/L	_____
Calibrator / control	Assigned concentration / accepted result	_____
Specimen result	Reported Hb or absorbance	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- One-point linear teaching example: standard Hb = 15.0 g/dL; standard absorbance = 0.50; test absorbance = 0.40, all blank-corrected.
- Hb = (0.40 ÷ 0.50) × 15.0 = 12.0 g/dL = 120 g/L.
- This formula requires a valid linear method and matched conditions; use the instrument's calibration when the method is not a simple one-point comparison.

Result

Method: ____. Haemoglobin = ____ g/dL or ____ g/L. The result was considered with the supplied interval and other relevant information.

Precautions

- Use only the specified reagent system; do not prepare hazardous historical reagents for this exercise.
- Turbidity, clots or poor specimen identification can invalidate a result.
- Do not infer iron deficiency from Hb alone or advise treatment from the classroom result.

Viva Questions and Answers

1. What does Hb concentration measure?

The mass concentration of haemoglobin in blood.

2. How are g/dL and g/L related?

Multiply g/dL by 10 to obtain g/L.

3. Why is a visual teaching method limited?

Colour matching and observer judgement can reduce precision compared with validated instrument measurement.

Bleeding Time and Clotting Time Study

Experiment 14 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To distinguish primary haemostasis from clot formation and calculate intervals using a supervised demonstration or simulation.

Principle

Bleeding time is the interval until bleeding stops under a specified test method and is influenced by platelet and small-vessel function. Whole-blood clotting time records a method-specific clot endpoint and relates more to coagulation. These historical teaching tests are not interchangeable with modern platelet studies, PT or aPTT; bleeding time is rarely used clinically today.

Requirements

- Instructor-selected video, simulated timing record or approved demonstration.
- Timer, endpoint descriptions and observation sheet.
- Any invasive demonstration is conducted only by authorised trained staff under institutional procedures.

Procedure

1. Identify the method

Record whether the demonstration concerns bleeding time or clotting time. Note the named method, time-zero definition and endpoint.

2. Observe bleeding endpoint

In a simulation or authorised demonstration, record the start and the first endpoint meeting the stated method. Do not carry out cuts or punctures on classmates.

3. Observe clot endpoint

Record when the stated clot criterion is reached and the conditions shown, including temperature where relevant.

4. Calculate intervals

Subtract the starting timestamp from each endpoint. Write both minutes and seconds; a decimal minute is not the same as a minute:second notation.

5. Discuss limitations

Compare the recorded interval with the method-specific laboratory interval. Discuss observer dependence and why modern investigations may be preferred.

Observations and Record

Test	Start / endpoint	Elapsed interval
Bleeding-time simulation	____ / ____	____ min ____ s
Clotting-time simulation	____ / ____	____ min ____ s
Method / conditions	_____	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Illustrative bleeding record: start 09:02:00; endpoint 09:05:30. Interval = 3 min 30 s = 3.5 min.
- Illustrative clotting record: start 09:10:00; endpoint 09:14:45. Interval = 4 min 45 s = 4.75 min.
- These times demonstrate arithmetic and are not patient findings or universal normal limits.

Result

Bleeding-time simulation: ____ min ____ s. Clotting-time simulation: ____ min ____ s. Method-specific limitations were identified.

Precautions

- Use the approved simulation rather than student self-puncture or improvised cuts.
- Do not stop medicines or infer a bleeding disorder from a classroom timing result.
- Test conditions and endpoint definitions must be recorded; different methods cannot be compared by one universal cutoff.

Viva Questions and Answers

1. Which process is especially relevant to bleeding time?

Primary haemostasis involving platelets and small vessels.

2. Are clotting time and aPTT the same?

No; they have different procedures and endpoints.

3. Why is bleeding time uncommon today?

It is difficult to perform reproducibly and more suitable investigations are available.

Total White Blood Cell Count

Experiment 15 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

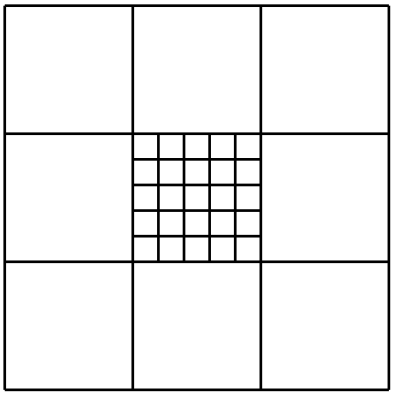
Aim

To calculate a total WBC count from a supervised chamber demonstration or counted teaching image.

Principle

A diluted cell suspension is counted in a known chamber volume. Cell concentration equals counted cells multiplied by dilution factor divided by counted volume.

Chamber Guide



Improved Neubauer chamber

Grid: 3 mm × 3 mm

Each large square: 1 mm^2

Chamber depth: 0.1 mm

Central square: 25 groups

Schematic; not to scale.

Requirements

- Improved Neubauer chamber and microscope or calibrated teaching image
- Instructor-provided material and the assigned dilution method

Procedure

1. Identify grid

Locate the four large corner squares in the supplied chamber.

2. Record dilution

Enter the actual dilution used; do not assume it from the instrument name.

3. Count

Count WBCs in the four 1 mm^2 corner squares using a consistent inclusion/exclusion boundary rule.

4. Calculate

The area is 4 mm^2 and depth 0.1 mm, so volume is 0.4 mm^3 = 0.4 microlitre.

5. Check

Compare duplicate counts and document any distribution, charging or boundary error.

Observations and Record

Field	Record
Dilution factor	_____
Four-square cell counts	_____
Total cells N	_____
Counted volume	0.4 microlitre
WBC count, cells/microlitre	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- WBC/microlitre = N × dilution factor / 0.4.
- Example: N = 160 and dilution factor = 20 gives 8,000 cells/microlitre = 8 × 10^9/L.

Result

Record the observed outcome and calculated value, with units. State whether the stated laboratory specification was met; do not copy the worked example as your result.

Precautions

- Use the correct coverslip and chamber depth.
- Reject overfilled, uneven or bubble-containing demonstrations.
- Do not identify a disease from a count alone.

Viva Questions and Answers

1. Why multiply by dilution?

The original suspension is more concentrated than the counted dilution.

2. Why is depth needed?

Counted area becomes a known volume only when depth is included.

3. How does total WBC differ from a differential?

Total count measures concentration; the differential describes proportions or absolute counts of types.

Total Red Blood Cell Count

Experiment 16 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To calculate a manual red-cell concentration and explain the chamber-area and dilution factors.

Principle

A validated isotonic RBC diluent preserves countable red cells. Five group squares in the centre of the improved Neubauer grid have total area 0.20 mm^2; with depth 0.1 mm the counted volume is 0.020 µL. Red-cell concentration alone does not describe haemoglobin content or identify the cause of anaemia.

Requirements

- Improved Neubauer chamber and specified coverslip.
- Instructor-supplied control or specimen, calibrated pipettes and approved RBC diluent.
- Microscope and count sheet.

Procedure

1. Confirm dilution

Record the assigned dilution, commonly 1:200 in the teaching calculation. Use the laboratory-approved diluent and procedure.

2. Prepare the chamber

Seat the special coverslip and load the well-mixed dilution without bubbles or overflow. Allow the specified settling time.

3. Select counting groups

Identify the four corner and one central group squares within the central 1 mm^2 area. Each group is 0.04 mm^2 and contains sixteen small squares.

4. Count

Count all cells in the five selected groups with the same border rule. Record group totals and assess the second chamber as required.

5. Calculate and interpret

Use N × D ÷ 0.020. Report units and compare with the provided interval alongside Hb, Hct and red-cell indices.

Observations and Record

Group square	Cells counted	Record
Central-grid corner groups	____; ____; ____; ____	Subtotal: ____
Central group	____	Total N: ____
Dilution / concentration	D: ____	____ cells/µL

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Illustrative count: N = 480, D = 200. RBC = 480 × 200 ÷ 0.020 = 4,800,000 cells/µL.
- Thus the usual factor for this exact area and dilution is 10,000. A different area or dilution needs a different factor.
- 4,800,000/µL = 4.8 million/µL = 4.8 × 10^{12}/L.

Result

N = ____ and D = ____. RBC concentration = ____ cells/µL, equivalent to ____ × 10^{12}/L.

Precautions

- Do not count five large 1 mm^2 squares when the method calls for five central group squares.
- Mix before loading because cells can settle in the dilution.
- Do not equate an RBC count with a haemoglobin concentration or a confirmed diagnosis.

Viva Questions and Answers

1. Why use an isotonic diluent?

To help preserve red-cell integrity for counting.

2. What is the counted volume for five groups?

0.020 µL at a 0.1 mm chamber depth.

3. What makes the count factor change?

Dilution, counted area or chamber depth.

Differential White Blood Cell Count

Experiment 17 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To classify white cells in a prepared stained blood-film teaching exercise.

Principle

A differential records the distribution of neutrophils, lymphocytes, monocytes, eosinophils and basophils. Cell morphology, film quality and the counting area affect classification.

Cell Identification Guide

Cell	Main teaching features
Neutrophil	Segmented nucleus; fine cytoplasmic granules
Lymphocyte	Dense round nucleus; variable rim of cytoplasm
Monocyte	Folded / kidney-like nucleus; more cytoplasm
Eosinophil	Often bilobed nucleus; conspicuous eosinophilic granules
Basophil	Dark coarse granules can obscure the nucleus

Requirements

- Instructor-prepared stained blood film or validated digital images
- Microscope / display and tally sheet

Procedure

1. Assess film

Locate a suitable monolayer region and avoid thick edges or damaged areas.

2. Identify cells

Classify cells by nuclear form, size, cytoplasm and granules; use the supplied morphology guide.

3. Count systematically

Follow the assigned traverse pattern and tally the specified number, commonly 100 teaching cells.

4. Calculate proportions

Percentage = type count / total classified × 100; the total should be 100%.

5. Calculate absolute counts

When total WBC is supplied, absolute type count = total WBC × fraction of that type.

Observations and Record

Type	Tally / count	Percentage
Neutrophils	_____	_____
Lymphocytes	_____	_____
Monocytes	_____	_____
Eosinophils	_____	_____
Basophils	_____	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Hypothetical exercise: 60 neutrophils out of 100 cells = 60%.
- If supplied total WBC is 8,000/microlitre, absolute neutrophils = 8,000 × 0.60 = 4,800/microlitre.

Result

Record the observed outcome and calculated value, with units. State whether the stated laboratory specification was met; do not copy the worked example as your result.

Precautions

- Use prepared slides rather than unsupervised specimen preparation.
- Do not classify damaged cells with confidence; seek instructor review.
- Percentages and absolute counts answer different questions.

Viva Questions and Answers

1. Which cells commonly have a multilobed nucleus?

Neutrophils.

2. Which commonly have prominent orange-red granules?

Eosinophils in an appropriate stain.

3. Why calculate absolute counts?

A normal-looking percentage can coexist with an abnormal total concentration.

Measurement of Blood Pressure

Experiment 18 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To measure resting blood pressure using the institution-approved device and method.

Principle

Blood pressure is recorded as systolic over diastolic pressure in mmHg. Cuff size, posture, rest, movement and technique affect the reading.

Key Points

- Use an appropriately sized validated upper-arm cuff.
- Allow quiet seated rest and support the back, feet and arm at heart level.
- Record arm, device, cuff and repeated readings.
- A screening measurement does not alone establish a diagnosis.

Activity Procedure

1. Prepare

Explain the activity and check for reasons to defer it; arrange seated rest.

2. Position

Place the cuff on a bare supported upper arm using the device instructions.

3. Measure

Use the validated automatic method or supervised manual auscultatory method; avoid conversation and movement.

4. Repeat

Repeat at the specified interval and record each reading without rounding to a preferred value.

5. Interpret

Use the institution's assessment protocol, symptoms and repeat readings to decide whether review is needed.

Record and Observations

Field	Reading 1	Reading 2
Arm / cuff / device	_____	_____
Systolic, mmHg	_____	_____
Diastolic, mmHg	_____	_____
Pulse / symptoms	_____	_____

Result

Complete the record using your activity, then state the findings, the action required and the reason for that action.

Viva Questions and Answers

1. Why does cuff size matter?

An unsuitable cuff can bias the measurement.

2. What do Korotkoff sounds indicate?

Flow-related sounds used in manual pressure measurement; the defined first and disappearance phases guide readings.

3. Can one reading diagnose hypertension?

Routine diagnosis requires an appropriate repeated assessment, with urgent evaluation when symptoms or severe readings indicate it.

Measurement of Body Temperature

Experiment 19 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To perform and document measurement of body temperature.

Principle

A clinical thermometer measures temperature at a specified body site; site and device differences affect interpretation.

Key Points

- Record site, device and units.
- Oral, axillary, tympanic and other methods have different technique and suitability.
- A value must be interpreted with symptoms and the person's circumstances.

Activity Procedure

1. Prepare

Explain the activity, obtain agreement and check the equipment and suitable resting conditions.

2. Perform

Use the selected thermometer according to its instructions, observe the required positioning and wait for the defined endpoint.

3. Record

Enter actual findings with units, method, time and any limitations.

4. Assess

Use the assigned teaching criteria and refer concerning symptoms for appropriate assessment.

Record and Observations

Field	Actual record
Site / device	_____
Temperature / units	_____
Time / symptoms	_____

Result

Complete the record using your activity, then state the findings, the action required and the reason for that action.

Precautions

- Use the device instructions and infection-prevention measures.
- Stop the teaching activity if the participant becomes unwell.

Viva Questions and Answers

1. Why record the site?

Measurements from different sites are not automatically interchangeable.

2. Why record units?

A number without units can be misunderstood.

3. Why repeat an unexpected measurement?

A repeat under valid conditions helps identify technique or device error; concerning symptoms still require prompt review.

Measurement of Pulse and Heart Rate

Experiment 20 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To perform and document measurement of pulse and heart rate.

Principle

A pulse reflects the pressure wave associated with cardiac contraction; rate and rhythm are separate observations.

Key Points

- A resting adult pulse is commonly assessed at the radial artery.
- Use fingertips, not the thumb.
- Count for a full minute when rhythm is irregular; follow the teaching protocol for other situations.

Activity Procedure

1. Prepare

Explain the activity, obtain agreement and check the equipment and suitable resting conditions.

2. Perform

Locate the radial pulse gently, count using a clock, assess rhythm and document any discrepancy with a separately supervised heart-rate measurement.

3. Record

Enter actual findings with units, method, time and any limitations.

4. Assess

Use the assigned teaching criteria and refer concerning symptoms for appropriate assessment.

Record and Observations

Field	Actual record
Site / resting state	_____
Count / counting duration	_____
Rate, beats/min	_____
Rhythm / symptoms	_____

Result

Complete the record using your activity, then state the findings, the action required and the reason for that action.

Precautions

- Use the device instructions and infection-prevention measures.
- Stop the teaching activity if the participant becomes unwell.

Viva Questions and Answers

1. Why avoid the thumb?

Its own pulse can confuse the examiner.

2. Why record units?

A number without units can be misunderstood.

3. Why repeat an unexpected measurement?

A repeat under valid conditions helps identify technique or device error; concerning symptoms still require prompt review.

Measurement of Respiratory Rate

Experiment 21 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To perform and document measurement of respiratory rate.

Principle

Respiratory rate counts complete breathing cycles per minute; depth, effort and pattern provide additional information.

Key Points

- One inspiration plus expiration is one cycle.
- Movement, anxiety and conversation can alter breathing.
- Record distress and irregular pattern as well as rate.

Activity Procedure

1. Prepare

Explain the activity, obtain agreement and check the equipment and suitable resting conditions.

2. Perform

Observe breathing discreetly while maintaining comfort, count the assigned duration, and document rate, pattern and effort.

3. Record

Enter actual findings with units, method, time and any limitations.

4. Assess

Use the assigned teaching criteria and refer concerning symptoms for appropriate assessment.

Record and Observations

Field	Actual record
Observation duration	_____
Cycles counted	_____
Rate, breaths/min	_____
Depth / effort / pattern	_____

Result

Complete the record using your activity, then state the findings, the action required and the reason for that action.

Precautions

- Use the device instructions and infection-prevention measures.
- Stop the teaching activity if the participant becomes unwell.

Viva Questions and Answers

1. What constitutes one breath?

One complete inspiration-expiration cycle.

2. Why record units?

A number without units can be misunderstood.

3. Why repeat an unexpected measurement?

A repeat under valid conditions helps identify technique or device error; concerning symptoms still require prompt review.

Pulse Oximetry

Experiment 22 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To perform and document pulse oximetry.

Principle

A pulse oximeter estimates peripheral oxygen saturation and pulse using optical signals; it does not measure carbon dioxide or diagnose every cause of breathlessness.

Key Points

- Use a warm, still finger and correct sensor position.
- Movement, poor perfusion, nail coverings and other factors can affect reliability.
- Interpret the reading with symptoms; a reassuring number does not override severe distress.

Activity Procedure

1. Prepare

Explain the activity, obtain agreement and check the equipment and suitable resting conditions.

2. Perform

Fit the device according to its instructions, wait for a stable signal, compare pulse with a manual count when needed and repeat if signal quality is poor.

3. Record

Enter actual findings with units, method, time and any limitations.

4. Assess

Use the assigned teaching criteria and refer concerning symptoms for appropriate assessment.

Record and Observations

Field	Actual record
Sensor site / device	_____
SpO2, %	_____
Pulse, beats/min	_____
Signal quality / symptoms	_____

Result

Complete the record using your activity, then state the findings, the action required and the reason for that action.

Precautions

- Use the device instructions and infection-prevention measures.
- Stop the teaching activity if the participant becomes unwell.

Viva Questions and Answers

1. Does SpO2 measure ventilation?

No; it estimates oxygen saturation and does not directly measure carbon dioxide clearance.

2. Why record units?

A number without units can be misunderstood.

3. Why repeat an unexpected measurement?

A repeat under valid conditions helps identify technique or device error; concerning symptoms still require prompt review.

Peak Expiratory Flow Measurement

Experiment 23 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To perform and document peak expiratory flow measurement.

Principle

Peak flow records the highest expiratory flow reached during a forceful blow from a full inspiration.

Key Points

- Use an individual clean mouthpiece and reset the indicator.
- Record the highest of three acceptable attempts rather than their mean.
- Use the person's prescribed plan and personal best for ongoing interpretation.

Activity Procedure

1. Prepare

Explain the activity, obtain agreement and check the equipment and suitable resting conditions.

2. Perform

With suitable posture, inhale fully, seal lips around the mouthpiece and blow hard and fast; repeat three acceptable attempts with rest as needed.

3. Record

Enter actual findings with units, method, time and any limitations.

4. Assess

Use the assigned teaching criteria and refer concerning symptoms for appropriate assessment.

Record and Observations

Field	Actual record
Attempt 1, L/min	_____
Attempt 2, L/min	_____
Attempt 3, L/min	_____
Highest acceptable value, L/min	_____

Result

Complete the record using your activity, then state the findings, the action required and the reason for that action.

Precautions

- Use the device instructions and infection-prevention measures.
- Stop the teaching activity if the participant becomes unwell.

Viva Questions and Answers

1. Why use the highest acceptable value?

A technically weaker effort can underestimate peak flow.

2. Why record units?

A number without units can be misunderstood.

3. Why repeat an unexpected measurement?

A repeat under valid conditions helps identify technique or device error; concerning symptoms still require prompt review.

Body Mass Index Calculation

Experiment 24 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To perform and document body mass index calculation.

Principle

BMI expresses mass relative to height squared: kg/m^2. It is a screening measure and does not directly measure body-fat distribution.

Key Points

- Measure mass in kg and height in metres without footwear using suitable equipment.
- Convert centimetres to metres before squaring.
- Children, pregnancy and some body-composition situations need additional assessment.

Practice Scenario

Illustrative BMI calculation: mass 60.0 kg and height 1.60 m gives 60 / 2.56 = 23.44 kg/m^2.

Activity Procedure

1. Prepare

Explain the activity, obtain agreement and check the equipment and suitable resting conditions.

2. Perform

Measure mass and height, calculate kg divided by metres squared, check units and interpret using the assigned population-specific chart.

3. Record

Enter actual findings with units, method, time and any limitations.

4. Assess

Use the assigned teaching criteria and refer concerning symptoms for appropriate assessment.

Record and Observations

Field	Actual record
Mass, kg	_____
Height, cm / m	_____
Height squared, m^2	_____
BMI, kg/m^2	_____

Result

Complete the record using your activity, then state the findings, the action required and the reason for that action.

Precautions

- Use the device instructions and infection-prevention measures.
- Stop the teaching activity if the participant becomes unwell.

Viva Questions and Answers

1. What is a common calculation error?

Using centimetres as though they were metres.

2. Why record units?

A number without units can be misunderstood.

3. Why repeat an unexpected measurement?

A repeat under valid conditions helps identify technique or device error; concerning symptoms still require prompt review.

Anatomical Study of the Cardiovascular System

Experiment 25 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the main structures of the cardiovascular system on models, charts or preserved teaching material.

Principle

Four chambers, valves, septa and great vessels. Structural relationships help explain the physiological function.

Structures and Functional Link

- Atrial and ventricular walls; atrioventricular and semilunar valves; aorta, venae cavae, pulmonary artery and veins.
- Systemic veins → right heart → lungs → left heart → systemic arteries.
- Arteries carry blood away from the heart; pulmonary arteries carry relatively deoxygenated blood.

Requirements

- Heart and major blood vessels model or chart
- Institution-approved preserved demonstration material if available
- Labelled drawing sheet

Procedure

1. Orient

Identify the anatomical position and major divisions of the model or chart.

2. Identify

Locate and label: Atrial and ventricular walls; atrioventricular and semilunar valves; aorta, venae cavae, pulmonary artery and veins.

3. Trace function

Systemic veins → right heart → lungs → left heart → systemic arteries.

4. Compare structures

Relate tissue or organ design to its major function.

5. Record

Draw a labelled schematic and explain the functional pathway in your own words.

Observations and Record

Structure / pathway	Identification / function
Main structures	_____
Inlet / outlet or connections	_____
Labelled drawing	_____
Functional pathway	_____
Structure-function explanation	_____

Result

The main structures were identified and labelled as _____. The functional pathway was explained as _____.

Precautions

- Handle museum material only as authorised.
- Use the provided orientation rather than assuming left/right from the viewer's position.
- Do not infer a patient diagnosis from the teaching model.

Viva Questions and Answers

1. Which structures should be identified?

Atrial and ventricular walls; atrioventricular and semilunar valves; aorta, venae cavae, pulmonary artery and veins.

2. What pathway should be traced?

Systemic veins → right heart → lungs → left heart → systemic arteries.

3. What key concept is illustrated?

Arteries carry blood away from the heart; pulmonary arteries carry relatively deoxygenated blood.

Anatomical Study of the Respiratory System

Experiment 26 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the main structures of the respiratory system on models, charts or preserved teaching material.

Principle

Conducting airways and the alveolar gas-exchange region. Structural relationships help explain the physiological function.

Structures and Functional Link

- Tracheal cartilage, bronchial branching, lung lobes and alveolar regions on an appropriate model.
- Nose → pharynx → larynx → trachea → bronchi → bronchioles → alveoli.
- Gas exchange depends on ventilation, diffusion and perfusion.

Requirements

- Nose, airway and lungs model or chart
- Institution-approved preserved demonstration material if available
- Labelled drawing sheet

Procedure

1. Orient

Identify the anatomical position and major divisions of the model or chart.

2. Identify

Locate and label: Tracheal cartilage, bronchial branching, lung lobes and alveolar regions on an appropriate model.

3. Trace function

Nose → pharynx → larynx → trachea → bronchi → bronchioles → alveoli.

4. Compare structures

Relate tissue or organ design to its major function.

5. Record

Draw a labelled schematic and explain the functional pathway in your own words.

Observations and Record

Structure / pathway	Identification / function
Main structures	_____
Inlet / outlet or connections	_____
Labelled drawing	_____
Functional pathway	_____
Structure-function explanation	_____

Result

The main structures were identified and labelled as _____. The functional pathway was explained as _____.

Precautions

- Handle museum material only as authorised.
- Use the provided orientation rather than assuming left/right from the viewer's position.
- Do not infer a patient diagnosis from the teaching model.

Viva Questions and Answers

1. Which structures should be identified?

Tracheal cartilage, bronchial branching, lung lobes and alveolar regions on an appropriate model.

2. What pathway should be traced?

Nose → pharynx → larynx → trachea → bronchi → bronchioles → alveoli.

3. What key concept is illustrated?

Gas exchange depends on ventilation, diffusion and perfusion.

Anatomical Study of the Digestive System

Experiment 27 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the main structures of the digestive system on models, charts or preserved teaching material.

Principle

A continuous digestive tube with liver, gallbladder and pancreas supporting digestion. Structural relationships help explain the physiological function.

Structures and Functional Link

- Stomach, duodenum, jejunum, ileum, colon, liver and pancreas.
- Mouth → pharynx → oesophagus → stomach → small intestine → large intestine → rectum.
- The liver produces bile; the gallbladder stores and concentrates it.

Requirements

- Gastrointestinal tract and accessory organs model or chart
- Institution-approved preserved demonstration material if available
- Labelled drawing sheet

Procedure

1. Orient

Identify the anatomical position and major divisions of the model or chart.

2. Identify

Locate and label: Stomach, duodenum, jejunum, ileum, colon, liver and pancreas.

3. Trace function

Mouth → pharynx → oesophagus → stomach → small intestine → large intestine → rectum.

4. Compare structures

Relate tissue or organ design to its major function.

5. Record

Draw a labelled schematic and explain the functional pathway in your own words.

Observations and Record

Structure / pathway	Identification / function
Main structures	_____
Inlet / outlet or connections	_____
Labelled drawing	_____
Functional pathway	_____
Structure-function explanation	_____

Result

The main structures were identified and labelled as _____. The functional pathway was explained as _____.

Precautions

- Handle museum material only as authorised.
- Use the provided orientation rather than assuming left/right from the viewer's position.
- Do not infer a patient diagnosis from the teaching model.

Viva Questions and Answers

1. Which structures should be identified?

Stomach, duodenum, jejunum, ileum, colon, liver and pancreas.

2. What pathway should be traced?

Mouth → pharynx → oesophagus → stomach → small intestine → large intestine → rectum.

3. What key concept is illustrated?

The liver produces bile; the gallbladder stores and concentrates it.

Anatomical Study of the Urinary System

Experiment 28 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the main structures of the urinary system on models, charts or preserved teaching material.

Principle

Nephrons form urine; the collecting and urinary passages convey it. Structural relationships help explain the physiological function.

Structures and Functional Link

- Renal cortex, medulla, pelvis, nephron model, ureter, bladder and urethra.
- Renal filtration and tubular processing → collecting system → ureters → bladder → urethra.
- Filtration, reabsorption and secretion are distinct renal processes.

Requirements

- Kidneys and urinary tract model or chart
- Institution-approved preserved demonstration material if available
- Labelled drawing sheet

Procedure

1. Orient

Identify the anatomical position and major divisions of the model or chart.

2. Identify

Locate and label: Renal cortex, medulla, pelvis, nephron model, ureter, bladder and urethra.

3. Trace function

Renal filtration and tubular processing → collecting system → ureters → bladder → urethra.

4. Compare structures

Relate tissue or organ design to its major function.

5. Record

Draw a labelled schematic and explain the functional pathway in your own words.

Observations and Record

Structure / pathway	Identification / function
Main structures	_____
Inlet / outlet or connections	_____
Labelled drawing	_____
Functional pathway	_____
Structure-function explanation	_____

Result

The main structures were identified and labelled as _____. The functional pathway was explained as _____.

Precautions

- Handle museum material only as authorised.
- Use the provided orientation rather than assuming left/right from the viewer's position.
- Do not infer a patient diagnosis from the teaching model.

Viva Questions and Answers

1. Which structures should be identified?

Renal cortex, medulla, pelvis, nephron model, ureter, bladder and urethra.

2. What pathway should be traced?

Renal filtration and tubular processing → collecting system → ureters → bladder → urethra.

3. What key concept is illustrated?

Filtration, reabsorption and secretion are distinct renal processes.

Anatomical Study of the Endocrine System

Experiment 29 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the main structures of the endocrine system on models, charts or preserved teaching material.

Principle

Ductless glands release hormones that regulate target tissues through the circulation. Structural relationships help explain the physiological function.

Structures and Functional Link

- Pituitary, thyroid, parathyroids, adrenals and endocrine pancreas.
- Hormonal signal → circulation → receptor-bearing target → response and feedback.
- Negative feedback helps stabilise many hormone-regulatory systems.

Requirements

- Major endocrine glands model or chart
- Institution-approved preserved demonstration material if available
- Labelled drawing sheet

Procedure

1. Orient

Identify the anatomical position and major divisions of the model or chart.

2. Identify

Locate and label: Pituitary, thyroid, parathyroids, adrenals and endocrine pancreas.

3. Trace function

Hormonal signal → circulation → receptor-bearing target → response and feedback.

4. Compare structures

Relate tissue or organ design to its major function.

5. Record

Draw a labelled schematic and explain the functional pathway in your own words.

Observations and Record

Structure / pathway	Identification / function
Main structures	_____
Inlet / outlet or connections	_____
Labelled drawing	_____
Functional pathway	_____
Structure-function explanation	_____

Result

The main structures were identified and labelled as _____. The functional pathway was explained as _____.

Precautions

- Handle museum material only as authorised.
- Use the provided orientation rather than assuming left/right from the viewer's position.
- Do not infer a patient diagnosis from the teaching model.

Viva Questions and Answers

1. Which structures should be identified?

Pituitary, thyroid, parathyroids, adrenals and endocrine pancreas.

2. What pathway should be traced?

Hormonal signal → circulation → receptor-bearing target → response and feedback.

3. What key concept is illustrated?

Negative feedback helps stabilise many hormone-regulatory systems.

Anatomical Study of the Reproductive System

Experiment 30 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the main structures of the reproductive system on models, charts or preserved teaching material.

Principle

Gonads form gametes and hormones; associated structures support transport and reproduction. Structural relationships help explain the physiological function.

Structures and Functional Link

- Testes, ducts, accessory glands; ovaries, uterine tubes, uterus, cervix and vagina.
- Trace sperm transport on a male model and the oocyte/uterine pathway on a female model.
- The ovary and testis have both gamete and endocrine functions.

Requirements

- Male and female reproductive organs model or chart
- Institution-approved preserved demonstration material if available
- Labelled drawing sheet

Procedure

1. Orient

Identify the anatomical position and major divisions of the model or chart.

2. Identify

Locate and label: Testes, ducts, accessory glands; ovaries, uterine tubes, uterus, cervix and vagina.

3. Trace function

Trace sperm transport on a male model and the oocyte/uterine pathway on a female model.

4. Compare structures

Relate tissue or organ design to its major function.

5. Record

Draw a labelled schematic and explain the functional pathway in your own words.

Observations and Record

Structure / pathway	Identification / function
Main structures	_____
Inlet / outlet or connections	_____
Labelled drawing	_____
Functional pathway	_____
Structure-function explanation	_____

Result

The main structures were identified and labelled as _____. The functional pathway was explained as _____.

Precautions

- Handle museum material only as authorised.
- Use the provided orientation rather than assuming left/right from the viewer's position.
- Do not infer a patient diagnosis from the teaching model.

Viva Questions and Answers

1. Which structures should be identified?

Testes, ducts, accessory glands; ovaries, uterine tubes, uterus, cervix and vagina.

2. What pathway should be traced?

Trace sperm transport on a male model and the oocyte/uterine pathway on a female model.

3. What key concept is illustrated?

The ovary and testis have both gamete and endocrine functions.

Anatomical Study of the Nervous System

Experiment 31 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the main structures of the nervous system on models, charts or preserved teaching material.

Principle

Central and peripheral components link sensory input, processing and motor output. Structural relationships help explain the physiological function.

Structures and Functional Link

- Cerebrum, cerebellum, brainstem, spinal cord, meninges and peripheral nerves.
- Receptor → sensory pathway → central processing → motor pathway → effector.
- Somatic and autonomic pathways serve different targets and functions.

Requirements

- Brain, spinal cord and major nerves model or chart
- Institution-approved preserved demonstration material if available
- Labelled drawing sheet

Procedure

1. Orient

Identify the anatomical position and major divisions of the model or chart.

2. Identify

Locate and label: Cerebrum, cerebellum, brainstem, spinal cord, meninges and peripheral nerves.

3. Trace function

Receptor → sensory pathway → central processing → motor pathway → effector.

4. Compare structures

Relate tissue or organ design to its major function.

5. Record

Draw a labelled schematic and explain the functional pathway in your own words.

Observations and Record

Structure / pathway	Identification / function
Main structures	_____
Inlet / outlet or connections	_____
Labelled drawing	_____
Functional pathway	_____
Structure-function explanation	_____

Result

The main structures were identified and labelled as _____. The functional pathway was explained as _____.

Precautions

- Handle museum material only as authorised.
- Use the provided orientation rather than assuming left/right from the viewer's position.
- Do not infer a patient diagnosis from the teaching model.

Viva Questions and Answers

1. Which structures should be identified?

Cerebrum, cerebellum, brainstem, spinal cord, meninges and peripheral nerves.

2. What pathway should be traced?

Receptor → sensory pathway → central processing → motor pathway → effector.

3. What key concept is illustrated?

Somatic and autonomic pathways serve different targets and functions.

Anatomical Study of the Eye

Experiment 32 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the main structures of the eye on models, charts or preserved teaching material.

Principle

Transparent optical components focus light on a sensory retina. Structural relationships help explain the physiological function.

Structures and Functional Link

- Cornea, sclera, iris, lens, retina, optic disc and optic nerve.
- Cornea → aqueous region → pupil → lens → vitreous → retina → optic nerve pathway.
- The lens changes optical power during accommodation.

Requirements

- Eye and associated optical structures model or chart
- Institution-approved preserved demonstration material if available
- Labelled drawing sheet

Procedure

1. Orient

Identify the anatomical position and major divisions of the model or chart.

2. Identify

Locate and label: Cornea, sclera, iris, lens, retina, optic disc and optic nerve.

3. Trace function

Cornea → aqueous region → pupil → lens → vitreous → retina → optic nerve pathway.

4. Compare structures

Relate tissue or organ design to its major function.

5. Record

Draw a labelled schematic and explain the functional pathway in your own words.

Observations and Record

Structure / pathway	Identification / function
Main structures	_____
Inlet / outlet or connections	_____
Labelled drawing	_____
Functional pathway	_____
Structure-function explanation	_____

Result

The main structures were identified and labelled as _____. The functional pathway was explained as _____.

Precautions

- Handle museum material only as authorised.
- Use the provided orientation rather than assuming left/right from the viewer's position.
- Do not infer a patient diagnosis from the teaching model.

Viva Questions and Answers

1. Which structures should be identified?

Cornea, sclera, iris, lens, retina, optic disc and optic nerve.

2. What pathway should be traced?

Cornea → aqueous region → pupil → lens → vitreous → retina → optic nerve pathway.

3. What key concept is illustrated?

The lens changes optical power during accommodation.

Anatomical Study of the Ear

Experiment 33 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the main structures of the ear on models, charts or preserved teaching material.

Principle

External and middle-ear structures transmit sound; inner-ear structures support hearing and balance. Structural relationships help explain the physiological function.

Structures and Functional Link

- Pinna, canal, eardrum, malleus, incus, stapes, cochlea and semicircular canals.
- Sound → canal → tympanic membrane → ossicles → cochlea; vestibular structures provide balance information.
- Cochlear and vestibular structures have different sensory roles.

Requirements

- External, middle and inner ear model or chart
- Institution-approved preserved demonstration material if available
- Labelled drawing sheet

Procedure

1. Orient

Identify the anatomical position and major divisions of the model or chart.

2. Identify

Locate and label: Pinna, canal, eardrum, malleus, incus, stapes, cochlea and semicircular canals.

3. Trace function

Sound → canal → tympanic membrane → ossicles → cochlea; vestibular structures provide balance information.

4. Compare structures

Relate tissue or organ design to its major function.

5. Record

Draw a labelled schematic and explain the functional pathway in your own words.

Observations and Record

Structure / pathway	Identification / function
Main structures	_____
Inlet / outlet or connections	_____
Labelled drawing	_____
Functional pathway	_____
Structure-function explanation	_____

Result

The main structures were identified and labelled as _____. The functional pathway was explained as _____.

Precautions

- Handle museum material only as authorised.
- Use the provided orientation rather than assuming left/right from the viewer's position.
- Do not infer a patient diagnosis from the teaching model.

Viva Questions and Answers

1. Which structures should be identified?

Pinna, canal, eardrum, malleus, incus, stapes, cochlea and semicircular canals.

2. What pathway should be traced?

Sound → canal → tympanic membrane → ossicles → cochlea; vestibular structures provide balance information.

3. What key concept is illustrated?

Cochlear and vestibular structures have different sensory roles.

Anatomical Study of the Skin

Experiment 34 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the main structures of the skin on models, charts or preserved teaching material.

Principle

Epidermis is an outer barrier; dermis contains connective tissue, vessels, nerves and appendages. Structural relationships help explain the physiological function.

Structures and Functional Link

- Epidermis, dermis, subcutaneous tissue, hair follicle, sweat gland and sebaceous gland.
- Relate surface barrier, sensory receptors and sweating to protection and temperature regulation.
- The epidermis has no blood vessels; the dermis supplies vascular support.

Requirements

- Skin and appendages model or chart
- Institution-approved preserved demonstration material if available
- Labelled drawing sheet

Procedure

1. Orient

Identify the anatomical position and major divisions of the model or chart.

2. Identify

Locate and label: Epidermis, dermis, subcutaneous tissue, hair follicle, sweat gland and sebaceous gland.

3. Trace function

Relate surface barrier, sensory receptors and sweating to protection and temperature regulation.

4. Compare structures

Relate tissue or organ design to its major function.

5. Record

Draw a labelled schematic and explain the functional pathway in your own words.

Observations and Record

Structure / pathway	Identification / function
Main structures	_____
Inlet / outlet or connections	_____
Labelled drawing	_____
Functional pathway	_____
Structure-function explanation	_____

Result

The main structures were identified and labelled as _____. The functional pathway was explained as _____.

Precautions

- Handle museum material only as authorised.
- Use the provided orientation rather than assuming left/right from the viewer's position.
- Do not infer a patient diagnosis from the teaching model.

Viva Questions and Answers

1. Which structures should be identified?

Epidermis, dermis, subcutaneous tissue, hair follicle, sweat gland and sebaceous gland.

2. What pathway should be traced?

Relate surface barrier, sensory receptors and sweating to protection and temperature regulation.

3. What key concept is illustrated?

The epidermis has no blood vessels; the dermis supplies vascular support.

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