

Pharm.D - Year 1

Human Anatomy and Physiology

Complete subject manual: 17 practicals and activities. Each chapter includes a student observation or work record.

Use the PDF bookmarks to navigate. The table gives each practical's content-page count; the combined manual has continuous page numbers.

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Epithelial and Muscular Tissues

Experiment 1 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify epithelial and muscular tissues on prepared teaching slides.

Principle

Tissue identification links visible cellular organisation to function. Epithelium forms closely arranged sheets; muscle is specialised for contraction. Connective tissue is recognised by its matrix and supporting structures; nervous tissue contains neurons and supporting cells.

Requirements

- Labelled prepared tissue slides, microscope and drawing materials.

Procedure

1. Survey

Record the slide label and examine a broad field at low power.

2. Compare features

Examine epithelial layer number, surface-cell shape, muscle striations, branching and nuclear position. Compare with the instructor-labelled standard.

3. Draw and identify

Make a labelled sketch of the features actually visible. State two observations supporting the identification.

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Observations and Record

Slide	Observed features	Identification
Slide 1	_____	_____
Slide 2	_____	_____

Worked Example

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

- Total magnification = eyepiece magnification × objective magnification. Example: 10x × 40x = 400x.

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Use prepared slides and avoid confusing sectioning artefacts with tissue structures.
- Keep the lens clear of the slide and use fine focus at higher power.

Viva Questions and Answers

1. Why compare several fields?

Section angle and preparation artefacts may change the apparent shape.

2. What supports identification?

A consistent set of structural features, not staining colour alone.

Connective and Nervous Tissues

Experiment 2 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify connective and nervous tissues on prepared teaching slides.

Principle

Tissue identification links visible cellular organisation to function. Epithelium forms closely arranged sheets; muscle is specialised for contraction. Connective tissue is recognised by its matrix and supporting structures; nervous tissue contains neurons and supporting cells.

Requirements

- Labelled prepared tissue slides, microscope and drawing materials.

Procedure

1. Survey

Record the slide label and examine a broad field at low power.

2. Compare features

Examine matrix, fibres, lacunae, neuronal cell bodies, processes and supporting cells. Compare with the instructor-labelled standard.

3. Draw and identify

Make a labelled sketch of the features actually visible. State two observations supporting the identification.

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Observations and Record

Slide	Observed features	Identification
Slide 1	_____	_____
Slide 2	_____	_____

Worked Example

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

- Total magnification = eyepiece magnification × objective magnification. Example: 10x × 40x = 400x.

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Use prepared slides and avoid confusing sectioning artefacts with tissue structures.
- Keep the lens clear of the slide and use fine focus at higher power.

Viva Questions and Answers

1. Why compare several fields?

Section angle and preparation artefacts may change the apparent shape.

2. What supports identification?

A consistent set of structural features, not staining colour alone.

Appliances Used in Haematology

Experiment 3 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify the main haematology appliances and relate each to its measurement

Principle

A reliable blood measurement depends on the measuring principle, calibrated device and specimen handling. Counting chambers measure cells in a known volume; analysers use electrical or optical signals; centrifuges separate components.

Requirements

- Instructor-provided labelled diagrams, traces or data for this activity.
- Calculator, graph paper or spreadsheet, and the activity record.

Procedure

1. Identify

Locate the counting chamber, coverslip, microscope, micropipette, haematocrit tube, centrifuge, haemoglobin instrument and ESR stand.

2. Explain

Record the output, units and calibration or quality-control check for each device.

3. Check the record

Distinguish a manual cell count from an analyser result and an ESR reading from a haematocrit measurement.

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Observations and Record

Record item	Entry
Activity / material identifier	_____
Measurement or visible feature	_____
Comparison / calculated outcome	_____
Interpretation and limitation	_____

Result

The recorded finding is ____; the supporting observation or calculation is _____. The main limitation is _____.

Precautions

- Use the supplied teaching material; distinguish a measured observation from an assumed value.
- Keep units, axes, labels and measurement conditions consistent.
- Record limitations and seek instructor review before applying a conclusion to a live case.

Viva Questions and Answers

1. What is the main endpoint?

Identify the main haematology appliances and relate each to its measurement

2. Does one observed result prove a general conclusion?

No. Controls, repeatability and the limitations of the method must be considered.

White Blood Cell Count

Experiment 4 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To calculate a manual white-cell count and identify the major white-cell types on an instructor-prepared stained smear.

Principle

A validated WBC diluent allows leukocytes to be counted while reducing interference from red cells. In an improved Neubauer chamber, four corner squares have volume $0.4 \mu\text{L}$. A differential describes the proportions of white-cell types; an absolute count combines the percentage with the total WBC count.

Requirements

- Improved Neubauer chamber, special coverslip, pipettes and laboratory-approved WBC diluent.
- Instructor-prepared blood control or supplied specimen and prepared stained smear.
- Microscope and counting record.

Procedure

1. Record the dilution

Use the supplied dilution or prepare the assigned dilution under instructor supervision. For $D = 20$, one original volume is included in twenty total volumes.

2. Load and count

Mix the diluted material, load the chamber correctly and allow the prescribed settling. Count the four large corner squares using one border rule. Count the second chamber as directed.

3. Calculate total WBC

Sum the cells and use $N \times D \div 0.4$ to obtain cells/ μL . Review chamber agreement before reporting.

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4. Examine the smear

Find a suitable monolayer region on the instructor-prepared smear. Use the prescribed microscope objective and a systematic path that avoids repeatedly counting the same cells.

5. Record the differential

Classify the assigned number of WBCs, commonly 100 for a teaching exercise. Sum the type counts and calculate percentages.

6. Interpret cautiously

Calculate selected absolute counts and compare with the supplied laboratory intervals. Explain that a small manual differential has counting uncertainty.

White-cell Recognition Guide

Cell type	Typical stained appearance	Broad role
Neutrophil	Segmented nucleus; fine granules	Innate defence
Lymphocyte	Dense rounded nucleus; variable cytoplasm	Adaptive immune functions
Monocyte	Larger cell; folded nucleus	Phagocytic and immune functions
Eosinophil	Often bilobed; conspicuous eosinophilic granules	Allergy and parasite-related responses
Basophil	Dark granules may obscure the nucleus	Allergic and inflammatory responses

Observations and Record

Count category	Number observed	Calculated result
Corner squares 1-4	___; ___; ___; ___	Total N = ___
Neutrophils / lymphocytes	___ / ___	___% / ___%
Monocytes / eosinophils / basophils	___ / ___ / ___	___% / ___% / ___%

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Worked Example

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

- Total WBC: $N = 136$, $D = 20$, counted volume = $0.4 \mu\text{L}$. $\text{WBC} = 136 \times 20 \div 0.4 = 6800/\mu\text{L}$.
- Illustrative differential of 100 cells: neutrophils 60, lymphocytes 30, monocytes 6, eosinophils 3, basophils 1; total = 100.
- Absolute neutrophils = $6800 \times 60/100 = 4080/\mu\text{L}$. A percentage alone can mislead when the total WBC count changes.

Result

Total WBC = ____ cells/ μL . Differential total = ____ cells. Absolute ____ count = ____ cells/ μL ; interpretation uses the supplied laboratory interval.

Precautions

- Do not confuse the four WBC corner squares with the five smaller RBC counting groups.
- Do not count in a thick smear region where cells overlap excessively.
- Apply specimen precautions and instructor disposal procedures; do not undertake unsupervised blood collection.

Viva Questions and Answers

1. Why calculate an absolute differential count?

It expresses the number of a particular WBC type per volume, rather than only its proportion.

2. What is the count factor at $D = 20$?

For four large squares, $\text{WBC} = N \times 50/\mu\text{L}$.

3. Can a differential alone diagnose infection?

No; the count must be considered with clinical assessment and other findings.

Red Blood Cell Count

Experiment 5 - 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 $0.020 \mu\text{L}$. 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 $N \times D \div 0.020$. Report units and compare with the provided interval alongside Hb, Hct and red-cell indices.

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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: $N = 480$, $D = 200$. $\text{RBC} = 480 \times 200 \div 0.020 = 4,800,000 \text{ cells}/\mu\text{L}$.
- Thus the usual factor for this exact area and dilution is 10,000. A different area or dilution needs a different factor.
- $4,800,000/\mu\text{L} = 4.8 \text{ million}/\mu\text{L} = 4.8 \times 10^{12}/\text{L}$.

Result

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

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?

$0.020 \mu\text{L}$ 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 6 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To classify white cells on a prepared blood film and calculate their relative proportions.

Principle

A differential count classifies white cells as neutrophils, lymphocytes, monocytes, eosinophils and basophils. Percentages are relative; the absolute count also depends on the total WBC concentration.

Requirements

- Instructor-prepared stained blood film, microscope and tally sheet.

Procedure

1. Survey the film

Identify the recommended counting region in the prepared film. Record its label and film quality.

2. Classify systematically

Use the agreed scan pattern and classify the assigned number of clearly identifiable cells by nuclear shape and cytoplasm.

3. Calculate

Calculate each class percentage. If the total WBC result is provided, calculate the absolute count.

4. Review

Check that percentages sum to approximately 100% after rounding; record uncertain cells for instructor review.

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Observations and Record

Cell class	Tally / count	Percentage
Neutrophils	—	—
Lymphocytes	—	—
Monocytes	—	—
Eosinophils	—	—
Basophils	—	—

Worked Example

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

- Percentage = cells in a class ÷ total cells counted × 100.
- Example: 60 of 100 cells are neutrophils: 60%. If total WBC = 7000 cells/μL, absolute neutrophils = 0.60 × 7000 = 4200 cells/μL.

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Use a prepared film; do not infer a diagnosis from the exercise.
- Avoid counting the same field twice or selecting only easily recognised cells.

Viva Questions and Answers

1. Can a normal percentage conceal an abnormal absolute count?

Yes. The total WBC concentration determines the absolute count.

2. Why scan systematically?

It reduces selection bias and duplicate counting.

ESR Haemoglobin Bleeding Time and Clotting Time

Experiment 7 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

1. Erythrocyte Sedimentation Rate

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

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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.

2. Haemoglobin Estimation and Interpretation

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.

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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.
- $Hb = (0.40 \div 0.50) \times 15.0 = 12.0 \text{ g/dL} = 120 \text{ g/L}$.
- 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.

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3. Bleeding Time and Clotting Time

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.

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- 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.

Blood Pressure and Blood Group

Experiment 8 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

1. Pulse Rate Heart Rate and Blood Pressure

Aim

To measure a supervised resting pulse and blood pressure and distinguish pulse rate from heart rate.

Principle

Pulse is the palpable arterial pressure wave; heart rate is the number of cardiac cycles per minute. They are usually equal in a regular effective rhythm but may differ. Blood pressure measurement depends on preparation, cuff size, arm position and repeated readings; one classroom reading does not diagnose hypertension.

Requirements

- Timer, validated upper-arm BP device and suitable cuff sizes.
- Stethoscope for the instructor-prescribed auscultatory demonstration.
- Consenting adult volunteer under classroom supervision or simulation.

Procedure

1. Prepare

Explain the activity and obtain consent. For a resting BP measurement, avoid exercise, smoking and caffeine for 30 minutes beforehand when following the standard procedure; allow at least five minutes of quiet seated rest.

2. Position

Seat with back supported, feet flat and legs uncrossed. Support the bare upper arm at heart level. Select the cuff specified for the measured arm circumference.

3. Measure pulse

Palpate the radial pulse with finger pads, not the thumb. Record rate and rhythm. Count for a full minute when irregular or when the protocol requires it.

4. Measure BP

Use the validated device instructions. Keep the volunteer still and silent. Repeat readings with the prescribed interval, commonly at least one minute, and record each result.

5. Observe auscultation

Where demonstrated, the first Korotkoff sounds identify systolic pressure and disappearance identifies adult diastolic pressure under the prescribed method.

6. Record and interpret

Record arm, cuff, position, device and readings. Do not change a person's treatment on the basis of the exercise.

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Observations and Record

Measurement	Reading 1	Reading 2
Pulse / heart rate	___ beats/min	___ beats/min
Blood pressure	___ / ___ mmHg	___ / ___ mmHg
Arm / cuff / position	_____	_____

Worked Example

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

- Regular pulse exercise: 36 beats in 30 s gives $36 \times 2 = 72$ beats/min. Use a full-minute count when required rather than extrapolating an irregular rhythm.
- Fictional BP readings: 124/78 and 122/80 mmHg. Arithmetic mean = 123/79 mmHg.
- An auscultated heart rate of 84/min with a radial pulse of 78/min gives a pulse deficit of 6/min, if counted under an appropriate comparable protocol.

Result

Pulse: ___ beats/min; rhythm: ___. BP readings: ___ and ___ mmHg. Device, cuff, arm and position are documented.

Precautions

- Use a cuff that fits the arm; an unsuitable cuff can bias the result.
- Do not measure over clothing or while the person talks.
- Concerning symptoms during a volunteer activity require the supervising clinician's attention.

Viva Questions and Answers

1. Why support the arm at heart level?

It helps standardise hydrostatic effects on the reading.

2. Why can pulse and heart rates differ?

Some cardiac cycles may not generate a palpable peripheral pulse.

3. Does one high reading establish hypertension?

No; correct repeated assessment and clinical evaluation are required.

2. Blood Group Determination

Aim

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

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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

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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.

Human Body Systems on Charts Models and Specimens

Experiment 9 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

1. Axial Skeleton

Aim

To identify the main structures of the axial skeleton on models and charts.

Principle

The arrangement of skull, vertebral column, ribs and sternum supports support and protection. Structure, position and connections should be described together, with a clear distinction between a model and an actual anatomical section.

Requirements

- Instructor-labelled charts, models or preserved teaching specimens; notebook.

Procedure

1. Orient

Identify the model view, body side and the relevant anatomical directions.

2. Trace structures

Locate skull, vertebral column, ribs and sternum. Trace the main connections in sequence.

3. Relate to function

Explain how two labelled structures support support and protection.

4. Record

Draw a labelled diagram and explain one clinically relevant structural relationship.

Observations and Record

Structure	Observed location / connection	Function
1	_____	_____
2	_____	_____
3	_____	_____

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Label only structures supported by the chart or teaching specimen.
- Do not confuse anatomical direction with the viewer's left and right.

Viva Questions and Answers

1. What is the main function of this system?

Support and protection.

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2. Why record connections?

The function depends on how components act together, not on isolated names.

2. Appendicular Skeleton

Aim

To identify the main structures of the appendicular skeleton on models and charts.

Principle

The arrangement of limb bones, pectoral girdle and pelvic girdle supports movement and attachment. Structure, position and connections should be described together, with a clear distinction between a model and an actual anatomical section.

Requirements

- Instructor-labelled charts, models or preserved teaching specimens; notebook.

Procedure

1. Orient

Identify the model view, body side and the relevant anatomical directions.

2. Trace structures

Locate limb bones, pectoral girdle and pelvic girdle. Trace the main connections in sequence.

3. Relate to function

Explain how two labelled structures support movement and attachment.

4. Record

Draw a labelled diagram and explain one clinically relevant structural relationship.

Observations and Record

Structure	Observed location / connection	Function
1	_____	_____
2	_____	_____
3	_____	_____

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Label only structures supported by the chart or teaching specimen.
- Do not confuse anatomical direction with the viewer's left and right.

Viva Questions and Answers

1. What is the main function of this system?

Movement and attachment.

2. Why record connections?

The function depends on how components act together, not on isolated names.

3. Cardiovascular System

Aim

To identify the main structures of the cardiovascular system on models and charts.

Human Anatomy and Physiology

Principle

The arrangement of heart chambers, valves, major vessels and pulmonary/systemic circuits supports blood circulation. Structure, position and connections should be described together, with a clear distinction between a model and an actual anatomical section.

Requirements

- Instructor-labelled charts, models or preserved teaching specimens; notebook.

Procedure

1. Orient

Identify the model view, body side and the relevant anatomical directions.

2. Trace structures

Locate heart chambers, valves, major vessels and pulmonary/systemic circuits. Trace the main connections in sequence.

3. Relate to function

Explain how two labelled structures support blood circulation.

4. Record

Draw a labelled diagram and explain one clinically relevant structural relationship.

Observations and Record

Structure	Observed location / connection	Function
1	_____	_____
2	_____	_____
3	_____	_____

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Label only structures supported by the chart or teaching specimen.
- Do not confuse anatomical direction with the viewer's left and right.

Viva Questions and Answers

1. What is the main function of this system?

Blood circulation.

2. Why record connections?

The function depends on how components act together, not on isolated names.

4. Respiratory System

Aim

To identify the main structures of the respiratory system on models and charts.

Principle

The arrangement of airways, lungs, alveoli, diaphragm and pulmonary vessels supports ventilation and gas exchange. Structure, position and connections should be described together, with a clear distinction between a model and an actual anatomical section.

Human Anatomy and Physiology

Requirements

- Instructor-labelled charts, models or preserved teaching specimens; notebook.

Procedure

1. Orient

Identify the model view, body side and the relevant anatomical directions.

2. Trace structures

Locate airways, lungs, alveoli, diaphragm and pulmonary vessels. Trace the main connections in sequence.

3. Relate to function

Explain how two labelled structures support ventilation and gas exchange.

4. Record

Draw a labelled diagram and explain one clinically relevant structural relationship.

Observations and Record

Structure	Observed location / connection	Function
1	_____	_____
2	_____	_____
3	_____	_____

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Label only structures supported by the chart or teaching specimen.
- Do not confuse anatomical direction with the viewer's left and right.

Viva Questions and Answers

1. What is the main function of this system?

Ventilation and gas exchange.

2. Why record connections?

The function depends on how components act together, not on isolated names.

5. Digestive System

Aim

To identify the main structures of the digestive system on models and charts.

Principle

The arrangement of alimentary canal, liver, gall bladder and pancreas supports digestion, absorption and accessory secretions. Structure, position and connections should be described together, with a clear distinction between a model and an actual anatomical section.

Requirements

- Instructor-labelled charts, models or preserved teaching specimens; notebook.

Procedure

1. Orient

Identify the model view, body side and the relevant anatomical directions.

Human Anatomy and Physiology

2. Trace structures

Locate alimentary canal, liver, gall bladder and pancreas. Trace the main connections in sequence.

3. Relate to function

Explain how two labelled structures support digestion, absorption and accessory secretions.

4. Record

Draw a labelled diagram and explain one clinically relevant structural relationship.

Observations and Record

Structure	Observed location / connection	Function
1	_____	_____
2	_____	_____
3	_____	_____

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Label only structures supported by the chart or teaching specimen.
- Do not confuse anatomical direction with the viewer's left and right.

Viva Questions and Answers

1. What is the main function of this system?

Digestion, absorption and accessory secretions.

2. Why record connections?

The function depends on how components act together, not on isolated names.

6. Urinary System

Aim

To identify the main structures of the urinary system on models and charts.

Principle

The arrangement of kidneys, nephron, ureters, bladder and urethra supports filtration, reabsorption, secretion and excretion. Structure, position and connections should be described together, with a clear distinction between a model and an actual anatomical section.

Requirements

- Instructor-labelled charts, models or preserved teaching specimens; notebook.

Procedure

1. Orient

Identify the model view, body side and the relevant anatomical directions.

2. Trace structures

Locate kidneys, nephron, ureters, bladder and urethra. Trace the main connections in sequence.

3. Relate to function

Explain how two labelled structures support filtration, reabsorption, secretion and excretion.

Human Anatomy and Physiology

4. Record

Draw a labelled diagram and explain one clinically relevant structural relationship.

Observations and Record

Structure	Observed location / connection	Function
1	_____	_____
2	_____	_____
3	_____	_____

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Label only structures supported by the chart or teaching specimen.
- Do not confuse anatomical direction with the viewer's left and right.

Viva Questions and Answers

1. What is the main function of this system?

Filtration, reabsorption, secretion and excretion.

2. Why record connections?

The function depends on how components act together, not on isolated names.

7. Nervous System

Aim

To identify the main structures of the nervous system on models and charts.

Principle

The arrangement of brain, spinal cord, peripheral nerves and autonomic divisions supports information processing and control. Structure, position and connections should be described together, with a clear distinction between a model and an actual anatomical section.

Requirements

- Instructor-labelled charts, models or preserved teaching specimens; notebook.

Procedure

1. Orient

Identify the model view, body side and the relevant anatomical directions.

2. Trace structures

Locate brain, spinal cord, peripheral nerves and autonomic divisions. Trace the main connections in sequence.

3. Relate to function

Explain how two labelled structures support information processing and control.

4. Record

Draw a labelled diagram and explain one clinically relevant structural relationship.

Human Anatomy and Physiology

Observations and Record

Structure	Observed location / connection	Function
1	_____	_____
2	_____	_____
3	_____	_____

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Label only structures supported by the chart or teaching specimen.
- Do not confuse anatomical direction with the viewer's left and right.

Viva Questions and Answers

1. What is the main function of this system?

Information processing and control.

2. Why record connections?

The function depends on how components act together, not on isolated names.

8. Special Senses

Aim

To identify the main structures of the special senses on models and charts.

Principle

The arrangement of eye, ear and the structures involved in taste, smell and balance supports sensory reception and transduction. Structure, position and connections should be described together, with a clear distinction between a model and an actual anatomical section.

Requirements

- Instructor-labelled charts, models or preserved teaching specimens; notebook.

Procedure

1. Orient

Identify the model view, body side and the relevant anatomical directions.

2. Trace structures

Locate eye, ear and the structures involved in taste, smell and balance. Trace the main connections in sequence.

3. Relate to function

Explain how two labelled structures support sensory reception and transduction.

4. Record

Draw a labelled diagram and explain one clinically relevant structural relationship.

Human Anatomy and Physiology

Observations and Record

Structure	Observed location / connection	Function
1	_____	_____
2	_____	_____
3	_____	_____

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Label only structures supported by the chart or teaching specimen.
- Do not confuse anatomical direction with the viewer's left and right.

Viva Questions and Answers

1. What is the main function of this system?

Sensory reception and transduction.

2. Why record connections?

The function depends on how components act together, not on isolated names.

9. Reproductive System

Aim

To identify the main structures of the reproductive system on models and charts.

Principle

The arrangement of male and female reproductive organs and their connections supports gamete production, hormonal function and reproduction. Structure, position and connections should be described together, with a clear distinction between a model and an actual anatomical section.

Requirements

- Instructor-labelled charts, models or preserved teaching specimens; notebook.

Procedure

1. Orient

Identify the model view, body side and the relevant anatomical directions.

2. Trace structures

Locate male and female reproductive organs and their connections. Trace the main connections in sequence.

3. Relate to function

Explain how two labelled structures support gamete production, hormonal function and reproduction.

4. Record

Draw a labelled diagram and explain one clinically relevant structural relationship.

Human Anatomy and Physiology

Observations and Record

Structure	Observed location / connection	Function
1	_____	_____
2	_____	_____
3	_____	_____

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Label only structures supported by the chart or teaching specimen.
- Do not confuse anatomical direction with the viewer's left and right.

Viva Questions and Answers**1. What is the main function of this system?**

Gamete production, hormonal function and reproduction.

2. Why record connections?

The function depends on how components act together, not on isolated names.

Family Planning Appliances

Experiment 10 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify common contraceptive devices and explain their general purposes.

Principle

Devices differ in how they prevent pregnancy and in whether they are placed before intercourse or provide a longer period of contraception. Protection against sexually transmitted infections is a separate consideration.

Requirements

- Teaching models or sealed device displays: condoms, intrauterine devices and implant models; charts.

Procedure

1. Identify

Record the device name, category and visible design.

2. Compare

Compare barrier methods with intrauterine and implant methods at a conceptual level.

3. Discuss counselling

State the information a trained clinician must assess when selecting or using a method.

Human Anatomy and Physiology

4. Record

Complete a comparison table; use models without performing a clinical insertion or fitting.

Observations and Record

Device	General purpose / mechanism	Counselling consideration
Condom	Barrier	Correct use; infection protection
Copper IUD	Intrauterine contraception	Clinician assessment and insertion
Hormonal device / implant	Hormone-mediated contraception	Eligibility, use period and follow-up

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Use teaching models; clinical fitting and insertion are performed by trained providers.
- Do not infer that every method prevents sexually transmitted infections.

Viva Questions and Answers

1. What is a barrier method?

A method that creates a physical barrier to sperm passage.

2. Why is individual assessment needed?

Suitability depends on health, preferences, risks and the method's characteristics.

Pregnancy Test Interpretation

Experiment 11 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To interpret a urine hCG teaching test according to its control and test indicators.

Principle

A urine pregnancy test detects human chorionic gonadotropin by an immunoassay. A valid control is required. A positive result indicates detected hCG; it does not determine pregnancy location or gestational age.

Requirements

- Instructor-provided test images or approved quality-control material; the test instructions.

Procedure

1. Check the test

Read the intended specimen, expiry, control requirement and interpretation window.

2. Observe the teaching result

Read the supplied result within the stated time window.

3. Classify

Record valid negative, valid positive or invalid using the manufacturer's rule.

Human Anatomy and Physiology

4. Explain limitations

Consider timing, urine dilution and the need for clinical confirmation where appropriate.

Observations and Record

Teaching test	Control indicator	Test indicator / result
1	_____	_____
2	_____	_____
3	_____	_____

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Use the instructions for the exact device; line patterns differ.
- An early negative result may not exclude pregnancy; do not diagnose from a teaching image.

Viva Questions and Answers

1. Why is the control important?

It checks the test process sufficiently to permit interpretation.

2. Does a positive urine test locate a pregnancy?

No. Clinical assessment is needed for location and other questions.

Appliances Used in Experimental Physiology

Experiment 12 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify physiological recording equipment and its input and output

Principle

A recording system combines a stimulus or physiological input, a transducer and a time-calibrated record. The instrument transforms a physical event into a trace; calibration connects trace size to the measured quantity.

Requirements

- Instructor-provided labelled diagrams, traces or data for this activity.
- Calculator, graph paper or spreadsheet, and the activity record.

Procedure

1. Identify

Inspect teaching images of a stimulator, recording lever, transducer, kymograph or digital acquisition system and time marker.

2. Trace the signal

Draw the pathway from physiological event to sensor and recorded trace.

3. Check calibration

Record units, time scale, baseline and calibration value before interpreting a trace.

Human Anatomy and Physiology

Observations and Record

Record item	Entry
Activity / material identifier	_____
Measurement or visible feature	_____
Comparison / calculated outcome	_____
Interpretation and limitation	_____

Result

The recorded finding is ____; the supporting observation or calculation is _____. The main limitation is _____.

Precautions

- Use the supplied teaching material; distinguish a measured observation from an assumed value.
- Keep units, axes, labels and measurement conditions consistent.
- Record limitations and seek instructor review before applying a conclusion to a live case.

Viva Questions and Answers

1. What is the main endpoint?

Identify physiological recording equipment and its input and output

2. Does one observed result prove a general conclusion?

No. Controls, repeatability and the limitations of the method must be considered.

Simple Muscle Curve

Experiment 13 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify twitch phases and calculate their durations

Principle

A single twitch has latent, contraction and relaxation phases. The trace shows mechanical response after stimulation.

Requirements

- Instructor-provided labelled diagrams, traces or data for this activity.
- Calculator, graph paper or spreadsheet, and the activity record.

Procedure

1. Review the record

Use the instructor-provided gastrocnemius-sciatic teaching trace or a simulated recording. Record the axes, gain and input markers.

2. Measure

Mark stimulus, response onset, peak and return to baseline. Compare their time coordinates.

3. Conclude

Explain the curve using the stated conditions and identify one limitation of the comparison.

Human Anatomy and Physiology

Observations and Record

Record item	Entry
Activity / material identifier	_____
Measurement or visible feature	_____
Comparison / calculated outcome	_____
Interpretation and limitation	_____

Worked Example

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

- Phase duration = end time – start time. If onset is 10 ms and peak is 40 ms, contraction time is 30 ms.

Result

The recorded finding is ____; the supporting observation or calculation is _____. The main limitation is _____.

Precautions

- Use the supplied teaching material; distinguish a measured observation from an assumed value.
- Keep units, axes, labels and measurement conditions consistent.
- Record limitations and seek instructor review before applying a conclusion to a live case.

Viva Questions and Answers

1. What is the main endpoint?

Identify twitch phases and calculate their durations

2. Does one observed result prove a general conclusion?

No. Controls, repeatability and the limitations of the method must be considered.

Summation Curve

Experiment 14 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To compare a single response with a summated response

Principle

A second input delivered before complete relaxation can increase the combined mechanical response. Summation is not a new muscle fibre type.

Requirements

- Instructor-provided labelled diagrams, traces or data for this activity.
- Calculator, graph paper or spreadsheet, and the activity record.

Procedure

1. Review the record

Use the instructor-provided gastrocnemius-sciatic teaching trace or a simulated recording. Record the axes, gain and input markers.

2. Measure

Compare response heights at the same recording gain and identify the interval between inputs.

3. Conclude

Explain the curve using the stated conditions and identify one limitation of the comparison.

Human Anatomy and Physiology

Observations and Record

Record item	Entry
Activity / material identifier	_____
Measurement or visible feature	_____
Comparison / calculated outcome	_____
Interpretation and limitation	_____

Worked Example

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

- Relative increase = (summed height – single height) ÷ single height × 100. Example: 18 mm versus 12 mm gives 50%.

Result

The recorded finding is ____; the supporting observation or calculation is _____. The main limitation is _____.

Precautions

- Use the supplied teaching material; distinguish a measured observation from an assumed value.
- Keep units, axes, labels and measurement conditions consistent.
- Record limitations and seek instructor review before applying a conclusion to a live case.

Viva Questions and Answers

1. What is the main endpoint?

Compare a single response with a summed response

2. Does one observed result prove a general conclusion?

No. Controls, repeatability and the limitations of the method must be considered.

Effect of Temperature on Muscle Response

Experiment 15 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To compare supplied twitch traces at different stated temperatures

Principle

Temperature changes reaction and mechanical-process rates; an isolated teaching trace must be interpreted within the tested range and recording conditions.

Requirements

- Instructor-provided labelled diagrams, traces or data for this activity.
- Calculator, graph paper or spreadsheet, and the activity record.

Procedure

1. Review the record

Use the instructor-provided gastrocnemius-sciatic teaching trace or a simulated recording. Record the axes, gain and input markers.

2. Measure

Record temperature, latency, contraction time, relaxation time and height from each supplied trace.

3. Conclude

Explain the curve using the stated conditions and identify one limitation of the comparison.

Human Anatomy and Physiology

Observations and Record

Record item	Entry
Activity / material identifier	_____
Measurement or visible feature	_____
Comparison / calculated outcome	_____
Interpretation and limitation	_____

Worked Example

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

- Compare absolute and percentage changes using the same calibration; do not infer a universal temperature optimum.

Result

The recorded finding is ____; the supporting observation or calculation is _____. The main limitation is _____.

Precautions

- Use the supplied teaching material; distinguish a measured observation from an assumed value.
- Keep units, axes, labels and measurement conditions consistent.
- Record limitations and seek instructor review before applying a conclusion to a live case.

Viva Questions and Answers

1. What is the main endpoint?

Compare supplied twitch traces at different stated temperatures

2. Does one observed result prove a general conclusion?

No. Controls, repeatability and the limitations of the method must be considered.

Effect of Load and Afterload on Muscle Response

Experiment 16 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To compare supplied load and afterload records

Principle

A preload is applied before contraction; an afterload is the opposing load during shortening. Load affects the relationship between shortening and work.

Requirements

- Instructor-provided labelled diagrams, traces or data for this activity.
- Calculator, graph paper or spreadsheet, and the activity record.

Procedure

1. Review the record

Use the instructor-provided gastrocnemius-sciatic teaching trace or a simulated recording. Record the axes, gain and input markers.

2. Measure

Identify the load arrangement from the diagram. Compare shortening at each stated load and record work where sufficient data are given.

3. Conclude

Explain the curve using the stated conditions and identify one limitation of the comparison.

Human Anatomy and Physiology

Observations and Record

Record item	Entry
Activity / material identifier	_____
Measurement or visible feature	_____
Comparison / calculated outcome	_____
Interpretation and limitation	_____

Worked Example

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

- Mechanical work = force $\times$ displacement. If force is 0.10 N and shortening is 0.005 m, work = 0.0005 J.

Result

The recorded finding is ____; the supporting observation or calculation is _____. The main limitation is _____.

Precautions

- Use the supplied teaching material; distinguish a measured observation from an assumed value.
- Keep units, axes, labels and measurement conditions consistent.
- Record limitations and seek instructor review before applying a conclusion to a live case.

Viva Questions and Answers

1. What is the main endpoint?

Compare supplied load and afterload records

2. Does one observed result prove a general conclusion?

No. Controls, repeatability and the limitations of the method must be considered.

Muscle Fatigue Curve

Experiment 17 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To describe changes in a supplied repeated-contraction trace

Principle

Repeated activation can reduce the mechanical response. The preparation, stimulation pattern, recovery and recording conditions affect the trace.

Requirements

- Instructor-provided labelled diagrams, traces or data for this activity.
- Calculator, graph paper or spreadsheet, and the activity record.

Procedure

1. Review the record

Use the instructor-provided gastrocnemius-sciatic teaching trace or a simulated recording. Record the axes, gain and input markers.

2. Measure

Compare initial and later heights, mark pauses and note any recovery after the pause.

3. Conclude

Explain the curve using the stated conditions and identify one limitation of the comparison.

Human Anatomy and Physiology

Observations and Record

Record item	Entry
Activity / material identifier	_____
Measurement or visible feature	_____
Comparison / calculated outcome	_____
Interpretation and limitation	_____

Worked Example

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

- Remaining response = later height $\div$ initial height $\times$ 100. Example: 4 mm $\div$ 10 mm $\times$ 100 = 40%.

Result

The recorded finding is ____; the supporting observation or calculation is _____. The main limitation is _____.

Precautions

- Use the supplied teaching material; distinguish a measured observation from an assumed value.
- Keep units, axes, labels and measurement conditions consistent.
- Record limitations and seek instructor review before applying a conclusion to a live case.

Viva Questions and Answers

1. What is the main endpoint?

Describe changes in a supplied repeated-contraction trace

2. Does one observed result prove a general conclusion?

No. Controls, repeatability and the limitations of the method must be considered.

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