

Biochemistry Lesson Plans

A compiled, topic-wise reference of the departmental teaching plans

49

LESSON PLANS

15

TOPIC SECTIONS

49

SOURCE DOCUMENTS

SUBJECT

Biochemistry — Phase I MBBS (and selected 2nd-year sessions)

CONTRIBUTING TEACHERS

Dr. Sharif M Ehsan · Dr. Farjana Sharmin · Dr. Nasrin · Dr. Shammi Akter

COMPILED

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PART I

Biophysics and Physical Chemistry

Acid-base concepts, pH and buffers, the law of mass action, solutions, colloids, isotopes and dialysis — the physico-chemical foundation of the Phase I Biochemistry course.

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PART I · BIOPHYSICS AND PHYSICAL CHEMISTRY

1. Physical Chemistry - 1: Acid, Base, pH and Buffers

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define acid, base and conjugate base.
2. Define buffer and mention the important body buffers.
3. Explain how a buffer acts and maintains the optimum pH.
4. Explain the concept of pH and its importance.
5. Explain the law of mass action and the Henderson-Hasselbalch equation with their applications.
6. Define the pH scale and its ranges.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Gaining attention	Biochemistry as a subject of the MBBS course; recapitulation of chemistry	Open lecture
5-15	Explanation of definitions	Definition of acid, base and conjugate base	PPT slides, interactive Q/A
15-50	Explanation of the concept of pH and buffers	Definition of pH and buffers; importance of pH; different levels of pH; pH scale; buffers of different body compartments; how a buffer acts	PPT slides, recap from card topics
50-55	Review of the topics		PPT slides and animation
55-60	Feedback		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-biophysics-1.docx · [Back to index](#)

PART I · BIOPHYSICS AND PHYSICAL CHEMISTRY

2. Physical Chemistry - 2: Law of Mass Action and the Henderson-Hasselbalch Equation

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Explain the law of mass action and the Henderson-Hasselbalch equation with their applications.
2. Deduce the Henderson-Hasselbalch equation.
3. Explain the pH scale and its ranges.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Recapitulation of previous session	pH and buffer; pH scale	Open lecture
5-15	Law of mass action and its importance	Concept of ion product and solubility product	PPT slides, interactive Q/A
15-40	Concept of the pH scale according to the law of mass action	Explanation of the pH scale based on the law of mass action, with dissociation of the H ₂ O molecule	PPT slides, recap from card topics
40-50	Henderson-Hasselbalch equation	Deduction of the Henderson-Hasselbalch equation; explanation of body pH based on the bicarbonate buffer	PPT slides and animation
50-55	PBQs	Calculation of H ⁺ and OH ⁻	Interaction and Q/A
55-60	Review of both sessions		

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-biophysic-2.docx · [Back to index](#)

3. Solution: Classification, Osmolarity and Tonicity

COURSE	Phase I MBBS — Biochemistry	TOPIC	Solution
PROVIDER	Dr. Shammi Akter	DURATION	1 hour

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define solution.
2. Classify solutions with examples.
3. Explain osmolarity and tonicity of solutions.
4. Calculate the osmolarity of different solutions.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	CONTENT	TEACHING METHOD
5 min	Introduction, learning objectives and importance of solutions	Interactive discussion
15 min	Classification of solutions (on the basis of tonicity and other types); uses of different types of solution	Lecture with diagrams
15 min	Iso-osmotic versus isotonic solution	Lecture with illustrations
15 min	Calculating the osmolarity of 0.9% NaCl, 5% DA and 5% DNS	Lecture with clinical correlation
5 min	Summary of key concepts	Discussion
5 min	Question-answer session and formative assessment	Oral viva

TEACHING-LEARNING ACTIVITIES

- Introduce the topic using a simple clinical example.
- Explain classification with appropriate diagrams.
- Discuss different types of solution with their uses.
- Encourage student participation through questioning.

TEACHING AIDS

- PowerPoint slides
- Whiteboard
- Marker

FORMATIVE ASSESSMENT

- Define a standard solution.
- Why is 0.9% NaCl solution called normal saline?
- Changes in RBC in a hypotonic solution.
- Mention permeable and non-permeable solutes.

4. Crystalloid and Colloid

COURSE	Phase I MBBS — Biochemistry	TOPIC	Crystalloid and colloid
PROVIDER	Dr. Shammi Akter	DURATION	1 hour

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define crystalloid and colloid with examples.
2. Differentiate between crystalloid and colloid.
3. Describe the properties of colloids (physical and special properties).
4. Explain the importance of colloids and colloidal osmotic pressure.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	CONTENT	TEACHING METHOD
5 min	Introduction and learning objectives	Interactive discussion
20 min	Physical properties of crystalloid and colloid	Lecture with diagrams
15 min	Special properties of colloid and their importance	Lecture with illustrations
10 min	Comparison of true sol, colloidal sol and suspension	Interactive lecture
10 min	Summary and formative assessment	Oral viva

FORMATIVE ASSESSMENT

- Give examples of crystalloid and colloid.
- Brownian movement and the Tyndall phenomenon.
- Colloidal osmotic pressure.

Source document: Lesson Plan com 35-Dr. Shammi.docx · [Back to index](#)

5. Isotopes and Dialysis

COURSE	Phase I MBBS — Biochemistry	TOPIC	Isotope and dialysis
PROVIDER	Dr. Shammi Akter	DURATION	1 hour

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define and classify isotopes with examples.
2. Describe the clinical uses of radioactive isotopes.
3. Describe the hazards of radioactive isotopes.
4. Explain the principle of dialysis.
5. Explain the importance of dialysis.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	CONTENT	TEACHING METHOD
5 min	Introduction and learning objectives	Interactive discussion
10 min	Stable and unstable isotopes with examples	Lecture with diagrams
20 min	Diagnostic and therapeutic uses of isotopes; disadvantages of isotopes	Interactive lecture
20 min	Dialysis and its importance	Lecture with illustrations
5 min	Summary and formative assessment	Viva and discussion

FORMATIVE ASSESSMENT

- Define isotope.
- Diagnostic uses of isotopes.
- In renal failure, which method is used to excrete toxic substances (urea, creatinine)?

Source document: Lesson Plan com 35-Dr. Shammi.docx · [Back to index](#)

PART II

Cell Biology: Cell Cycle and Cell Division

The eukaryotic cell cycle, its checkpoints, mitosis and meiosis, and the chromosomal disorders that follow errors in cell division.

2 LESSON PLANS · LESSON PLANS 6-7

PART II · CELL BIOLOGY: CELL CYCLE AND CELL DIVISION

6. Cell Cycle

COURSE	Phase I MBBS (COM34) — Biochemistry	TOPIC	Cell cycle
DURATION	1 hour	PROVIDER	Dr. Nasrin

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define the cell cycle.
2. Explain the events occurring in the G₁, S, G₂ and M phases.
3. Explain the biomedical importance of the cell cycle.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	CONTENT	TEACHING METHOD
5 min	Introduction, learning objectives and importance of the cell cycle	Interactive discussion
10 min	Definition and overview of the cell cycle	Lecture with diagrams
20 min	Phases of the cell cycle (G ₁ , S, G ₂ , M, G ₀)	Lecture with flowchart
15 min	Cell cycle checkpoints (G ₁ /S, G ₂ /M, spindle checkpoint)	Interactive lecture
10 min	Summary and formative assessment	Oral viva

FORMATIVE ASSESSMENT

- List the phases of the cell cycle.
- State the events of the S phase.
- Name the major cell cycle checkpoints.
- State the function of the p53 gene.

REFERENCES

- Harper's Illustrated Biochemistry, 33rd edition.
- Lippincott Illustrated Reviews: Biochemistry, 8th edition.
- Guyton & Hall Textbook of Medical Physiology.

Source document: Lesson Placom 34-dr. nasrin-cell cycle.docx (also in Lesson Plan-com 34.docx) · [Back to index](#)

PART II · CELL BIOLOGY: CELL CYCLE AND CELL DIVISION

7. Cell Division: Mitosis and Meiosis

COURSE	Phase I MBBS (COM34) — Biochemistry	TOPIC	Cell division (mitosis and meiosis)
DURATION	1 hour	PROVIDER	Dr. Nasrin

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Describe the stages of mitosis.
2. Explain the stages of meiosis I and meiosis II.
3. Compare mitosis and meiosis.
4. Describe changes in chromosome number and DNA content during meiosis.
5. Correlate errors in cell division with chromosomal disorders.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	CONTENT	TEACHING METHOD
5 min	Introduction and learning objectives	Interactive discussion
20 min	Mitosis: phases and significance	Lecture with diagrams
20 min	Meiosis I and II: stages, chromosome behaviour and reduction division	Lecture with flowcharts
10 min	Comparison of mitosis and meiosis	Interactive discussion
5 min	Summary and formative assessment	Oral viva

FORMATIVE ASSESSMENT

- Differentiate meiosis I and meiosis II.
- Explain why meiosis I is called reduction division.
- Explain why meiosis II is called equational division.
- State the chromosome number after meiosis I and meiosis II.

CLINICAL CORRELATIONS

- Down syndrome due to meiotic non-disjunction
- Turner syndrome
- Klinefelter syndrome

REFERENCES

- Harper's Illustrated Biochemistry, 33rd edition.
- Lippincott Illustrated Reviews: Biochemistry, 8th edition.
- Guyton & Hall Textbook of Medical Physiology.

Source document: Lesson Placom 34-dr. nasrin-cell division.docx (also in Lesson Plan-com 34.docx) · [Back to index](#)

PART III

Chemistry of Carbohydrates

Classification, physical and chemical properties, isomerism, homopolysaccharides and the glycosaminoglycans, with their clinical correlations.

4 LESSON PLANS · LESSON PLANS 8-11

PART III · CHEMISTRY OF CARBOHYDRATES

8. Classification and Properties of Carbohydrates

COURSE	Phase I MBBS — Biochemistry	TOPIC	Classification and properties of carbohydrates
DURATION	1 hour	PROVIDER	Dr. Nasrin

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define carbohydrates.
2. Classify carbohydrates on the basis of carbon atoms, functional group and degree of polymerisation.
3. Describe the physical properties of carbohydrates.
4. Explain the chemical properties of carbohydrates.
5. Differentiate reducing and non-reducing sugars.
6. Correlate the properties of carbohydrates with common clinical conditions.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	CONTENT	TEACHING METHOD
5 min	Introduction, learning objectives and importance of carbohydrates	Interactive discussion
15 min	Classification of carbohydrates (carbon atoms, functional group, degree of polymerisation)	Lecture with diagrams
15 min	Physical properties (solubility, sweetness, optical activity, mutarotation)	Lecture with illustrations
15 min	Chemical properties (oxidation, reduction, esterification, glycoside formation, reducing property, Benedict's test)	Lecture with clinical correlation
5 min	Summary of key concepts	Discussion
5 min	Question-answer session and formative assessment	Oral viva

TEACHING-LEARNING ACTIVITIES

- Introduce the topic using a simple clinical example.
- Explain classification with appropriate diagrams.
- Discuss physical and chemical properties using examples.
- Correlate concepts with diabetes mellitus, lactose intolerance and diabetic cataract.
- Encourage student participation through questioning.

TEACHING AIDS

- PowerPoint slides
- Whiteboard
- Marker
- Carbohydrate structure charts (Fischer and Haworth projections)

FORMATIVE ASSESSMENT

- Classify glucose and fructose.
- Differentiate aldose and ketose.
- Identify reducing and non-reducing sugars.
- Explain mutarotation.
- State the principle of Benedict's test.

Source document: Lesson Plan com 35-dr. nasrin-CHO-1.docx · [Back to index](#)

PART III · CHEMISTRY OF CARBOHYDRATES

9. Isomerism and Polysaccharides

COURSE	Phase I MBBS — Biochemistry	TOPIC	Isomerism, polysaccharides
DURATION	1 hour	PROVIDER	Dr. Nasrin

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define isomerism.
2. Differentiate between enantiomers, epimers, anomers and D/L isomers.
3. Explain mutarotation and its significance.
4. Define invert sugar and explain its formation and clinical importance.
5. Classify polysaccharides with examples.
6. Describe the structure and functions of important polysaccharides.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	CONTENT	TEACHING METHOD
5 min	Introduction and learning objectives	Interactive discussion
20 min	Carbohydrate isomerism (D/L isomers, enantiomers, epimers, anomers, mutarotation)	Lecture with diagrams
15 min	Polysaccharides (classification, structure, functions, examples)	Lecture with illustrations
10 min	Invert sugar (definition, preparation, properties, importance)	Interactive lecture
5 min	Clinical correlations	Case-based discussion
5 min	Summary and formative assessment	Oral viva

FORMATIVE ASSESSMENT

- | | |
|-----------------------------------|---|
| — Differentiate D- and L-glucose. | — Define invert sugar. |
| — Identify epimers and anomers. | — Classify polysaccharides. |
| — Explain mutarotation. | — Compare starch, glycogen and cellulose. |

Source document: Lesson Plan com 35-dr. nasrin-CHO-2.docx · [Back to index](#)

PART III · CHEMISTRY OF CARBOHYDRATES

10. Homopolysaccharides

COURSE	Phase I MBBS — Biochemistry	TOPIC	Homopolysaccharides
DURATION	1 hour	PROVIDER	Dr. Nasrin

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Classify polysaccharides.
2. Describe the structure, properties and functions of the major homopolysaccharides.
3. Compare starch, glycogen, cellulose, dextran and inulin.
4. Correlate homopolysaccharides with clinical conditions.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	CONTENT	TEACHING METHOD
5 min	Introduction to complex carbohydrates	Interactive discussion
10 min	Definition and classification of polysaccharides	Lecture with diagrams
30 min	Homopolysaccharides: starch, glycogen, cellulose, dextran, inulin	Interactive lecture
10 min	Clinical correlations (dietary fibre)	Case-based discussion
5 min	Summary and formative assessment	Viva and discussion

TEACHING-LEARNING ACTIVITIES

- Explain classification with examples.
- Compare starch, glycogen, cellulose, dextran and inulin using tables.
- Discuss $\alpha(1\rightarrow4)$, $\alpha(1\rightarrow6)$ and $\beta(1\rightarrow4)$ glycosidic linkages.

FORMATIVE ASSESSMENT

- Differentiate starch and glycogen.
- Explain why cellulose cannot be digested by humans.

Source document: Lesson Plan com 35-dr. nasrin-CHO-3.docx · [Back to index](#)

PART III · CHEMISTRY OF CARBOHYDRATES

11. Mucopolysaccharides (Glycosaminoglycans)

COURSE	Phase I MBBS — Biochemistry	TOPIC	Mucopolysaccharides (glycosaminoglycans)
DURATION	1 hour	PROVIDER	Dr. Nasrin

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define mucopolysaccharides (glycosaminoglycans, GAGs).
2. Classify glycosaminoglycans.
3. Describe the structure, composition and functions of the major GAGs.
4. Explain the biomedical importance of GAGs.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	CONTENT	TEACHING METHOD
5 min	Introduction to heteropolysaccharides	Interactive discussion
10 min	Definition, structure and classification of GAGs	Lecture with diagrams
25 min	Hyaluronic acid, chondroitin sulfate, dermatan sulfate, keratan sulfate, heparin, heparan sulfate	Interactive lecture
15 min	Clinical correlations (mucopolysaccharidoses, osteoarthritis, anticoagulant use of heparin)	Case-based discussion
5 min	Summary and formative assessment	Viva and discussion

TEACHING-LEARNING ACTIVITIES

- Explain the repeating disaccharide structure of GAGs.
- Compare different GAGs using a summary table.
- Discuss the locations and functions of each GAG.
- Introduce the mucopolysaccharidoses with clinical examples.

CLINICAL CORRELATIONS

- Heparin as a clinically important anticoagulant
- Hyaluronic acid in synovial fluid
- Osteoarthritis

REFERENCES

- Harper's Illustrated Biochemistry, 33rd edition.
- Lippincott Illustrated Reviews: Biochemistry, 8th edition.
- Satyanarayana U. Biochemistry.
- Guyton & Hall Textbook of Medical Physiology (relevant clinical correlations).

Source document: Lesson Plan com 35-dr. nasrin-CHO-4.docx · [Back to index](#)

PART IV

Enzymes

Definition, classification and mechanism of enzyme action; kinetics, factors affecting activity, inhibitors, regulation and the clinically important isoenzymes.

2 LESSON PLANS · LESSON PLANS 12-13

PART IV · ENZYMES

12. Enzymes - 1: Definition, Classification and Mechanism of Action

COURSE	Phase I MBBS — Biochemistry	DURATION	60 minutes
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LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define enzymes.
2. Classify and explain the different classes with examples.
3. Explain the mechanism of enzyme action and the energy of activation.
4. Enumerate the factors influencing enzyme activity.
5. Explain $V_{\max}$, the K_m constant and their relationship.
6. Explain the auxiliary substances of enzymes and their sources.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Gaining attention	Regarding chemical reaction and catalysis	Open lecture
5-10	Introduction and review	Recapitulation of previous knowledge regarding enzymes	PPT slides, interactive Q/A
10-50	Explanation and description	Historical background; definition and classification; different sites of an enzyme; mechanism of action; characteristics of action and nomenclature	PPT slides, recap from card topics
50-55	Review of the topics		PPT slides and animation
55-60	Feedback		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-Enzyme.docx · [Back to index](#)

PART IV · ENZYMES

13. Enzymes - 2: Kinetics, Inhibitors, Regulation and Isoenzymes

COURSE	Phase I MBBS — Biochemistry	DURATION	60 minutes
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LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Enumerate the factors influencing enzyme activity.
2. Explain $V_{\max}$, the K_m constant and their relationship.
3. Explain the auxiliary substances of enzymes and their sources.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Introduction and review	Recapitulation of the previous session	Open lecture
5-40	Explanation and description	Factors influencing enzyme activity; $V_{\max}$, the K_m constant and their relationship, Q_{10} ; auxiliary substances of enzymes and their sources; enzyme inhibitors and regulation of enzyme activity	PPT slides, interactive Q/A
40-50	Clinical correlation of enzymes	Isoenzymes and their distribution	PPT slides, recap from card topics
50-55	Review of the topics	Recapitulation of the two lecture sessions	PPT slides and animation
55-60	Feedback		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-enzyme-2.docx · [Back to index](#)

PART V

Bioenergetics

Thermodynamic laws applied to living systems, free energy and coupled reactions, ATP, redox potential, the electron transport chain and oxidative phosphorylation.

2 LESSON PLANS · LESSON PLANS 14-15

PART V · BIOENERGETICS

14. Bioenergetics – 1: Thermodynamics, Free Energy and Coupled Reactions

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes	DATE & TIME	September 2026, 09:30–10:30 am

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define bioenergetics.
2. Explain enthalpy, entropy and free energy.
3. Define and list exergonic and endergonic reactions.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0–5	Introduction to the importance of thermodynamics in medical science		Open lecture
5–20	List the laws with explanation; describe enthalpy and entropy with palatable examples	Laws of thermodynamics, enthalpy and entropy	PPT slides, interactive Q/A
20–40	Definition of exergonic and endergonic reactions; explanation with exothermic and endothermic reactions; examples of these reactions in the human body with coupled reactions	Exergonic and endergonic reactions; coupled reactions	PPT slides
40–55	Explanation of free energy and how the body utilises energy	Definition of bioenergetics; free energy	PPT slides and animation
55–60	Summary of the session	Definition and laws of thermodynamics; different types of chemical reaction in biological systems; free energy and its utilisation	Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — MCQ (SBA + MTF) and PBQ

Source document: Lesson Plan-bioenergetics.docx · [Back to index](#)

PART V · BIOENERGETICS

15. Bioenergetics - 2: Biological Oxidation, ETC and Oxidative Phosphorylation

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes	DATE & TIME	September 2026, 09:30-10:30 am

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define oxidation, reduction and oxidative phosphorylation.
2. Explain the location of the electron transport chain.
3. Mention the inhibitors and regulators of the electron transport chain.
4. Explain coenzyme Q and its functions.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Recapitulation of the previous session		Open lecture
5-10	Definition of ATP and demonstration of the bonds in ATP; why ATP is a high-energy phosphate molecule	ATP; the ATP-ADP cycle; transduction of energy	PPT slides, interactive Q/A
10-15	Explanation of the most common oxidative reactions in biological systems with examples	Oxidation and reduction; oxido-reductive reactions	PPT slides
15-22	Explanation of how free radicals are released and why they tend to become oxidised or reduced	Potentiality of being reduced; redox potential	PPT slides
25-45	Different complexes, substrates and products of the ETC; oxidative phosphorylation; role of ATP synthase	ETC or respiratory chain, its inhibitors and regulators; ATP synthase	PPT slides and video clip
45-57	Explanation with a flowchart of the consequences of lack of oxygen	Response in hypoxic conditions	PPT slides
57-60	Demonstration of the sites of ATP production	Summary	PPT slides

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — MCQ (SBA + MTF) and PBQ

PART VI

Introduction to Metabolism

The organising framework for the metabolism course: definition, purpose, classification, phases and the paradigm of metabolism.

1 LESSON PLAN · LESSON PLAN 16

PART VI · INTRODUCTION TO METABOLISM

16. Introduction to Metabolism

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define metabolism.
2. Mention the purposes of metabolism.
3. Classify metabolism.
4. Enumerate the phases of metabolism.
5. Mention the different types of reaction in metabolism.
6. Draw a paradigm of metabolism.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Gaining attention	Briefly state the metabolism of different fuels in the human body	Open lecture
5-15	Definition, purpose and classification of metabolism	Metabolism	PPT slides, interactive Q/A
15-25	Description of the different phases of metabolism	Phases of metabolism	PPT slides
25-40	Description of the catabolic, anabolic and energy-consuming reactions in metabolism	Different types of metabolic reaction	PPT slides
40-50	Explanation of primary, secondary and tertiary metabolism; mention the high-energy phosphate molecules	Paradigm of metabolism	PPT slides
50-60	Review of the session		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-introduction of metabolism.docx · [Back to index](#)

PART VII

Carbohydrate Metabolism

The TCA cycle, glycolysis, fates of pyruvate and the Cori cycle, gluconeogenesis, the HMP shunt and glycogenesis — a four-lecture block.

4 LESSON PLANS · LESSON PLANS 17-20

PART VII · CARBOHYDRATE METABOLISM

17. Carbohydrate Metabolism - 1: The TCA Cycle

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define the TCA cycle.
2. Explain why the TCA cycle is known as the common metabolic and amphibolic pathway.
3. Describe the different steps with production of reduced coenzymes.
4. Calculate the energy produced in the TCA cycle.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-15	Definition and explanation of the TCA cycle with figures	TCA cycle	PPT slides
15-25	Explanation of the different names with justification	Nomenclature of the TCA cycle	PPT slides, interactive Q/A
25-35	Explanation of the stepwise reactions in which the reducing equivalents are produced	Reduced coenzymes	PPT slides
35-45	Explanation of the importance of the intermediates	Intermediates of the TCA cycle	PPT slides and animation
45-55	Demonstration of substrate-level phosphorylation and calculation of ATP and GTP	Phosphorylation and calculation of ATP	PPT slides and whiteboard
55-60	Review of the session		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-carbohydrate metabolism-1.docx · [Back to index](#)

PART VII · CARBOHYDRATE METABOLISM

18. Carbohydrate Metabolism - 2: Glucostatic Function of the Liver and Glycolysis

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Explain how the liver maintains the blood glucose level.
2. Mention the fates of circulatory glucose.
3. Define glycolysis.
4. Explain the different steps of glycolysis.
5. Locate the site of phosphorylation in the Embden–Meyerhof pathway.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-10	Describe the normal blood glucose level and how it is maintained by the liver	Glucostatic function of the liver	PPT slides
10-20	Explanation of glucose entry into the cell using GLUTs; definition of glycolysis and its importance	Different fates of circulatory glucose; glycolysis	PPT slides, interactive Q/A
20-35	Explanation of the catabolic pathway through a flowchart	Steps of glycolysis	PPT slides
35-45	Substrate-level phosphorylation and production of reduced coenzymes	Phosphorylation in glycolysis	PPT slides and animation
45-55	Explanation of the regulatory and inhibiting reactions of the pathway	Regulation of glycolysis	PPT slides and whiteboard
55-60	Review of the session		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-carbohydrate metabolism-2.docx · [Back to index](#)

PART VII · CARBOHYDRATE METABOLISM

19. Carbohydrate Metabolism - 3: Fates of Pyruvate, Cori Cycle and Gluconeogenesis

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Describe the fates of pyruvate.
2. Explain the fate of lactate and the Cori cycle.
3. Define gluconeogenesis.
4. Correlate gluconeogenesis with glycolysis.
5. Mention the substrates of gluconeogenesis.
6. Mention the important enzymes involved in this pathway.
7. Describe how the pathway is regulated.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-10	Explanation of decarboxylation of pyruvate and conversion of lactate into glucose	Fates of pyruvate and the Cori cycle	PPT slides
10-25	Explanation of the Rapoport-Luebering shunt	Glycolysis in the RBC	PPT slides, interactive Q/A
25-40	Enumerate the substrates of the gluconeogenic pathway and compare with the different steps of glycolysis	Gluconeogenesis	PPT slides
40-45	Description of the 1st, 2nd and 3rd bypass steps of gluconeogenesis	Bypass steps	PPT slides and animation
45-55	Describe the regulatory steps of the gluconeogenic pathway	Regulation	PPT slides and whiteboard
55-60	Review of the session		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

PART VII · CARBOHYDRATE METABOLISM

20. Carbohydrate Metabolism - 4: HMP Shunt and Glycogenesis

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Mention the different names of the HMP shunt.
2. Mention the tissues that use glucose in this pathway and why.
3. Mention the end products and by-products of this pathway.
4. Explain the importance of NADPH.
5. Explain glycogenesis and its regulation.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-05	Different names of the shunt	HMP shunt	PPT slides
05-10	Enumerate the different tissues in which the shunt takes place	Sites of the HMP shunt	PPT slides, interactive Q/A
10-15	Mention ribose sugar and reduced coenzyme	Products and by-products of the shunt	PPT slides
15-30	Explanation of how the RBC utilises NADPH to prevent lysis	Importance of NADPH	PPT slides and animation
30-50	Explanation of the synthetic pathway of glycogen	Glycogenesis	PPT slides and whiteboard
50-60	Review of carbohydrate metabolism		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-carbohydrate metabolism-4.docx · [Back to index](#)

PART VIII

Lipid and Lipoprotein Metabolism

Lipolysis, β -oxidation and ATP yield, ketone bodies, lipogenesis, cholesterol synthesis and its regulation, and the metabolism of the plasma lipoproteins.

5 LESSON PLANS · LESSON PLANS 21-25

PART VIII · LIPID AND LIPOPROTEIN METABOLISM

21. Lipid Metabolism - 1: Lipolysis and the Fate of Glycerol

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Mention the principal lipids of metabolic importance.
2. Explain the fate of glycerol produced from lipolysis.
3. Explain how glycerol is engaged in the gluconeogenic and glycolytic pathways.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Gaining attention	Briefly state the importance of lipid metabolism for the human body	Open lecture
5-15	Explain the differentiation of blood lipids and metabolic lipids	Important lipids used as metabolic fuel	PPT slides, interactive Q/A
15-35	Enzymes involved in this process; in which compartment of the cell it occurs; importance of lipolysis and its end products	Lipolysis	PPT slides
35-55	Explained how the liver utilises free glycerol to produce TAG; how glycerol is involved in glycolysis and gluconeogenesis	Fates of the end products of lipolysis	PPT slides and animation
55-60	Review of the session		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-lipid metabolism-1.docx · [Back to index](#)

PART VIII · LIPID AND LIPOPROTEIN METABOLISM

22. Lipid Metabolism - 2: β -Oxidation of Fatty Acids and ATP Yield

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Describe the different steps of oxidation of fatty acids.
2. Calculate the ATP generated from fatty acids through oxidation.
3. List the fates of acetyl-CoA.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Recapitulation of lipolysis and the fate of the end products	Gist of the previous session	Open lecture
5-25	Description of the carnitine shuttle mechanism; why this is called β -oxidation; end products of the oxidative reaction	Oxidation of long-chain fatty acids	PPT slides, interactive Q/A and animation
25-35	Explanation of the fate of propionic acid	Oxidation of odd-numbered fatty acids	PPT slides
35-50	List the reduced coenzymes gained from the oxidative pathway; explain the fate of acetyl-CoA and how many reducing equivalents are obtained from the TCA cycle	Calculation of ATP	PPT slides
50-55	List the products produced from acetyl-CoA	Fates of acetyl-CoA	PPT slides
55-60	Review of the session		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-lipid metabolism-2.docx · [Back to index](#)

PART VIII · LIPID AND LIPOPROTEIN METABOLISM

23. Lipid Metabolism - 3: Ketone Bodies and Lipogenesis

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Mention the ketone bodies and how the body synthesises and utilises them.
2. Describe the process of lipogenesis.
3. Explain the conversion of carbohydrate into lipid.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Recapitulation of the products produced from acetyl-CoA	Review of the previous class	Open lecture
5-20	List the primary and secondary ketone bodies; explain the hepatocytic synthesis pathway and the interrelation of these ketones	Synthesis of ketone bodies	PPT slides, interactive Q/A and animation
20-35	Explanation of how they are excreted from the body and how and when they are used as an alternative fuel	Fates of ketone bodies	PPT slides
35-50	List the lipogenic cells; free glycerol and esterified glycerol are further esterified and converted into TAG	Lipogenesis	PPT slides
50-55	How TAG is synthesised from carbohydrate	Lipid from carbohydrate	PPT slides
55-60	Review of the session		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-lipid metabolism-3.docx · [Back to index](#)

PART VIII · LIPID AND LIPOPROTEIN METABOLISM

24. Lipid Metabolism - 4: Cholesterol Synthesis and its Regulation

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Explain the synthesis of cholesterol and its regulation.
2. Describe the regulatory steps of synthesis.
3. Explain the relation between cholesterol and a saturated or unsaturated lipid diet.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Described the importance of cholesterol for the human body	Cholesterol	Open lecture
5-20	Briefing on the synthetic pathway of cholesterol	Synthesis of cholesterol	PPT slides, interactive Q/A and animation
20-30	Importance of the enzyme and its clinical role	Rate-limiting enzyme and regulation of synthesis	PPT slides
30-45	Relation of serum cholesterol level with diet and fasting	Clinical explanation	PPT slides
45-55	A summary of lipid metabolism		PPT slides
55-60	Feedback from learners		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-lipid metabolism-4.docx · [Back to index](#)

PART VIII · LIPID AND LIPOPROTEIN METABOLISM

25. Lipoprotein Metabolism

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define lipoprotein and apolipoprotein.
2. Describe the different forms of chylomicron and how it is metabolised.
3. Explain the conversion of VLDL and IDL into LDL.
4. Explain the mechanism of formation of the atherosclerotic plaque.
5. Enumerate the steps of reverse cholesterol transport.
6. Explain ACAT and LCAT (PCAT).

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Definition and visualisation of the lipoprotein molecule	Lipoprotein and apolipoprotein	Open lecture
5-20	Explanation of the metabolic pathway of chylomicron and how exogenous lipids are made available in the circulation	Chylomicron metabolism	PPT slides, interactive Q/A
20-30	Production of VLDL from the liver and its conversion into LDL	VLDL, IDL and LDL	PPT slides
30-45	Reverse cholesterol transport and the role of LDL and HDL lipoprotein	Metabolism of HDL	PPT slides and animation
45-50	Explanation of the role of these enzymes in cellular uptake and atherosclerotic change of vessels	LCAT and ACAT	PPT slides
50-55	Explained the clinical importance of NASH	Fatty change of the liver	PPT slides
55-60	Review of the session		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-lipoprotein metabolism.docx · [Back to index](#)

PART IX

Protein and Amino Acid Metabolism

The amino acid pool and protein turnover, transamination and deamination, ammonia transport, the urea cycle and ammonia intoxication.

2 LESSON PLANS · LESSON PLANS 26-27

In the source files these two plans carried the heading “Lipid Metabolism”; the title has been corrected here to match their actual content.

PART IX · PROTEIN AND AMINO ACID METABOLISM

26. Protein Metabolism - 1: Amino Acid Pool, Protein Turnover and Transamination

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Describe the amino acid pool and its sources.
2. Mention the non-protein nitrogenous substances.
3. Explain the turnover of protein.
4. Describe transamination and its importance.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Gaining attention	Briefly state the importance of protein or amino acid metabolism for the human body	Open lecture
5-20	Definition, amount and explanation with a flowchart	Amino acid pool	PPT slides, interactive Q/A
20-25	List the NPN substances, their sources and importance; explained the amount of protein excreted from the body and regained	NPN substances; protein turnover	PPT slides
25-45	Explanation of transamination, the importance of the coenzyme and of transamination; how the non-essential amino acids are synthesised in the body; which amino acid is most common in this reaction	Different metabolic pathways of amino acids	PPT slides and animation
45-50	Mention oxidative and non-oxidative deamination	Deamination	PPT slides
50-60	Review of the session		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-protein metabolism-1.docx · [Back to index](#)

PART IX · PROTEIN AND AMINO ACID METABOLISM

27. Protein Metabolism - 2: Urea Cycle and Ammonia Intoxication

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Explain deamination and the transport of ammonia.
2. Describe the urea cycle and the fate of urea.
3. Describe the metabolism of ammonia and ammonia intoxication.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Briefly recapitulate	Previous session	Open lecture
5-20	Description of the reaction; how the amine group is removed; which amino acid is commonly involved; how ammonia is transiently detoxified and carried to the hepatocyte	Oxidative deamination	PPT slides, interactive Q/A
20-35	Explanation of the cycle; formation and excretion of urea from the body; portohepatic circulation of urea	Urea cycle	PPT slides
35-50	Explained why toxicity develops; biochemical explanation of intoxication	Ammonia intoxication	PPT slides and animation
50-55	Explanation of the clinical scenario and solving the problem	PBQ	PPT slides
55-60	Review of the session		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-protein metabolism-2.docx · [Back to index](#)

PART X

Nutrition and Energy Metabolism

Basic concepts of food and nutrition, dietary indices, balanced diet, nutritional disorders, and the measurement and calculation of metabolic rate and total daily calorie requirement.

4 LESSON PLANS · LESSON PLANS 28-31

PART X · NUTRITION AND ENERGY METABOLISM

28. Nutrition and Food - 1: Basic Concepts and Dietary Indices

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes	DATE & TIME	3 August 2026, 09:30–10:30 am

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define nutrition, nutrient, food and diet.
2. Mention the proximate principles of food.
3. Describe the benefits of dietary fibre.
4. Mention and describe the different dietary indices.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Introduction to the importance of the new card in medical science		Open lecture
5-20	Explanation of the concepts of nutrition, nutrients, food and diet	Basic definitions regarding food and nutrition	PPT slides, interactive Q/A
20-40	Explanation of the reasons why they are treated as the basic components of food	Proximate principles of food	PPT slides
40-55	Definition and description of DRIs — RDA, MDR — and the factors affecting the indices, with examples	Dietary indices	PPT slides and animation
55-60	Review of the session and feedback		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-nutrition-1.docx · [Back to index](#)

PART X · NUTRITION AND ENERGY METABOLISM

29. Nutrition and Food - 2: Balanced Diet, SDA and Nutritional Assessment

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes	DATE & TIME	10 August 2026, 09:30-10:30 am

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define a balanced diet and prepare a diet chart.
2. Describe SDA and its importance.
3. Mention the nutritional disorders in our community.
4. Assess nutritional status by anthropometric indices.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Recapitulation of the last session		Open lecture
5-20	Explain the concept of why it is known as balanced; preparation of a diet chart; discussion of previous questions regarding the topic	Balanced diet	PPT slides, interactive Q/A
20-30	Explanation of the thermic effect of food and its importance	SDA	PPT slides
30-45	Mentioning the under- and over-nutritional disorders of our society	Nutritional disorders	PPT slides and animation
45-55	Explanation and visualisation of different anthropometric scales and the WHO-prescribed scale	Measurement of nutritional status	PPT slides and calculation on the whiteboard
55-60	Review of the session and feedback		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-nutrition-2.docx · [Back to index](#)

PART X · NUTRITION AND ENERGY METABOLISM

30. Nutrition and Food - 3: Protein-Energy Malnutrition and Obesity

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes	DATE & TIME	17 August 2026, 09:30-10:30 am

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Describe PEM and differentiate kwashiorkor from marasmus.
2. Mention and describe the over-nutritional disorders.
3. Mention the complications and clinical consequences of obesity.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Recapitulation of the last session		Open lecture
5-20	Definition, classification, clinical presentation, biochemical findings and the basic difference between marasmus and kwashiorkor are explained	Protein-energy malnutrition	PPT slides, focusing on pictures of PEM
20-30	Definition and interpretation of anthropometric scales; calculation of BMI	Obesity	PPT slides
30-45	How and when an individual becomes obese; explanation of the complications of an obese person; clinical consequences of obesity	Complications of obesity	PPT slides and animation
45-60	Review of the session and feedback on all three sessions on food and nutrition		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-nutrition-3.docx · [Back to index](#)

PART X · NUTRITION AND ENERGY METABOLISM

31. Metabolic Rate, Basal Metabolic Rate and Total Calorie Calculation

COURSE	MBBS Phase I — Biochemistry	YEAR	1st year
DURATION	60 minutes	VENUE	Lecture gallery
TEACHING METHOD	Interactive lecture with PowerPoint presentation	INSTRUCTOR	Dr. Farjana Sharmin
DATE	2 August 2026		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define metabolic rate and basal metabolic rate.
2. Describe the standard conditions required for measuring BMR.
3. Explain the physiological processes responsible for basal energy expenditure.
4. Differentiate between basal metabolic rate and resting metabolic rate.
5. Mention the major factors affecting BMR.
6. Describe the procedure of measuring BMR using the Atwater-Benedict-Roth apparatus.
7. Calculate metabolic rate from oxygen consumption.
8. Explain the Harris-Benedict equations for estimating BMR.
9. Describe the relationship between body surface area and BMR.
10. State the approximate normal values of BMR.
11. Define specific dynamic action or the thermic effect of food.
12. Explain the effect of carbohydrate, protein and fat on diet-induced thermogenesis.
13. Classify different levels of physical activity.
14. Calculate the total daily energy requirement of an individual.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Introduction and review	Introduction to body weight and body composition; concept of energy balance; energy intake and energy expenditure	Open lecture and interactive questioning
5-10	Explanation of food energy	Energy content of food; definition of calorie and kilocalorie; components of daily energy requirement — BMR, thermic effect of food and physical activity	PowerPoint slides and examples
10-15	Explanation of metabolic rate	Definition of metabolic rate; energy liberated per unit time; energy equivalent of oxygen; calculation: $0.25 \text{ L oxygen/minute} \times 4.8 \text{ kcal/L} = 1.2 \text{ kcal/minute}$	PowerPoint slides and calculation on whiteboard
15-23	Description of BMR	Definition of basal metabolic rate; BMR as the minimum energy expenditure necessary to maintain life; contribution of BMR to total daily energy expenditure	Interactive lecture
23-28	Discussion of basal conditions	Twelve hours of fasting; overnight sound sleep; awake state; complete physical and mental rest; comfortable environmental temperature; minimum voluntary activity	PowerPoint slides and question-answer session

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
28-33	Physiological significance of BMR	Energy expenditure for cardiac activity, respiration, temperature regulation, muscle tone, renal function, ion transport, neural activity, synthesis of enzymes and hormones, and gastrointestinal movement	PowerPoint slides and explanation
33-37	Comparison between BMR and RMR	Conditions for measuring BMR and RMR; RMR under less strict and sometimes non-fasting conditions; reasons why RMR is higher than BMR	Comparative explanation using a table
37-42	Factors affecting BMR	Age; height and body surface area; growth; pregnancy; lean body mass; fever; stress; environmental temperature; fasting and starvation; malnutrition; thyroxine	PowerPoint slides and interactive discussion
42-47	Measurement of BMR	Atwater-Benedict-Roth basal metabolism apparatus; closed-circuit method; oxygen consumption; absorption of carbon dioxide by soda lime; recording oxygen consumption over six minutes	Diagram, PowerPoint slides and explanation
47-52	Calculation and normal values of BMR	Calculation of heat production from oxygen consumption; Harris-Benedict equations for men and women; expression of BMR as kcal/m ² /hour; body surface area using the DuBois formula; approximate normal values presented in the lecture	PowerPoint slides and numerical demonstration
52-56	Specific dynamic action	Definition of SDA or thermic effect of food; energy needed for digestion, absorption, transport and storage; thermic effects of carbohydrate, protein and fat; approximate SDA of a mixed diet	PowerPoint slides and food-based examples
56-59	Physical activity and calorie requirement	Sedentary, moderate and heavy activity; activity-related additions to BMR; Harris-Benedict activity factors; additional energy requirements during pregnancy and lactation	PowerPoint slides and worked example
59-60	Summary and evaluation	Recapitulation of definitions, basal conditions, measurement and calculation; one-minute oral assessment	Interaction and question-answer session

TEACHING MATERIALS

- PowerPoint presentation
- Multimedia projector
- Whiteboard and markers
- Charts showing BMR, RMR, SDA and physical activity factors

Source document: Lesson Plan. BMR.docx · [Back to index](#)

PART XI

Vitamins

The fat-soluble vitamins A, E, D and K, the energy-yielding and other water-soluble B vitamins with vitamin C, and the haematopoietic vitamins B9 and B12 — each with its active coenzyme form, biochemical role and deficiency syndrome.

7 LESSON PLANS · LESSON PLANS 32–38

PART XI · VITAMINS

32. Vitamin A and Vitamin E

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes	DATE & TIME	7 September 2026, 09:30–10:30 am

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Link this knowledge with the clinical presentation of different nutritional problems.
2. List the fat- or lipid-soluble vitamins, especially vitamins A and E.
3. Explain why they are called so.
4. Mention the different forms of these vitamins and their sources.
5. Describe the visual cycle.
6. Mention their deficiency disorders, especially xerophthalmia.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Introduction to the lipid-soluble vitamins and the history of their discovery		Open lecture
5-15	Explanation of natural sources and the different chemical forms, and how they are available in nature	Different forms and sources of vitamin A	PPT slides, interactive Q/A
15-25	Explanation of the role of vitamin A in vision and colour vision	Visual cycle	PPT slides
25-30	Dark adaptation and the function of cone cells	Adaptation of vision	PPT slides
30-40	Description of xerophthalmia	Deficiency disorders	PPT slides and drawing
40-50	Different forms of vitamin E, its active form and role	Forms of vitamin E	PPT slides
50-55	Description of extraocular manifestations	Other deficiency disorders	PPT slides
55-60	Review of the session and feedback		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

PART XI · VITAMINS

33. Vitamin D and Vitamin K

COURSE	MBBS Phase I — Biochemistry	YEAR	1st year
DURATION	60 minutes	TEACHING METHOD	Interactive lecture
VENUE	Lecture gallery	TEACHER	Dr. Farjana Sharmin
TOPIC	Vitamin D and vitamin K		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. State the major forms of vitamin D.
2. Describe the important sources of vitamin D.
3. Explain the activation of vitamin D in the skin, liver and kidney.
4. Explain the role of calcitriol in calcium and phosphate homeostasis.
5. Describe the major manifestations of vitamin D deficiency.
6. State the major forms of vitamin K.
7. Describe the important sources of vitamin K.
8. Explain the role of vitamin K in gamma-carboxylation of glutamate residues.
9. List the major vitamin K-dependent proteins involved in blood coagulation.
10. Describe the important manifestations of vitamin K deficiency.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	TOPIC	DETAILED CONTENT	METHOD
0–5 min	Introduction	Overview of fat-soluble vitamins and the importance of vitamins D and K in calcium homeostasis, bone health and blood coagulation.	Interactive discussion, PPT
5–10 min	Vitamin D — forms and sources	Vitamin D2 (ergocalciferol) and D3 (cholecalciferol); sunlight exposure, fish, egg yolk, liver and fortified foods.	Interactive lecture, PPT
10–18 min	Vitamin D — activation	Formation of cholecalciferol in skin; 25-hydroxylation in liver to 25-hydroxyvitamin D (calcidiol); 1- α -hydroxylation in kidney to active 1,25-dihydroxyvitamin D (calcitriol). Brief regulation by PTH, calcium and phosphate.	Lecture, flowchart, PPT
18–28 min	Vitamin D — functions	Role of calcitriol in increasing intestinal absorption of calcium and phosphate; renal conservation and maintenance of bone mineralisation and calcium balance.	Lecture, whiteboard, PPT
28–35 min	Vitamin D — deficiency and clinical correlation	Deficiency leading to impaired mineralisation: rickets in children and osteomalacia in adults. Discuss common biochemical and skeletal consequences at an introductory level.	Clinical discussion, PPT
35–40 min	Vitamin K — forms and sources	Vitamin K1 (phyloquinone) and vitamin K2 (menaquinones); green leafy vegetables and intestinal bacterial contribution.	Interactive lecture, PPT

TIME	TOPIC	DETAILED CONTENT	METHOD
40-49 min	Vitamin K — biochemical role	Vitamin K as a cofactor for gamma-glutamyl carboxylase; gamma-carboxylation of glutamate residues permits calcium binding and functional activation of vitamin K-dependent proteins.	Lecture, whiteboard, PPT
49-55 min	Vitamin K — clinical importance and deficiency	Vitamin K-dependent coagulation factors II, VII, IX and X and proteins C and S. Deficiency may cause prolonged bleeding; briefly mention newborn susceptibility and the relationship with vitamin K antagonists.	Clinical correlation, PPT
55-60 min	Summary and assessment	Sequential recap: vitamin D → activation → calcitriol → calcium/phosphate balance → rickets/osteomalacia; vitamin K → gamma-carboxylation → coagulation proteins → bleeding tendency. Short oral questions and key take-home messages.	Q&A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for activation pathways and biochemical mechanisms
- Marker and laser pointer

Source document: MBBS lesson plan vitamin D & vitamin K.docx · [Back to index](#)

PART XI · VITAMINS

34. Energy-Yielding Vitamins: B1 (Thiamine), B2 (Riboflavin) and B3 (Niacin)

COURSE	MBBS Phase I — Biochemistry	YEAR	1st year
DURATION	60 minutes	TEACHING METHOD	Interactive lecture
VENUE	Lecture gallery	TEACHER	Dr. Farjana Sharmin
TOPIC	Energy-yielding vitamins: vitamin B1 (thiamine), vitamin B2 (riboflavin) and vitamin B3 (niacin)		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Describe vitamin B1 (thiamine) and its active coenzyme form, TPP.
2. Explain how TPP helps in oxidative decarboxylation reactions.
3. Explain the role of thiamine in transketolase reactions.
4. Describe the important features of thiamine deficiency, including beriberi and Wernicke-Korsakoff syndrome.
5. Describe vitamin B2 (riboflavin) and its active forms, FMN and FAD.
6. Explain how FMN and FAD take part in oxidation-reduction reactions.
7. Describe the common features of riboflavin deficiency.
8. Describe vitamin B3 (niacin) and its active forms, NAD and NADP.
9. Explain how NAD and NADP contribute to energy-producing reactions.
10. Describe pellagra and its major clinical features.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	TOPIC	DETAILED CONTENT	METHOD
0-5 min	Introduction	Concept of energy-yielding vitamins. Introduce B1, B2 and B3 as water-soluble vitamins that function through coenzyme forms involved in energy metabolism.	Interactive discussion, PPT
5-9 min	Vitamin B1 — introduction and active form	Thiamine (vitamin B1); anti-beriberi/antineuritic factor. Active coenzyme form: thiamine pyrophosphate (TPP). Briefly relate thiamine to glucose metabolism and normal nerve, muscle and heart function.	Interactive lecture, PPT
9-16 min	Vitamin B1 — biochemical functions	TPP-dependent oxidative decarboxylation of pyruvate to acetyl-CoA and alpha-ketoglutarate to succinyl-CoA. TPP also acts as a coenzyme for transketolase in the HMP shunt. Relate these reactions to ATP production and cellular energy metabolism.	Lecture, PPT and whiteboard
16-23 min	Vitamin B1 — deficiency and clinical correlation	Explain why the nervous system is sensitive to thiamine deficiency. Discuss dry, wet and infantile beriberi; Wernicke encephalopathy and Wernicke-Korsakoff syndrome. Mention erythrocyte transketolase activity as an assay of thiamine status.	Clinical discussion, PPT

TIME	TOPIC	DETAILED CONTENT	METHOD
23–27 min	Vitamin B2 — introduction and active forms	Riboflavin (vitamin B2), a yellow-green fluorescent water-soluble vitamin. Active coenzyme forms: FMN and FAD. Introduce its general role in oxidation–reduction reactions.	Interactive lecture, PPT
27–33 min	Vitamin B2 — biochemical functions	FMN/FAD act as hydrogen/electron carriers in energy metabolism and assist metabolism of carbohydrate, fat and protein. Examples from the lecture: succinate to fumarate and oxidation of fatty acyl-CoA.	Lecture, PPT and whiteboard
33–39 min	Vitamin B2 — deficiency and clinical correlation	Riboflavin deficiency: glossitis, magenta tongue, angular stomatitis/cheilosis, dermatitis, cracks and sores around the mouth and lips, and ocular manifestations such as corneal vascularisation, keratitis and watering of eyes.	Clinical correlation, PPT
39–43 min	Vitamin B3 — introduction and active forms	Niacin (vitamin B3), also called nicotinic acid/nicotinamide. Active coenzyme forms: NAD and NADP. Note that niacin can be synthesised in the body from tryptophan.	Interactive lecture, PPT
43–49 min	Vitamin B3 — biochemical functions	NAD/NADP participate in dehydrogenation and oxidation–reduction reactions involved in energy metabolism. Examples from the lecture include glyceraldehyde-3-phosphate to 1,3-BPG and pyruvate to acetyl-CoA. Briefly mention the lipid-lowering action of niacin described in the lecture.	Lecture, PPT and whiteboard
49–55 min	Vitamin B3 — deficiency and clinical correlation	Pellagra: the 4 Ds — diarrhoea, dermatitis, dementia and death. Discuss photosensitive dermatitis, Casal's necklace, pellagra glove/boot, glossitis and stomatitis.	Clinical discussion, PPT
55–60 min	Summary and assessment	Sequential recap: B1 → TPP → oxidative decarboxylation/transketolase → beriberi/Wernicke–Korsakoff; B2 → FMN/FAD → redox reactions → glossitis/cheilosis; B3 → NAD/NADP → dehydrogenation → pellagra. Short oral questions and take-home messages.	Q&A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for metabolic pathways and comparison diagrams
- Marker and laser pointer

Source document: MBBS lesson plan energy yielding vitamins 1.docx · [Back to index](#)

PART XI · VITAMINS

35. Vitamin B5 (Pantothenic Acid) and Vitamin B7 (Biotin)

COURSE	MBBS Phase I — Biochemistry	YEAR	1st year
DURATION	60 minutes	TEACHING METHOD	Interactive lecture
VENUE	Lecture gallery	TEACHER	Dr. Farjana Sharmin
TOPIC	Vitamin B5 (pantothenic acid) and vitamin B7 (biotin)		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Describe pantothenic acid as vitamin B5 and a component of coenzyme A (CoA).
2. Explain how CoA helps transfer acyl groups in metabolic reactions.
3. Describe the role of vitamin B5 in carbohydrate and fat metabolism.
4. List important compounds formed with the involvement of CoA.
5. Describe biotin as vitamin B7 and a coenzyme for carboxylase enzymes.
6. Explain the role of biotin in gluconeogenesis and fatty-acid metabolism.
7. Describe the important functions of biotin in the body.
8. Describe the common features of biotin deficiency.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	TOPIC	DETAILED CONTENT	METHOD
0-5 min	Introduction	Overview of water-soluble B vitamins in metabolism. Clarify that the supplied lecture does not include a vitamin B4 section.	Interactive discussion, PPT
5-10 min	Vitamin B5: introduction	Pantothenic acid; meaning of “pantos”; water-soluble nature; component of CoA; dietary requirement overview.	Interactive lecture, PPT
10-20 min	Vitamin B5: CoA and mechanism	CoA as an acyl-group carrier; reactive -SH group; formation of acetyl-CoA, fatty acyl-CoA and succinyl-CoA.	Lecture, PPT and whiteboard
20-30 min	Vitamin B5: metabolic roles	Role in pyruvate → acetyl-CoA, the TCA cycle, fatty-acid activation and β -oxidation; contribution to ATP production.	Diagram discussion, PPT
30-35 min	Vitamin B5: other functions	Role of CoA-derived intermediates in synthesis of fatty acids, cholesterol, steroid hormones, ketone bodies, acetylcholine and haem.	Interactive lecture, PPT
35-40 min	Vitamin B7: introduction	Biotin; also known as vitamin H and coenzyme R; daily requirement overview.	Interactive lecture, PPT
40-48 min	Vitamin B7: coenzyme role	Biotin as a coenzyme for carboxylase enzymes; involvement in gluconeogenesis and metabolism/synthesis of fatty acids and selected amino acids.	Lecture, PPT and whiteboard
48-53 min	Vitamin B7: functions	Role in glucose production, fatty-acid and amino-acid metabolism; maintenance of skin, mucous membranes, nervous system and hair.	Interactive lecture, PPT

TIME	TOPIC	DETAILED CONTENT	METHOD
53-57 min	Vitamin B7: deficiency	Nausea, anorexia, seborrheic erythematous rash; in infants, alopecia, rash around the ears and hypotonia.	Clinical correlation, PPT
57-60 min	Summary and assessment	Recap of CoA-dependent functions of B5 and carboxylase-dependent functions of B7; short oral questions and key take-home messages.	Q&A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for pathways, reaction diagrams and flowcharts
- Marker and laser pointer

Source document: MBBS lesson plan energy yielding vitamins 2.docx · [Back to index](#)

PART XI · VITAMINS

36. Water-Soluble Vitamins: Vitamin C and Vitamin B6

COURSE	MBBS Phase I — Biochemistry	YEAR	1st year
DURATION	60 minutes	TEACHING METHOD	Interactive lecture
VENUE	Lecture gallery	TEACHER	Dr. Farjana Sharmin
TOPIC	Water-soluble vitamins: vitamin C and vitamin B6		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Describe the general characteristics of water-soluble vitamins.
2. List the major dietary sources and RDA of vitamin C and vitamin B6.
3. Explain the major biochemical functions of vitamin C, including collagen maturation, iron absorption and antioxidant action.
4. Describe the biochemical basis and major clinical features of vitamin C deficiency (scurvy).
5. Identify the three forms of vitamin B6 and state pyridoxal phosphate (PLP) as its active coenzyme form.
6. Explain the role of PLP in amino-acid metabolism and neurotransmitter synthesis.
7. Explain the roles of vitamin B6 in haem synthesis, glycogenolysis, tryptophan-to-niacin conversion, transsulfuration and sphingolipid synthesis.
8. Describe the major features of vitamin B6 deficiency, including peripheral neuropathy and hypochromic microcytic anaemia.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	TOPIC	DETAILED CONTENT	METHOD
0-5 min	Introduction	Definition and general characteristics of water-soluble vitamins: water solubility, easy absorption, limited storage (except B12), urinary excretion and coenzyme roles.	Interactive discussion, PPT
5-13 min	Vitamin C: sources and RDA	Ascorbic acid; major fruit and vegetable sources. RDA: infants, children, adults, pregnancy and lactation.	Interactive lecture, PPT
13-26 min	Vitamin C: functions	Collagen maturation by hydroxylation of proline and lysine; increased non-haem iron absorption; antioxidant action; roles in catecholamine synthesis, steroidogenesis, tyrosine, cholesterol and folate metabolism.	Lecture with questioning, PPT and whiteboard
26-35 min	Vitamin C deficiency	Scurvy: defective collagen formation and its clinical features including bleeding gums, petechiae/bruising, woody leg, joint/nasal/GIT bleeding, delayed wound healing and iron deficiency anaemia.	Clinical correlation, PPT
35-42 min	Vitamin B6: forms, sources and RDA	Pyridoxine, pyridoxal and pyridoxamine; active form pyridoxal phosphate (PLP). Major animal and plant sources and RDA.	Interactive lecture, PPT
42-52 min	Vitamin B6: major functions	PLP in transamination, deamination, decarboxylation and transsulfuration; neurotransmitter synthesis; haem and RBC formation; glycogen phosphorylase; tryptophan-to-niacin conversion; cysteine formation and sphingolipid synthesis.	Interactive lecture, PPT and whiteboard

TIME	TOPIC	DETAILED CONTENT	METHOD
52-56 min	Vitamin B6 deficiency	Reduced biogenic amine synthesis, demyelination/peripheral neuropathy and decreased haem synthesis leading to hypochromic microcytic anaemia.	Clinical correlation, PPT
56-60 min	Summary and assessment	Recap of key functions, active forms and deficiency features of vitamins C and B6; short oral questions and take-home messages.	Q&A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for diagrams, reaction pathways and flowcharts
- Marker and laser pointer

Source document: MBBS lesson plan water soluble vitamins (vit-C & vit B6).docx · [Back to index](#)

PART XI · VITAMINS

37. Vitamin B9 (Folic Acid)

COURSE	MBBS Phase I — Biochemistry	YEAR	1st year
DURATION	60 minutes	TEACHING METHOD	Interactive lecture
VENUE	Lecture gallery	TEACHER	Dr. Farjana Sharmin
TOPIC	Vitamin B9 (folic acid)		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Describe the basic structure and dietary sources of folic acid.
2. State tetrahydrofolate (THF) as the active form of folate.
3. Explain the role of THF in one-carbon transfer reactions.
4. Describe the role of folate in purine and thymidylate synthesis.
5. Explain the role of folate in methionine and homocysteine metabolism.
6. Describe the folate trap in vitamin B12 deficiency.
7. List the important causes of folate deficiency.
8. Describe the major manifestations of folate deficiency.
9. Explain the relationship between folate deficiency and megaloblastic anaemia.
10. Describe the importance of folate in prevention of neural tube defects.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	TOPIC	DETAILED CONTENT	METHOD
0-5 min	Introduction	Overview of vitamin B9; folic acid/folate; importance in rapidly dividing cells and DNA synthesis.	Interactive discussion, PPT
5-10 min	Structure, sources and absorption	Pteridine ring, PABA and glutamate; dietary sources; absorption mainly from the jejunum; daily requirement and increased need in pregnancy.	Lecture, PPT
10-17 min	Active form of folate	Conversion of folate to DHF and tetrahydrofolate (THF); THF as the active coenzyme form.	Interactive lecture, PPT
17-29 min	One-carbon metabolism	THF as carrier of one-carbon units; major folate derivatives and their role in transfer reactions.	Lecture with diagram, PPT/whiteboard
29-39 min	Major biochemical functions	Serine to glycine conversion; thymidylate synthesis; purine synthesis; histidine catabolism; methionine formation from homocysteine.	Interactive lecture, pathway discussion
39-44 min	Folate trap	Dependence of N5-methyl-THF regeneration on vitamin B12; functional folate deficiency in B12 deficiency.	Diagram discussion, PPT
44-52 min	Folate deficiency	Causes: increased requirement, poor intake, malabsorption, drugs and the folate trap; reduced DNA synthesis, macrocytic/megaloblastic anaemia and hyperhomocysteinaemia.	Clinical correlation, PPT

TIME	TOPIC	DETAILED CONTENT	METHOD
52-56 min	Pregnancy and neural tube defects	Importance of folate in pregnancy; relationship of deficiency to neural tube defects and the preventive supplementation concept.	Clinical discussion, PPT
56-60 min	Summary and assessment	Recap of THF, one-carbon metabolism, DNA synthesis, folate trap and deficiency; short oral questions.	Q&A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for pathways, reaction diagrams and flowcharts
- Marker and laser pointer

Source document: MBBS lesson plan hematopoietic vitamins (folic acid).docx · [Back to index](#)

PART XI · VITAMINS

38. Vitamin B12 (Cobalamin)

COURSE	MBBS Phase I — Biochemistry	YEAR	1st year
DURATION	60 minutes	TEACHING METHOD	Interactive lecture
VENUE	Lecture gallery	TEACHER	Dr. Farjana Sharmin
TOPIC	Vitamin B12 (cobalamin)		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Describe vitamin B12 (cobalamin), its basic structure and important forms.
2. State methylcobalamin and 5'-deoxyadenosylcobalamin as the active coenzyme forms.
3. Describe the dietary sources and absorption of vitamin B12.
4. Explain the role of intrinsic factor and the terminal ileum in vitamin B12 absorption.
5. Explain the role of vitamin B12 in the methionine synthase reaction.
6. Explain the role of vitamin B12 in the methylmalonyl-CoA mutase reaction.
7. Describe the relationship of vitamin B12 with folate metabolism, DNA synthesis and myelin maintenance.
8. Describe the major causes and clinical features of vitamin B12 deficiency.
9. Outline the laboratory methods used to detect vitamin B12 deficiency.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	TOPIC	DETAILED CONTENT	METHOD
0-5 min	Introduction and structure	Vitamin B12 as cobalamin; corrin ring with cobalt; overview of cyanocobalamin, hydroxocobalamin, methylcobalamin and adenosylcobalamin.	Interactive discussion, PPT
5-10 min	Sources and active forms	Major dietary sources shown in the lecture; methylcobalamin and 5'-deoxyadenosylcobalamin as the two biologically active coenzyme forms.	Lecture, PPT
10-20 min	Absorption and transport	Food-bound B12 released by HCl and pepsin; binding to cobalophilin/haptocorrin/R-protein; pancreatic proteases; intrinsic factor binding; terminal ileal absorption through the cubilin receptor; transport by transcobalamin II.	Flowchart discussion, PPT/whiteboard
20-31 min	B12-dependent reactions	Methionine synthase: homocysteine → methionine using methylcobalamin. Methylmalonyl-CoA mutase: methylmalonyl-CoA → succinyl-CoA using adenosylcobalamin.	Interactive lecture, pathway discussion
31-38 min	Folate relationship and DNA synthesis	Regeneration of THF from N5-methyl-THF; role in purine and thymidylate synthesis; folate trap; importance for normal DNA synthesis and cell division.	Diagram discussion, PPT
38-44 min	Methylation and myelin	Formation of SAM from methionine; role in methylation reactions; relationship of methionine, choline, lecithin and sphingomyelin to myelin; effect of impaired methylmalonyl-CoA metabolism on nervous tissue.	Lecture with flowchart, PPT

TIME	TOPIC	DETAILED CONTENT	METHOD
44-52 min	Deficiency and clinical features	Causes highlighted in the lecture: poor dietary intake, vegetarian/vegan diet, atrophic gastritis, pernicious anaemia, small-intestinal disorders and alcohol misuse. Haematological, gastrointestinal and neurological features; impaired RBC maturation and reduced turnover of intestinal cells.	Clinical correlation, PPT
52-56 min	Detection of deficiency	Serum vitamin B12 assessment, the Schilling test as presented in the lecture, peripheral blood smear with hypersegmented neutrophils, and biochemical markers such as homocysteine and methylmalonic acid.	Case-based discussion, PPT
56-60 min	Summary and assessment	Recap of absorption, coenzyme reactions, folate relationship, myelin and deficiency; short oral questions and take-home messages.	Q&A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for pathways, reaction diagrams and flowcharts
- Marker and laser pointer

Source document: MBBS lesson plan hematopoietic vitamins (cobalamin).docx · [Back to index](#)

PART XII

Minerals

Classification of minerals, the metabolism of iron and iodine with their deficiency disorders, and an overview of the other macro- and micro-minerals.

2 LESSON PLANS · LESSON PLANS 39-40

PART XII · MINERALS

39. Minerals – 1: Classification and Iron Metabolism

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes	DATE & TIME	24 August 2026, 09:30-10:30 am

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define minerals.
2. Classify minerals.
3. Describe the metabolism (digestion, absorption and storage) of iron.
4. Mention the deficiency disorders of iron.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Introduction to minerals, their gross function and importance in biological systems		Open lecture
5-15	Definition and classification of minerals; explanation of macro-, micro-, trace and ultra-trace elements	Minerals	PPT slides
20-35	Explanation of body content, different forms, sources, function and daily requirement by sex	Iron and its metabolism	PPT slides
35-50	Explain the iron balance; iron absorption, the mucosal block mechanism and excretion of iron	Metabolism of iron	PPT slides and animation
50-60	Morphology of the RBC, different indices of iron status, recycling of iron	Deficiency disorders	PPT slides and whiteboard writing

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-mineral-1.docx · [Back to index](#)

PART XII · MINERALS

40. Minerals – 2: Iodine Metabolism and Other Minerals

COURSE	Phase I MBBS — Biochemistry	LEARNERS	1st year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-3
DURATION	60 minutes	DATE & TIME	31 August 2026, 09:30-10:30 am

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Describe the metabolism (digestion, absorption and storage) of iodine.
2. Mention the deficiency disorders of iodine.
3. Mention the sources, functions and deficiency disorders of the other minerals.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Recapitulation of the previous session		Open lecture
5-15	Explanation of body content, sources, function and daily requirement by sex	Iodine and its metabolism	PPT slides
15-20	Explain the iodine balance	Metabolism of iodine	PPT slides and flowchart
20-30	Explanation of importance, functions and causes of deficiency	Deficiency disorders	PPT slides and whiteboard writing
30-45	Explanation of sources, functions and deficiency disorders	Other macro- and micro-minerals	PPT slides
45-60	Review and feedback on both sessions on minerals		Q/A and interaction

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-minerals-2.docx · [Back to index](#)

PART XIII

Molecular Biology and Genetics

Genome and gene organisation, the genetic code, translation and post-translational modification, and the fundamentals of inheritance with the Mendelian and cytogenetic disorders.

3 LESSON PLANS · LESSON PLANS 41-43

PART XIII · MOLECULAR BIOLOGY AND GENETICS

41. Genome, Gene, Genetic Code, Genotype and Phenotype

COURSE	MBBS Phase I — Biochemistry	YEAR	2nd year
DURATION	60 minutes	TEACHING METHOD	Interactive lecture
VENUE	Lecture gallery	TEACHER	Dr. Farjana Sharmin
TOPIC	Genome, gene, genetic code, genotype, phenotype		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define genome and gene.
2. Describe the basic organisation of the human genome and chromosomes.
3. Explain the structure of a eukaryotic gene, including promoter, exons, introns and regulatory regions.
4. Describe the functions of exons, introns, promoter, enhancers and silencers.
5. Define genetic code and explain the meaning of codon.
6. Describe the major features of the genetic code, including its triplet nature, degeneracy, specificity, non-overlapping nature and universality.
7. Define trait, genotype, phenotype and allele.
8. Differentiate homozygous and heterozygous genotypes.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	TOPIC	DETAILED CONTENT	METHOD
0-5 min	Introduction to genetics	Overview of genetics and the relationship among genome, chromosome, DNA and gene. Introduce the lecture objectives.	Interactive discussion, PPT
5-12 min	Genome	Definition of genome as the complete set of genetic instructions. Organisation of DNA into chromosomes and genes; human nuclear and mitochondrial genetic material.	Interactive lecture, PPT
12-20 min	Gene and gene locus	Gene as the basic functional unit of heredity and a segment of DNA carrying information for a protein or functional RNA. Gene locus and chromosome mapping. Briefly discuss alleles and mutation as presented in the lecture.	Lecture with questioning, PPT
20-30 min	Eukaryotic gene structure	Promoter, exons, introns, terminator, enhancers, silencers, upstream and downstream regions. Explain exon and intron functions, transcriptional regulation and mRNA-related roles of regulatory regions.	Diagram discussion, PPT and whiteboard
30-38 min	Genetic code	Definition of genetic code and codon. Examples: AUG as start codon and UAA as stop codon. Introduce 64 codons, 61 sense codons and 3 stop codons.	Interactive lecture, PPT
38-47 min	Features of the genetic code	Triplet nature, universality, degeneracy/redundancy, specificity/unambiguity, non-overlapping and comma-less nature. Briefly mention wobble at the third codon position.	Lecture with examples, PPT

TIME	TOPIC	DETAILED CONTENT	METHOD
47-54 min	Trait, genotype and phenotype	Definition of trait; qualitative and quantitative traits. Distinguish genotype from phenotype using simple examples from the lecture.	Interactive discussion, PPT
54-57 min	Alleles and types of genotype	Allele as a version of a gene. Homozygous dominant, homozygous recessive and heterozygous genotypes; relation to haploid and diploid cells.	Examples and questioning
57-60 min	Summary and assessment	Recap: genome → gene → gene structure → genetic code → trait/genotype/phenotype/allele. Short oral questions and key take-home messages.	Q&A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard and marker
- Diagrams of chromosome and eukaryotic gene structure

Source document: MBBS lesson plan genome and gene.docx · [Back to index](#)

42. Translation and Post-Translational Modification

COURSE	MBBS Phase I — Biochemistry	YEAR	2nd year
DURATION	60 minutes	TEACHING METHOD	Interactive lecture
VENUE	Lecture gallery	TEACHER	Dr. Farjana Sharmin
TOPIC	Translation		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define translation and describe its role in protein synthesis.
2. Describe the roles of mRNA, tRNA and ribosomes in translation.
3. Differentiate the major features of prokaryotic and eukaryotic ribosomes.
4. Explain the initiation of translation.
5. Describe the major events of elongation, including peptide-bond formation and translocation.
6. Explain how translation is terminated.
7. Outline the overall sequence of protein synthesis from mRNA to polypeptide.
8. Describe common post-translational modifications and their importance.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME	TOPIC	DETAILED CONTENT	METHOD
0-5 min	Introduction	Definition of translation. Explain that the nucleotide sequence of mRNA is read to produce the amino-acid sequence of a polypeptide. Relate translation to gene expression and protein synthesis.	Interactive discussion, PPT
5-12 min	Components required for translation	Role of mRNA as the template, tRNA as the adaptor carrying amino acids, and ribosomes as the site of protein synthesis. Briefly review codon-anticodon recognition and the start codon AUG.	Interactive lecture, PPT
12-18 min	Ribosome	Structure of ribosomes; small and large subunits. Compare prokaryotic and eukaryotic ribosomes as presented in the lecture. Introduce the functional ribosomal sites involved in translation.	Lecture with diagrams, PPT
18-28 min	Initiation	Assembly of the ribosome around the mRNA and the first tRNA carrying methionine. Recognition of AUG and formation of the pre-initiation/initiation complex required to begin translation.	Diagram discussion, PPT
28-40 min	Elongation	Sequential entry of aminoacyl-tRNA, codon-anticodon pairing, peptide-bond formation and progressive elongation of the polypeptide chain. Emphasise that amino acids are added in the order specified by mRNA.	Interactive lecture, PPT and whiteboard
40-47 min	Translocation	Movement of the ribosome along mRNA after peptide-bond formation, shifting of tRNAs through the ribosome and exposure of the next codon for continuation of elongation.	Whiteboard diagram, PPT

TIME	TOPIC	DETAILED CONTENT	METHOD
47-52 min	Termination	Recognition of the termination signal/stop codon, release of the newly formed polypeptide and dissociation of the translation complex.	Interactive lecture, PPT
52-57 min	Post-translational modification	Common modifications from the lecture: phosphorylation, glycosylation, acetylation, methylation, ubiquitination, proteolytic cleavage, disulfide-bond formation and lipidation. Relate these changes to protein activation, stability, localisation, interactions and degradation.	Lecture, PPT
57-60 min	Summary and assessment	Recap the sequence: mRNA → ribosome/ tRNA → initiation → elongation → translocation → termination → post-translational modification. Short oral questions and key take-home messages.	Q&A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard and marker
- Diagrams of ribosomal structure and stages of translation
- Flowchart of initiation, elongation, translocation and termination

Source document: MBBS lesson plan Translation.docx (duplicate copy: MBBS lesson plan Translation (1).docx) · [Back to index](#)

43. Fundamentals of Inheritance and Genetic Disorders

COURSE	Phase I MBBS — Biochemistry	LEARNERS	2nd year students
PRESENTER	Dr. Sharif M Ehsan	VENUE	Gallery-2
DURATION	60 minutes	DATE & TIME	20 July 2026, 10:30-11:30 am

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Mention Mendel's laws of inheritance.
2. Mention the genetic disorders of various types.
3. Explain the Mendelian variants of genetic disorders.
4. Calculate the risk of genetic disorders.
5. Explain the pathogenesis of different cytogenetic disorders.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Gaining attention	Briefly state the role of Gregor Mendel in heredity; compare the activities of Mendel and H. Kapali	Open lecture
5-20	Explanation of some facts regarding cell division	Mitotic and meiotic cell division; gametogenesis (spermatogenesis and oogenesis)	PPT slides, interactive Q/A
20-45	Description of genetic disorders; explanation of Mendel's laws	Classification of genetic disorders; the laws of Mendel; single-gene disorders, polygenic disorders and multifactorial disorders	PPT slides
45-55	Description of cytogenetic disorders	Trisomy, non-disjunction, mutation — deletion and insertion, mixoploidy and chimerism	PPT slides and animation
55-60	Feedback	Genetic, congenital and hereditary disorders	Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-genetic disorder.docx · [Back to index](#)

PART XIV

Biotechnology

A four-lecture block on recombinant DNA technology: restriction enzymes and palindromes, CRISPR, blotting techniques and cloning, RFLP, DNA fingerprinting, gene therapy and PCR.

4 LESSON PLANS · LESSON PLANS 44-47

44. Biotechnology - 1: Concepts, History and Applications

COURSE	Phase I MBBS — Biochemistry	DURATION	60 minutes
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LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define and mention the different types of biotechnology.
2. Define recombinant DNA.
3. Explain palindromic sequences of double-stranded DNA.
4. Explain restriction enzymes, their source, function and nomenclature.
5. Explain RFLP and its importance.
6. Define DNA cloning and its types.
7. Explain the PCR procedure and its applications.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Introduction and review	Basic concept of biotechnology	Open lecture
5-25	Explanation and description	Invention of biotechnological consumer products (Horri Dhan and Horripoda Kapali), front page of TIME magazine; definition and different types of biotechnology; explanation of “red biotechnology”	PPT slides, interactive
25-40	History of the Gulf War and Saddam Hussein	History and infographic of biotechnology; history of the cloned “Dolly”	PPT slides, recap from card topics
40-50	Clarification of the formalin concept for preserving different plant products	Explanation of adulteration of different foods; concept of formalin regarding preservation of different fruits	PPT slides and animation
55-60	Biotechnology in Bangladesh	Biotechnological food invented in our country (BAU kul); different medicines; insulin, etc.	Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

Source document: Lesson Plan- Biotechnology 1.docx · [Back to index](#)

PART XIV · BIOTECHNOLOGY

45. Biotechnology - 2: Restriction Enzymes, Palindromes and CRISPR

COURSE	Phase I MBBS — Biochemistry	DURATION	60 minutes
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LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define and mention the different types of biotechnology.
2. Define recombinant DNA.
3. Explain palindromic sequences of double-stranded DNA.
4. Explain restriction enzymes, their source, function and nomenclature.
5. Explain RFLP and its importance.
6. Define DNA cloning and its types.
7. Explain the PCR procedure and its applications.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Recapitulation of the last class	Historical background, definition and types of biotechnology	Open lecture
5-15	Explanation of the different components of biotechnology	Isolation of restriction enzymes; cleavage of DNA into fragments	PPT slides, interactive
25-40	Description of restriction enzymes	Definition, sources, nomenclature and functions	PPT slides, recap from card topics
40-50	Palindromes and CRISPR	Definition of a DNA palindrome with example; restriction site; how restriction enzymes cut DNA; restriction fragments; CRISPR — definition and function	PPT slides and animation
50-55	Video presentation on restriction sites and restriction fragments		
55-60	Review and feedback		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-biotechnology-2.docx · [Back to index](#)

PART XIV · BIOTECHNOLOGY

46. Biotechnology - 3: Blotting Techniques and Biological Cloning

COURSE	Phase I MBBS — Biochemistry	DURATION	60 minutes
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LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define and mention the different types of biotechnology.
2. Define recombinant DNA.
3. Explain palindromic sequences of double-stranded DNA.
4. Explain restriction enzymes, their source, function and nomenclature.
5. Explain RFLP and its importance.
6. Define DNA cloning and its types.
7. Explain the PCR procedure and its applications.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Recapitulation of the last session	Restriction enzymes, restriction fragments, restriction sites — palindromes and CRISPR	Open lecture
5-15	Description of the components of biotechnology	Isolation of DNA fragments by Southern blot; construction of recombinant DNA; cloning of hybrid DNA; development of nucleic acid probes; transfer of genes from one species to another; isolation of reverse transcriptase	PPT slides, interactive
15-40	Explanation of blotting techniques and cloning	Video animation on Southern blot, Northern blot and Western blot	PPT slides, interactive
40-55	Description of biological cloning	Vector; nucleic acid probe; isolation and combination — reconstruction	PPT slides and animation
55-60	Review and feedback		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-biotechnology-3.docx · [Back to index](#)

PART XIV · BIOTECHNOLOGY

47. Biotechnology - 4: RFLP, DNA Fingerprinting, Gene Therapy and PCR

COURSE	Phase I MBBS — Biochemistry	DURATION	60 minutes
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LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Define and mention the different types of biotechnology.
2. Define recombinant DNA.
3. Explain palindromic sequences of double-stranded DNA.
4. Explain restriction enzymes, their source, function and nomenclature.
5. Explain RFLP and its importance.
6. Define DNA cloning and its types.
7. Explain the PCR procedure and its applications.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Recapitulation of the previous class	Nucleic acid probe, vector, blotting techniques and cloning	Open lecture
5-25	Explanation and description	RFLP; DNA fingerprinting; DNA library; gene therapy	PPT slides, interactive
25-45	In-vitro cloning	PCR — requirements, definition, procedure, importance and legal implementation	PPT slides, recap from card topics
45-50	Video presentation on the PCR technique		PPT slides and animation
50-60	Review and feedback on biotechnology		Interaction and Q/A

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
- Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan-biotechnology-4.docx · [Back to index](#)

PART XV

Clinical Biochemistry and Laboratory Interpretation

Two applied sessions on interpreting the common biochemical test panels — liver function tests with bilirubin metabolism and jaundice, and thyroid function tests with the autoimmune thyroid disorders.

2 LESSON PLANS · LESSON PLANS 48-49

PART XV · CLINICAL BIOCHEMISTRY AND LABORATORY INTERPRETATION

48. Liver Function Tests, Bilirubin Metabolism and Jaundice

COURSE	Phase I MBBS — Biochemistry	DURATION	120 minutes (two hours)
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LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Mention the functions of the liver.
2. Mention different parameters for the different functions of the liver.
3. Mention the catabolic end products of haem.
4. Mention the sources and fate of bilirubin.
5. Mention the names of the different types of bilirubin.
6. Define jaundice and classify it.
7. Differentiate the various types of jaundice.
8. Explain neonatal jaundice and kernicterus.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Gaining attention	Real-life story regarding jaundice and sugarcane juice	Open lecture
5-10	Introduction and review	Functions of the liver	PPT slides, interactive Q/A
10-40	Tests on the different functions of the liver	Tests based on synthetic functions of the liver; serum protein estimation; prothrombin time; prothrombin index; enzymes of LFTs; the aminotransferases (AST and ALT); alkaline phosphatase (ALP); gamma-glutamyl transpeptidase (γGT)	PPT slides, recap from card topics
40-55	Bilirubin metabolism	Haem-containing substances	PPT slides and animation
60-70	Review of the 1st hour	Flowchart of RBC catabolism and formation of bilirubin; availability of unconjugated bilirubin in circulation; hepatic uptake and conjugation; excretion from the liver and modification in the intestine with flowchart; further modification and excretion through urine	Interaction and Q/A
70-85	Jaundice	Definition and classification; causes of the different jaundices; different biomarkers and cardinal findings; difference between the jaundices	PPT slides and visualisation of different examining sites
85-115	Neonatal jaundice	Definition, types and aetiology; kernicterus; risks or complications of neonatal jaundice; diagnostic parameters and findings	Problem-based questions and SBA/MCQ construction and discussion
115-120	Conclusion		

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class

— Summative — MCQ (SBA + MTF), SEQ and PBQ

Source document: Lesson Plan on LFT.docx · [Back to index](#)

PART XV · CLINICAL BIOCHEMISTRY AND LABORATORY INTERPRETATION

49. Interpretation of Thyroid Function Tests

COURSE	MBBS — Biochemistry	YEAR	2nd year
TOPIC	Interpretation of thyroid function tests	FORMAT	Lecture
DURATION	60 minutes	VENUE	Gallery-2
DATE & TIME	27 April 2026, 9:30 am	TEACHER	Dr. Sharif M Ehsan
PREREQUISITES	Knowledge of the thyroid organ, its secretory and controlling hormones, the functions of thyroid hormone and autoimmune antibodies		

LEARNING OBJECTIVES

At the end of the session, students will be able to:

1. Explain primary and secondary hypothyroidism.
2. Differentiate hypothyroidism from subclinical or compensated hypothyroidism.
3. Explain primary and secondary hyperthyroidism.
4. Differentiate hyperthyroidism from subclinical or compensated hyperthyroidism.
5. Differentiate Graves' disease and Hashimoto's and other thyroiditides on the basis of TSI, TgAb and TPOAb.
6. Mention the importance of serum Tg measurement.
7. Explain why and how thyroid screening is done.

LESSON SCHEDULE AND CONTENT OUTLINE

TIME (MINS)	ACTIVITY	CONTENT	TEACHING METHOD
0-5	Gaining attention	Real-life story regarding iodised salt and the importance of iodine and thyroid hormone	Open lecture
5-15	Introduction and review	Names of the thyroid hormones and the controlling hormone; synthesis of T4 and T3; metabolic effects of thyroid hormones; normal ranges of hormones	PPT slides, interactive Q/A
15-25	Explanation of the hypothyroid types	Primary and secondary, subclinical and overt types; radioactive iodine uptake test — interpretation; myxoedema and cretinism — interpretation and differentiation	PPT slides, recap from card topics
25-35	Explanation of the hyperthyroid types	Primary and secondary, subclinical and overt types; TRH test — interpretation; thyrotoxicosis	PPT slides
35-40	Review and feedback		Interaction and Q/A
40-55	Description of the autoimmune thyroid disorders and others	Graves' disease, Hashimoto's and other thyroiditis — findings and interpretation with TSI, TgAb and TPOAb; malignancy and serum Tg; thyroid ultrasonography	PPT slides and visualisation of different examining sites
55-60	Conclusion		

TEACHING MATERIALS

- PowerPoint presentation
- Whiteboard for drawing and flowcharts

ASSESSMENT

- Formative — class attendance and interaction during class
 - Summative — MCQ (SBA + MTF), SEQ and PBQ
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Source document: thyroid-interpretation.docx · [Back to index](#)