CHAPTER E — RESPIRATORY PHYSIOLOGY

E1 — The Uneven Chest Expansion

During a respiratory lab, a physiotherapy intern observes that one student subject shows reduced chest expansion on the right side during deep inspiration. Breath sounds are present but diminished. The mentor asks which physiological factor most directly explains reduced ventilation on one side without assuming pathology.

Options

A. Reduced lung compliance on the affected side
B. Increased alveolar surface tension
C. Reduced oxygen diffusion capacity
D. Decreased hemoglobin concentration

Reasoning

Ventilation depends on compliance; reduced compliance limits expansion even if airways are patent.

✅ Correct: A

E2 — The Quiet Lung Fields

While auscultating a healthy volunteer breathing rapidly and shallowly, a student notes reduced breath sounds. The tutor asks which physiological explanation fits best.

Options

A. Reduced alveolar ventilation
B. Increased dead space ventilation
C. Increased respiratory rate
D. Increased airway resistance

Reasoning

Rapid shallow breathing increases dead space ventilation → less alveolar airflow → softer sounds.

✅ Correct: B

E3 — The Oxygen Transport Debate

Two interns discuss why oxygen saturation remains normal in early hypoventilation. The mentor asks which mechanism buffers oxygen levels initially.

Options

A. Increased hemoglobin concentration
B. Shape of oxyhemoglobin dissociation curve
C. Increased respiratory rate
D. Increased pulmonary blood flow

Reasoning

Flat upper portion of dissociation curve maintains saturation despite mild PO_2 drop.

✅ Correct: B

E4 — The CO_2 Retention Puzzle

A physiotherapy student notes that CO_2 levels rise rapidly with reduced ventilation compared to oxygen changes. The tutor asks why.

Options

A. CO_2 has lower solubility
B. CO_2 diffuses slowly
C. CO_2 is transported mostly in dissolved form
D. Ventilation primarily controls CO_2 elimination

Reasoning

CO_2 elimination depends tightly on alveolar ventilation.

✅ Correct: D

E5 — The V/Q Mismatch Scenario

During observation of different lung zones, an intern is asked why apex alveoli have higher ventilation-perfusion ratios.

Options

A. Higher blood flow at apex
B. Lower ventilation at apex
C. Gravity reduces perfusion more than ventilation
D. Increased surfactant production at apex

Reasoning

Gravity affects perfusion more than ventilation → higher V/Q at apex.

✅ Correct: C

E6 — The Surfactant Insight

A neonatal physiotherapy student learns that premature infants struggle with lung expansion. The mentor asks which physiological role of surfactant is missing.

Options

A. Increasing alveolar pressure
B. Reducing surface tension
C. Increasing respiratory rate
D. Enhancing oxygen diffusion

Reasoning

Surfactant reduces surface tension → prevents alveolar collapse.

✅ Correct: B

E7 — The Hypoxia Classification

During altitude training discussion, a student asks why oxygen saturation drops despite normal lung mechanics. The tutor asks for the physiological classification.

Options

A. Hypoxic hypoxia
B. Anemic hypoxia
C. Stagnant hypoxia
D. Histotoxic hypoxia

Reasoning

Low ambient oxygen → hypoxic hypoxia.

✅ Correct: A

E8 — The Acid–Base Observation

A physiotherapy intern notices that a patient hyperventilating during anxiety shows tingling sensations. The mentor asks which acid–base change explains this.

Options

A. Respiratory acidosis
B. Metabolic acidosis
C. Respiratory alkalosis
D. Metabolic alkalosis

Reasoning

Hyperventilation ↓ CO_2 → respiratory alkalosis.

✅ Correct: C

E9 — The Spirometry Interpretation

During lung function testing, a student notices reduced vital capacity but normal FEV_1/FVC ratio. The tutor asks what physiological pattern this suggests.

Options

A. Obstructive pattern
B. Restrictive pattern
C. Mixed defect
D. Normal ventilation

Reasoning

Restrictive disease → ↓ volumes with normal ratio.

✅ Correct: B

E10 — The Artificial Respiration Decision

A physiotherapy intern assisting in ICU notices that artificial ventilation must maintain adequate alveolar ventilation. The mentor asks what variable most directly determines alveolar ventilation.

Options

A. Respiratory rate alone
B. Tidal volume minus dead space
C. Oxygen concentration
D. Lung compliance

Reasoning

Alveolar ventilation = (VT – dead space) × RR.

✅ Correct: B