

## Pathology Class 4:

### Organ Systems Pathology (Ages 14-18yo)

1. Which part of the respiratory system is mainly affected in bronchitis?  
**A. Bronchi**  
B. Alveoli  
C. Sinuses  
D. Diaphragm
2. Why is pneumonia usually more serious than bronchitis?  
A. It causes more coughing  
B. It lasts longer  
C. It always causes chest pain  
**D. It fills the air sacs and interferes with oxygen exchange**
3. Which condition involves inflammation of the heart muscle after a viral illness?  
A. Hypertension  
B. Arrhythmia  
**C. Myocarditis**  
D. Atherosclerosis
4. Sudden cardiac death in teenagers is most often caused by:  
**A. Electrical signaling problems in the heart**  
B. Clogged arteries  
C. Weak heart muscle from aging  
D. High cholesterol
5. What is the main problem in anemia?  
A. Too much iron absorption  
**B. Reduced oxygen delivery to tissues**  
C. Too much blood in circulation  
D. Blood clots forming too easily
6. In spherocytosis, why does the spleen remove red blood cells early?  
A. They are infected  
B. They are too large  
C. They carry too little oxygen  
**D. Their membranes are fragile and fail quality control**
7. What does a high reticulocyte percentage usually indicate?  
**A. The bone marrow is increasing red blood cell production**  
B. Oxygen levels are normal  
C. Blood sugar is low  
D. The spleen is not working
8. Why does asthma cause breathing difficulty even when oxygen is still in the air?  
A. The diaphragm stops working  
B. Red blood cells stop carrying oxygen  
**C. Airways become inflamed, narrowed, and clogged with mucus**  
D. The lungs stop expanding
9. Why can hormonal acne worsen during puberty even with good hygiene?  
A. Sweat glands block pores

**B. Hormones increase oil production and inflammation**

C. Bacteria increase during adolescence

D. Skin becomes thinner

10. Which organ uses a surprisingly large amount of the body's oxygen compared to its size?

A. Liver

B. Pancreas

C. Kidneys

**D. Brain**

**Home Activity – Answer Key*****Activity 1 — Failure Mode detective***Case 1 — Teen with asthma attack during exercise

Condition or event: Exercise-triggered asthma attack

Main organ system: Respiratory (lower airway)

Primary failure mode: Communication + barrier (inflammatory airway control failure)

What actually failed first: Airway smooth muscle control and inflammatory signaling → bronchoconstriction and mucus narrowing

One early warning sign that might appear: Chest tightness, wheezing, cough with exercise, reduced peak flow

Notes for instructor: Mechanism is *hyperreactive airway signaling* with inflammatory barrier swelling and smooth muscle constriction. Gas transport drops secondarily.

Case 2 — Athlete collapses from arrhythmia

Condition or event: Sudden collapse from cardiac arrhythmia

Main organ system: Cardiovascular

Primary failure mode: Communication (electrical signaling failure)

What actually failed first: Cardiac electrical rhythm control → unstable ventricular rhythm → loss of effective pumping

One early warning sign that might appear: Palpitations, unexplained dizziness, near-syncope with exertion

Notes for instructor: Emphasize electrical vs plumbing failure. Structure can look normal. This reinforces “electrical failures dominate in youth” teaching point.

Case 3 — Teen with repeated concussions

Condition or event: Recurrent concussions / mild traumatic brain injury

Main organ system: Neurologic

Primary failure mode: Structural + regeneration failure

What actually failed first: Axonal and microvascular brain tissue integrity from repeated mechanical trauma

One early warning sign that might appear: Headache, slowed thinking, light sensitivity, memory gaps after impacts

Notes for instructor: First hit is structural injury. Repetition converts it into regeneration and communication problems with persistent symptoms.

Case 4 — Teen with uncontrolled type 2 diabetes

Condition or event: Poorly controlled type 2 diabetes

Main organ system: Endocrine / metabolic

Primary failure mode: Dysregulation (hormone signaling failure)

What actually failed first: Insulin signaling response at the cell receptor level → insulin resistance → rising blood glucose

One early warning sign that might appear: Increased thirst, frequent urination, fatigue, elevated fasting glucose or A1C

Notes for instructor: This is a signaling and regulation failure first, transport injury later.

Vascular and nerve damage are downstream, not primary.

**Activity 2 — System Sorting Table**

Key for Bonus column  
 I = inflammation driven  
 S = signaling driven  
 T = transport driven

Condition	Blood	Respiratory — Upper	Respiratory — Lower	Cardiovascular	Neurologic	Endocrine / Metabolic	Bonus (I / S / T)
Sinus infection		✓					I
Pneumonia			✓				I
Asthma			✓				I
Anemia	✓						T
Heart arrhythmia				✓			S
Concussion					✓		I
Type 1 diabetes						✓	S
Hormonal acne						✓	I + S
Bronchitis			✓				I
Myocarditis				✓			I

Instructor notes for edge cases (so your graders stay consistent):

- Asthma could be tagged I + S, but use I as dominant for this table since airway inflammation is central in your notes.
- Concussion is structural first, but symptom driver is neuroinflammation
- Hormonal acne is signaling plus inflammation; classify as inflammation here because the visible pathology is inflammatory.
- Type 1 diabetes is signaling failure first (insulin absence), even though transport of glucose is affected downstream. (T)

**Activity 3 — Device vs Problem Match (tool logic)**

Tools:

- Peak flow meter
- Spirometry
- Nebulizer
- Steam inhaler
- Inspiratory muscle trainer
- Oscillatory PEP device

Match each to its main role:

- A — Measures airflow
- B — Delivers medication deep into lungs
- C — Helps loosen mucus
- D — Measures lung volumes and flow patterns
- E — Trains breathing muscles
- F — Moistens upper airways for comfort

Peak flow meter → A — Measures airflow (exhalation)

Spirometry → D — Measures lung volumes and flow patterns

Nebulizer → B — Delivers medication deep into lungs

Steam inhaler → F — Moistens upper airways for comfort

Inspiratory muscle trainer → E — Trains breathing muscles

Oscillatory PEP device → C — Helps loosen mucus

Instructor notes and clarifications:

- Peak flow meter is speed of exhalation only, not volumes.
- Spirometry gives volumes plus flow curves and patterns.
- Nebulizer is deep delivery, not measurement or strengthening.
- Steam inhaler is comfort and moisture only, not deep treatment.
- Inspiratory muscle trainer targets diaphragm and accessory muscles.
- Oscillatory PEP devices are clearance tools for mucus retention.