

Chapter 10: Course Review

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After this chapter you should be able to apply the Five-Question Method to any rhythm, in a fixed order and under time pressure; compare every rhythm in the book side by side by origin, rate, P wave, PR interval and QRS width; resolve the confusion pairs this material reliably produces; and evaluate an outside source against the textbook. **Reading: Aehlert, *ECGs Made Easy*, 7th ed., Chapter 10 Posttest (p. 259).** This chapter introduces no new rhythms. It is a place to consolidate the nine that came before.

Note to students: This guide is a synthesis, not a new chapter. There is nothing in it you have not already been taught, and that is the point: it exists so that you can revise from one document instead of nine. Rates and cutoffs still follow **Aehlert, 7th edition**, because that is the edition this guide follows, and every number here is the same number you were given the week you first met it. **What Chapters 1 through 9 give you:** an entire vocabulary and a fixed method for using it. What is left is not more content. It is speed, order, and nerve.

At a Glance: this chapter in one box

Numbers that carry the whole book

- Small box **0.04 s**, large box **0.20 s**, 5 large boxes per second, **300** per minute. Everything else is derived from 25 mm/s.
- PR **0.12 to 0.20 s**. QRS **0.06 to 0.10 s**, and **wide at 0.12 s or more**.
- Escape hierarchy: SA node **60 to 100**, AV junction **40 to 60**, ventricles **20 to 40**. Four numbers: 100, 60, 40, 20.
- Rate method: **300 sequence** on regular rhythms only; **6-second method** on anything irregular.

The three rules everything else hangs on

- **Deflection:** toward the positive electrode writes up, away from it writes down.
- **Bifurcation:** started above it, the QRS is **narrow**; started below it, the QRS is **wide**.
- **Escape hierarchy:** the fastest pacemaker wins; when it fails, the next one down takes over, slower.

Top 4 traps

- Naming a rhythm from its overall look before measuring anything.
- Assuming wide always means ventricular, and that ventricular is always wide. Neither holds.
- Trying to classify **2:1 AV block** from a single strip. It cannot be done.
- Believing a normal 12-lead rules out infarction. It does not.

The Five-Question Method, Restated

You have been asked these five questions in this order since Chapter 2, and they are the last thing you should carry into the exam room. Say them in your head, in order, on every strip, including the ones you think you recognized on sight.

1. **Is it regular?**
2. **What is the rate?**
3. **Are there P waves, and is there one for every QRS?**
4. **What is the PR interval?**
5. **How wide is the QRS?**

Every rhythm you will ever be handed resolves through those five questions. Not most of them. All of them. The method was built precisely for the strip you cannot name at a glance, which means the moment you feel stuck is the moment the method becomes useful rather than optional. A pilot reads the checklist aloud on the ten thousandth flight for the same reason: the cost of skipping a step has nothing to do with how well you know the step.

One practical note for a timed exam. Answer the strips you recognize immediately, flag the ones that need caliper work, and come back to them. Students who fight the hardest strip first run out of clock and lose points on strips they genuinely knew.

Three Rules, Not Thirty Facts

1. The deflection rule (Chapter 2). Current traveling **toward** a positive electrode writes an **upward** deflection; current traveling **away** from it writes a **downward** one. That single sentence generates the appearance of every waveform you have studied. It is why the P wave is upright in lead II during sinus rhythm, why it is inverted when the junction depolarizes the atria backward, why a ventricular beat carries a T wave pointing opposite its QRS, and why twelve leads see one heartbeat twelve different ways.

2. The bifurcation rule (Chapters 2, 4, 5, 6, 7, 8). A rhythm starting **above** the bundle branch bifurcation gets on the fast bundles and is **narrow**. Starting **below** it, the impulse has missed the on-ramp and crawls muscle cell to muscle cell, so it is **wide**. Students carry this as five separate facts: atrial rhythms are narrow, junctional rhythms are narrow, ventricular rhythms are wide, bundle branch block is wide, ventricular paced beats are wide. **Those are not five facts. They are one fact, seen five times.**

3. The escape hierarchy (Chapters 2, 5, 6, 7). SA node **60 to 100**, AV junction **40 to 60**, ventricles **20 to 40**. The fastest available pacemaker takes the load and holds the slower ones quiet, which is why a healthy heart shows you only the SA node. When a level fails, the next one down takes over, and each demotion costs rate. **An escape rhythm is protective and is never suppressed.** It may be the only thing perfusing your patient.



Normal sinus rhythm at 75, printed to true clinical scale. This is the reference the whole table on the next page is measured against: regular, 60 to 100, an upright P before every QRS, PR 0.12 to 0.20 s and constant, QRS 0.06 to 0.10 s. Every other row differs from this one in a way you can name.

Every Rhythm in the Course, Side by Side

Two tables, split by QRS width because that is the first fork you take. Everything in Table A is **supraventricular**, so the QRS stays **narrow at 0.06 to 0.10 s** in every single row; the work is all in the P wave. Table B is where width becomes the finding.

Rhythm	Regularity	Rate	P waves	PR	QRS
Table A. Supraventricular origins. QRS narrow throughout.					
<i>Sinus mechanisms (Chapter 3)</i>					
Normal sinus	Regular	60 to 100	Upright, uniform, one per QRS	0.12 to 0.20, constant	0.06 to 0.10
Sinus bradycardia	Regular	Under 60	Unchanged	Unchanged	Narrow
Sinus tachycardia	Regular	Over 100	Upright; may hide in the prior T	Unchanged	Narrow
Sinus arrhythmia	Irregular; R-R varies > 0.12 s with breathing	Usually 60 to 100	Upright, uniform	Unchanged	Narrow
SA block	Regular except the pause, which is an exact multiple	Underlying 60 to 100	Whole P-QRS-T drops; pause is empty	Unchanged on conducted beats	Narrow
Sinus arrest	Irregular; pause is not a multiple	Underlying 60 to 100	Whole P-QRS-T drops	Unchanged on conducted beats	Narrow
<i>Atrial rhythms (Chapter 4)</i>					
PAC	Underlying regular, interrupted early	Underlying unaffected	Early P, shape differs from sinus, may hide in the prior T	Varies with the focus	Narrow
Wandering pacemaker	atrial Irregular	100 or less	At least 3 shapes in one lead	Varies	Narrow
Multifocal tach.	atrial Irregular	Over 100	At least 3 shapes in one lead	Varies	Narrow
Atrial tachycardia (an SVT)	Regular	150 to 250	One abnormal shape; often buried in the T	Often not measurable	Narrow
Atrial flutter	Depends on the conduction ratio	Atrial 250 to 350; ventricular set by the ratio	Sawtooth F waves, no true P	Not measurable	Narrow
Atrial fibrillation	Irregularly irregular	Atrial 350 to 600; ventricular varies	None. Fibrillatory baseline only	Not measurable	Narrow
<i>Junctional rhythms (Chapter 5)</i>					
PJC	Underlying regular, interrupted early	Underlying unaffected	Inverted in II when visible; before, buried, or after	Under 0.12 when the P precedes	Narrow
Junctional escape	Regular	40 to 60	Inverted, buried, or retrograde	Under 0.12 when measurable	Narrow
Accelerated junctional	Regular	60 to 100	Inverted, buried, or retrograde	Under 0.12 when measurable	Narrow
Junctional tachycardia	Regular	101 to 180	Often lost inside the prior T	Under 0.12 when measurable	Narrow

Rhythm	Regularity	Rate	P waves	PR	QRS
Table B. Ventricular, blocks, and paced. QRS width is the finding.					
<i>Ventricular rhythms (Chapter 6)</i>					
PVC	Underlying regular, interrupted early	Underlying unaffected	None before the PVC	Not measurable	0.12 s or more , bizarre, T opposite
Idioventricular	Regular	20 to 40	Absent	Not measurable	Wide
Accelerated idioventricular	Regular	41 to 100	Absent	Not measurable	Wide
Monomorphic VT	Essentially regular	Over 100	Absent or dissociated	Not measurable	Wide, all alike
Polymorphic VT and torsades	Irregular	Torsades typically 200 to 250	None visible	Not measurable	Wide, continuously changing
Ventricular fibrillation	Chaotic, no complexes	Not countable	None	None	None. Coarse ≥ 3 mm, fine < 3 mm
Asystole	Flat or near flat	None	Sometimes present alone	None	Absent
<i>AV blocks (Chapter 7). The P waves are sinus; the question is whether they got through.</i>					
First degree	Regular	Underlying rate	Upright, one per QRS, all conduct	Over 0.20 s , constant	Usually narrow
Second degree type I	Irregular; pause less than twice the shortest R-R	Atrial regular, ventricular slower	More P waves than QRS	Progressively lengthens until a QRS drops	Usually narrow
Second degree type II	Pause is an exact multiple of the prior R-R	Atrial regular, ventricular slower	More P waves than QRS	Constant on conducted beats	Often wide
2:1 AV block	Regular	Atrial exactly twice ventricular	Two P waves per QRS	Constant, but unclassifiable from one strip	Narrow or wide
Third degree	Both regular, independently	Atrial faster; ventricular 40 to 60 or 20 to 40	Present, no relationship to the QRS	Varies randomly; none	Narrow if junctional escape, wide if ventricular
<i>Paced rhythms (Chapter 8). Find the spike before you name anything.</i>					
Atrial paced	Regular	Programmed rate	Spike immediately before each P	Normal if conduction is intact	Narrow
Ventricular paced	Regular	Programmed rate	Absent, or unrelated sinus P waves	Not measurable	Wide by design , LBBB-like
Dual chamber paced	Regular	Programmed rate	Spike before the P and before the QRS	Set by the device	Wide

The three pacemaker malfunctions, in one line each. **Failure to pace** (failure to fire): no spike where a spike should be. **Failure to capture**: a spike is there with nothing behind it. **Failure to sense** (undersensing): a spike delivered that should never have been delivered, because the device did not see the patient's own beat; this is the dangerous one, because a ventricular spike landing on a T wave is R-on-T.

The Decision Paths Worth Memorizing

Four forks. Between them they resolve most of the strips you will meet, and each one is a single measurement rather than a judgment call.

1. Narrow versus wide, always first. Measure the QRS before you argue with yourself about anything else. **Narrow (0.06 to 0.10 s)** puts the origin above the bundle branch bifurcation, which means sinus, atrial, or junctional, and sends you into Table A. **Wide (0.12 s or more)** means the impulse did not use the normal fast pathway, and sends you into Table B. Half the confusion pairs in this book resolve at that one fork: junctional escape versus ventricular escape, and SVT versus VT, are both settled by QRS width alone.

2. The three-way P wave sorter (Chapter 4). Once you are in Table A, count the P wave shapes in a single lead.

- **One normal P shape, matching the sinus P:** sinus tachycardia.
- **One abnormal P shape:** atrial tachycardia.
- **Three or more P shapes in one lead:** wandering atrial pacemaker if the rate is **100 or less**, multifocal atrial tachycardia if it is **over 100**. Same picture, two speeds.

- **No discrete P waves and no flat baseline:** atrial fibrillation. If instead the baseline is organized into sawtooth waves, it is flutter.

3. The PR consistency check (Chapter 7). Once you have decided a block is present, look only at the conducted beats and ask whether the PR interval is doing the same thing every time. **Consistent PR** points to first degree (if every P conducts) or type II (if some do not). **Inconsistent PR** points to Wenckebach (progressive lengthening, with a repeating pattern) or third degree (no pattern at all, because the P waves and QRS complexes are not related). That is one measurement, made three or four times in a row, and it separates the entire chapter.

4. The pause test (Chapters 3 and 7). When a beat is missing, set your calipers to the underlying interval and walk them across the gap.

- **An exact multiple** of the underlying interval means the upstream clock kept running: **SA block** if the whole P-QRS-T dropped, **type II** if a P wave is sitting there alone.
- **Not a multiple** means the clock stopped and restarted on its own schedule: **sinus arrest**.
- **Less than twice the shortest R-R** on a strip with lengthening PR intervals: **Wenckebach**.

One pair does not resolve on the monitor at all. **Pulseless electrical activity versus a perfusing rhythm** looks identical on the paper, because the difference is not electrical. It resolves on the patient, and the answer to “what do you do” is always **check a pulse**.

Sources You Will Find Online That Are Wrong

You will study tonight with a phone in your hand, and you should. Free ECG sites are genuinely useful, and several of them are better than any textbook at showing you a hundred strips fast. The catch is that a handful of confidently written pages contain errors that have been copied across the internet for years, and some of them contradict this book directly. None of this means the people who wrote them are careless; it means published material drifts, and a working clinician checks. Here are the ones most likely to reach you.

What you will read	Why it is wrong	What is correct
A widely used ECG teaching site publishes intrinsic rates as “AV node 60, ventricles 40 to 60”	It inverts the backup order. If the ventricles outran the junction, the junction could never serve as the escape above them	SA node 60 to 100, AV junction 40 to 60, ventricles 20 to 40 , which is what Aehlert, LITFL, StatPearls and SkillStat all give
Sinus arrhythmia: “the rate slows on inspiration”	The physiology is stated backward. Vagal tone <i>withdraws</i> as you breathe in	Inspiration speeds the heart up ; expiration slows it. Check it on your own radial pulse
“Mobitz II has no pattern” (a popular nursing site)	It confuses two different things. Type II frequently conducts at fixed ratios such as 3:2 or 4:3 and can look strikingly regular	What is absent is progressive PR lengthening . The PR is constant on conducted beats and the pause is an exact multiple
Atrial fibrillation described as having “random P waves” (same site)	A P wave means the atria depolarized as a unit. Fibrillating atria never do	A-fib has fibrillatory waves, never P waves . That is the definition, not a detail
The PAILS reciprocal-change mnemonic	The last step is wrong. It sends you to the septal leads for a lateral infarct	A lateral infarct (I, aVL, V5, V6) shows reciprocal change in the inferior leads (II, III, aVF). Inferior and lateral are the reciprocal pair
Two emergency medicine sites file pace-maker exit block under undersensing	Undersensing is a <i>sensing</i> failure: the device fired because it never saw an intrinsic beat. In exit block the spike is delivered and nothing follows it	Exit block is a capture problem, so it belongs with failure to capture
Pacemaker code tables where position IV is programmability and position V is antitachy function	That is the 1987 code, still circulating on teaching sites	This course teaches the 2002 NBG revision , where position IV is rate modulation (O or R)

The transferable skill here is not a list of bad websites, because that list changes. It is the habit: when an outside source disagrees with your textbook on a number, **check before you memorize**, and answer from Aehlert. Being able to say precisely *how* two sources disagree is a more useful professional skill than being able to recite either one.

How to Practice

The method below is not a study-skills poster. It is how practising clinicians actually get good at reading strips, and it works because it stacks three things that are known to build durable recall: retrieval practice, immediate feedback, and spaced

review.

Read 5 to 10 strips a day. Not fifty in one sitting the night before. Volume spread across days beats volume crammed into an evening, every time, and it is a smaller ask than most students expect.

Commit to an interpretation out loud or in writing before you look at the answer. This is the step people skip, and it is the step that does the work. Reading an explanation while the answer is visible feels productive and teaches you almost nothing, because recognition is not recall. Say the five questions aloud, write down a rhythm name, and only then turn the answer over. Being wrong on purpose, in private, is the cheapest learning available to you.

Annotate the strip itself while you read the explanation. Circle the P wave you missed. Mark the PR interval you eyeballed instead of measuring. Write the rate you calculated next to the rate you should have calculated. The annotation is what turns a wrong answer into a specific correction rather than a vague feeling that you should study more.

Revisit your annotated strips before you start new ones. Five minutes with yesterday's marked-up strips at the start of each session is spaced review, and it is worth more than five new strips.

Where to get the strips. Any ungraded practice set with unlimited attempts is ideal, because working through it twice costs you nothing. Then use the **Stop and Review** exercises and the end-of-chapter strips in Aehlert, and Chapter 10's Posttest beginning on p. 259. Go back to the chapters with the highest strip density: Chapter 3 sinus, Chapter 4 atrial, Chapter 6 ventricular, Chapter 7 AV blocks. **Do not go hunting for new material.** You already have more strips than you have hours, and a new source late on adds unfamiliar formatting and contradicting numbers rather than skill.

One last piece of exam-room advice. **Change an answer when you have a reason taken from the tracing, not from nerves.** Measuring a PR interval you had only eyeballed is a reason. Second-guessing yourself is not.

Common Trap

A wide QRS always means the beat started in the ventricle, and a stable, talking patient cannot be in ventricular tachycardia. How many of those are true?

Neither. The width rule fails in both directions: bundle branch block, supraventricular tachycardia with aberrancy, ventricular paced beats, and hyperkalemia all widen the QRS without a ventricular origin, and roughly one in five ventricular tachycardias can be narrow when the focus sits close enough to the conduction system to get on the highway anyway. The honest version: **a wide QRS tells you the impulse did not use the normal fast pathway. It does not by itself tell you why.**

The second half is the more dangerous belief. Clinical stability does not distinguish VT from SVT with aberrancy, and a young patient with good ventricular function can hold a blood pressure in VT for a surprisingly long time. About **four out of five** wide-complex tachycardias are VT, and the published criteria can rule VT *in* but never *out*. **If in doubt, treat it as VT.**

Common Trap

There is a pause on the strip. One question tells you whether the problem is the node or something downstream. What is it?

Is there a naked P wave sitting in the pause? In **SA block** the impulse never escaped the node, so the atria were never depolarized and the **entire P-QRS-T is missing together**, leaving a flat baseline across the gap. In **AV block** the atria depolarized perfectly well and the impulse was stopped further down, so the **P wave is still there** with no QRS behind it.

Then measure the pause. An **exact multiple** of the underlying interval means the upstream clock never lost time (SA block above, type II below). **Not a multiple** means the sinus node stopped and restarted on its own schedule, which is sinus arrest. Either way, **a pause of 3 seconds or more gets investigated**, whatever you decided to call it.

Common Trap

A strip shows two P waves for every QRS, and the PR interval on the conducted beats never changes. Is that Mobitz I or Mobitz II?

Neither, and refusing to choose is the correct answer. In 2:1 conduction every conducted beat is followed by a blocked P, so the strip never shows two conducted beats in sequence. Without **two consecutive PR intervals** you cannot tell whether the PR was lengthening or constant, and lengthening versus constant is the entire distinction. Classification needs at least 3:2 conduction.

Call it exactly what it is: **"2:1 AV block."** If an answer choice reads 2:1 AV block and the strip shows two P waves per QRS

with no other information, that is the choice. Naming it type I or type II on that evidence is a guess dressed up as an interpretation.

Before You Move On

You should now be able to:

- run the Five-Question Method automatically on any strip you are handed
- state the three rules that unify the whole book, and use them instead of memorizing rhythms one at a time
- use the comparison tables to place any rhythm by origin, rate, P wave, PR interval and QRS width
- recognize which widely circulated claims are wrong, and check anything you read online against the book

That is the whole book. Everything after this is practice, and practice is the only thing that turns recognition into speed.

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