MEDICAL-SURGICAL NURSING I · STUDY GUIDE

Exam 1 Study Guide

This guide covers the first two chapters. You will learn how a med-surg nurse thinks, who to see first and when to call, then how water, salt and acid move and what to do when they go wrong. Work one chapter at a time. Read the "what to know" paragraphs, copy the tables out by hand, then try each worked case with the steps covered. Finish each chapter with its ten self-test items. The cram sheet at the end puts every number and rule in one place.

WHAT THIS GUIDE COVERS

- Chapter 1 · the med-surg role and ADPIE, the six steps of the Clinical Judgment Measurement Model, priority frameworks, vital-sign and lab ranges, red flags and SBAR, the older adult, delegation, high-alert drugs, handoff and teach-back.
- Chapter 2 · fluid compartments and the forces that move water, volume deficit, excess and third spacing, sodium and potassium, calcium, magnesium and phosphorus, ABGs with ROME and the anion gap, IV solutions by tonicity, safe potassium, infusion complications, delegation and the older adult.

CHAPTER 1

The Medical-Surgical Nurse and Clinical Judgment

Read it in full: **Chapter 1 in the textbook**. Practice it in the lab: **What Do You Do First? A Priority Sorter** and **Deterioration Watch: Trends, Labs and the SBAR Call**.

What to know

Medical-surgical nursing is the care of adults with acute and chronic illness who need hospital monitoring but not an intensive care bed. You will carry four to six patients at once, each changing at a different rate. That is the defining feature of the work: many changing people at the same time.

Because you are at the bedside and the provider is not, you are the hospital's surveillance system. The book names **failure to rescue** as the main mechanism of preventable death: the warning sign was documented, and nobody acted on it. Most patients who arrest on a med-surg unit show deranged vital signs for six to eight hours first. Your value lives in that window.

The nursing process (ADPIE: assessment, diagnosis, planning, implementation, evaluation) is still the operating system. It is cyclical, not a form filled out once, and the whole process belongs to the RN. An LPN may collect data; the RN interprets it. A UAP may report that a patient looks tired; the RN decides what it means.

A shift has a shape. Take handoff, then lay eyes on every patient in the first 30 to 45 minutes before the med pass, then do focused assessments, cluster care, chart in real time and reassess after any change or as-needed drug. The book calls the early look at everyone the single highest-yield habit on the unit.

The NCSBN **Clinical Judgment Measurement Model** gives six steps: recognize cues, analyze cues, prioritize hypotheses, generate solutions, take action and evaluate outcomes. Recognizing cues means sorting data into relevant, expected and irrelevant, judged against the diagnosis, the timeline and the patient's own baseline. Analyzing cues links the cluster to one mechanism, such as poor perfusion. Prioritizing ranks the explanations by what kills soonest. The Next Generation NCLEX, in use since April 2023, tests these steps with case studies, bow-tie, matrix and trend items and partial credit.

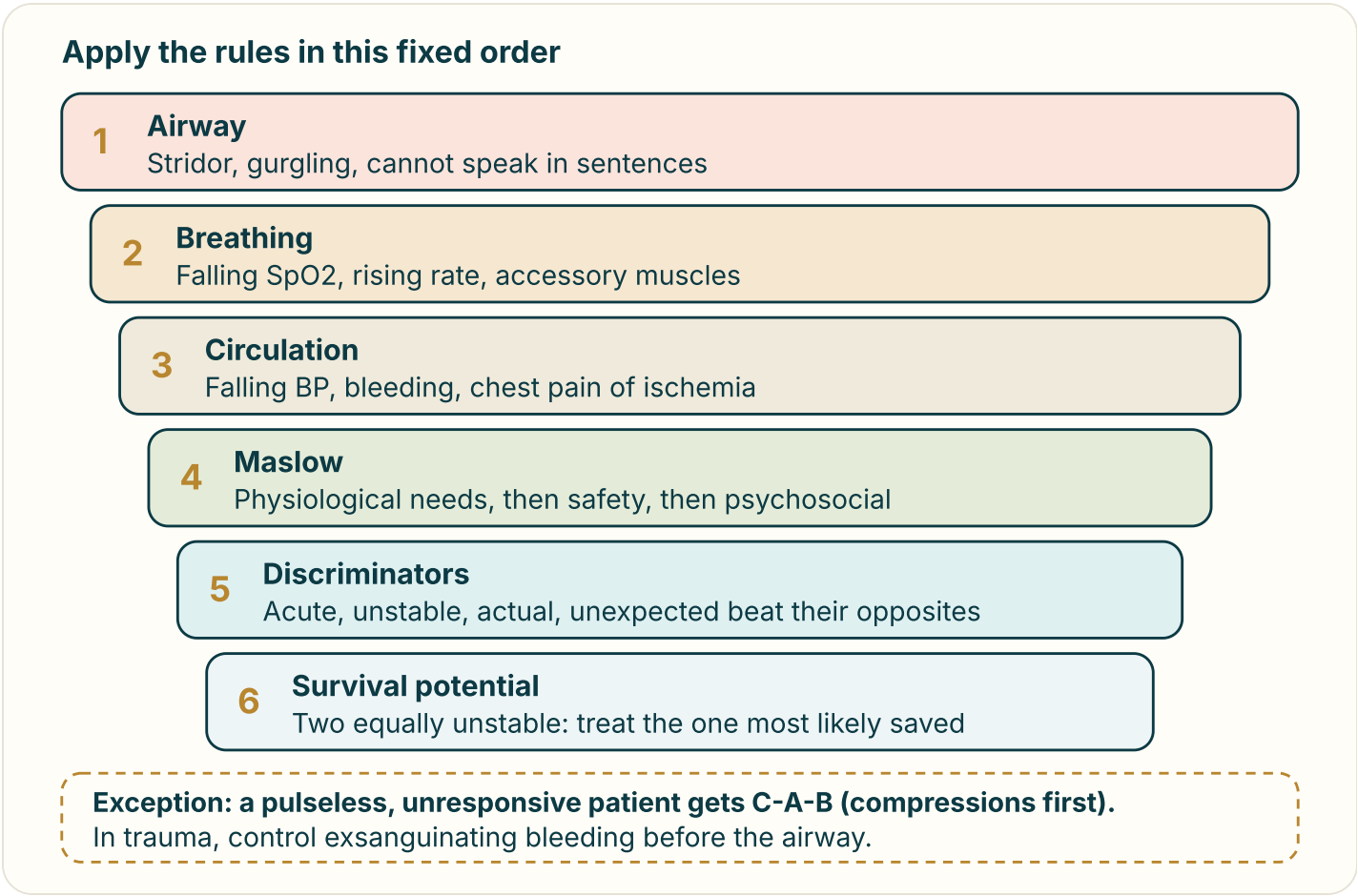
Abnormal is not the same as unexpected, and expected is not the same as ignorable. A low-grade fever on post-op day one is expected from the inflammatory response to surgery; a spiking fever with purulent drainage on day four is not. A potassium of 3.4 on furosemide is expected, but it still needs replacing, urgently if the patient takes digoxin.

Priority follows a fixed order. ABC first (airway, breathing, circulation), with C-A-B for the pulseless patient and bleeding control first in exsanguinating trauma. Then Maslow (physiological before safety before psychosocial). Then the discriminators: acute over chronic, unstable over stable, actual over potential, unexpected over expected. The patient to see first is usually the one

who has **changed** from baseline. “First” rarely means “call the provider” when a nursing action can stabilize the patient now.

Trends beat single numbers. Respiratory rate is the most sensitive vital sign and the most often falsified, so count it for 30 to 60 seconds. Escalate with SBAR (situation, background, assessment, recommendation) and do not drop the R. In older adults, infection may show no fever and an MI may show no chest pain; new confusion is a perfusion or oxygenation problem until proven otherwise, so check the saturation and the glucose first. Hypoactive delirium is the most common and most missed form.

Delegation uses five rights: task, circumstance, person, direction and communication, supervision and evaluation. The RN never delegates assessment, nursing diagnosis, care planning, initial teaching, evaluation or any unstable patient. High-alert drugs (insulin, opioids, anticoagulants, concentrated electrolytes, neuromuscular blockers, chemotherapy, sedatives) need an independent double check. Concentrated potassium chloride is never given IV push. Close every handoff and teaching session with read-back or teach-back.



The priority ladder. Climb down only when the rung above is safe. Most exam stems are decided on the first three rungs or by a change from baseline.

LOCK THESE IN

- Failure to rescue: the sign was charted but not acted on. Arrests follow 6 to 8 hours of abnormal vital signs.
- CJMM: recognize cues, analyze cues, prioritize hypotheses, generate solutions, take action, evaluate outcomes.
- Priority order: ABC, then Maslow, then acute over chronic, unstable over stable, actual over potential, unexpected over expected.
- C-A-B for the pulseless, unresponsive patient. Control exsanguinating bleeding before the airway in trauma.
- The patient who has changed from baseline beats the one with the most abnormal single number.
- SBAR ends with a specific Recommendation. “The nurse is worried” is a valid rapid response trigger.
- Never delegated: assessment, nursing diagnosis, care planning, initial teaching, evaluation, unstable patients.
- Two identifiers, never the room number. Apical pulse a full minute before digoxin; hold if under 60.

Vital signs and when to escalate (adult)

Parameter	Normal	Escalate when
Heart rate	60 to 100/min	Under 40 or over 130, or a new symptomatic dysrhythmia
Respiratory rate	12 to 20/min	Under 8 or over 28, or a rising trend with accessory muscle use
Blood pressure	Systolic 90 to 120, diastolic 60 to 80 mm Hg	Systolic under 90, or a fall of more than 40 from baseline
MAP	70 to 100 mm Hg	Under 65 (organ perfusion threshold)
SpO_2	95 to 100% on room air (88 to 92% target in chronic CO_2 retention)	Under 90% despite oxygen, or a 4 point fall from baseline
Temperature	36.5 to 37.5 °C	Over 38.3 °C or under 36 °C
Urine output	At least 0.5 mL/kg/hr (about 30 mL/hr)	Under 30 mL/hr for two hours in a row
Mentation	Alert, oriented x4	Any acute change, new confusion, hard to rouse

Lab values to know cold (Chapter 1 table)

Test	Adult range	Why it matters
Sodium	135 to 145 mEq/L	Below 120 risks seizure; correct slowly
Potassium	3.5 to 5.0 mEq/L	Dysrhythmia at both ends; never IV push
Calcium (total)	8.6 to 10.2 mg/dL	Tetany and laryngospasm when low
Magnesium	1.6 to 2.6 mg/dL	Low Mg causes refractory low K and torsades
BUN / creatinine	10 to 20 / 0.6 to 1.2 mg/dL	Creatinine rise: hold nephrotoxins and contrast
Glucose (fasting)	70 to 99 mg/dL	Under 70: treat first in a confused diabetic
Hemoglobin	M 14 to 18, F 12 to 16 g/dL	Falling Hgb plus tachycardia is bleeding until proven otherwise
Platelets	150,000 to 400,000/mm^3	Precautions under 50,000; spontaneous bleeding under 20,000
WBC and ANC	WBC 5,000 to 10,000; ANC = WBC x (% segs + % bands)	ANC under 1,500 neutropenia; under 500 severe
INR / aPTT	0.8 to 1.1 (warfarin goal 2 to 3) / 30 to 40 s	Antidotes: vitamin K for warfarin, protamine for heparin
Lactate	0.5 to 2.2 mmol/L	Over 2 hypoperfusion; over 4 a sepsis alarm
Albumin	3.5 to 5.0 g/dL	Low: poor healing, edema, altered drug binding

Who can do what (delegation)

Role	Commonly appropriate	Never this role
UAP	Bathing, feeding without dysphagia, ambulation, vital signs on a stable patient, I&O, weights, specimens	Assessment, teaching, medications, sterile procedures, unstable patients
LPN/LVN	Data collection, oral, subcutaneous and IM drugs, sterile dressings, catheters, trach care, reinforcing teaching	Initial assessment, care plan, evaluation, new teaching, IV push and blood in most states
RN	The full nursing process, admission assessment, all teaching, IV drugs, blood, unstable patients	Not applicable

Worked cases

WORKED CASE 1 · WHICH OF FOUR PATIENTS FIRST

At 0715 you receive four patients: (A) a post-op day two patient asking for pain medication, 7 of 10; (B) a patient with COPD whose SpO_2 has fallen from 91% to 84% and who is now using accessory muscles; (C) a patient with chronic back pain resting at 8 of 10; (D) a patient going home today who is anxious about discharge. Who do you see first?

STEP 1 · APPLY ABC

Only patient B has a breathing problem. A and C have pain, which is not an ABC problem unless it signals one. D is psychosocial.

STEP 2 · LOOK FOR CHANGE

An SpO_2 of 89 to 91% may be this patient's normal, since the target in chronic CO_2 retention is 88 to 92%. The fall to 84% with new accessory muscle use is a change from baseline.

STEP 3 · ACT, THEN NOTIFY

See **patient B** first: sit the patient up, apply oxygen as ordered and assess, then escalate with SBAR.

WHY NOT THE PAIN

Pain must be treated soon, and A comes next. But the trajectory in B is the threat. The number alone is rarely the answer; the trend is.

WORKED CASE 2 · AN SBAR CALL WITH THE NUMBERS CHECKED

Mr. Okafor, 66, is post-op day two after a bowel resection. Over three hours his respiratory rate rose from 18 to 30, his heart rate is 122 and his blood pressure is 96/58. His SpO_2 is 88% on 4 L. His right calf is swollen and tender. Build the call.

STEP 1 · FIND THE MAP

MAP = (systolic + 2 x diastolic) ÷ 3 = (96 + 116) ÷ 3 = **70.7 mm Hg**. Still above 65, but the trend is down.

STEP 2 · SITUATION

Name, unit, patient and room. His respiratory rate has climbed from 18 to 30 over three hours and SpO_2 is 88% on 4 L.

STEP 3 · BACKGROUND

Post-op day two, bowel resection, anticoagulant held for a procedure.

STEP 4 · ASSESSMENT

Tachycardic, softening blood pressure, calf swollen and tender. “I am concerned about a pulmonary embolism.”

STEP 5 · RECOMMENDATION

“I am asking you to come now and order a stat CT pulmonary angiogram and blood gas. I have raised the head of the bed and increased his oxygen.”

CHECK IT

If the pressure falls to 84/50, the MAP becomes (84 + 100) ÷ 3 = 61.3, under 65. That crosses the perfusion threshold and calls for a rapid response.

WORKED CASE 3 · READING AN ANC AND A URINE OUTPUT

Ms. Delgado, 70 kg, has a WBC of 3,200/mm^3 with 30% segs and 5% bands. Her urine output for the last two hours was 28 and 26 mL. What do these mean?

STEP 1 · COMPUTE THE ANC

ANC = WBC x (segs + bands) = 3,200 x 0.35 = **1,120/mm^3**.

STEP 2 · CLASSIFY IT

1,120 is under 1,500, so she is neutropenic. It is not under 500, so it is not severe, but any fever now matters more.

STEP 3 · FIND HER URINE GOAL

0.5 mL/kg/hr x 70 kg = 35 mL/hr. The rule of thumb is about 30 mL/hr.

STEP 4 · COMPARE

Both hours are under 30 mL/hr, two in a row. That meets the escalation trigger. Assess volume status and the bladder, review nephrotoxic drugs, and call with SBAR.

WORKED CASE 4 · DELEGATE IT OR KEEP IT

You have a UAP and an LPN. Tasks: (1) vital signs on a stable post-op day three patient; (2) teaching a new insulin pen; (3) the first walk after a cardiac catheterization that needs evaluation; (4) a sterile dressing change on a stable wound; (5) intake and output on a heart failure patient.

STEP 1 · UAP

Task 1 and task 5. Give a reporting parameter: “Tell me right away if systolic is under 100 or heart rate is over 110.”

STEP 2 · LPN

Task 4, a sterile dressing on a stable patient, is within LPN scope.

STEP 3 · RN

Task 2 is new teaching and task 3 needs evaluation. Both stay with you.

SCOPE CHECK

Delegating the task never delegates the accountability. You follow up on every one.

TRAPS PEOPLE FALL INTO

- **Calling the provider first.** If an independent nursing action can stabilize the patient (raise the head of the bed, apply oxygen, stop the infusion), do that, then notify.
- **Picking the worst single number.** A COPD SpO_2 of 89% may be baseline. The patient whose numbers are changing is the priority.
- **Treating pain as an ABC problem.** Pain is real work but not first unless it signals ischemia, perforation, compartment syndrome or a clot.
- **Calling day-one fever an infection.** A low-grade fever in the first 24 to 48 hours is the inflammatory response to surgery. Atelectasis is common but does not cause the fever.
- **Ignoring expected abnormals.** A low potassium on furosemide is expected and still needs replacing.
- **Leaving out the R in SBAR.** The specific request is the part that produces action.
- **Delegating to a UAP because the task looks simple.** Any task on an unstable or changing patient stays with the RN.
- **Charting sundowning.** New confusion in an older adult is hypoxia, hypoglycemia, infection or a drug until proven otherwise.

Chapter 1 self-test · ten items

1. A patient’s chart shows a heart rate climbing from 88 to 118 over six hours, with no action taken until the patient arrests. What does this describe?

A. Failure to rescue
B. Failure to diagnose
C. A sentinel near-miss
D. An expected finding

A. Failure to rescue Failure to rescue means the warning sign was documented and nobody acted. The book names it as the main mechanism of preventable hospital death.

2. Which CJMM step links a cluster of cues to one pathophysiologic explanation?

A. Recognize cues
B. Generate solutions
C. Evaluate outcomes
D. Analyze cues

D. Analyze cues Recognizing cues sorts the data. Analyzing cues connects the cluster to a story, such as poor perfusion from bleeding or sepsis.

3. On post-op day one after a hip replacement, which finding is expected?

A. Purulent wound drainage
B. Respiratory rate 30/min
C. Temperature 38.0 °C
D. New confusion at noon

C. Temperature 38.0 °C A low-grade fever in the first 24 to 48 hours is the inflammatory response to surgery. The others need action.

4. Four patients need you. Whom do you see first?

A. Chest tube day two, pain 6 of 10
B. Post-thyroidectomy, new inspiratory stridor
C. Diabetic, glucose 210 mg/dL at lunch
D. Discharge today, very anxious about going home

B. Post-thyroidectomy, new inspiratory stridor Stridor is an airway threat, and airway outranks everything else.

5. A patient is unresponsive with no pulse. What is the first action after calling for help?

A. Open the airway and give breaths
B. Apply high-flow oxygen first
C. Check a blood glucose level
D. Start chest compressions

D. Start chest compressions Arrest uses C-A-B. Oxygen already in the blood is useless if nothing circulates it.

6. A UAP reports a blood pressure of 88/50 on a patient whose baseline was 134/80. Which action belongs to the RN now?

A. Assess the patient at the bedside
B. Have the UAP recheck in an hour
C. Ask the LPN to evaluate the patient
D. Chart the value and continue

A. Assess the patient at the bedside A fall of more than 40 mm Hg from baseline is an escalation trigger. Assessment of a changing patient cannot be delegated.

7. A patient's WBC is 4,000/mm^3 with 10% segs and 2% bands. What is the ANC?

A. 4,000/mm^3
B. 1,200/mm^3
C. 480/mm^3
D. 400/mm^3

C. 480/mm^3 ANC = 4,000 x 0.12 = 480. That is under 500, which is severe neutropenia.

8. Which task may the RN assign to a UAP?

A. Teaching a patient to use an inhaler
B. Weighing a stable patient each morning
C. Giving an oral medication at 0900
D. Assessing lung sounds after a diuretic

B. Weighing a stable patient each morning Weights on a stable patient are a UAP task. Teaching, medications and assessment are not.

9. Before giving digoxin, the nurse should first check which value?

A. Apical pulse for a full minute
B. Radial pulse for fifteen seconds
C. Blood glucose at the bedside
D. Respiratory rate and depth

A. Apical pulse for a full minute Take the apical pulse for one full minute and hold the dose if it is under 60.

10. An 82-year-old with a urinary infection is newly confused. What should the nurse check first?

A. A dementia screening score
B. The last dose of the sleep aid
C. Oxygen saturation and blood glucose
D. Whether family can sit with her tonight

C. Oxygen saturation and blood glucose New confusion is a perfusion or oxygenation problem until proven otherwise. Saturation and glucose are fast, free and often the answer.

CHAPTER 2

Fluid, Electrolyte and Acid-Base Balance

Read it in full: **Chapter 2 in the textbook**. Practice it in the lab: **Ninety-Second ABG: ROME and the Tic-Tac-Toe Grid** and **Sodium and Potassium Console: Interpret, then Prioritize**.

What to know

Water is about 60% of an adult male and 50 to 55% of an adult female. Two thirds is intracellular. Of the extracellular third, about three quarters is interstitial and only one quarter is plasma, which is why losing a few liters from the vessels is a catastrophe. Water moves by osmosis toward more particles. Serum osmolality is 275 to 295 mOsm/kg and is set mostly by sodium, so **where sodium goes, water follows**.

In the capillary, hydrostatic pressure pushes fluid out and oncotic pressure (mostly albumin, 3.5 to 5.0 g/dL) pulls it in. High hydrostatic pressure (heart failure, over-infusion) and low albumin (cirrhosis, nephrotic syndrome, burns) both cause edema, for opposite reasons. ADH saves water, aldosterone saves sodium and wastes potassium, and natriuretic peptides do the reverse. All are blunted in older adults.

Fluid volume deficit shows tachycardia first, then orthostatic hypotension (a fall of 20 systolic or 10 diastolic within three minutes of standing), flat neck veins, slow capillary refill, dry

membranes, urine under 0.5 mL/kg/hr with specific gravity above 1.030, rising hematocrit and a BUN to creatinine ratio above 20 to 1. Replace with isotonic 0.9% saline or lactated Ringer's. **Fluid volume excess** shows weight gain, bounding pulse, JVD, an S3, edema and the finding that matters most: crackles with a falling saturation. One kilogram equals one liter equals 2.2 pounds.

Third spacing moves fluid into a space where it does no work: ascites, burns, sepsis, bowel obstruction, pancreatitis. The patient looks wet but is functionally dry: tachycardic, hypotensive and oliguric. Treat the intravascular deficit first. Later the fluid returns, and the same patient can tip into overload.

Sodium (135 to 145) is a water problem and a brain problem. Low sodium swells brain cells: headache, confusion, seizure. Common causes are SIADH, heart failure, cirrhosis, thiazides and hypotonic fluid. Treat by volume status: fluid restriction for SIADH and overload, isotonic saline for the dry patient, small-volume 3% saline only for severe symptoms. Raise it no more than 8 to 10 mEq/L in 24 hours or risk osmotic demyelination. High sodium means a water deficit, often in someone who cannot get water; treat with water or hypotonic fluid and lower it no more than 10 to 12 in 24 hours.

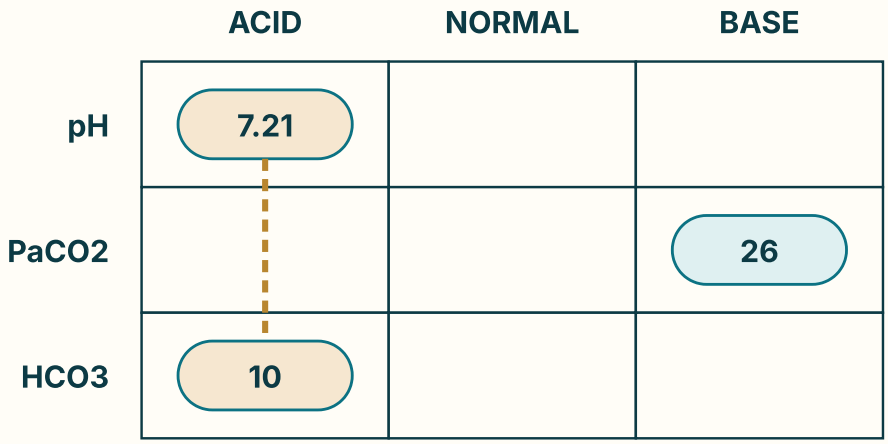
Potassium (3.5 to 5.0) is a heart problem fixed now. Low potassium causes weakness, ileus, flat T waves and U waves and makes digoxin toxic. High potassium causes peaked T waves, then a long PR and lost P waves, a wide QRS, a sine wave and arrest. Treatment runs in a fixed order: **calcium gluconate** to protect the heart (it does not lower potassium), then insulin with dextrose or albuterol to shift it into cells, then a loop diuretic, binder or dialysis to remove it. Stop every potassium source.

Low calcium and low magnesium make membranes twitchy: tingling, tetany, Chvostek and Trousseau signs, laryngospasm, long QT and torsades. High calcium causes stones, bones, groans, moans and thrones, with a short QT. High magnesium takes away the deep tendon reflexes first, then the breathing. Refractory low potassium is a magnesium problem. Phosphorus runs opposite to calcium; binders are given with meals.

For an ABG use **ROME**: Respiratory Opposite, Metabolic Equal. Check the pH, find the value that matches it, then see whether the other value has moved to compensate. A normal pH with

both values abnormal is full compensation; split the normal range at 7.40 to find the primary problem. Anion gap = Na minus (Cl + HCO_3), normal 8 to 12. A high gap means added acid (DKA, lactate, kidney failure, toxins).

Isotonic fluids (0.9% saline, lactated Ringer's) fill the vessels. Hypotonic fluids (0.45% saline, D5W once the dextrose is used) move water into cells and are dangerous in head injury or stroke. D5W is never a resuscitation fluid. Hypertonic fluids (3% saline) pull water into the vessels. Only 0.9% saline runs with blood. Potassium is never pushed, always diluted, always pumped: up to 10 mEq/hr on a peripheral line without monitoring. Confirm urine output first.



Read it
pH and HCO3 share the ACID column: metabolic acidosis. PaCO2 sits in the opposite column: the lung is compensating. pH still abnormal: **partially compensated.**

Cut points
pH: acid below 7.35, base above 7.45.
PaCO2: acid above 45, base below 35 (CO_2 is an acid).
HCO3: acid below 22, base above 26 (bicarbonate is a base).

ROME: Respiratory Opposite, Metabolic Equal.

Tic-tac-toe for a gas. Put each value in its own column. The value that lines up with the pH names the disorder; a value in the opposite column is compensating.

LOCK THESE IN

- Water follows sodium. Osmolality 275 to 295 mOsm/kg. 1 kg = 1 L = 2.2 lb.
- Deficit: tachycardia first, BUN:creatinine above 20:1, urine specific gravity above 1.030. Excess: crackles matter most.
- Na 135 to 145, K 3.5 to 5.0, Ca 8.5 to 10.5, Mg 1.5 to 2.5 mEq/L, Phos 2.5 to 4.5 (Chapter 2 values).
- Hyponatremia correction: no more than 8 to 10 mEq/L in 24 h (osmotic demyelination).
- Hyperkalemia: calcium gluconate protects, insulin plus dextrose shifts, binder or dialysis removes.
- Refractory hypokalemia means check the magnesium. Phosphate binders go with meals.
- ROME: Respiratory Opposite, Metabolic Equal. Anion gap = Na minus ($Cl + HCO_3$), normal 8 to 12.
- Potassium: never IV push, always on a pump, 10 mEq/hr peripheral limit, confirm urine output first.

Electrolytes at a glance

Electrolyte	Range	Low	High
Sodium	135 to 145 mEq/L	Confusion, seizure, weak reflexes	Thirst, agitation, dry furrowed tongue
Potassium	3.5 to 5.0 mEq/L	Weakness, ileus, flat T, U wave	Peaked T, wide QRS, diarrhea, weakness
Calcium (total)	8.5 to 10.5 mg/dL	Tetany, Chvostek, Trousseau, long QT	Stones, bones, groans, lethargy, short QT
Magnesium	1.5 to 2.5 mEq/L	Tremor, hyperreflexia, torsades	Lost reflexes, respiratory depression
Phosphorus	2.5 to 4.5 mg/dL	Muscle and diaphragm weakness	Few signs; tetany from low calcium

ABG patterns

Disorder	pH	$PaCO_2$ (35 to 45)	HCO_3 (22 to 26)	Typical picture
Respiratory acidosis	Low	High (primary)	Normal or high	COPD flare, opioid overdose
Respiratory alkalosis	High	Low (primary)	Normal or low	Anxiety, pain, early sepsis, PE
Metabolic acidosis	Low	Normal or low	Low (primary)	DKA, shock, kidney failure, diarrhea
Metabolic alkalosis	High	Normal or high	High (primary)	Vomiting, NG suction, diuretics

IV solutions by tonicity

Tonicity	Examples	Water moves	Use	Watch for
Isotonic	0.9% NaCl, lactated Ringer's	Stays extracellular	Hypovolemia, blood (0.9% only)	Overload; LR has 4 mEq/L K
Hypotonic	0.45% NaCl, D5W after metabolism	Into cells	Hypernatremia, later DKA	Cerebral edema; never in head injury
Hypertonic	3% NaCl, D5NS, D10W, TPN	Out of cells into vessels	Severe hyponatremia, cerebral edema	Overload; pump; sodium checks
Colloid	Albumin	Interstitium into vessels	Low albumin, paracentesis	Overload; starches no longer advised

Worked cases

WORKED CASE 1 · ROME IN THREE STEPS

Mr. Tran, 71, has COPD and is drowsy. ABG: pH 7.30, $PaCO_2$ 62, HCO_3 30. Two days later: pH 7.37, $PaCO_2$ 60, HCO_3 34.

STEP 1 · READ THE PH

7.30 is below 7.35: acidosis.

STEP 2 · FIND THE MATCH

$PaCO_2$ 62 is high, and high CO_2 is acid. It moves opposite to the pH, so the problem is **respiratory**.

STEP 3 · GRADE COMPENSATION

HCO_3 30 has risen in the compensating direction, but the pH is still low: **partially compensated respiratory acidosis**.

STEP 4 · READ THE SECOND GAS

pH 7.37 is normal, but both other values are abnormal: full compensation. 7.37 sits on the acid side of 7.40, so the primary problem is still respiratory acidosis.

SAFETY

Priority is ventilation: sit him up and support breathing. Bicarbonate is not the answer; the lung is.

WORKED CASE 2 · AN ANION GAP

Ms. Ruiz has pH 7.28, $PaCO_2$ 30, HCO_3 12, Na 140, Cl 104. Name the disorder and the gap.

STEP 1 · READ THE GAS

pH 7.28 is acidosis. HCO_3 12 is low and moves the same way: **metabolic acidosis**. $PaCO_2$ 30 is low, the lung compensating, but the pH is still abnormal: partially compensated.

STEP 2 · COMPUTE THE GAP

Anion gap = 140 minus (104 + 12) = 140 minus 116 = **24 mEq/L**.

STEP 3 · INTERPRET

24 is well above 8 to 12, so acid has been added: ketones, lactate, uremic acids or a toxin, not bicarbonate lost to diarrhea.

SAFETY

Watch the potassium. Acidosis pushes potassium out of cells, so the serum level can fall sharply as the acidosis is corrected.

WORKED CASE 3 · A WEIGHT CHANGE AND A SODIUM CORRECTION

Mrs. Abara has heart failure and weighed 79.2 kg yesterday and 81.4 kg today. A second patient, Mr. Lind, had a sodium of 119 that is now 131 after 24 hours of treatment.

STEP 1 · CONVERT THE WEIGHT

81.4 minus 79.2 = 2.2 kg, which is about **2.2 L** retained (2.2 x 2.2 = 4.8 lb).

STEP 2 · ASSESS FIRST

Listen to her lungs and check her saturation and work of breathing before anything else. Pulmonary edema is what kills.

CHECK THE SODIUM RISE

131 minus 119 = **12 mEq/L** in 24 hours.

STEP 4 · COMPARE TO THE LIMIT

The limit is 8 to 10 mEq/L in 24 hours. A 12 point rise is too fast and risks osmotic demyelination. Report it now and expect the infusion to be stopped or changed.

WORKED CASE 4 · CORRECTED CALCIUM

Mr. Banerjee has a total calcium of 7.6 mg/dL and an albumin of 2.5 g/dL. He has no tingling or spasm.

STEP 1 · FIND THE ALBUMIN GAP

Albumin sits 4.0 minus 2.5 = 1.5 g/dL below 4.0.

STEP 2 · APPLY THE RULE

Add 0.8 mg/dL per 1 g/dL: 0.8 x 1.5 = 1.2. Corrected calcium = 7.6 + 1.2 = **8.8 mg/dL**.

STEP 3 · INTERPRET

8.8 is inside 8.5 to 10.5. The low total is mostly from low albumin, which fits his lack of symptoms.

CHECK IT

In a critically ill patient, ask for an ionized calcium (4.5 to 5.6 mg/dL) and skip the arithmetic.

TRAPS PEOPLE FALL INTO

- **Giving D5W for low blood pressure.** It acts as free water once the dextrose is used. Only about a twelfth stays in the vessels.
- **Thinking calcium gluconate lowers potassium.** It protects the heart for 30 to 60 minutes. Shifting and removal still have to follow.
- **Correcting sodium fast because it is very low.** Speed causes osmotic demyelination. Seizures get small-volume 3% saline and close sodium checks.
- **Replacing potassium again and again.** If it will not rise, check and replace the magnesium.
- **Giving phosphate binders between meals.** They bind dietary phosphorus, so they go with food.
- **Treating third spacing with diuretics first.** The patient is dry inside the vessels. Restore volume first.
- **Sedating Kussmaul breathing.** That breathing is compensation for metabolic acidosis and is keeping the patient alive.
- **Assuming anxiety in a post-op patient who is hyperventilating.** Rule out pulmonary embolism first.

Chapter 2 self-test · ten items

1. Which finding is usually the earliest reliable sign of fluid volume deficit?

A. Tachycardia
B. Hypotension
C. Weak thready pulse
D. Cool mottled skin

A. Tachycardia The heart compensates first. Hypotension and mottling are late, near shock.

2. A patient with heart failure gained 1.8 kg overnight. About how much fluid was retained?

A. 0.8 L
B. 3.6 L
C. 18 L
D. 1.8 L

D. 1.8 L One kilogram of weight change equals one liter of fluid.

3. A patient with SIADH has a sodium of 128 and no symptoms. What is the expected treatment?

A. D5W infusion
B. Rapid 3% saline
C. Fluid restriction
D. Free-water flushes

C. Fluid restriction Euvolemic hyponatremia from SIADH is treated by restricting water.

4. A potassium of 6.9 comes with peaked T waves. Which drug is given first?

A. Sodium polystyrene
B. IV calcium gluconate
C. IV furosemide bolus
D. Oral potassium binder

B. IV calcium gluconate Calcium stabilizes the myocardium first. It does not lower the potassium.

5. Two days after thyroid surgery a patient has perioral tingling and a hoarse voice. What is the first action?

A. Draw a magnesium level
B. Offer an oral calcium
C. Recheck in one hour
D. Assess the airway

D. Assess the airway Hoarseness signals possible laryngospasm from low calcium, an airway emergency.

6. During a magnesium infusion, the patellar reflex is absent. What should the nurse do first?

A. Stop the infusion
B. Slow the rate by half
C. Recheck in 30 minutes
D. Give a second bolus

A. Stop the infusion Lost reflexes come before respiratory depression. Stop it; calcium gluconate is the antidote.

7. Interpret pH 7.49, $PaCO_2$ 44, HCO_3 33.

A. Partly compensated respiratory alkalosis
B. Fully compensated metabolic acidosis
C. Uncompensated metabolic alkalosis
D. Uncompensated respiratory acidosis

C. Uncompensated metabolic alkalosis pH high, HCO_3 high and moving the same way: metabolic. $PaCO_2$ is still normal, so no compensation yet.

8. Na 138, Cl 100, HCO_3 14. What is the anion gap?

A. 38 mEq/L
B. 24 mEq/L
C. 14 mEq/L
D. 10 mEq/L

B. 24 mEq/L 138 minus (100 + 14) = 24, a high gap that points to added acid.

9. Which IV fluid is the poorest choice for a patient with a head injury?

A. 0.45% sodium chloride
B. 0.9% sodium chloride
C. Lactated Ringer’s
D. 3% sodium chloride

A. 0.45% sodium chloride Hypotonic fluid moves water into cells and can swell the brain.

10. An order reads “KCl 10 mEq IV push now.” What should the nurse do?

A. Give it slowly over 5 minutes
B. Dilute it in a 10 mL flush
C. Hold it and clarify the order
D. Give half and recheck the level

C. Hold it and clarify the order Potassium is never pushed. Clarify, request a diluted pump infusion, and document the clarification.

ONE PAGE

Cram sheet

Everything from chapters 1 and 2 in one place. Cover the right column and see if you can rebuild each row.

Numbers to know

Item	Value	Note
Pre-arrest window	6 to 8 hours of abnormal vital signs	Failure to rescue lives here
Rapid response triggers	HR under 40 or over 130; RR under 8 or over 28; SBP under 90	Plus “the nurse is worried”
MAP	70 to 100; act under 65	(SBP + 2 x DBP) ÷ 3
Urine output	At least 0.5 mL/kg/hr (about 30 mL/hr)	Under 30 for two hours: escalate
SpO_2 target in CO_2 retention	88 to 92%	A change from baseline is what matters
Body water	60% male, 50 to 55% female	Two thirds intracellular; plasma about a quarter of ECF
Osmolality	275 to 295 mOsm/kg	2 x Na + glucose ÷ 18 + BUN ÷ 2.8
Electrolytes	Na 135 to 145; K 3.5 to 5.0; Ca 8.5 to 10.5; Mg 1.5 to 2.5 mEq/L; Phos 2.5 to 4.5	Chapter 1 table lists Ca 8.6 to 10.2, Mg 1.6 to 2.6 mg/dL
ABG	pH 7.35 to 7.45; $PaCO_2$ 35 to 45; HCO_3 22 to 26; PaO_2 80 to 100	Anion gap 8 to 12
Sodium correction	Up no more than 8 to 10 mEq/L in 24 h	Down no more than 10 to 12 in 24 h
IV potassium	Peripheral up to 10 mEq/100 mL and 10 mEq/hr	Central up to 20 mEq/hr with ECG monitoring
Daily weight	1 kg = 1 L = 2.2 lb	Call for 2 to 3 lb in a day or 5 lb in a week

Key terms and comparisons

Term	Meaning
Abnormal vs unexpected	Abnormal compares to the textbook; unexpected compares to this patient, diagnosis and timeline
Hyponatremia vs hypernatremia	Water excess, brain swells, reflexes down; water deficit, brain shrinks, agitation and hyperreflexia
Hypokalemia vs hyperkalemia	Flat T, U wave, ileus, digoxin toxicity; peaked T, wide QRS, diarrhea, arrest
Chvostek vs Trousseau	Facial twitch on tapping; carpopedal spasm under a cuff (more specific)
Infiltration vs extravasation	Non-vesicant leak; vesicant leak with tissue necrosis
Isotonic vs hypotonic vs hypertonic	Fills vessels; hydrates cells; pulls water into vessels

Rules that are not equations

Topic	The rule
Priority	ABC, then Maslow, then acute, unstable, actual, unexpected. C-A-B in arrest.
First action	A stabilizing nursing action comes before the phone call.
Stop the infusion	Transfusion reaction or air embolism: stop, keep the line open with saline on new tubing. Air: clamp, left side, Trendelenburg.
Delegation	Never assessment, teaching, evaluation, care planning or an unstable patient.
Hyperkalemia order	Protect (calcium), shift (insulin and dextrose, albuterol), remove (diuretic, binder, dialysis).
ROME	Respiratory Opposite, Metabolic Equal; split a normal pH at 7.40.
Potassium	Never IV push, IM or subcutaneous. Pump, dilute, check urine output and magnesium.
Older adult	New confusion: check SpO_2 and glucose, then a metabolic panel, not a sedative.

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