FUNDAMENTALS OF NURSING · STUDY GUIDE

Exam 7 Study Guide

This guide covers chapters 13 and 14. Chapter 13 starts with the bath, which is really a skin assessment, and moves through pressure injuries, wound healing, wound description and dressings, drains, and heat and cold. Chapter 14 is oxygenation: how air and blood meet, how hypoxia shows itself, how to clear an airway, how to choose an oxygen device, and how to handle a tracheostomy, a chest tube and an arrest. Both chapters are full of numbers and sequences. Cover the steps of each case and solve it before you check.

WHAT THIS GUIDE COVERS

- Chapter 13 · hygiene principles, baths, oral care, dentures, diabetic foot care, eye, ear and perineal care, bed making and delegation, pressure, shear, friction and moisture, the Braden scale, blanching, staging, IAD and skin tears, prevention, healing phases, primary, secondary and tertiary intention, factors that delay healing, hemorrhage, infection, dehiscence and evisceration, assessment and the clock method, drainage types, irrigation, debridement, dressings, drains, sutures and staples, heat and cold.
- Chapter 14 · ventilation, compliance, surfactant, diffusion and transport, shunt and dead space, control of breathing, hypoxemia and hypoxia, early and late signs, breath sounds, sputum, pulse oximetry and ABG values, positioning, breathing exercises, coughing, incentive spirometry, chest physiotherapy, suctioning, oxygen devices and FiO2, oxygen safety and toxicity, chronic CO2 retention, oral and nasal airways, tracheostomy care and decannulation, chest tubes, choking and adult basic life support.

CHAPTER 13

Hygiene, Skin Integrity and Wound Care

Read it in full: **Chapter 13 in the textbook**. Practice it in the lab: **Braden Scale Scorer** and **Wound Measure and Dress**.

What to know

Hygiene is assessment, infection prevention and dignity at once. Learn the patient's routines and cultural practices, encourage self care, keep the patient covered and warm, and work **clean to**

dirty (eyes and face first, perineum last). Bath water is commonly about 43 to 46 C (110 to 115 F); test it, especially for patients with neuropathy, spinal cord injury or confusion. Use long strokes distal to proximal on the limbs. Do not massage reddened areas or bony prominences. Return the bed to the lowest position with the call light in reach.

Oral care prevents hospital acquired pneumonia. Brush twice a day with a soft brush; avoid lemon and glycerin swabs and alcohol mouthwash. For an unconscious or dysphagic patient, place side lying with the head turned, have suction ready, use small amounts of fluid and never put fingers between the teeth. Clean dentures over a lined or water filled sink in cool or lukewarm water and store them in a labeled cup.

Diabetic foot care: inspect daily with a mirror, wash in lukewarm water, dry between the toes, **do not soak**, lotion on tops and soles but not between the toes, well fitting shoes, never barefoot, no heating pads. Nails are cut straight across, and in diabetes, vascular disease or anticoagulation are trimmed by podiatry or per policy. Eyes: water only, **inner to outer canthus**. Ears: no swabs in the canal. Perineal care: female **front to back**; male from the meatus outward, and always **return the foreskin** to prevent paraphimosis. Catheter care cleans from the meatus outward about 10 cm.

Linens: hold soiled linen away from your uniform, never shake it or put it on the floor, and do not carry extra clean linen into a room. Hygiene for stable patients is often delegated to assistive personnel, but the nurse tells them what to report and assesses the skin personally.

A **pressure injury** is damage to skin and soft tissue over bone or under a device from pressure, or pressure with **shear**. Capillary closing pressure is about 32 mm Hg. Muscle and fat tolerate ischemia worse than skin, so damage often starts deep, in a cone. Shear happens when the head of the bed is above 30 degrees and the patient slides. Friction scrapes the epidermis; moisture macerates skin. The heels are second only to the sacrum.

The **Braden scale** scores sensory perception, moisture, activity, mobility and nutrition 1 to 4 and friction and shear 1 to 3, for 6 to 23. **Lower means higher risk**: 15 to 18 mild, 13 to 14 moderate, 10 to 12 high, 9 or below very high. Each low subscale points to an action: moisture to incontinence care, nutrition to a dietitian, friction to lift sheets and head of bed limits. Test

blanching: blanchable redness whitens and refills; nonblanchable erythema stays red. In dark skin, rely on warmth, coolness, firmness, bogginess, pain and purple or darker color.

Stages: **1** intact nonblanchable erythema; **2** partial thickness with exposed dermis or a serum blister; **3** full thickness with fat visible (slough, eschar, undermining and tunneling possible); **4** exposed or palpable fascia, muscle, tendon, ligament, cartilage or bone; **unstageable** when slough or eschar hides the base (leave stable dry heel eschar); **deep tissue pressure injury** with persistent deep red, maroon or purple discoloration or a blood blister. Never reverse stage; restage deeper if needed. Incontinence associated dermatitis and skin tears are not pressure injuries. Prevent with 30 degree tilts at least every 2 hours, head of bed 30 degrees or less when possible, floating heels, lifting not dragging, redistribution surfaces, moisture care, nutrition, padding devices, no donut cushions and no massage.

Healing phases: **hemostasis** (clot), **inflammatory** (days 1 to about 4 to 6; mild redness and swelling along an incision are expected), **proliferative** (about day 3 to 21; collagen, beefy red granulation, contraction, epithelialization; a healing ridge by the end of week 1) and **maturation** (week 3 to a year or more; scar reaches only about 80% of original strength). **Primary intention**: edges closed, fastest. **Secondary**: left open to granulate, slow, bigger scar. **Tertiary**: delayed closure. Healing slows with age, poor nutrition (protein, vitamin C, zinc), poor perfusion, smoking, diabetes, steroids, infection, necrotic tissue and tension.

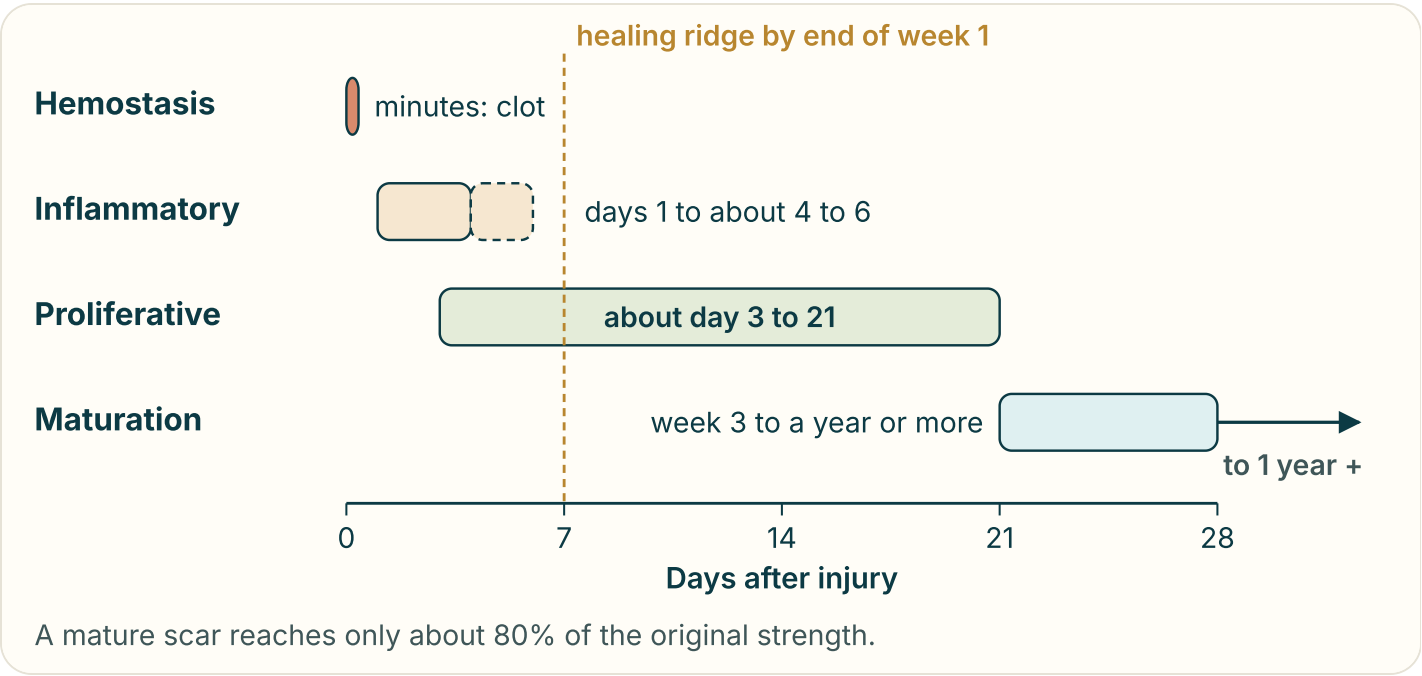
Complications: **hemorrhage** in the first 24 to 48 hours (check under the patient); **infection** about days 3 to 5 (spreading redness, warmth, purulent drainage, fever; confusion in older adults); **dehiscence** around days 5 to 8 ("something gave way," a gush of serosanguineous fluid); **evisceration** is an emergency: stay, have someone call the surgeon, cover with sterile saline moistened dressings, do not push organs back, low Fowler's with knees bent, NPO, watch for shock. Teach splinting with a pillow.

Assess location, size, tissue percentages, drainage, edges (undermining, tunneling, epibole), periwound skin, pain and odor **after cleansing**. The **clock method** puts 12 o'clock toward the head: length head to toe, width side to side, depth at the deepest point. Drainage: **serous** (clear), **sanguineous** (bright red), **serosanguineous** (pale pink; a sudden increase can precede

dehiscence), **purulent** (thick, colored, often with odor). Cleanse with saline from clean to dirty. **Irrigate** at 4 to 15 psi; a 35 mL syringe with a 19 gauge needle or catheter gives about 8 psi.

Debridement can be sharp, mechanical, enzymatic, autolytic or biological. Dressings follow **moist wound healing**: transparent film for stage 1 and superficial stage 2; hydrocolloid for shallow wounds with light drainage (not infected); hydrogel for dry wounds; **alginate** and foam for heavy drainage; antimicrobial for infected wounds; negative pressure for large deep wounds (commonly about 125 mm Hg). Pack dead space loosely and count pieces in and out. Empty Jackson-Pratt and Hemovac drains at about half full, measure, then **compress** before closing. Remove every other suture or staple first; stop if edges separate.

Heat dilates vessels and relaxes muscle; cold constricts vessels, limits swelling and numbs. Use **cold first** for 24 to 48 hours after an acute injury, then heat. Limit applications to about 15 to 20 minutes and check the skin every 5 to 10 minutes because of the **rebound phenomenon** and receptor adaptation. Never apply directly to skin, never let the patient lie on a heating pad. Heat is contraindicated in the first 24 hours after trauma, active bleeding, acute localized inflammation such as appendicitis and impaired sensation; cold in open wounds, impaired circulation and Raynaud phenomenon. Document wounds in centimeters with anatomical locations and objective words.



Wound healing phases overlap. Mild redness in the first days is expected inflammation. A healing ridge should be felt by the end of week 1, and the scar never regains full strength.

LOCK THESE IN

- Clean to dirty; eyes inner to outer; female front to back; return the foreskin.
- Diabetic feet: inspect daily, dry between toes, no soaking, no lotion between toes.
- Braden 6 to 23; lower is worse; 10 to 12 high, 9 or below very high.
- Stage 1 skin intact, 2 shallow dermis, 3 fat, 4 structures; hidden base unstageable; maroon intact is DTPI.
- Never reverse stage, never massage red skin, no donut cushions.
- Infection about days 3 to 5; dehiscence about days 5 to 8.
- Evisceration: stay, sterile saline moistened cover, low Fowler's with knees bent, NPO.
- Irrigate at 4 to 15 psi; empty drains at half full and recompress; heat or cold 15 to 20 minutes.

Key terms and comparisons: wound drainage and dressings

Item	Description	Use or meaning
Serous	Clear, thin, pale yellow	Normal early healing
Sanguineous	Bright red, thin	Fresh bleeding; report increasing amounts
Serosanguineous	Pale pink, watery	Common early after surgery; sudden increase can precede dehiscence
Purulent	Thick, yellow, green or tan, often odor	Infection; report and culture as ordered
Transparent film	See through, occlusive	Stage 1 and superficial stage 2; not for draining wounds
Hydrocolloid	Occlusive gel forming wafer	Shallow wounds, light drainage; not infected
Hydrogel	Donates moisture	Dry or sloughy wounds; needs a cover
Alginate or foam	Absorbs heavy drainage	Moderate to heavy exudate; alginate packs dead space

Priority rules: healing timeline and emergencies

Item	Rule
Hemorrhage	First 24 to 48 h; check under the patient
Infection	About days 3 to 5; culture after cleansing, before antibiotics
Dehiscence	About days 5 to 8; splint when coughing
Evisceration	Sterile saline moist cover, low Fowler's, knees bent, NPO, stay
Maturation	Scar reaches about 80% of original strength
Clock method	12 o'clock toward the head
Irrigation	4 to 15 psi; 35 mL syringe and 19 gauge gives about 8 psi
Heat or cold	15 to 20 min; skin checks every 5 to 10 min; cold first after injury

Worked cases

WORKED CASE 1 · SCORING THE BRADEN SCALE

Mrs. Lindstrom, 84, two days after hip surgery, responds only to painful stimuli (sensory 2), is often moist from incontinence (moisture 2), is bedfast (activity 1), makes only slight position changes (mobility 2), eats about half of her meals (nutrition 2), and slides down in bed needing help to move (friction and shear 1).

STEP 1 · ADD THE SUBSCALES

2 + 2 + 1 + 2 + 2 + 1 = **10**.

STEP 2 · BAND IT

10 falls in the high risk range (10 to 12). Lower is worse.

STEP 3 · MATCH ACTIONS TO LOW SUBSCALES

Moisture: prompt incontinence care and barrier cream. Nutrition: dietitian. Friction and shear: lift sheet, head of bed 30 degrees or less. Mobility: 30 degree tilts at least every 2 hours, heels floated, redistribution mattress.

RULE

The assistant reports reddened skin; the nurse assesses and stages it.

WORKED CASE 2 · DESCRIBING A WOUND

Mr. Hanley, 72, has a sacral wound 5.5 cm head to toe, 4 cm side to side, 2 cm deep, with fat visible, 70% granulation and 30% yellow slough, moderate serosanguineous drainage and a 2 cm shelf under the edge from 1 to 4 o'clock.

STEP 1 · STAGE IT

Fat is visible and no bone or muscle shows: **stage 3**. The slough covers only part of the base, so it is not unstageable.

STEP 2 · NAME THE EDGE FINDING

A shelf under intact edges is **undermining**, described as 2 cm from 1 to 4 o'clock.

STEP 3 · CLEAN AND FILL

Irrigate with warmed saline at safe pressure, loosely fill the dead space and undermining with alginate or saline moistened gauze, cover with foam.

STEP 4 · DOCUMENT

Size, tissue percentages, drainage, undermining by clock position, pieces of packing, pain.

RULE

No dressing heals a wound that is still under pressure. Keep offloading.

WORKED CASE 3 · EVISCERATION ON DAY 6

Mr. Ortega, 59, BMI 41, with diabetes, is on day 6 after an open colectomy. While coughing he says, "Something popped," and loops of bowel are visible.

STEP 1 · RECOGNIZE

Day 6, obesity, diabetes and coughing are risks for dehiscence; visible bowel is evisceration.

STEP 2 · STAY AND CALL

Stay with him and have someone else notify the surgeon.

STEP 3 · COVER

Sterile towels or dressings moistened with sterile saline over the bowel. Do not push it back. No dry gauze.

STEP 4 · POSITION AND PREPARE

Low Fowler's with knees bent, NPO, watch for shock.

PREVENTION

Splint with a pillow when coughing and control blood glucose after surgery.

WORKED CASE 4 · A DRAIN THAT LOST SUCTION

Ms. Ward, 46, is on day 2 after a mastectomy. Her Jackson-Pratt bulb is round and full looking with 20 mL of serosanguineous fluid, and the insertion dressing is damp.

STEP 1 · RECOGNIZE

A round bulb has lost suction, so fluid collects and leaks around the tube.

STEP 2 · EMPTY AND MEASURE

Empty the bulb and record 20 mL.

STEP 3 · RESTORE SUCTION

Compress the bulb fully before closing the port, and check the tubing for kinks.

STEP 4 · JUDGE THE DRAINAGE

Serosanguineous on day 2 is expected. Increasing bright red output or a hard swelling would prompt a call.

TEACH

Show her and her family how to empty, compress and record before discharge.

TRAPS PEOPLE FALL INTO

- **Soaking diabetic feet.** Soaking macerates skin. Wash, dry well, inspect.
- **Massaging a reddened sacrum.** Massage injures fragile deep tissue.
- **Calling a maroon intact area stage 1.** That is a deep tissue pressure injury.
- **Reading a high Braden score as high risk.** Braden is reversed: lower scores mean higher risk.
- **Calling IAD a pressure injury.** Diffuse, shiny redness in skin folds is moisture damage, not pressure.
- **Pushing eviscerated bowel back in.** Cover with sterile saline moistened dressings and call the surgeon.
- **Judging odor before cleansing.** Old exudate smells. Assess odor after cleansing.
- **Packing a wound tightly.** Tight packing compresses vessels. Pack loosely.
- **Turning up a heating pad for a patient with neuropathy.** Keep the ordered setting and check skin more often.

Chapter 13 self-test · ten items

1. A nurse is washing a patient's eyes. Which technique is correct?

A. Circular motion around the whole eye
B. Inner to outer canthus with mild soap
C. Outer to inner canthus with mild soap
D. Inner to outer canthus with water only

D. Inner to outer canthus with water only Moving from inner to outer canthus carries debris away from the nasolacrimal duct, and soap irritates the eyes.

2. Which instruction is correct for diabetic foot care?

A. Soak the feet in warm water for 20 minutes
B. Apply lotion generously between the toes
C. Dry carefully between the toes after washing
D. Use a heating pad on cold feet at night

C. Dry carefully between the toes after washing Soaking macerates skin, lotion between toes promotes fungus and heat can burn numb feet.

3. After perineal care for an uncircumcised male, what must the assistant do?

A. Leave the foreskin pulled back to air dry
B. Return the foreskin to its natural position
C. Wash from the scrotum up toward the tip
D. Apply talcum powder under the foreskin

B. Return the foreskin to its natural position Leaving it retracted can cause paraphimosis and impaired blood flow.

4. A Braden score is 12. How should the nurse interpret it?

A. The patient is at high risk
B. The patient is at mild risk
C. The patient is at moderate risk
D. The patient is not at risk

A. The patient is at high risk Scores of 10 to 12 are high risk. Lower scores mean higher risk.

5. A pressure injury shows full thickness loss with exposed tendon. What stage is it?

A. Stage 3
B. Unstageable
C. Stage 4
D. Stage 2

C. Stage 4 Exposed tendon, muscle, fascia, cartilage or bone is stage 4. Fat alone is stage 3.

6. A healing stage 4 pressure injury now looks shallower. How should it be documented?

A. As a healing stage 4 pressure injury
B. As an unstageable pressure injury
C. As a stage 3 pressure injury now
D. As a stage 2 pressure injury now

A. As a healing stage 4 pressure injury Pressure injuries are never reverse staged. Granulation and scar do not replace lost muscle and fat.

7. A surgical patient on day 6 says, "Something gave way," and the nurse sees bowel through the incision. What is the first action?

A. Gently push the bowel back inside the abdomen
B. Cover the bowel with sterile saline moist dressings
C. Leave to call the surgeon from the station phone
D. Cover the whole area with dry sterile gauze pads

B. Cover the bowel with sterile saline moist dressings Moist sterile coverage protects the organs. The nurse stays and has someone else call the surgeon.

8. Which drainage type is pale pink and watery?

A. Serous fluid
B. Sanguineous
C. Purulent pus
D. Serosanguineous

D. Serosanguineous Serosanguineous drainage mixes plasma and red cells and is common in the first days after surgery.

9. How should a nurse handle a Jackson-Pratt drain that is half full?

A. Remove the bulb and replace it with a new one
B. Empty it, measure, then compress before closing
C. Empty it and close the port with the bulb round
D. Leave it until the bulb is completely full

B. Empty it, measure, then compress before closing Compressing the bulb restores suction. A round bulb has no suction.

10. A runner twisted an ankle at practice this morning and it is swelling. What should the nurse apply today?

A. Cold for about 15 to 20 minutes
B. Alternate heat and cold hourly
C. Heat for about 15 to 20 minutes
D. Heat for about 60 minutes

A. Cold for about 15 to 20 minutes Cold limits swelling and bleeding in the first 24 to 48 hours. Heat comes later.

CHAPTER 14

Oxygenation

Read it in full: **Chapter 14 in the textbook**. Practice it in the lab: **Oxygen Device Picker** and **Hypoxia Detective**.

What to know

Oxygenation needs **ventilation** (air in and out), **diffusion** (gas across the alveolar capillary membrane), **perfusion** (blood through the lungs and to tissues), hemoglobin to carry oxygen and cardiac output to deliver it. Inspiration is active (diaphragm, phrenic nerves C3 to C5); normal expiration is passive. Accessory muscle use shows increased work. **Compliance** falls with fibrosis and edema. **Surfactant** keeps alveoli open; shallow breathing without deep breaths causes **atelectasis**.

About 97 to 98% of oxygen rides on **hemoglobin**, so delivery depends on hemoglobin, saturation and cardiac output. Severe anemia can show a normal saturation with too little oxygen content. Carbon monoxide binds hemoglobin over 200 times more strongly than oxygen. A **shunt** is perfused but not ventilated lung (atelectasis, pneumonia) and responds poorly to oxygen; **dead space** is ventilated but not perfused lung (pulmonary embolism). Rising CO2 is the main drive to breathe; low PaO2 (below about 60) is a backup. Opioids and sedatives depress the medulla.

Hypoxemia is low arterial oxygen; **hypoxia** is low tissue oxygen. Early signs: restlessness, anxiety, new confusion, tachycardia, tachypnea, dyspnea, pallor, accessory muscles. Late signs: decreased consciousness, bradycardia, bradypnea, hypotension, central cyanosis. Cyanosis is late and unreliable, especially with anemia and in darker skin (check mucosa and conjunctivae). Chronic hypoxemia shows clubbing and a barrel chest in emphysema; children show retractions, grunting and head bobbing.

Breath sounds: vesicular is normal; **fine crackles** mean fluid or reopening alveoli; coarse crackles mean secretions; **wheezes** mean narrowed airways; **rhonchi** mean large airway secretions and may clear with cough; **stridor** is an upper airway emergency; a friction rub means inflamed pleura; diminished sounds suggest atelectasis, effusion or pneumothorax. Sputum: rust colored in pneumococcal pneumonia, pink frothy in pulmonary edema. Collect it early in the morning after a water rinse, deep cough, sterile cup, before antibiotics.

Pulse oximetry normal is 95 to 100%; many protocols target 92 to 96% in acutely ill adults and 88 to 92% in chronic CO2 retention. Falsely low or unreliable with poor perfusion, motion, poor fit, bright light, dark polish or artificial nails; falsely high with **carbon monoxide**; may overestimate in darker skin. It says nothing about CO2. Below about 90%, the patient is on the steep part of the curve. Normal ABG: **pH 7.35 to 7.45, PaCO2 35 to 45, HCO3 22 to 26, PaO2 80 to 100, SaO2 95 to 100%**. After a radial stick, hold pressure at least 5 minutes (longer on anticoagulants).

Airway clearance: high or semi Fowler's (orthopneic for distress), turn at least every 2 hours, walk early, put the **good lung down** for one sided disease (except abscess or bleeding). **Pursed lip breathing**: in through the nose about 2 counts, out through pursed lips 4 or more. Effective cough: upright, two or three deep breaths, cough from the chest, **splint** incisions and premedicate. Huff coughing is less tiring. **Incentive spirometry**: sit up, exhale, seal lips, **inhale slowly and deeply**, hold 3 to 5 seconds, about 10 times an hour while awake. Chest physiotherapy is done before meals or 1 to 2 hours after, never over the spine, sternum, breasts or kidneys.

Suction only when needed (visible or audible secretions, coarse crackles, weak cough, falling SpO2). Oropharyngeal (Yankauer) is clean technique; airway suction is sterile. Adult wall suction about 100 to 150 mm Hg, catheter no more than half the airway diameter, **preoxygenate**, insert **without suction**, apply intermittent suction while withdrawing and rotating for **no more than 10**

to 15 seconds, reoxygenate with 20 to 30 seconds between passes, about 2 or 3 passes, trachea before mouth. Stop and oxygenate for bradycardia, dysrhythmias or a sharp SpO2 drop.

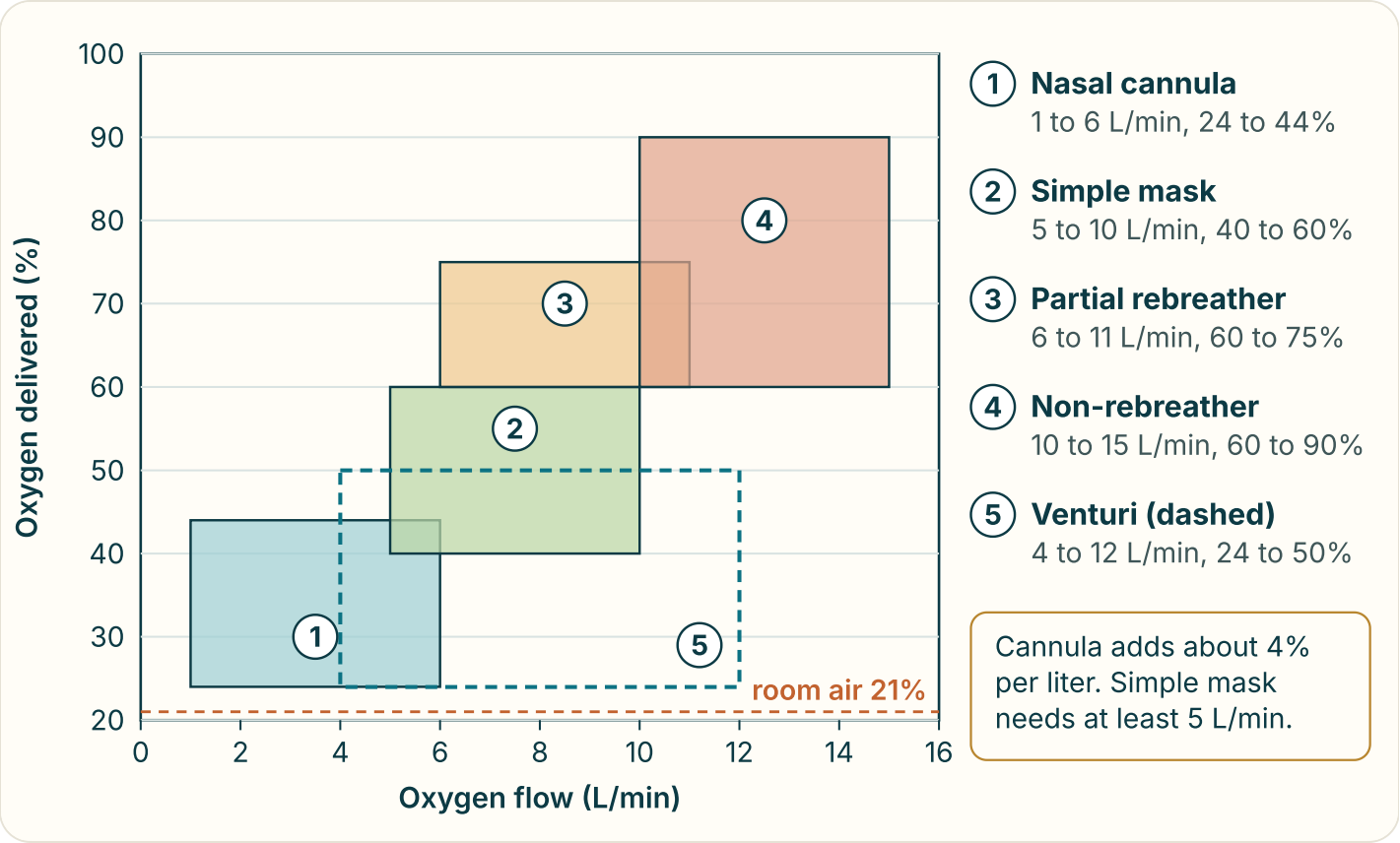
Oxygen is a **drug** with an order or target. Low flow devices: **nasal cannula** 1 to 6 L/min, about 24 to 44% (about 4% per liter above room air); **simple mask** 5 to 10 L/min (at least 5 to flush CO2), 40 to 60%; partial rebreather 6 to 11 L/min, about 60 to 75%; **non-rebreather** 10 to 15 L/min, about 60 to 90%, bag must stay inflated. High flow: **Venturi** for a precise 24 to 50%; high flow nasal cannula up to about 60 L/min. CPAP gives one pressure; BiPAP gives higher inspiratory pressure.

Oxygen safety: oxygen is not flammable but strongly supports combustion; no smoking or flames, no petroleum products on the face, secure cylinders upright, check flow and placement each shift. Humidify per policy and **always** for artificial airways. **Oxygen toxicity** can follow FiO2 above about 50% for more than 24 to 48 hours (substernal discomfort, dry cough, dyspnea); use the lowest effective FiO2. In **chronic CO2 retention**, titrate to about 88 to 92% (Venturi or low flow cannula) and watch for drowsiness and slowing breathing, but **never withhold** oxygen from a hypoxemic patient.

An **oropharyngeal airway** is only for unconscious patients without a gag reflex; size from the mouth corner to the jaw angle, insert tip up and rotate 180 degrees. A **nasopharyngeal airway** suits semiconscious patients (nose tip to earlobe) but is avoided with suspected basilar skull fracture, facial trauma or bleeding disorders. For an endotracheal tube, confirm with exhaled CO2 and bilateral breath sounds pending x ray, note the cm mark, keep the head of the bed 30 to 45 degrees and give oral care.

Tracheostomy: outer cannula with flange, removable inner cannula, cuff with pilot balloon, obturator. Keep the **obturator**, spare tubes (same size and one smaller), suction, bag valve mask and oxygen at the bedside. Care at least every 8 hours: suction first if needed, clean or replace the inner cannula, clean the stoma outward with sterile saline, use precut split gauze (never cut gauze), change ties with a second person holding the tube, one finger under the ties. Cuff pressure about 20 to 25 mm Hg. A speaking valve needs a deflated cuff. Accidental decannulation of a mature tract: reinsert with the obturator; of a fresh tract: call for help, oxygenate, and bag over the mouth and nose with the stoma covered if needed.

Chest tubes drain air, blood or fluid. The unit has a collection chamber, a **water seal** and suction control. **Tidaling** is expected; intermittent bubbling with a pneumothorax is expected; **continuous water seal bubbling** is an air leak; more than about 100 mL per hour or bright red drainage is reported. Keep the unit upright and below the chest, no dependent loops, no routine milking, no clamping without an order. If the tube disconnects from the unit, put the end 2 to 3 cm under sterile water and reconnect a new system. If it pulls out of the chest, cover with a dressing taped on three sides. Choking: abdominal thrusts (chest thrusts in late pregnancy or obesity), no blind finger sweep. Adult BLS: check breathing and carotid pulse within 10 seconds, compressions 100 to 120 per minute, at least 5 cm and not more than about 6 cm, 30:2, AED as soon as it arrives.



Each device has a flow range and an oxygen range. Read across for flow and up for percent. The Venturi is the choice when a precise, low concentration matters.

LOCK THESE IN

- Early hypoxia is behavior: restlessness, confusion, tachycardia, tachypnea. Cyanosis is late.
- SpO2 95 to 100%; target often 88 to 92% in CO2 retainers; CO poisoning reads falsely high.
- ABG: pH 7.35 to 7.45, PaCO2 35 to 45, HCO3 22 to 26, PaO2 80 to 100.
- Incentive spirometer: inhale slowly, hold 3 to 5 seconds, 10 times an hour.
- Suction: preoxygenate, none on insertion, intermittent on withdrawal, 10 to 15 seconds.
- Cannula 1 to 6 L; simple mask at least 5 L; non-rebreather 10 to 15 L with bag inflated; Venturi precise.
- Obturator and spare tubes at every tracheostomy bedside.
- Tidaling good; continuous water seal bubbling is a leak; disconnected tube goes under sterile water.

Key terms and comparisons: oxygen devices

Device	Flow	Approximate FiO2 and points
Nasal cannula	1 to 6 L/min	24 to 44%; about 4% per liter; can eat and talk
Simple face mask	5 to 10 L/min	40 to 60%; at least 5 L/min to flush CO2
Partial rebreather	6 to 11 L/min	About 60 to 75%; bag one third to one half full
Non-rebreather	10 to 15 L/min	About 60 to 90%; bag must not collapse
Venturi mask	Per adapter, often 4 to 12 L/min	24 to 50%, precise; good in chronic CO2 retention
High flow nasal cannula	Up to about 60 L/min	21 to 100%, heated and humidified
Trach collar, face tent	Often 8 to 10 L/min or more	Variable; humidified

Priority rules: airway skills, chest tubes and BLS

Item	Rule
Suction pressure (adult)	About 100 to 150 mm Hg
Suction pass	No more than 10 to 15 s; 2 or 3 passes
Trach cuff pressure	About 20 to 25 mm Hg
Trach ties	One finger fits under; second person holds the tube
Chest drain	Below chest; tidaling expected; no routine clamping or milking
Chest drain alarm signs	Continuous water seal bubbling; over about 100 mL/h or bright red
Disconnect from unit	Tube end 2 to 3 cm under sterile water
Adult compressions	100 to 120 per minute, at least 5 cm, not over about 6 cm, 30:2
Infant	Brachial pulse; about 4 cm; 15:2 with two rescuers

Worked cases

WORKED CASE 1 · RESTLESS AFTER SURGERY

Mrs. Pham, 72, on the first night after a hip replacement, is suddenly pulling at her gown and trying to get up. Pulse 118, RR 26, SpO2 87% on room air, fine crackles at both bases.

STEP 1 · RECOGNIZE

Acute restlessness with tachycardia, tachypnea and low saturation.

STEP 2 · ANALYZE

This is hypoxia until proven otherwise, possibly atelectasis, fluid overload or a pulmonary embolism.

STEP 3 · ACT

Stay, raise the head of the bed, apply oxygen per protocol, reassess SpO2 and breath sounds, call the rapid response team or provider.

RULE

Restraints or a sedative for "delirium" treat the symptom and can worsen hypoventilation.

WORKED CASE 2 · ESTIMATING FIO2 ON A CANNULA

A patient on room air (21%) is placed on a nasal cannula. Estimate the FiO2 at 2 L/min and at 4 L/min using about 4% per liter.

STEP 1 · 2 L/MIN

21 + (4 x 2) = **about 29%**.

STEP 2 · 4 L/MIN

21 + (4 x 4) = **about 37%**.

STEP 3 · CHECK THE RANGE

Both sit inside the commonly taught 24 to 44% range for 1 to 6 L/min.

NOTE

Low flow FiO2 is approximate because it varies with the breathing pattern. When an exact FiO2 matters, use a Venturi mask.

WORKED CASE 3 · TOO MUCH OXYGEN IN CHRONIC CO2 RETENTION

Mr. Volkov, 70, with severe COPD and chronic CO2 retention, was placed on a nasal cannula at 6 L/min. Two hours later he is hard to arouse, his RR fell from 24 to 10, and SpO2 is 99%.

STEP 1 · RECOGNIZE

High SpO2 with drowsiness and slowing breathing suggests rising PaCO2.

STEP 2 · ACT

Stimulate him, lower the oxygen to the ordered target (often 88 to 92%), notify the provider, expect an ABG and possibly noninvasive ventilation.

STEP 3 · AVOID THE TRAP

Do not turn the oxygen off completely; severe hypoxemia kills faster.

RULE

The goal is the right saturation, not a perfect one.

WORKED CASE 4 · A CHEST TUBE COMES APART

Ms. Rivas, 34, has a right chest tube for a spontaneous pneumothorax. While walking, the tubing separates from the drainage unit. She is anxious, RR 22, SpO2 94%.

STEP 1 · RECOGNIZE

The pleural space is now open to air.

STEP 2 · RECREATE THE WATER SEAL

Put the end of the chest tube 2 to 3 cm under sterile water or saline.

STEP 3 · RECONNECT

Attach a new sterile drainage unit, help her to bed.

STEP 4 · ASSESS AND REPORT

Breath sounds, SpO2, work of breathing; notify the provider.

RULE

Clamping can cause a tension pneumothorax. Keep sterile water at the bedside.

TRAPS PEOPLE FALL INTO

- **Sedating a newly restless patient.** Restlessness may be hypoxia. Check airway, breathing and SpO2 first.
- **Trusting a normal SpO2 after smoke or a generator in the garage.** Carbon monoxide reads as saturated. Give 100% oxygen by non-rebreather.
- **Blowing into an incentive spirometer.** The patient inhales slowly and deeply.
- **Suctioning while inserting the catheter.** Suction only while withdrawing, for 10 to 15 seconds.
- **Running a simple mask at 2 L/min.** At least 5 L/min is needed to flush exhaled CO2.
- **Withholding oxygen in COPD.** Titrate to target, never withhold from a hypoxemic patient.
- **Using an oral airway in an awake patient.** It triggers gagging and vomiting. Oral airways are for unconscious patients only.
- **Cutting regular gauze for a trach dressing.** Fibers can enter the airway. Use precut split gauze.
- **Clamping a chest tube when it disconnects.** Submerge the end in sterile water instead.

Chapter 14 self-test · ten items

1. A postoperative patient may be developing low oxygen. Which change would likely appear first?

A. A decreased level of awareness
B. A falling heart rate of 48
C. New restlessness and anxiety
D. Central cyanosis of the lips

C. New restlessness and anxiety Behavior changes come first. Cyanosis, bradycardia and decreased consciousness are late.

2. A family exposed to a running generator has headaches and an SpO2 of 99%. What should the nurse do?

A. Reassure them, since saturation is normal
B. Start a nasal cannula at 2 L/min
C. Recheck the SpO2 on a different finger
D. Give 100% oxygen by non-rebreather mask

D. Give 100% oxygen by non-rebreather mask Carbon monoxide reads as oxygenated hemoglobin. Treat on suspicion with high concentration oxygen.

3. Which ABG value is outside the normal range?

A. pH of 7.40
B. PaCO2 of 52 mm Hg
C. PaO2 of 90 mm Hg
D. HCO3 of 24 mEq/L

B. PaCO2 of 52 mm Hg Normal PaCO2 is 35 to 45. The other values are within normal limits.

4. Which instruction about the incentive spirometer is correct?

A. Inhale slowly and deeply, then hold it
B. Use it once a day, just before bedtime
C. Exhale forcefully into the mouthpiece
D. Breathe in and out quickly ten times

A. Inhale slowly and deeply, then hold it Slow, deep inhalation with a 3 to 5 second hold, about 10 times an hour, opens collapsed alveoli.

5. Halfway through a suction pass on a tracheostomy, the monitor shows the pulse falling to 50. What is the correct response?

A. Insert the catheter further
B. Increase the suction pressure
C. Continue to finish the pass
D. Stop suctioning and oxygenate

D. Stop suctioning and oxygenate Vagal stimulation and hypoxia cause bradycardia. Stop and reoxygenate.

6. What is the minimum flow rate for a simple face mask?

A. 2 L/min
B. 5 L/min
C. 3 L/min
D. 1 L/min

B. 5 L/min At least 5 L/min flushes exhaled CO2 from the mask.

7. Which device delivers the most precise oxygen concentration?

A. Partial rebreather
B. Simple face mask
C. Venturi mask
D. Nasal cannula

C. Venturi mask Color coded adapters set an exact FiO2.

8. A patient arrives on the unit with a new tracheostomy. Which item belongs at the bedside at all times?

A. The obturator
B. A spare dressing
C. A tongue blade
D. An oral airway

A. The obturator The obturator, with spare tubes, is needed to reinsert a tube after decannulation.

9. On rounds, the water seal chamber of a patient's chest drain bubbles steadily without stopping. What does this suggest?

A. A blocked drainage tube
B. Full re-expansion of the lung
C. Normal function of the unit
D. An air leak in the system

D. An air leak in the system Tidaling is expected; continuous water seal bubbling suggests a leak. Check connections from the dressing down.

10. An adult is unresponsive with no pulse. What compression rate is correct?

A. 100 to 120 per minute
B. 120 to 140 per minute
C. 80 to 100 per minute
D. 60 to 80 per minute

A. 100 to 120 per minute High quality compressions are 100 to 120 per minute, at least 5 cm deep.

ONE PAGE

Cram sheet

Chapters 13 and 14 on one page. These are full of numbers, so say each one out loud.

Hygiene, skin and wounds

Item	Rule
Hygiene	Clean to dirty; water about 43 to 46 C; distal to proximal strokes
Oral care, unconscious	Side lying, suction ready, no fingers
Diabetic feet	Inspect daily, dry between toes, no soaking
Perineal	Female front to back; male meatus outward; return foreskin
Braden	6 to 23; 10 to 12 high; 9 or below very high
Stages	1 intact red; 2 dermis; 3 fat; 4 structures; unstageable; DTPI
Prevention	30 degree tilt every 2 h; HOB 30 or less; float heels; no massage
Healing	Hemostasis, inflammation, proliferation, maturation; scar about 80% strength
Complications	Bleeding 24 to 48 h; infection days 3 to 5; dehiscence days 5 to 8
Evisceration	Sterile saline moist cover, low Fowler's, knees bent, NPO, stay
Wound care	Clock method; irrigate 4 to 15 psi; pack loosely; drains half full, recompress
Heat and cold	Cold first; 15 to 20 min; check skin every 5 to 10 min

Oxygenation

Item	Rule
Steps	Ventilation, diffusion, perfusion, transport, delivery
Hypoxia	Early restless, tachycardic; late cyanosis, bradycardia
Sounds	Crackles fluid; wheezes narrowing; rhonchi secretions; stridor emergency
SpO2	95 to 100%; 88 to 92% in CO2 retainers; CO reads high
ABG	pH 7.35 to 7.45; PaCO2 35 to 45; HCO3 22 to 26; PaO2 80 to 100
Spirometer	Inhale slowly, hold 3 to 5 s, 10 times an hour
Suction	100 to 150 mm Hg; preoxygenate; withdraw only; 10 to 15 s
Devices	Cannula 1 to 6; mask 5 to 10; NRB 10 to 15; Venturi precise
Toxicity	FiO2 above about 50% for 24 to 48 h
Trach	Obturator and spares; cuff 20 to 25 mm Hg; one finger under ties
Chest tube	Below chest; tidaling ok; continuous bubbling leak; under sterile water if disconnected
BLS	100 to 120/min, 5 to 6 cm, 30:2, AED early

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