NPTE REVIEW · STUDY GUIDE

Study Guide 6

This guide goes with Practice Exam 6. Chapter 11 covers the other systems patients bring with them: glucose, thyroid, bone, pelvic floor, pregnancy, cancer treatment, rheumatologic disease, organ pain that looks like joint pain, and the drugs that change the exercise response. Chapter 12 is the most number heavy chapter in the book: modality parameters, device fitting, wheelchair sizes and prosthetic deviations. Learn the two diagrams as number lines, work the cases with the steps covered, then take the ten board-style items for each chapter.

WHAT THIS GUIDE COVERS

- Chapter 11 · type 1 and 2 diabetes, glucose thresholds, hypoglycemia and DKA, thyroid and adrenal disease, osteoporosis and obesity, GI and renal referral, the pelvic floor, incontinence types, pregnancy and postpartum care, cancer treatment effects, blood count thresholds, bone metastasis and oncologic emergencies, HIV, RA versus OA, visceral referral, red flags and drug classes.
- Chapter 12 · heat transfer, hot packs, paraffin, cryotherapy, ultrasound frequency and intensity, diathermy, currents and parameters, TENS modes, NMES, HVPC, iontophoresis, EMG biofeedback, e-stim contraindications, traction, compression and the ABI, CPM, aquatic properties, device fitting, gait patterns, stairs and guarding, wheelchairs, accessibility, transfers, K levels, sockets, prosthetic deviations and orthoses.

CHAPTER 11

Other Systems and System Interactions

Read it in full: **Chapter 11 in the textbook**. Practice it: **Practice Exam 6** and the **flashcards**.

What to know

Diabetes is diagnosed by fasting glucose 126 or more, a 2 hour OGTT of 200 or more, or HbA1c 6.5 percent or more; prediabetes is fasting 100 to 125 or HbA1c 5.7 to 6.4. Exercise moves glucose into muscle through GLUT4 without insulin, and training improves insulin sensitivity for

24 to 72 hours. Aim for 150 minutes a week over at least 3 days, no more than 2 days off in a row, plus resistance work 2 to 3 days.

Check glucose before exercise in anyone on **insulin or a sulfonylurea**. **Below 70**: do not start; 15 g fast carbohydrate, recheck in 15 minutes. **70 to 100**: 15 to 30 g first. **100 to 250**: exercise. **Above 250**: check ketones; with ketones, no vigorous exercise. Hypoglycemia is fast: shaky, sweaty, tachycardic, then confused. Beta blockers hide the tremor and tachycardia, leaving sweating. Unresponsive: nothing by mouth, call EMS. Avoid injecting into a limb about to be exercised.

Both hypo- and hyperthyroidism cause proximal myopathy; hypothyroidism adds carpal tunnel and slow reflex relaxation, hyperthyroidism adds tachycardia and atrial fibrillation. Cushing syndrome (usually steroid medication) brings proximal myopathy, osteoporosis, fragile skin and poor healing. **Osteoporosis** is a T score of −2.5 or below; exercise with resistance, impact as tolerated, balance and extensor work, and **no loaded flexion or flexion with rotation**.

Visceral pain is deep, poorly localized, not changed by movement and tied to organ function. Gallbladder refers to the right shoulder and scapula, pancreas to the mid back (relieved leaning forward), duodenal ulcer to T6 to T10, kidney to the flank, spleen to the left shoulder (Kehr sign), heart to the left arm and jaw. The psoas and obturator signs can make appendicitis look like a hip problem.

Incontinence types map to mechanisms. **Stress**: leaks with cough or lift; pelvic floor training first line (holds toward 10 seconds plus quick flicks, 8 to 12 reps three times a day for at least 12 weeks) and "the knack." **Urge**: detrusor overactivity; bladder diary, timed voiding, urge suppression. **Overflow**: failed emptying; refer. **Functional**: barriers outside the bladder. An overactive, high tone pelvic floor needs downtraining before strengthening.

Pregnancy raises blood volume 40 to 50 percent and resting HR 10 to 20. Use RPE about 12 to 14 or the talk test. After the first trimester avoid prolonged supine (vena cava compression); use left side lying. Diastasis recti over about 2 cm is significant. Stop for vaginal bleeding, regular painful contractions, fluid leakage, chest pain, dizziness or calf swelling. Pregnancy is hypercoagulable; headache, visual change and sudden facial swelling with high BP suggest preeclampsia.

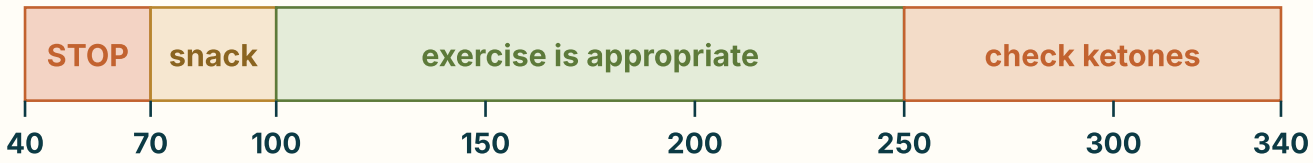
During cancer treatment check the counts every session. **Platelets**: above 50,000 progressive; 20,000 to 50,000 light, no heavy resistance; **below 20,000** essential activity only after consulting. **ANC below 500**: neutropenic precautions. Hemoglobin below about 8: defer or limit. Anthracyclines and trastuzumab are cardiotoxic; taxanes and platinum cause neuropathy; bleomycin causes lung fibrosis. Bone metastases: no heavy resistance or twisting through the lesion. Cord compression and neutropenic fever are emergencies.

RA is symmetric, small joint, more than an hour of morning stiffness, systemic, with atlantoaxial instability (no cervical manipulation). In a flare: rest, splints, gentle ROM, isometrics. OA is asymmetric with under 30 minutes of stiffness. HIV: exercise is safe and does not lower CD4 counts. The strongest single red flag for spinal malignancy is a **history of cancer**. Do not start exercise with resting BP 180/110 or more, HR above about 120, SpO_2 below about 88 to 90 percent or fever with systemic signs.

Drugs by consequence: **beta blockers** flatten HR (use RPE), nonselective ones can provoke bronchospasm; diuretics cause hypokalemia and orthostasis; anticoagulants make any head strike an emergency; long term steroids weaken bone, muscle and skin; opioids sedate and depress breathing; NSAIDs cause GI bleeding; **fluoroquinolones** threaten the Achilles; statins can cause rhabdomyolysis; baclofen withdrawal causes seizures and fever; oral bisphosphonates need 30 to 60 minutes upright.

Pre-exercise glucose (mg/dL) for patients on insulin or a sulfonylurea

Below 70: do not start. 15 g fast carbs,
recheck in 15 min.



70 to 100:
15 to 30 g carbs first.

Usual range for activity.
Watch for delayed hypoglycemia after.

Ketones present:
no vigorous exercise, contact provider.

Hypoglycemia: shaky, sweaty, fast heart, then confusion. A beta blocker can hide the tremor and tachycardia, leaving sweating. Unresponsive: give nothing by mouth and call emergency services.

Glucose zones before exercise. Check glucose before every session in patients on insulin or a sulfonylurea, and act on the zone the number falls in.

LOCK THESE IN

- Glucose < 70 treat; 70 to 100 snack; 100 to 250 go; > 250 check ketones.
- Beta blockers mask hypoglycemia; sweating remains.
- Osteoporosis: no loaded flexion or flexion with rotation.
- Stress: closure; urge: detrusor; overflow: refer; functional: access.
- Pregnancy: RPE 12 to 14; no prolonged supine after first trimester.
- Platelets < 20,000: essential activity only; ANC < 500: neutropenic precautions.
- Visceral pain does not change with movement.
- Beta blocker: RPE. Anticoagulant plus head strike: immediate evaluation.

Blood counts and exercise

Value	Guide
Platelets > 50,000	Progressive exercise as tolerated
Platelets 20,000 to 50,000	Light aerobic, active ROM, no heavy resistance
Platelets < 20,000	Essential ADLs and walking only, after consulting
ANC < 1,500	Neutropenia
ANC < 500	Severe: treat in the room, masks, strict hand hygiene
Hemoglobin 8 to 10	Light, symptom guided
Hemoglobin < 8	Defer or limit to essential activity; consult
Fever with low ANC	Emergency (neutropenic fever)

Viscera that mimic musculoskeletal pain

Source	Referral and clue
Heart	Left arm, jaw; exertional, relieved by rest
Pericardium	Left shoulder; worse supine, eased sitting forward
Gallbladder	Right shoulder and scapula; fatty meals
Pancreas	Mid back; eased leaning forward
Spleen	Left shoulder (Kehr sign) after trauma
Kidney	Flank, costovertebral angle; fever, dysuria
AAA	Low back; pulsatile mass, older male smoker
Pancoast tumor	Shoulder and medial arm (C8 to T1); Horner syndrome

Worked cases

WORKED CASE 1 · GLUCOSE BEFORE A SESSION

A 62 year old with type 2 diabetes on glipizide and metoprolol has a pre-session glucose of 84 mg/dL. Halfway through gait training she becomes sweaty and confused.

STEP 1 · BEFORE THE SESSION

84 is in the 70 to 100 band on a secretagogue: give 15 to 30 g carbohydrate first.

STEP 2 · DURING THE SESSION

Sweating and confusion: hypoglycemia until proven otherwise; the beta blocker hides tremor and tachycardia.

STEP 3 · ACT

Stop, sit her down, give 15 g fast carbohydrate if she can swallow safely, recheck in 15 minutes.

IF UNRESPONSIVE

Nothing by mouth; call emergency services.

WORKED CASE 2 · A HOME PROGRAM FOR OSTEOPOROSIS

A 68 year old with a T score of −2.8 and a healed T12 compression fracture has a draft program: crunches, standing toe touches, wall slides and single leg stance at a counter.

STEP 1 · FIND THE FLEXION

Crunches and toe touches load the anterior vertebral bodies in flexion: remove them.

STEP 2 · KEEP THE SAFE ITEMS

Wall slides (closed chain quadriceps) and supported single leg stance (balance).

STEP 3 · REPLACE

Prone or seated thoracic extension, bracing in neutral and hip hinge training.

ADD

Fall risk and home hazard screen.

WORKED CASE 3 · READING THE COUNTS

A 56 year old on chemotherapy has Hgb 9.2, platelets 18,000 and ANC 1,800. He wants to keep lifting free weights.

STEP 1 · HEMOGLOBIN

9.2: light, symptom guided activity.

STEP 2 · ANC

1,800: acceptable.

STEP 3 · PLATELETS

18,000 is below 20,000: high risk of spontaneous bleeding.

STEP 4 · DECIDE

Defer resistance work; essential mobility and light walking after talking with oncology, with fall prevention. Watch for petechiae, nosebleeds and headache.

WORKED CASE 4 · SHOULDER PAIN THAT IS NOT THE SHOULDER

A 62 year old smoker with hypertension self refers for left shoulder and arm pain that started while shoveling snow. Range and resisted tests are full and painless. Pain comes after one flight of stairs and settles with rest.

STEP 1 · TEST THE MUSCULOSKELETAL PATTERN

Nothing reproduces the pain.

STEP 2 · FIND THE ORGAN LINK

Exertional pain eased by rest, with cardiac risk factors: angina.

STEP 3 · ACT

Stop and refer for prompt medical evaluation; activate EMS if pain is at rest, prolonged or with diaphoresis, dyspnea or nausea.

WORKED CASE 5 · ORTHOSTATIC HYPOTENSION ON DAY 2

A 74 year old on warfarin, furosemide, metoprolol and oxycodone is 2 days after hip fracture repair. BP falls from 128/76 supine to 104/68 standing with dizziness; HR 64 to 68.

STEP 1 · COMPUTE THE DROP

128 − 104 = 24 mmHg systolic: orthostatic hypotension (20 or more).

STEP 2 · EXPLAIN THE HR

The beta blocker blunts the compensatory rise.

STEP 3 · ACT

Return her to sitting or supine, then progress slowly (ankle pumps, sitting, dangling, standing), hydrate as allowed, consider compression and report.

WHY IT MATTERS

A fall on warfarin risks intracranial bleeding.

TRAPS PEOPLE FALL INTO

- **Calling sweaty confusion a vasovagal episode.** In diabetes it is hypoglycemia until proven otherwise.
- **Crunches for an osteoporotic spine.** Loaded flexion drives wedge fractures.
- **Strengthening a painful high tone pelvic floor.** Downtrain and relax first.
- **Supine bridging at 28 weeks.** Prolonged supine after the first trimester risks supine hypotension.
- **Lighter weights with platelets under 20,000.** Resistance still carries bleeding risk; defer it.
- **Another shoulder test when nothing reproduces the pain.** Think visceral and refer.

Chapter 11 self-test · ten items

1. Which patient most needs a glucose check before exercise?

A. A woman with prediabetes taking no drugs
B. A man with type 2 diabetes on metformin only
C. A woman with type 2 diabetes on a GLP-1 agonist
D. A man with type 2 diabetes taking glyburide

D. A man with type 2 diabetes taking glyburide Sulfonylureas such as glyburide can drive glucose too low. Metformin and GLP-1 agonists rarely cause hypoglycemia alone.

2. A patient with type 1 diabetes has a pre-exercise glucose of 280 mg/dL and ketones in the urine. What is correct?

A. Proceed with vigorous exercise to lower it
B. Proceed at light intensity for 30 minutes
C. No vigorous exercise; contact the provider
D. Give 15 g of carbohydrate, then exercise

C. No vigorous exercise; contact the provider Above 250 with ketones signals insulin deficiency; exercise can raise glucose and ketones further.

3. Which exercise is most appropriate for a woman with a T score of −3.0?

A. Sit ups on an incline bench
B. Prone thoracic extension
C. Standing toe touch stretches
D. Seated trunk rotation with a weight

B. Prone thoracic extension Extension work and neutral spine loading are safe; flexion and flexion with rotation raise fracture risk.

4. A woman leaks a small amount of urine whenever she coughs or jumps. What is first line PT care?

A. Pelvic floor muscle training
B. Referral for catheterization
C. Timed voiding at fixed intervals
D. Bladder diary and urge suppression

A. Pelvic floor muscle training This is stress incontinence; pelvic floor training (with the knack) is first line.

5. A man has constant dribbling, a weak stream and a feeling of incomplete emptying. What should the therapist do?

A. Begin pelvic floor strengthening now
B. Refer for medical evaluation
C. Start a prompted voiding schedule
D. Teach urge suppression techniques

B. Refer for medical evaluation This pattern suggests overflow incontinence from failed emptying, which needs medical evaluation.

6. At 30 weeks of pregnancy, which change to a mat program is most important?

A. Add breath holding with heavy lifting
B. Use a target HR from 220 minus age
C. Move supine work to side lying or incline
D. Add full sit ups to target diastasis

C. Move supine work to side lying or incline After the first trimester, prolonged supine positions can compress the vena cava. Use RPE, not HR formulas.

7. A patient on chemotherapy has an ANC of 400 per microliter. What is required?

A. Neutropenic precautions, treat in the room
B. Usual gym session with hand washing
C. No precautions if the patient feels well
D. Heavy resistance to boost immunity

A. Neutropenic precautions, treat in the room ANC below 500 is severe neutropenia with a high infection risk.

8. A patient with long standing RA reports a new occipital headache and tingling in both hands. What is the safest action?

A. Upper cervical manipulation to restore motion
B. Cervical traction at 9 to 13 kg today
C. Resisted neck flexion to stabilize C1 to C2
D. Prompt medical evaluation; no neck manipulation

D. Prompt medical evaluation; no neck manipulation RA can cause atlantoaxial instability; new neurologic symptoms suggest possible cord compromise.

9. Right shoulder pain after fatty meals with nausea, and a normal shoulder exam, most likely comes from which organ?

A. The left kidney
B. The gallbladder
C. The spleen
D. The pancreas

B. The gallbladder Gallbladder disease refers to the right shoulder and scapula and links to fatty meals.

10. An older man taking a fluoroquinolone and prednisone reports new heel cord pain. What is the main concern?

A. Rebound tachycardia on withdrawal
B. Hypoglycemia from the antibiotic
C. Peptic ulcer from the antibiotic
D. Achilles tendon rupture risk

D. Achilles tendon rupture risk Fluoroquinolones raise the risk of Achilles rupture, especially in older adults on corticosteroids.

CHAPTER 12

Therapeutic Modalities, Equipment and Devices

Read it in full: **Chapter 12 in the textbook**. Practice it: **Practice Exam 6** and the **flashcards**.

What to know

Heat moves by conduction (hot packs, paraffin), convection (whirlpool, fluidotherapy), radiation (infrared) and conversion (ultrasound, diathermy). Fat insulates, so superficial agents heat only about **1 to 2 cm**. Hot packs: 6 to 8 towel layers, 15 to 20 minutes, check at 5. Paraffin about 52 to 54 °C. No heat on acute, bleeding, clotting, malignant or insensate tissue. Cold: 10 to 20 minutes

(ice massage 5 to 10); avoid with cold urticaria, cryoglobulinemia, cold hemoglobinuria, compromised circulation and Raynaud; caution over the fibular head and ulnar nerve.

Ultrasound: 1 MHz reaches about 2 to 5 cm; 3 MHz about 1 to 2 cm and heats about three times faster. Continuous for heating, pulsed (often 20 percent) for nonthermal goals. Treat 2 to 4 times the ERA, move about 4 cm per second, BNR under about 5 to 6. Mild heating about 1 °C, moderate 2 to 3, vigorous 3 to 4; stretch during or right after vigorous heating. Avoid over malignancy, the pregnant abdomen, eyes, pacemaker, a laminectomy site, DVT and infection; cemented and plastic implants heat fast. Inductive diathermy heats muscle; any implanted metal rules it out.

Current types: DC (iontophoresis, denervated muscle), AC (interferential, Russian) and pulsed. Short phases favor sensory fibers; longer phases recruit motor then pain fibers. About **30 to 50 pps** gives a tetanic contraction. Current density is highest under the smaller electrode; electrodes farther apart drive current deeper.

Conventional TENS: about 80 to 150 pps, 50 to 100 µs, sensory level, gate control. **Acupuncture-like TENS**: about 2 to 10 pps, longer phase, visible twitch, endogenous opioids, longer carryover. Interferential uses a carrier near 4,000 Hz. **NMES** for the quadriceps after TKA or ACL reconstruction: 35 to 50 pps, about 200 to 400 µs, 2 s ramp, on:off 1:3 to 1:5 at first, at least about 50 percent of MVIC. Electrically elicited contractions recruit large fast units early and fatigue sooner.

Iontophoresis uses DC and **like repels like**: dexamethasone, acetic acid, salicylate and iodine under the negative electrode; lidocaine, hyaluronidase and calcium chloride under the positive. Dose = current × time, often **40 mA·min** (4 mA for 10 minutes). The cathode irritates skin more, so it is often larger. EMG biofeedback: for uptraining, high gain and wider spacing; for downtraining, close electrodes and a falling threshold. Never stimulate over a demand pacemaker, the carotid sinus, a DVT, a malignancy or the pregnant abdomen (labor TENS is an exception).

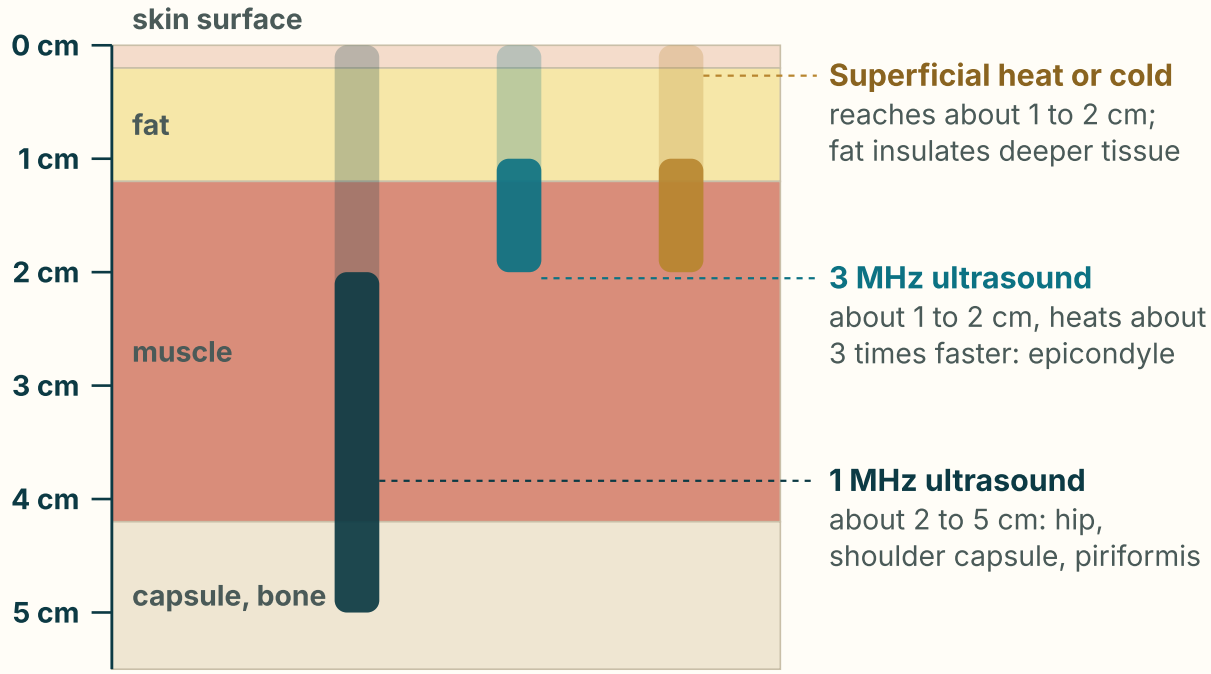
Cervical traction: supine, 20 to 30 degrees of flexion for lower cervical foramina, start about 3.5 to 4.5 kg (8 to 10 lb) and separate at about 9 to 13.5 kg. Lumbar traction on a split table: about 25 percent of body weight to start, about **50 percent** to separate. Stop or reduce if symptoms

peripheralize. Check the **ABI** before compression; below about 0.5 rules it out. IPC: upper limb about 30 to 60 mmHg, lower 40 to 80, kept below diastolic pressure. CPM is no longer routine after TKA.

Water: buoyancy unloads by depth, about **10 percent at the neck, 25 to 35 at the xiphoid, 50 at the waist**; hydrostatic pressure helps venous return; resistance rises with speed. Thermoneutral is 33.5 to 35.5 °C. Keep water cooler for MS. Avoid pools with fever, open wounds, unmanaged incontinence, uncontrolled seizures or vital capacity below about 1 L.

Fit canes, crutches and walkers to the **wrist crease with 20 to 30 degrees of elbow flexion**; axillary crutch tops about 5 cm below the axilla. A cane goes opposite the involved limb. Three point gait for NWB or PWB; four point is slow and stable; swing through is fastest. **Up with the good, down with the bad.** Guard behind and to the involved side on level ground, behind and below going up, in front and below going down. Wheelchair: standard 18 in wide, 16 in deep, about 20 in high; hemi height about 17 to 17.5 in. Ramps 1:12, doors at least 32 in, turning circle 60 in.

K levels guide prosthetic parts: K1 household (manual lock knee, SACH foot), K2 limited community, K3 variable cadence community (fluid or microprocessor knee, dynamic foot), K4 high impact. Transfemoral limbs drift into hip flexion, abduction and ER; transtibial into knee flexion. Pressure sensitive in a transtibial socket: fibular head, tibial crest and tubercle, distal tibia. **Vaulting** and circumduction mean a functionally long prosthesis (too long, poor suspension, knee will not flex). AFOs: posterior leaf spring for isolated foot drop, solid for spasticity or ML instability, floor reaction for crouch gait.



Dark part of each bar = the stated reach, drawn to depth. Continuous ultrasound heats; pulsed is nonthermal. Absorption is highest in collagen rich tissue (tendon, capsule) and lowest in fat.

How deep each heating agent reaches. Pick the agent by the depth of the target: superficial heat and 3 MHz for shallow tissue, 1 MHz for deep tissue.

LOCK THESE IN

- Superficial agents about 1 to 2 cm; 3 MHz 1 to 2 cm; 1 MHz 2 to 5 cm.
- Treat 2 to 4 times the ERA; continuous heats, pulsed is nonthermal.
- Conventional TENS high rate short phase sensory; low rate is motor and opioid.
- NMES 35 to 50 pps, on:off 1:3 to 1:5 at first.
- Iontophoresis: DC, like repels like, 40 mA·min.
- Lumbar traction to separate about 50% body weight; cervical start 8 to 10 lb.
- Water: neck 10%, xiphoid 25 to 35%, waist 50% weight bearing.
- Wrist crease, 20 to 30 degrees elbow flexion; up with the good, down with the bad.

Electrical stimulation settings

Goal	Typical parameters
Conventional TENS	80 to 150 pps, 50 to 100 µs, sensory level
Acupuncture-like TENS	2 to 10 pps, 150 to 250+ µs, visible twitch
Brief intense TENS	100 to 150 pps, long phase, max tolerable, ≤ 15 min
NMES strengthening	35 to 50 pps, 200 to 400 µs, 1:3 to 1:5, 2 s ramp
Russian current	2,500 Hz carrier in 50 bursts per second
Denervated muscle	Phase over about 10 ms or DC
Iontophoresis dose	mA × minutes; often 40 mA·min
Negative electrode drugs	Dexamethasone, acetic acid, salicylate, iodine

Devices and access

Item	Rule
Cane height	Greater trochanter or wrist crease; 20 to 30 degrees elbow flexion
Axillary crutches	About 5 cm below axilla; tips 5 cm lateral, 15 cm anterior
Forearm cuff	2.5 to 4 cm below the olecranon
Wheelchair standard	18 in wide, 16 in deep, about 20 in seat height
Ramp	1:12; 36 in wide; landing every 30 in of rise
Doorway	At least 32 in clear
Min assist	Patient does 75% or more
Max assist	Patient does 25 to 49%

Worked cases

WORKED CASE 1 · CHOOSING A HEATING AGENT

A 52 year old has chronic adhesive capsulitis. The therapist wants to heat the anterior and inferior capsule before mobilization. Hot pack, 3 MHz continuous, 1 MHz continuous or ice massage?

STEP 1 · FIND THE DEPTH

The inferior and anterior capsule lies several centimeters deep.

STEP 2 · FIND THE GOAL

Vigorous heating of collagen to increase extensibility.

STEP 3 · RULE OUT

Hot pack reaches 1 to 2 cm; 3 MHz is for superficial targets; ice lowers extensibility.

STEP 4 · CHOOSE

1 MHz continuous ultrasound at a thermal intensity over 2 to 4 times the ERA, then mobilize and stretch at once.

WORKED CASE 2 · AN IONTOPHORESIS DOSE

A dexamethasone patch is ordered at 40 mA·min. The patient tolerates 2.5 mA. How long should the treatment run, and under which electrode does the drug go?

STEP 1 · REARRANGE

Time = dose ÷ current.

STEP 2 · DIVIDE

40 ÷ 2.5 = **16 minutes**.

STEP 3 · POLARITY

Dexamethasone sodium phosphate is negative, so it goes under the **negative electrode (cathode)**.

SKIN

The cathode makes an alkaline reaction; inspect the skin after.

WORKED CASE 3 · LUMBAR TRACTION FORCE

A 90 kg man with lumbar radicular pain is set up for traction on a split table. What force starts treatment, and what force separates the vertebrae?

STEP 1 · START

25% × 90 kg = **22.5 kg**.

STEP 2 · SEPARATE

50% × 90 kg = **45 kg**.

WATCH

Reduce force or stop if symptoms peripheralize.

WORKED CASE 4 · FITTING A CANE

A 72 year old with painful left hip OA holds a cane in her left hand and leans to the left. Her front steps have a rail on the right going up.

STEP 1 · FIX THE SIDE

Move the cane to the **right** hand, opposite the painful hip.

STEP 2 · FIX THE HEIGHT

Handle at the wrist crease, elbow flexed 20 to 30 degrees.

STEP 3 · STAIRS

Up: right rail, right leg first, then left leg and cane. Down: cane and left leg first.

STEP 4 · GUARD

Behind and below going up; in front and below going down; gait belt on.

WORKED CASE 5 · A VAULTING AMPUTEE

A 61 year old with a new transfemoral amputation vaults on the sound limb during prosthetic swing. Standing limb lengths are equal.

STEP 1 · ASK WHAT IT ACHIEVES

Vaulting clears a prosthesis that is functionally too long in swing.

STEP 2 · RULE OUT LENGTH

Length is equal, so shortening the pylon is the wrong answer.

STEP 3 · FIND THE CAUSE

Check suspension and knee friction with the prosthetist and train controlled knee flexion in swing.

SAFETY

Inspect the sound foot every session.

TRAPS PEOPLE FALL INTO

- **3 MHz for a deep target.** 3 MHz is superficial; use 1 MHz.
- **Putting dexamethasone under the positive electrode.** Like repels like: it is negative.

- **Conventional TENS to strengthen a quadriceps.** Use NMES at 35 to 50 pps.
- **Compression with an ABI of 0.45.** Below about 0.5 compression is contraindicated.
- **Cane on the same side as the painful hip.** It goes in the opposite hand.
- **Shortening a prosthesis of equal length for vaulting.** Look at suspension and knee flexion.

Chapter 12 self-test · ten items

1. Which agent heats by conversion?

A. Fluidized heated cellulose
B. Paraffin dip and wrap
C. Moist hot pack in towels
D. Therapeutic ultrasound

D. Therapeutic ultrasound Ultrasound converts acoustic energy into heat in tissue. Hot packs and paraffin conduct; fluidotherapy convects.

2. Which is a contraindication to cryotherapy?

A. Postoperative knee pain
B. Raynaud phenomenon
C. Muscle guarding
D. Acute ankle sprain

B. Raynaud phenomenon The cold list: cold urticaria, cryoglobulinemia, cold hemoglobinuria, compromised circulation and Raynaud.

3. A sound head has an ERA of 5 cm^2. What is the largest area to treat in one session?

A. About 50 cm^2
B. About 100 cm^2
C. About 20 cm^2
D. About 5 cm^2

C. About 20 cm^2 Treat 2 to 4 times the ERA: 10 to 20 cm^2.

4. Which TENS settings match conventional mode?

A. 100 pps, 60 µs, sensory level
B. 4 pps, 200 µs, visible twitch
C. 35 pps, 300 µs, strong contraction
D. 100 pps, 250 µs, maximal tolerated

A. 100 pps, 60 µs, sensory level Conventional TENS is high rate, short phase and sensory level, working through gate control.

5. Two weeks after TKA a patient has a 20 degree extensor lag despite good effort. Which adjunct has the best evidence?

A. Continuous passive motion
B. High volt pulsed current
C. NMES to the quadriceps
D. Conventional TENS to the knee

C. NMES to the quadriceps Arthrogenic inhibition limits voluntary activation; NMES at 35 to 50 pps improves quadriceps strength.

6. A 4 mA iontophoresis treatment runs 10 minutes. What is the dose?

A. 14 mA·min
B. 40 mA·min
C. 400 mA·min
D. 0.4 mA·min

B. 40 mA·min Dose = current × time = 4 × 10 = 40 mA·min.

7. Which cervical traction setup best opens the lower cervical foramina?

A. Sitting, neck in full extension
B. Prone, neck in neutral rotation
C. Supine, neck in 10 degrees extension
D. Supine, about 25 degrees of flexion

D. Supine, about 25 degrees of flexion About 20 to 30 degrees of flexion opens the posterior elements and foramina of the lower cervical spine.

8. A patient limited to about 25 to 35 percent weight bearing wants to start gait training in the pool. To what depth should the water reach?

A. About the xiphoid
B. About the waist
C. About the neck
D. About the knees

A. About the xiphoid Xiphoid depth leaves about 25 to 35% of body weight; waist depth about 50%; neck about 10%.

9. A patient with a NWB left leg and good balance uses axillary crutches. Which pattern fits?

A. Four point gait
B. Two point gait
C. Three point gait
D. Swing through gait

C. Three point gait Both crutches and the involved limb advance together, then the uninvolved limb: three point.

10. A transtibial amputee has excessive knee flexion in early stance. Which cause is most likely?

A. Socket set too far anterior
B. Foot set in too much plantarflexion
C. Heel cushion that is too soft
D. Socket set too far posterior

A. Socket set too far anterior An anterior socket, dorsiflexed foot or stiff heel cushion pushes the knee into flexion in early stance.

ONE PAGE

Cram sheet

One page for Study Guide 6. Cover the right column and say the answer before you look.

Other systems

Topic	Rule
Glucose	< 70 treat; 70 to 100 snack; > 250 ketones
Hypoglycemia	15 g fast carbohydrate, recheck in 15 min; unresponsive = EMS
Osteoporosis	T ≤ −2.5; no loaded flexion or rotation
Incontinence	Stress PFMT; urge diary and suppression; overflow refer
Pregnancy	RPE 12 to 14; no prolonged supine; stop for bleeding or calf swelling
Counts	Platelets < 20,000 essential only; ANC < 500 precautions
RA	Symmetric, > 1 h stiffness, C1 to C2 instability
Visceral	Not changed by movement; tied to organ function
Red flag	History of cancer is the strongest for malignancy
Drugs	Beta blocker RPE; anticoagulant head strike = evaluate

Modalities and devices

Topic	Rule
Depth	Superficial 1 to 2 cm; 3 MHz 1 to 2; 1 MHz 2 to 5
Ultrasound	2 to 4 × ERA; continuous heats; pulsed nonthermal
TENS	Conventional 80 to 150 pps sensory; low rate 2 to 10 motor
NMES	35 to 50 pps; 1:3 to 1:5; ramp 2 s
Ionto	DC; like repels like; 40 mA·min
Traction	Cervical 8 to 10 lb start; lumbar 50% BW to separate
Water	Neck 10%, xiphoid 25 to 35%, waist 50%
Devices	Wrist crease; 20 to 30 degrees; cane opposite
Wheelchair	18 × 16 in; ramp 1:12; door 32 in
Prosthetics	K1 to K4; vaulting = functionally long limb

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