NeuroTrace Study Guide

Domain: Domain II – Performing the EEG Study
Section: Electrode Application & 10–20 System
Style: Technical, measurement-based, exam-oriented

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1. Core Principles (Must Know)

10-20 System Is Standard for Electrode Placement

- **10-20 system is the international standard for EEG electrode placement**
- Ensures consistent, reproducible electrode positions
- Allows comparison across studies and facilities
- Based on percentages of head measurements

Measurements Are Based on Head Anatomy

- **Measurements use anatomical landmarks:**
- Nasion (bridge of nose)
- Inion (back of head, occipital protuberance)
- Preauricular points (ear canals)
- Head circumference

Key Principle

- **Consistent electrode placement ensures accurate localization and comparison**
- Proper placement is foundational for all EEG interpretation
- Measurements must be accurate

Practical Application

- Measure carefully using anatomical landmarks
- Use 10% and 20% increments
- Verify electrode positions
- Document any deviations

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2. Head Measurements

Required Measurements

- **Nasion to Inion (sagittal):** Front to back of head
- **Left to Right Preauricular (coronal):** Ear to ear
- **Head Circumference:** Around head at electrode level

Measurement Technique

- **Use flexible measuring tape**
- Measure along scalp surface (not straight line)
- Record measurements
- Calculate 10% and 20% increments

Key Rule

- **Measurements must be accurate - errors affect all electrode positions**
- Double-check measurements

- Use consistent technique

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3. 10-20 System Electrode Locations

Frontal Electrodes

- **Fp1, Fp2:** 10% above nasion
- **F3, F4:** 20% from midline, 20% from Fp
- **F7, F8:** 10% above Fp, at temporal line
- **Fz:** Midline, 20% from Fp

Central Electrodes

- **C3, C4:** 20% from midline, along central line
- **Cz:** Vertex (midpoint of nasion-inion and preauricular lines)

Parietal Electrodes

- **P3, P4:** 20% from midline, along parietal line
- **Pz:** Midline, 20% from Cz

Temporal Electrodes

- **T3, T4:** At temporal line, 20% from F7/F8
- **T5, T6:** Posterior temporal, 20% from T3/T4

Occipital Electrodes

- **O1, O2:** 10% above inion, 20% from midline
- **Oz:** Midline, 10% above inion

Key Rule

- **Electrode names indicate location:**
- Odd numbers = left, Even numbers = right
- Z = midline
- F = frontal, C = central, P = parietal, T = temporal, O = occipital

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4. Electrode Application

Skin Preparation

- **Clean skin:** Remove oils, lotions, dead skin
- **Abrade if necessary:** Light abrasion to reduce impedance
- **Apply conductive paste/gel:** Ensure good contact
- **Check impedance:** Verify <5 kΩ (ideally <2 kΩ)

Application Technique

- **Apply electrodes systematically:** Follow consistent order
- **Ensure good contact:** No gaps, secure attachment
- **Check all electrodes:** Verify placement and impedance
- **Document any issues:** Note deviations or problems

Key Rule

- **Proper application ensures optimal signal quality**
- Take time to prepare skin properly

- Verify impedance before recording

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5. Ground and Reference Electrodes

Ground Electrode

- **Location:** Typically Fpz or separate ground site
- **Purpose:** Electrical safety and signal reference
- **Essential for:** Safety and common-mode rejection

Reference Electrodes

- **Common references:** A1 (left ear), A2 (right ear), Cz (vertex)
- **Linked ears:** A1+A2 (averaged)
- **Average reference:** All electrodes averaged
- **Selection affects:** Localization and artifact appearance

Key Rule

- **Ground and reference are essential for recording**
- Must be properly applied
- Reference choice affects interpretation

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6. Impedance Requirements

Optimal Impedance

- **Target:** <5 kΩ (ideally <2 kΩ)
- **Balanced:** All electrodes should have similar impedance
- **Stable:** Impedance should remain stable during recording

High Impedance Problems

- **Causes:** Poor skin preparation, inadequate paste/gel, poor contact
- **Effects:** Increased noise, artifacts, reduced signal quality
- **Solution:** Re-prepare electrode site

Key Rule

- **Low, balanced impedance is essential for optimal signal quality**
- Check impedance before and during recording
- Re-prepare if impedance is high

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7. Common Placement Errors

Measurement Errors

- **Incorrect measurements:** Affect all electrode positions
- **Solution:** Double-check measurements, use consistent technique

Application Errors

- **Poor contact:** High impedance, artifacts
- **Wrong location:** Affects localization
- **Solution:** Careful application, verify positions

Key Rule

- **Errors in placement affect all subsequent interpretation**
- Take time to place electrodes correctly
- Verify positions before recording

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8. Special Considerations

Pediatric Patients

- **Smaller head size:** Use modified 10-20 system
- **Fewer electrodes:** Appropriate for head size
- **Age-specific:** Adapt for developmental stage

Neonatal Patients

- **Modified system:** 9-11 electrodes typical
- **Smaller spacing:** Appropriate for head size
- **Age-specific patterns:** Different normal patterns

Key Rule

- **Adapt technique for patient age and head size**
- Use appropriate electrode count
- Understand age-specific considerations

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9. Exam Readiness Checklist

Use this checklist to verify your understanding:

- [ ] Can measure head using nasion, inion, preauricular points
- [ ] Understand 10% and 20% increments
- [ ] Know electrode naming system (odd/even, Z for midline)
- [ ] Can identify electrode locations (Fp1, F3, C3, P3, O1, etc.)
- [ ] Understand skin preparation technique
- [ ] Know optimal impedance values (<5 kΩ, ideally <2 kΩ)
- [ ] Understand ground and reference electrode placement
- [ ] Can identify common placement errors
- [ ] Understand pediatric/neonatal modifications

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10. Internal Cross-Links

Workflow

- **Electrodes & Impedance:** Detailed impedance information
- **EEG Electrode Types & Application:** Electrode types and materials
- **Recording Procedures:** Application in workflow

Quizzes

- **10-20 system MCQs:** Questions on measurements and placement
- **Electrode application questions:** Questions on technique

- **Impedance questions:** Questions on optimal values

Study Tips

1. **Memorize electrode locations:** Know where each electrode goes
2. **Understand measurements:** Practice calculating 10% and 20% increments
3. **Learn naming system:** Odd/even, Z for midline
4. **Know impedance targets:** <5 kΩ, ideally <2 kΩ
5. **Understand ground/reference:** Essential for recording
6. **Practice placement:** Visualize electrode positions
7. **ABRET focus:** Expect questions on measurements, electrode locations, and impedance

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End of Study Guide

For additional practice, complete quiz questions tagged: 10-20, electrode-placement, measurements, impedance