

# NeuroTrace Study Guide

**Domain:** Domain II – Performing the EEG Study

**Section:** Activation Procedures

**Style:** Protocol-driven, safety-focused, exam-oriented

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## 1. Core Principles (Must Know)

### Activation Procedures Enhance Diagnostic Yield

- **Activation procedures enhance diagnostic yield by provoking or modifying cerebral activity**
- Hyperventilation, photic stimulation, and sleep are standard activations
- Each procedure has specific indications and contraindications
- Proper technique is essential for effectiveness

### Safety Is Paramount

- **Patient safety overrides diagnostic yield**
- Know contraindications for each procedure
- Monitor patient during activation
- Stop if patient experiences distress

### Key Principle

- **Activation procedures increase likelihood of detecting epileptiform activity**
- Use appropriate procedures based on clinical indication
- Follow proper protocols

### Practical Application

- Know indications and contraindications
  - Follow proper technique
  - Monitor patient safety
  - Document responses
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## 2. Hyperventilation (HV)

### Purpose

- **Hyperventilation provokes epileptiform discharges**
- Particularly effective for absence seizures
- Creates hypocapnia (low CO<sub>2</sub>)
- Causes cerebral vasoconstriction

### Technique

- **Duration:** 3-5 minutes or until activation occurs
- **Rate:** Deep, regular breathing at 20-30 breaths per minute
- **Patient position:** Comfortable, able to breathe deeply
- **Monitoring:** Watch patient condition and EEG

### Normal Response

- **Children/adolescents:** Build-up of posterior slow activity (theta/delta)
- **Adults:** Minimal response or slight theta increase

- **Gradual development:** Build-up occurs over 1-3 minutes
- **Gradual resolution:** Resolves over 1-2 minutes after stopping

### **Abnormal Response**

- **Generalized spike-and-wave:** Absence epilepsy
- **Focal spikes:** Focal epilepsy
- **Excessive slowing:** May indicate encephalopathy

### **Contraindications**

- **Recent stroke:** Vasoconstriction risk
- **Severe cardiac disease:** Cardiovascular risk
- **Sickle cell disease:** Sickling crisis risk
- **Severe asthma:** Bronchospasm risk
- **Uncontrolled hypertension:** Cardiovascular risk

### **Safety Monitoring**

- **Watch for:** Chest pain, shortness of breath, lightheadedness, distress
  - **Stop if:** Patient experiences any concerning symptoms
  - **Document:** Response, duration, any complications
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## **3. Photic Stimulation (IPS)**

### **Purpose**

- **Photic stimulation tests for photosensitivity**
- Provokes photic driving (normal) or photosensitive epileptiform responses (abnormal)
- Tests visual system reactivity

### **Technique**

- **Flash lamp:** Positioned 30 cm from patient's eyes, at eye level
- **Eyes closed:** Standard protocol (enhances alpha range response)
- **Frequencies:** 1, 2, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30 Hz (or similar range)
- **Duration:** 10 seconds per frequency
- **Intensity:** Standardized, moderate intensity

### **Normal Response**

- **Photic driving:** Posterior rhythm matches flash frequency (most prominent 8-16 Hz)
- **Harmonics:** Multiples of flash frequency (e.g., 20 Hz with 10 Hz flashes)
- **Subharmonics:** Fractions of flash frequency (e.g., 6 Hz with 12 Hz flashes)
- **May not occur at all frequencies:** Normal variability

### **Abnormal Response**

- **Photosensitive epileptiform response:** Generalized spike-and-wave time-locked to flash
- **Focal spikes:** Focal photosensitivity
- **Myoclonic response:** Clinical myoclonus

### **Contraindications**

- **Photosensitive seizures:** Use reduced intensity, specific frequencies to avoid, emergency response ready
- **Recent eye surgery:** Consult physician
- **Severe photosensitivity:** May need to skip or modify protocol

## Safety Monitoring

- **Watch for:** Seizure activity, myoclonus, patient distress
  - **Stop if:** Seizure occurs or patient requests
  - **Document:** Frequencies tested, responses, any complications
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## 4. Sleep Activation

### Purpose

- **Sleep activation enhances detection of epileptiform discharges**
- Particularly effective for focal temporal lobe epilepsy (10-100x increase)
- Activates sleep-specific patterns
- Increases diagnostic yield

### Sleep Deprivation

- **Purpose:** Increase likelihood of sleep during study
- **Technique:** Patient stays awake longer than usual (typically 4-6 hours less sleep)
- **Effectiveness:** Enhances sleep during study and activation of discharges

### Sleep Stages

- **N1 (Stage 1):** Light sleep, vertex waves
- **N2 (Stage 2):** Sleep spindles (11-15 Hz), K-complexes
- **N3 (Stage 3):** Deep sleep, high-amplitude delta (>20% of epoch)
- **REM:** Low-voltage, mixed-frequency, rapid eye movements, muscle atonia

### Normal Sleep Patterns

- **Sleep spindles:** 11-15 Hz, central, N2 sleep
- **K-complexes:** High-amplitude, sharp negative-positive, N2 sleep
- **Vertex waves:** Sharp, high-amplitude, Cz, light sleep
- **POSTS:** Positive occipital sharp transients, sleep

### Abnormal Sleep Patterns

- **Epileptiform discharges:** Increased during sleep
  - **Sleep-specific patterns:** ESES, continuous spike-and-wave during sleep
  - **Abnormal sleep architecture:** May indicate encephalopathy
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## 5. Combined Activation

### Sleep + Hyperventilation

- **Technique:** Perform hyperventilation during drowsiness/sleep
- **Effectiveness:** May enhance activation
- **Use:** When single activation is insufficient

### Sleep + Photic

- **Technique:** Perform photic stimulation during sleep
- **Effectiveness:** May enhance photosensitive responses
- **Use:** For suspected photosensitive epilepsy

### Key Rule

- **Combined activations may enhance diagnostic yield**
  - Use when clinically indicated
  - Follow safety protocols for all procedures
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## 6. Documentation

### Required Documentation

- **Procedures performed:** Hyperventilation, photic, sleep
- **Technique:** Duration, frequencies, patient cooperation
- **Responses:** Normal vs abnormal, timing, characteristics
- **Complications:** Any adverse events or patient distress
- **Contraindications:** Any procedures not performed and why

### Key Rule

- **Complete documentation is essential**
  - Document all procedures and responses
  - Note any limitations or complications
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## 7. Exam Readiness Checklist

Use this checklist to verify your understanding:

- Know hyperventilation technique (3-5 minutes, 20-30 breaths/min)
  - Understand normal hyperventilation responses (age differences)
  - Know hyperventilation contraindications
  - Understand photic stimulation protocol (frequencies, positioning)
  - Know normal photic responses (driving, harmonics, subharmonics)
  - Understand abnormal photic responses (photosensitivity)
  - Know sleep activation effectiveness (focal temporal, 10-100x increase)
  - Understand sleep stages and characteristics
  - Know sleep deprivation purpose and technique
  - Can identify normal vs abnormal activation responses
  - Understand safety monitoring during activations
  - Know when to stop activation procedures
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## 10. Internal Cross-Links

### Workflow

- **Recording Procedures:** Activation in workflow
- **Patient Safety:** Safety considerations
- **Documentation:** Documenting activation responses

### Patterns

- **Epileptiform Discharges:** Activated by procedures
- **Normal Variants:** May be activated

### Quizzes

- **Activation procedures MCQs:** Questions on techniques and responses
  - **Hyperventilation questions:** Questions on protocol and responses
  - **Photic stimulation questions:** Questions on protocol and responses
  - **Sleep activation questions:** Questions on effectiveness and patterns
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## Study Tips

1. **Memorize activation protocols:** Hyperventilation (3-5 min, 20-30/min), photic (frequencies, positioning)
  2. **Know normal responses:** Age differences, frequency-specific responses
  3. **Learn contraindications:** Safety is paramount
  4. **Understand sleep activation:** Most effective for focal temporal (10-100x)
  5. **Know sleep stages:** N1, N2, N3, REM characteristics
  6. **Practice safety monitoring:** Know when to stop procedures
  7. **ABRET focus:** Expect questions on activation techniques, normal vs abnormal responses, contraindications, and safety
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## End of Study Guide

For additional practice, complete quiz questions tagged: *activation, hyperventilation, photic-stimulation, sleep, sleep-deprivation*