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## RPSGT Exam Corner – Frequently Asked Questions

**1** Arousal-producing noradrenergic cells that project directly to the cerebral cortex, hippocampus, amygdala, and other subcortical areas originate in which of the following areas of the brain?

- A. Locus coeruleus
- B. Raphe nucleus
- C. Putamen
- D. Wernicke's area

**2** Of the following waveforms on a polysomnographic recording, which one warrants further evaluation?

- A. Positive occipital sharp transients of sleep (POSTS)
- B. Spike-and-slow wave activity
- C. Mu rhythm
- D. Benign epileptiform transients of sleep (BETS)

**3** Which one of the following statements regarding sleep physiology is true?

- A. The brain is less responsive to internal than external stimuli
- B. The brain becomes more responsive to environmental stimuli
- C. Both homeostatic and circadian processes determine the quality of sleep
- D. Sleep is a passive state that is initiated through withdrawal of sensory input

**4** Irregular R-R rhythm without changes in P, QRS, and T waves is present in which of the following arrhythmias?

- A. Premature atrial contraction
- B. Third degree AV block
- C. Sinus arrhythmia
- D. Second degree AV block

**5** During a multiple sleep latency test which of the following best defines sleep onset?

- A. Appearance of spindles on EEG
- B. Three 30-second epochs of stage N1 or single epoch of other sleep stages
- C. First 30-second epoch with more than 15 seconds of cumulative sleep
- D. First 30-second epoch when alpha begins to disappear

### ANSWERS

#### Question 1:

Answer is A. Locus coeruleus

**Reference:** Neurobiological mechanisms for the regulation of mammalian sleep-wake behavior: reinterpretation of historical evidence and inclusion of contemporary cellular and molecular evidence. *Neurosci Biobehav Rev.* 31: 775–824; 2007

#### Question 2:

Answer is B. Spike-and-slow wave activity

**Reference:** Monitoring and Staging Human Sleep In: Kryger MH, Roth T, Dement WC, eds. *Principles and Practices of Sleep Medicine*, 5th edition

#### Question 3:

Answer is C. Both homeostatic and circadian drives determine the quality of sleep

**Reference:** Normal Sleep, Sleep Physiology, and Sleep Deprivation. <http://emedicine.medscape.com/article/1188226-overview#aw2aab6b3>.

#### Question 4:

Answer is C. Sinus arrhythmia

**Reference:** Asymptomatic Irregular Cardiac Rhythm, *Am J Crit Care* 429-430 23 2014

#### Question 5:

Answer is C. First 30-second epoch with more than 15 seconds of cumulative sleep

**Reference:** Standards of Practice Committee of the American Academy of Sleep Medicine. Practice parameters for clinical use of the multiple sleep latency tests and the maintenance of wakefulness test. *SLEEP* 2005; 28(1):113-121.

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# Sleep watching

ASEAN SLEEP TECHNOLOGY NEWSLETTER NEWS / OPINIONS / INSIGHTS



MR. HAIRUL BIN BORHAN  
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Graduated from the National University of Singapore with a Bsc in Microbiology. One of the first Singaporean to be a certified RPSGT (Registered Polysomnograph Technologist, 2003). Altogether I have about 15 years worth of experience in sleep medicine.

## Interview with Mr. Hairul Bin Borhan on monitoring respiratory system during the sleep study

**Which 4 respiratory parameters are measured during a routine sleep study?**

The following respiratory parameters are recorded during sleep study – airflow, respiratory effort, oxygen saturation, snoring and CO2 levels in children and suspected Hypoventilating patients.

**Which are the 5 types of sensors that can be used to measure airflow during diagnostic sleep study? How do we measure airflow during titration study?**

5 sensors that can be used to record airflow during diagnostic study are – thermistor, thermocouple, pressure transducer, expired CO2 sensors and pneumotachography. AASM recommends thermistor and pressure transducer. We can measure airflow by PAP device flow signal during titration study and should not place thermistor or pressure transducer under the mask.

During level 1 diagnostic sleep study airflow is recorded using both thermistor and pressure transducer. In Home Sleep Testing (HST) airflow can be recorded using either thermistor or pressure transducer.

**What is the difference in technology between thermistor and thermocouple?**

A thermistor has a series of resistors whose values are changed by the temperature changes around them. These value changes affect a current that is generated either by the recording system into which they are plugged or by inline batteries. A thermocouple comprises of two wires made from dissimilar metals. A temperature change at the junction of these two metals will generate an electrical signal because of their metallurgical properties. This is accomplished using specific metals. Different metals are used to measure different temperature ranges resulting in different types of thermocouples.

**What is the principle of pressure transducer?**

It measures pressure fluctuations at the nares as a surrogate of airflow. The square root of pressure curves is directly proportional to flow.

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### Which sensors are recommended to define apnea and hypopnea during a diagnostic sleep study?

The oronasal thermal sensor is the recommended sensor for the identification of apneas and the nasal pressure transducer is the recommended sensor for the identification of hypopnea during diagnostic sleep study.

### Which sensors are recommended to define apnea and hypopnea during a titration sleep study?

PAP device flow signal sensors are recommended in titration sleep study to define apnea and hypopnea.

### Name the alternate sensors used to define apnea and hypopnea.

Respiratory event	Alternate sensor
Apnea	Nasal pressure transducer RIP Sum RIP Flow PVDF Sum
Hypopnea	End Tidal CO2 in children Oronasal thermal sensor RIP Sum RIP Flow PVDF Sum

### Name 4 types of sensors that can be used to measure respiratory effort? Which is the gold standard for measuring respiratory effort?

4 types of sensors that can be used to measure respiratory effort are esophageal pressure transducer, respiratory inductance plethysmography (RIP) belts, polyvinylidene fluoride (PVDF) belts and intercostal/diaphragm EMG. We can use piezoelectric belts as well to measure respiratory effort but AASM neither recommends it nor contradicts its usage. The esophageal pressure transducer is the gold standard for measuring respiratory effort.

During level 1 diagnostic sleep studies, respiratory effort is recorded using both abdominal and chest belts. In HST, either a chest or abdominal belt can be used.

### What is the difference in technology used by Piezoelectric and RIP belts?

Piezoelectric belts contain a piezo-electric device that responds linearly to changes in length. It measures changes in thoracic or abdominal circumferences during respiration.

RIP belts have a wire running through the length of the belts in a zigzag fashion. When chest and abdomen expand, the inductance of the wire changes, which is proportional to the cross sectional area the belt encloses. This change in inductance is recorded as signals. To ensure quality signals, RIP belts should be placed at the standard locations: near the nipple line (or mid-chest) and just above the belly button.

### Where do we place surface electrodes to measure diaphragm and intercostal EMG?

To record the activity of the diaphragm, surface electrodes are placed in the seventh or eighth intercostal spaces on the right side of the body at the midclavicular line, and for the external intercostal muscles, electrodes are placed in the second or third intercostal space at the midclavicular line.

### Which technology is used to record snoring?

A microphone is used to record snoring during level 1 sleep study. A pressure transducer can be used to record snoring during HST.

### Which two wavelengths of light are used by the pulse oximeter to measure SpO2?

660 nm (red) and 940 nm (infrared) wavelengths are used to measure SpO2 by pulse oximeter.

### What should be the average sampling time of pulse oximeter used during sleep study?

Maximum averaging time should be 3 sec at a heart rate of 80bpm.

### What are the different ways to measure CO2 levels during diagnostic and titration sleep study?

Arterial blood gases (ABG), transcutaneous CO2 (TcCO2) monitoring and end tidal CO2 (EtCO2) monitoring can be used to measure CO2 levels during diagnostic sleep study. During titration sleep study we can use ABG or TcCO2 for monitoring CO2 levels.

### What is the principle of end tidal and transcutaneous CO2 measurement?

Etco2 refers to the measurement and quantification of inhaled or exhaled CO2 concentrations at the airway opening. Transcutaneous is monitored by a small sensor, which houses a pH electrode, a reference electrode, an electrolyte solution, a teflon membrane, and a heating element. An adhesive ring fastens the sensor to the skin. The heating element warms the skin to 42° to 45°C. The CO2 that diffuses through the stratum corneum by the warming of the skin passes across the sensor's semipermeable membrane and into a diluted bicarbonate solution (electrolyte solution) in the sensor chamber. Adding CO2 lowers the pH of the solution (increases acidity); a glass electrode measures the change. The electrode's output is converted into a signal, which the instrument records as transcutaneous CO2.



MISS BAE, JIN-YEONG  
South Korea

Sleep technician at Seoul Sleep Center

During my college years I was very much interested in patient consultation which fit greatly with my personality. I feel great when patients are happier after treatment and with improvement in quality of sleep.

## Personal opinions of a sleep technologist

### Why did you decide to become a sleep technologist?

After I graduated from college with a degree in clinical laboratory, I experienced a period of insomnia due to unemployment stress. During this time I got interested in the idea of quality sleep. I then came across a sleep technician job opening at one of the hospitals in Seoul, Korea. All this time my interest was deepening in finding a solution for good quality sleep. I conducted my own research and realized that many others also suffered from poor sleep. So I decided to become sleep technician to support those who need help.

### What is the most challenging aspect of your profession?

In my experience the most difficult aspect of the job was working night shifts. However, I was able to overcome it with guidance and help from our director and with support from my colleagues.

Currently I have realised that persuading patients to use PAP therapy at night is difficult. I am trying to devise better ways of educating the patients regarding the importance of using PAP therapy at night and how to improve public awareness regarding various sleep disorders. Also, it is a challenge to explain about overnight PSG tests, proper mask wearing and the consequences of sleep disorder being not treated when the awareness about sleep disorders and their management is low in general public.

### What is the biggest change in the profession since you began?

I also had a time where sleep was a simple act of 'sleeping', and I did not put any effort in increasing the quality of sleep. After becoming a sleep technologist, I was able to realise the immense impact that low quality sleep has on the overall quality of life. When patients talk about the effect that low quality sleep has on work or daily lives due to tardiness despite long hours of sleep, I reinforce my thoughts about the importance of not only sleeping but of having quality sleep.

I also snore during sleep and to increase my quality of sleep I have put in efforts to change my sleeping posture and get sufficient sun light whenever I can to compensate for working overnight shifts.

### What factors do you think affect patient adherence to CPAP?

From the perspective of a sleep technician, I believe that finding the optimal pressure is the most important factor that affects patient adherence to CPAP. This is because effectivity of treatment is low when pressure is too low, and patient adherence to PAP therapy is difficult if there is excessive pressure.

From the patient's perspective, I believe proper education regarding the use of PAP machine and mask is crucial. The patients should be taught how to troubleshoot simple issues that may arise during use of PAP therapy to maximise treatment effects. The clinician/sleep technologist should be able to explain in simple terms regarding sleep disorders and about use of PAP therapy. This will enable the patient to build trust in the clinical team and follow their advice to adhere to PAP therapy.

### What factors tend to influence patient choice of mask?

In my experience, the primary factor that influences patient's choice is the patient preference for a particular type of mask. Most show better adherence when using the mask they first favour. Secondly, suggesting the right mask after proper observation of sleep pattern including changes in sleep posture during the PSG test is important. Suggesting movement-restricting mask showed high rates of dropouts. Lastly, level of leak compensation is also very important. In order to increase the treatment efficacy, proper delivery of the prescribed pressure is important, and large leak may compromise the pressures being delivered to the patient.