Physiol-08B11 Write brief notes on the physiological changes associated with sleep.

Background

Sleep is a necessary reversible reduction in consciousness from which one can be easily aroused via sensory stimuli

Stages of Sleep

Sleep is divided into non-rapid eye movement (NREM) and rapid eye movement (REM) sleep

NREM sleep is further divided into 4 stages, each stage deeper than the previous Stages 3 and 4 are collectively known as slow wave sleep responsible for the refreshing properties of sleep

REM sleep is characterised by random movement of the eyes, muscle atonia and vivid dreams

In adult, sleep is usually divided into 90 minute cycles each cycle approx 5 ~ 20 minutes of REM sleep approximately 3 ~ 6 cycles per night

Physiological Changes of Sleep

<table>
<thead>
<tr>
<th>System</th>
<th>NREM sleep</th>
<th>REM sleep</th>
</tr>
</thead>
</table>
| CNS    | Divided into 4 stages, each with characteristic EEG patterns  
Stage 1 = α waves disappear to low amp high freq θ waves; may see hypnic jerks  
Stage 2 = bursts of sleep spindles  
Stage 3 = high amplitude δ waves with K complexes (bursts of δ wave)  
Stage 4 = synchronised δ waves  
Non-vivid, non-memorable dreams  
CMRO₂ reduced  
†parasympathetic tone | EEG resembles a wakeful state to high frequency, desynchronised waveform  
Vivid dreams  
CMRO₂ reduced |
| CVS    | ↓HR  
↓BP (due to loss of vasomotor tone)  
↓CO | ↑HR  
↑BP (vasoconstriction in skeletal muscle) |
| RESP   | ↓FRC (supine + ↓resp muscle tone)  
↓SaO₂ (basal atelectasis)  
↓pharyngeal tone to OSA  
↓response to hypoxia and hypercarbia  
RR regular, unchanged  
↓TV + ↓RR to ↓MV (up to 15%) | ↓FRC (supine + ↓resp muscle tone)  
↓SaO₂ (basal atelectasis)  
↓↓ pharyngeal tone to OSA  
↓↓ response to hypoxia and hypercarbia  
RR irregular, ↑RR  
Atonia of non-diaphragm resp muscles  
Ventilation = purely activity of diaphragm |
| RENAL  | ↓RBF  
↓GFR  
↑urine concentration and ↓urine output | |
| GIT    | ↓saliva production  
↑peristalsis | ↓saliva production  
↑peristalsis |
Examiner’s Comments – 39% passed.

A definition of sleep, an indication of the components of sleep and their duration followed by a brief notation of the physiological changes occurring in the neurological, cardiovascular, respiratory and metabolic systems was rewarded with a good pass. Additional detail, particularly in regard to the neurological changes, was rewarded with additional marks.

Sleep is a NECESSARY REVERSIBLE reduction in the conscious state from which one can be easily AROUSED by sensory or other stimuli. The most common reason for not passing this question was a poor definition (or no definition at all) and simply not notating an adequate number of physiological changes. The most common error was to correctly state that parasympathetic tone predominates during sleep only to then state that gut motility was reduced. Quite a few answers lacked any structure whatsoever.
Credit was not given for descriptions of physiological compensatory mechanisms, such as for reduced venous return or determinant of GFR.