tpo_24_passage_2

Of all the physiological differences in human sleep compared with wakefulness that have been discovered in the last decade, changes in respiratory control are most dramatic. Not only are there differences in the level of the functioning of respiratory systems, there are even changes in how they function. Movements of the rib cage for breathing are reduced during sleep, making the contractions of the diaphragm more important. Yet because of the physics of lying down, the stomach applies weight against the diaphragm and makes it more difficult for the diaphragm to do its job. However, there are many other changes that affect respiration when asleep. During wakefulness, breathing is controlled by two interacting systems. The first is an automatic, metabolic system whose control is centered in the brain stem. It subconsciously adjusts breathing rate and depth in order to regulate the levels of carbon dioxide CO2 and oxygen O2, and the acid-base ratio in the blood. The second system is the voluntary, behavioral system. Its control center is based in the forebrain, and it regulates breathing for use in speech, singing, sighing, and so on. It is capable of ignoring or overriding the automatic, metabolic system and produces an irregular pattern of breathing. During NREM(the phase of sleep in which there is no rapid eye movement) breathing becomes deeper and more regular, but there is also a decrease in the breathing rate, resulting in less air being exchanged overall. This occurs because during NREM sleep the automatic, metabolic system has exclusive control over breathing and the body uses less oxygen and produces less carbon dioxide. Also, during sleep the automatic metabolic system is less responsive to carbon dioxide levels and oxygen levels in the blood. Two things result from these changes in breathing control that occur during sleep. First, there may be a brief cessation or reduction of breathing when falling asleep as the sleeper waxes and wanes between sleep and wakefulness and their differing control mechanisms. Second, once sleep is fully obtained, there is an increase of carbon dioxide and a decrease of oxygen in the blood that persists during NREM. But that is not all that changes. During all phases of sleep, several changes in the air passages have been observed. It takes twice as much effort to breathe during sleep because of greater resistance to airflow in the airways and changes in the efficiency of the muscles used for breathing. Some of the muscles that help keep the upper airway open when breathing tend to become more relaxed during sleep, especially during REM (the phase of sleep in which there is rapid eye movement). Without this muscular action, inhaling is like sucking air out of a balloon-the narrow passages tend to collapse. Also there is a regular cycle of change in resistance between the two sides of the nose. If something blocks the "good" side, such as congestion from allergies or a cold, then resistance increases dramatically. Coupled with these factors is the loss of the complex interactions among the muscles that can change the route of airflow from nose to mouth. Other respiratory regulating mechanisms apparently cease functioning during sleep. For example, during wakefulness there is an immediate, automatic, adaptive increase in breathing effort when inhaling is made more difficult (such as breathing through a restrictive face mask). This reflexive adjustment is totally absent during NREM sleep. Only after several inadequate breaths under such conditions, resulting in the considerable elevation of carbon dioxide and reduction of oxygen in the blood, is breathing effort adjusted. Finally, the coughing reflex in reaction to irritants in the airway produces not a cough during sleep but a cessation of breathing. If the irritation is severe enough, a sleeping person will arouse, clear the airway, then resume breathing and likely return to

sleep. Additional breathing changes occur during REM sleep that are even more dramatic than the changes that occur during NREM. The amount of air exchanged is even lower in REM than NREM because, although breathing is more rapid in REM, it is also more irregular, with brief episodes of shallow breathing or absence of breathing. In addition, breathing during REM depends much more on the action of the diaphragm and much less on rib cage action.

question 1

According to paragraph 1, which of the following can be inferred about the diaphragm during sleep?

A During sleep the diaphragm requires increased movement of the rib cage.

B The diaphragm helps with breathing as movements of the rib cage decrease during sleep.

C The diaphragm requires a great amount of pressure to function properly.

D The diaphragm contributes to the effective functioning of the rib cage.

question 2

According to paragraph 2, all of the following are true of the voluntary breathing system EXCEPT:

A It has its control center in the brain stem.

B It controls breathing for a number of activities during wakefulness.

C It is able to bypass the automatic system.

D It produces an irregular breathing pattern.

question 3

According to paragraph 3, which of the following may occur just before NREM sleep begins?

A The automatic, metabolic system may increase its dependence on air exchanges.

B Breathing can stop for a short time as a person falls asleep.

C An increase in the oxygen level in the blood can occur as sleep becomes fully

obtained.

D The level of carbon dioxide in the blood may drop suddenly.

question 4

What is the author's purpose in stating that "inhaling is like sucking air out of a balloon" ?

A To refute the argument that additional effort is necessary for breathing during sleep

B To argue that REM sleep is more important than NREM sleep

C To illustrate the difficulty of breathing during sleep

D To illustrate how blockage of narrow passages can be prevented during sleep

question 5

All of the following are mentioned in paragraph 4 as being characteristic of breathing during sleep EXCEPT

A relaxation of the muscles involved in the respiratory system

B changes in resistance between the two sides of the nose

C easier airflow in the passages of the upper airway

D absence of certain complex muscle interactions

question 6

According to paragraph 5, what happens during NREM sleep when inhaling is difficult?

A There is an immediate, automatic, adaptive increase in breathing effort.

B The sleeping person takes several inadequate breaths before the breathing effort is adjusted.

C The coughing reflex causes the breathing effort to adjust.

D The airways become cleared as the blood removes irritants.

question 7

It can be inferred from paragraph 5 that a very mild irritation during sleep will likely cause the sleeping person to

A increase the breathing effort

B wake up and remove the source of irritation

C cough while still sleeping

D stop breathing temporarily while still sleeping

question 8

Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

A Because breathing is more shallow and irregular in REM than in NREM, less air is exchanged in REM.

B Breathing in NREM is less effective than breathing in REM because of irregular episodes of rapid breathing during NREM.

C Because breathing is more rapid in NREM sleep than in REM sleep, breathing often becomes shallow.

D Although REM has brief episodes of shallow breathing or lack of breathing, breathing is more rapid than in NREM.

question 9

Look at the four squares [ ] that indicate where the following sentence could be added to the passage.

Of all the physiological differences in human sleep compared with wakefulness

that have been discovered in the last decade, changes in respiratory control are most dramatic. Not only are there differences in the level of the functioning of respiratory systems, there are even changes in how they function. Movements of the rib cage for breathing are reduced during sleep, making the contractions of the diaphragm more important. [] Yet because of the physics of lying down, the stomach applies weight against the diaphragm and makes it more difficult for the diaphragm to do its job. [] However, there are many other changes that affect respiration when asleep. [] During wakefulness, breathing is controlled by two interacting systems. [] The first is an automatic, metabolic system whose control is centered in the brain stem. It subconsciously adjusts breathing rate and depth in order to regulate the levels of carbon dioxide CO2 and oxygen O2, and the acid-base ratio in the blood. The second system is the voluntary, behavioral system. Its control center is based in the forebrain, and it regulates breathing for use in speech, singing, sighing, and so on. It is capable of ignoring or overriding the automatic, metabolic system and produces an irregular pattern of breathing. During NREM(the phase of sleep in which there is no rapid eye movement) breathing becomes deeper and more regular, but there is also a decrease in the breathing rate, resulting in less air being exchanged overall. This occurs because during NREM sleep the automatic, metabolic system has exclusive control over breathing and the body uses less oxygen and produces less carbon dioxide. Also, during sleep the automatic metabolic system is less responsive to carbon dioxide levels and oxygen levels in the blood. Two things result from these changes in breathing control that occur during sleep. First, there may be a brief cessation or reduction of breathing when falling asleep as the sleeper waxes and wanes between sleep and wakefulness and their differing control mechanisms. Second, once sleep is fully obtained, there is an increase of carbon dioxide and a decrease of oxygen in the blood that persists during NREM. But that is not all that changes. During all phases of sleep, several changes in the air passages have been observed. It takes twice as much effort to breathe during sleep because of greater resistance to airflow in the airways and changes in the efficiency of the muscles used for breathing. Some of the muscles that help keep the upper airway open when breathing tend to become more relaxed during sleep, especially during REM (the phase of sleep in which there is rapid eye movement). Without this muscular action, inhaling is like sucking air out of a balloon-the narrow passages tend to collapse. Also there is a regular cycle of change in resistance between the two sides of the nose. If something blocks the "good" side, such as congestion from allergies or a cold, then resistance increases dramatically. Coupled with these factors is the loss of the complex interactions among the muscles that can change the route of airflow from nose to mouth. Other respiratory regulating mechanisms apparently cease functioning during sleep. For example, during wakefulness there is an immediate, automatic, adaptive increase in breathing effort when inhaling is made more difficult (such as breathing through a restrictive face mask). This reflexive adjustment is totally absent during NREM sleep. Only after several inadequate breaths under such conditions, resulting in the considerable elevation of carbon dioxide and reduction of oxygen in the blood, is breathing effort adjusted. Finally, the coughing reflex in reaction to irritants in the airway produces not a cough during sleep but a cessation of breathing. If the irritation is severe enough, a sleeping person will arouse, clear the airway, then resume breathing and likely return to sleep. Additional breathing changes occur during REM sleep that are even more dramatic than the changes that occur during NREM. The amount of air exchanged is even lower in REM than NREM because, although breathing is more rapid in REM, it is also more irregular, with brief episodes of shallow breathing or

absence of breathing. In addition, breathing during REM depends much more on the action of the diaphragm and much less on rib cage action.

question 10

Directions: From the seven statements below, select the statements that correctly characterize breathing during wakefulness and those statements that correctly characterize breathing during sleep. Drag each answer choice you select into the appropriate box of the table. Two of the answer choices will NOT be used. This question is worth 3 points.

A. The role of the rib cage increases and the role of the diaphragm decreases.

B. Carbon dioxide in blood rises and oxygen drops.

C. The coughing reflex is extremely complex.

D. A great deal of effort is used for breathing.

E. Upper airways are resistant to colds and allergies.

F. There is a drop in the volume of air that is exchanged.

G. Automatic and voluntary respiratory systems are both involved.