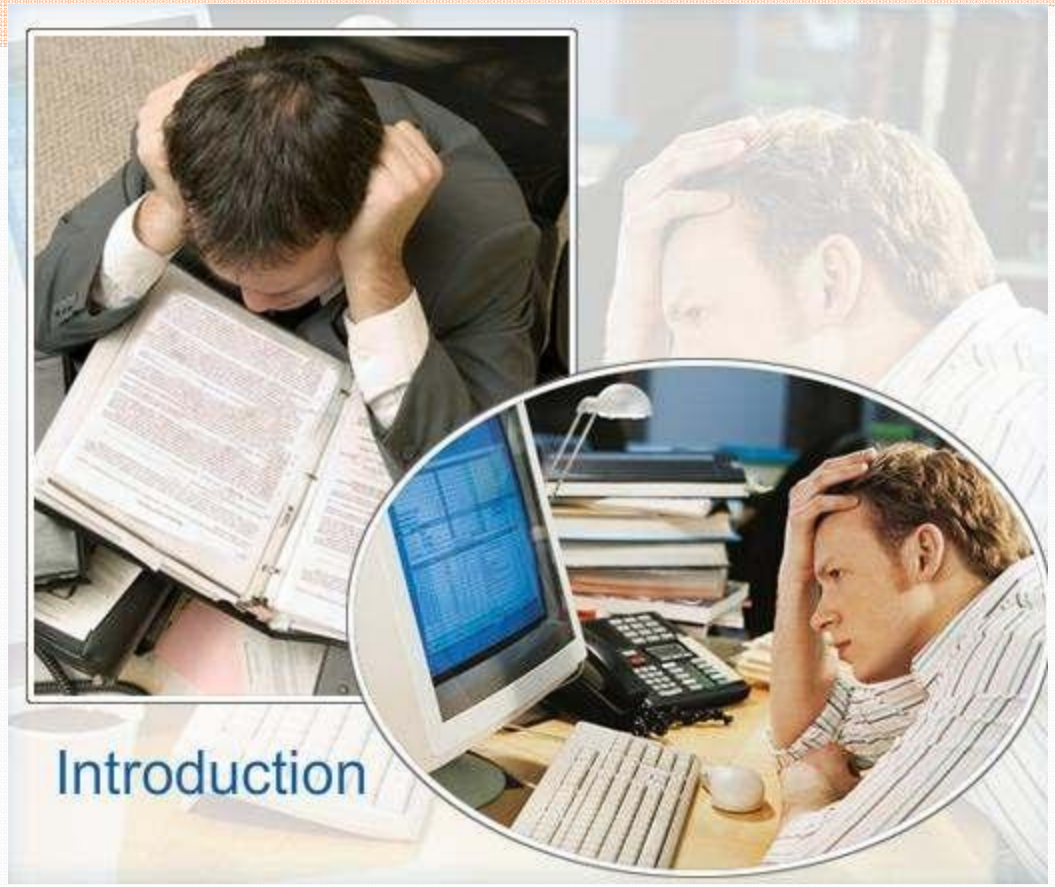
The Science of Sleep and Fatigue

Part 1. The Causes of Fatigue

Course name: The Science of Sleep and Fatigue



Script Text:

Introduction

This training is designed to address the problems of managing Fatigue and Alertness in the railroad industry.

People have become accustomed to the advantages of extended hours of operation for everything from grocery stores to banking services.

People who work in hospitals, police and fire departments, and other emergency-related occupations must be available at all hours. The same applies to people in the manufacturing and transportation sectors, including, of course, the railroad industry.

The railroad industry, and BNSF in particular, have recognized the need to help its employees be rested and stay alert, so that they can work and live safely and productively.

Course name: The Science of Sleep and Fatigue

Script Text:

Lesson Objective

After successfully completing this lesson, you will be able to:

•discuss the science of fatigue and alertness.

•describe the states of sleep and sleep cycle.

•explain Circadian Rhythm.

•discuss how sleep loss affects the railroad worker.

•determine how much sleep you need.

•explain the cumulative effects of sleep loss.

•judge your own level of sleepiness and alertness.

•list substances that can disrupt sleep.

•avoid misconceptions about sleep.

•decide whether or not you could be suffering from a sleep disorder.

Course name: The Science of Sleep and Fatigue

Script Text:

Fatigue

Fatigue:

•may be manifested by sleepiness, tiredness, physical discomfort, or mental distraction.

•on the job can be dangerous and contribute to accidents and injuries and impair job performance.

Note: Much of the information here was originally developed by NASA for the aviation industry. Later, it was adapted to other safety-sensitive industries, including the railroad.

Fatigue

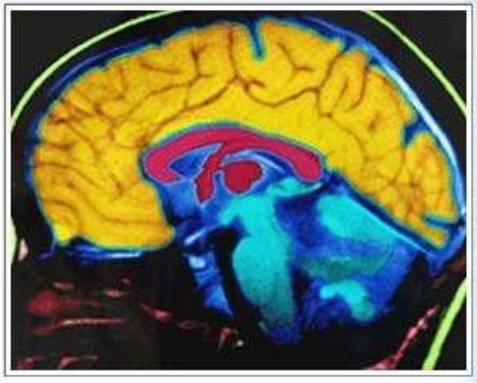
Research shows people suffering from fatigue:

•have slower reaction times.
•poorer physical coordination.
•foggier mental processes.

*For more information about fatigue research, see **Note** below.*

Course name: The Science of Sleep and Fatigue

Lack of Quality Sleep



•Non-Rapid Eye Movement (Non-REM)
•Rapid Eye Movement (REM)

For more information about REM and Non-REM, click each bullet point.

Script Text:

Fatigue: Non-REM and REM

There are various causes for fatigue, but the most basic and direct cause is lack of quality sleep. Sleep is a primal drive, just like hunger or thirst. Human beings cannot function without proper sleep.

Sleep is a highly complex physiological cycle that must play itself out in order to rest and refresh us.

During sleep, the brain and the body alternate between the two states of activity and quiet. These two states are called Non-Rapid Eye Movement (Non-REM) and Rapid Eye Movement (REM).

Course name: The Science of Sleep and Fatigue

Non-REM Sleep

Non-REM Sleep

- Physiological & mental activities slow down
- Heart rate & breathing rate decrease, become regular
- Divided into four stages of sleep
- Deepest in stages three and four
- Therapeutic sleep

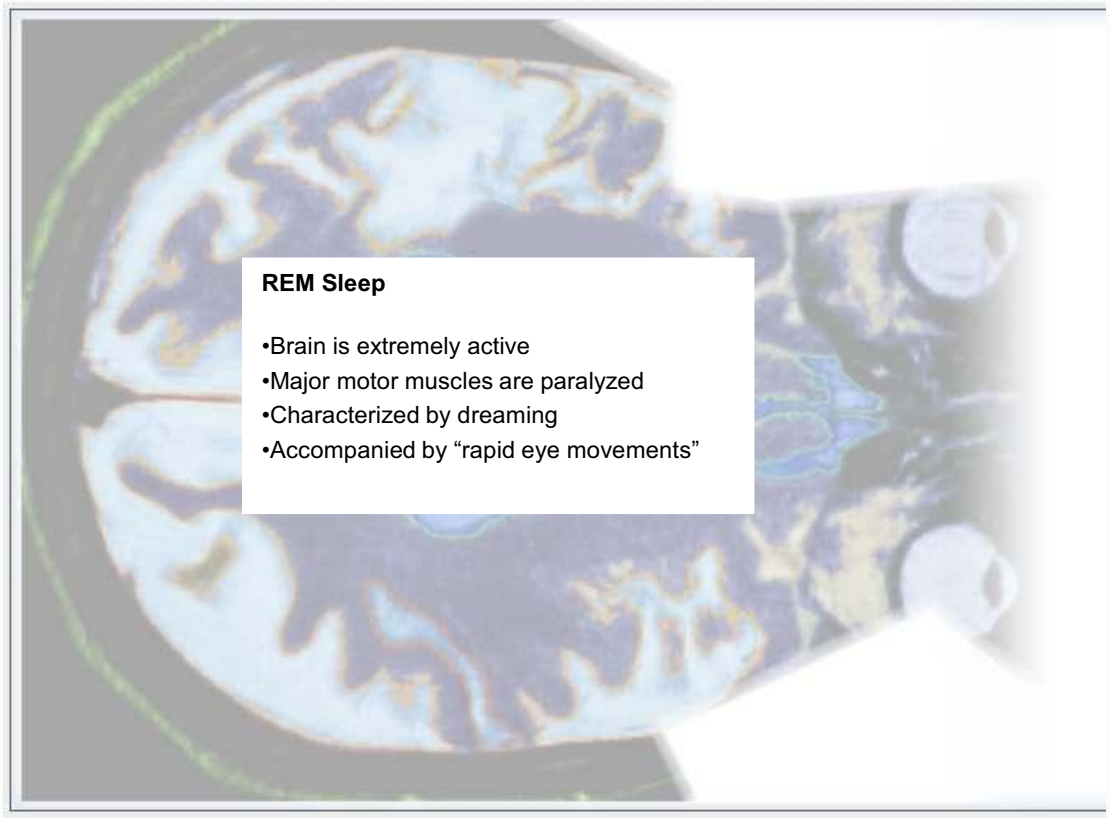
Non-REM Sleep

Awakened in Non-REM Stage 3 or 4

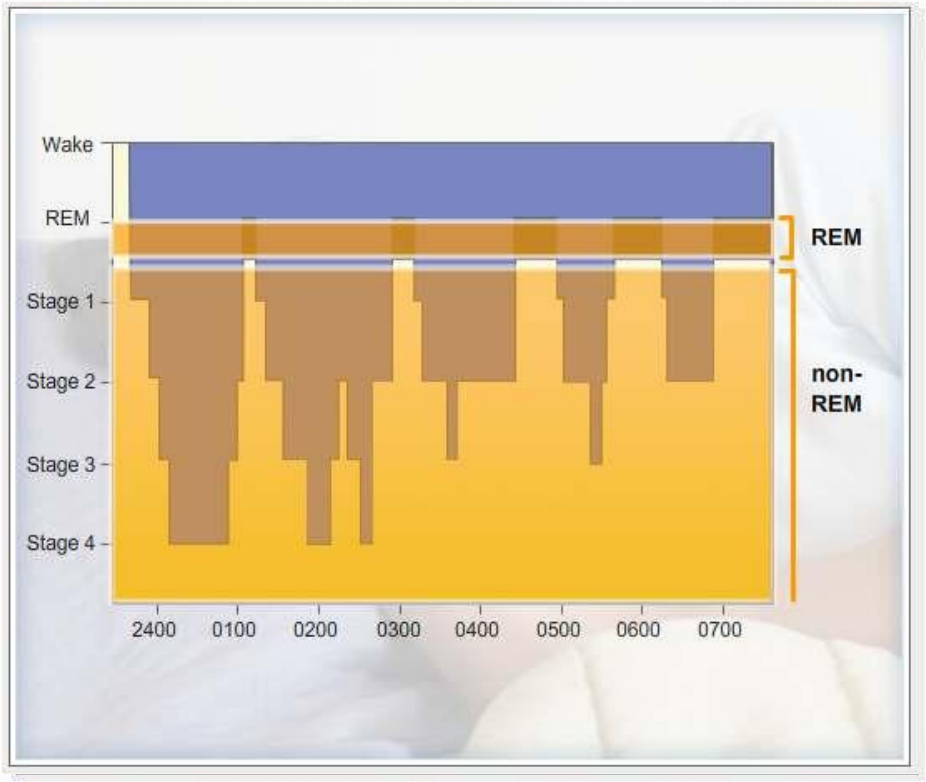
- Difficulty waking
- Continue to feel sleepy, groggy, disoriented for 10 or 15 minutes
- Called “sleep inertia”

Course name: The Science of Sleep and Fatigue

Script Text:



Course name: The Science of Sleep and Fatigue



Script Text:

Non-REM and REM Sleep

Non-REM and REM sleep occur in 90-minute cycles that repeat throughout the sleep period. Within each 90-minute cycle, there is a stage of Non-REM and a stage of REM sleep. The Non-REM stage is longer than the REM stage.

Course name: The Science of Sleep and Fatigue

Circadian Rhythm Dips

- 1 P.M.- 3 P.M.
- 3 A.M. - 5 A.M.
- 2 A.M. - 6 A.M - Nocturnal Window
- 6 P.M. - 8 P.M. – No Sleep Zone

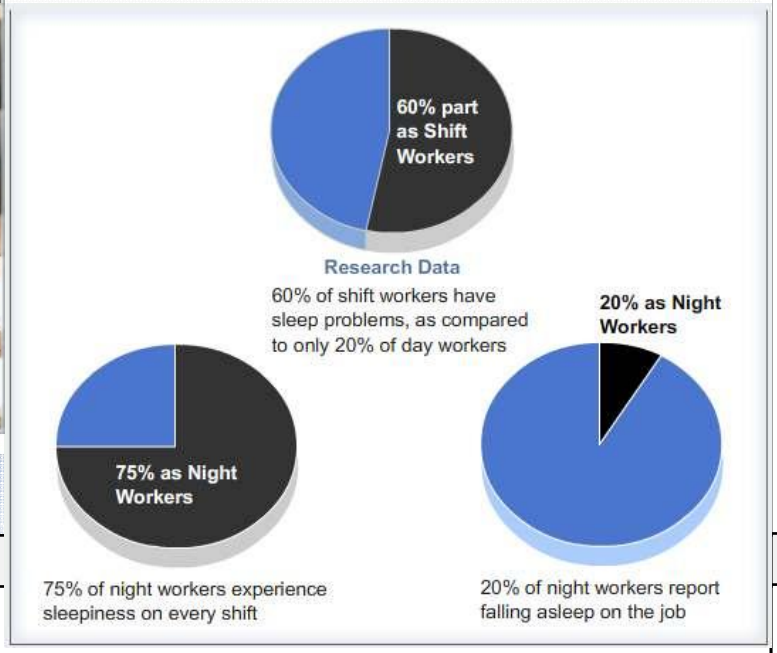
Script Text:

Circadian Rhythm

- Influences our daily cycles of temperature, digestion, performance, hormones and sleeping and waking patterns

- "Biological Clock"

Course name: The Science of Sleep and Fatigue



Script Text:

Night Workers

People working at night

•Must override Circadian clock

•Work/rest schedule may reset body's clock

•May feel influence of daytime & nighttime cues

•Society will pull person back toward daytime activity

•Most shift workers revert to normal waking/sleeping schedules on days off

Course name: The Science of Sleep and Fatigue

The human body is programmed to be awake during daylight and asleep during nighttime.

*Select the correct option and click the **Check Answer** button.*

A.True
B.False

Correct Answer: Option A
<Feedbacks>
That's correct/ That’s incorrect. The Circadian Clock influences the human body to be active during the day and sleep during the night.

Course name: The Science of Sleep and Fatigue

When is the Circadian Rhythm most likely to cause sleepiness?

*Select the correct options and click the **Check Answer** button.*

A.Between 1 p.m. and 3 p.m.
B.Between 1 a.m. and 3 a.m.
C.Between 6 p.m. and 8 p.m.
D.Between 3 a.m. and 5 a.m.

Correct Answers: Option A and D
<Feedbacks>
That's correct/ That’s incorrect/ That’s partial correct. The Circadian Rhythm causes sleepiness between 1 p.m. and 3 p.m. and between 3 a.m. and 5 a.m.

Course name:

This concludes the review of this lesson.

If you exit with incomplete lessons, you will not get credit for completing the course.

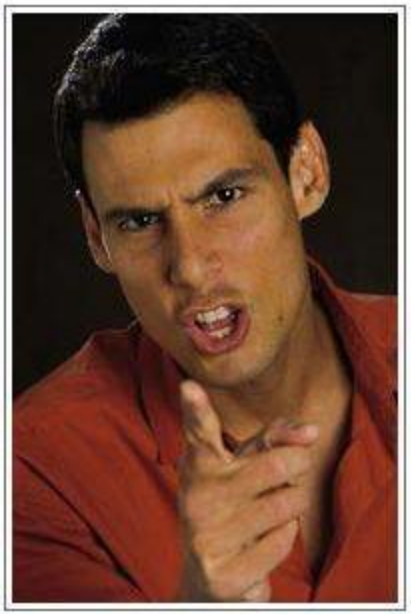
To ensure you have completed all lessons, click "Menu" and check for a completed status. Completed lessons will be indicated by a check mark.

Course name:

The Science of Sleep and Fatigue

Part 2. Sleep Requirement

Course name: The Science of Sleep and Fatigue



Script Text:

Signs and Symptoms of Fatigue

•Forgetfulness

•Poor decision making

•Slowed reaction time

•Reduced vigilance

•Poor communication

•Becoming fixated (tunnel vision)

•Apathy

•Bad moods

•Nodding off

Course name: The Science of Sleep and Fatigue

Script Text:

Sleep Requirement

The amount of sleep a person needs changes over their life span. See the Amount of Sleep Needed chart on screen.

Adult Sleep Needed

•8 hours in 24 hour period
• Average only 6:57 during week
• Average only 7:31 on weekends
• With age - sleep less deep
• Sleep more disrupted
• Total amount of nocturnal sleep decreases
• Consolidated & continuous nocturnal sleep decreases
• Napping is effective

Course name: The Science of Sleep and Fatigue

Script Text:

Sleep: Physiological Need

Sleep Loss

•Occasional sleep loss without serious consequences

• Cannot experience sustained sleep loss

•Sleep loss is additive and can result in a cumulative sleep debt

•Sleep loss will accumulate into sleep debt - affects judgement & performance

Course name: The Science of Sleep and Fatigue

Script Text:

Sleep Debt

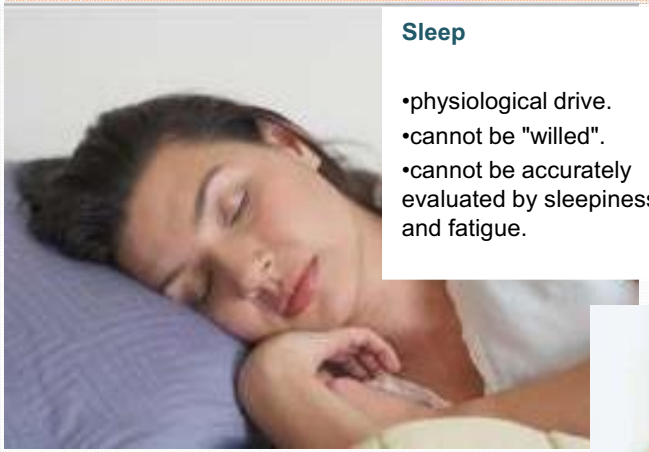
Sleep must be repaid. It was once thought that you have to "make-up" for lost sleep by sleeping a number of hours equal to the number of hours of lost sleep.

Research shows that recovery sleep is deeper rather than longer.

In other words, more Non-REM stages 3 and 4 sleep. During recovery sleep, an individual may sleep somewhat longer but deeper sleep is key feature.

Effect of Sleep on Task Performance

Course name: The Science of Sleep and Fatigue



Sleep

- physiological drive.
- cannot be "willed".
- cannot be accurately evaluated by sleepiness and fatigue.

Script Text:

Sleep

Two ways to evaluate sleepiness and fatigue.

•Objective: Objective is your actual physiological state with regard to sleep. Objective sleepiness can be scientifically measured by monitoring the activity of your heart and brain, using medical tests, such as EKG or EEG.

•Subjective: Subjective sleepiness is your introspective self-report of that status. You might rate your sleepiness on a scale from "wide awake and alert" to "extremely sleepy, ready to nod off."

Self Report

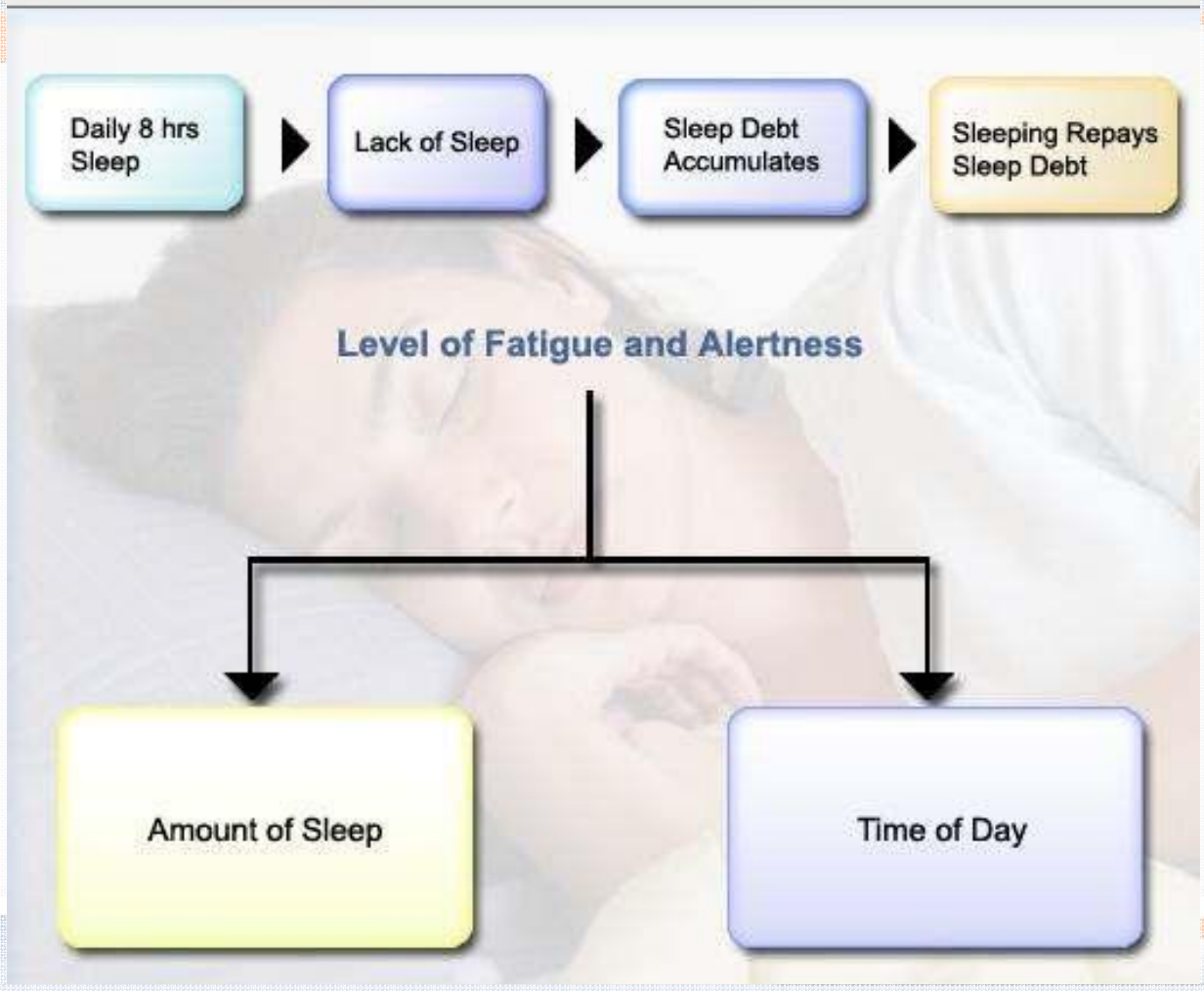
•Physiological sleepiness can be concealed (activity, caffeine, etc.)

•Usually more alert than physiologically valid

•Difficult to reliably estimate quantity or quality of sleep or waking alertness

•You are more likely to be sleepier than you think or report

Course name: The Science of Sleep and Fatigue



Script Text:

Sleep (Cont.)

To avoid sleepiness most adults need 8 hours of sleep in every 24-hour period.

The quality of the sleep you get is as important as the amount of sleep you receive. If you get eight hours of sleep, but the sleep is constantly disrupted, you will still suffer the effects of fatigue during your waking hours.

Course name: The Science of Sleep and Fatigue

Script Text:

Sleep Disrupting Factors

Biological Programming

•People sleep during night - dark, quiet and cool

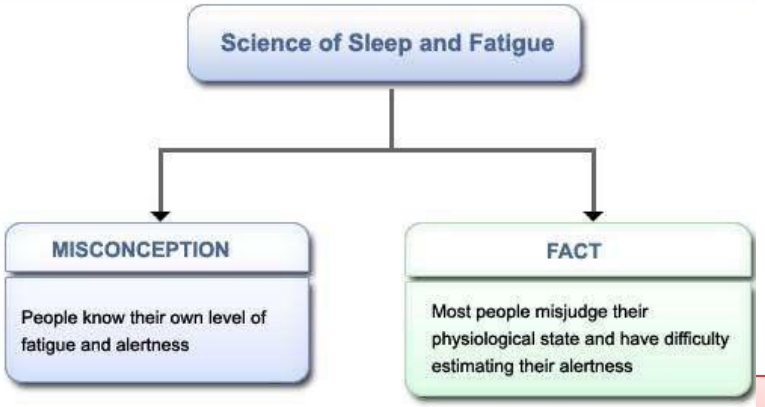
Environmental Factors Affect Sleep

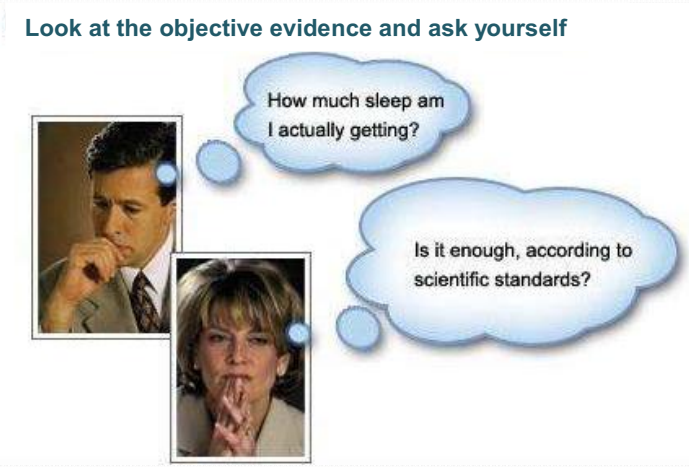
•Sleep disrupted by light, noise, temperature

Substances can Disrupt Sleep

•Alcohol most widely used sleep aid
•Initially helpful but interferes with sleep cycle
• Sleepy people will be more affected by alcohol
• Rx & OTC medications can impair sleep
• Sleep aids can have serious side effects
• None should be taken without the advice of a physician

Course name: The Science of Sleep and Fatigue





Script Text:

Science of Sleep & Fatigue

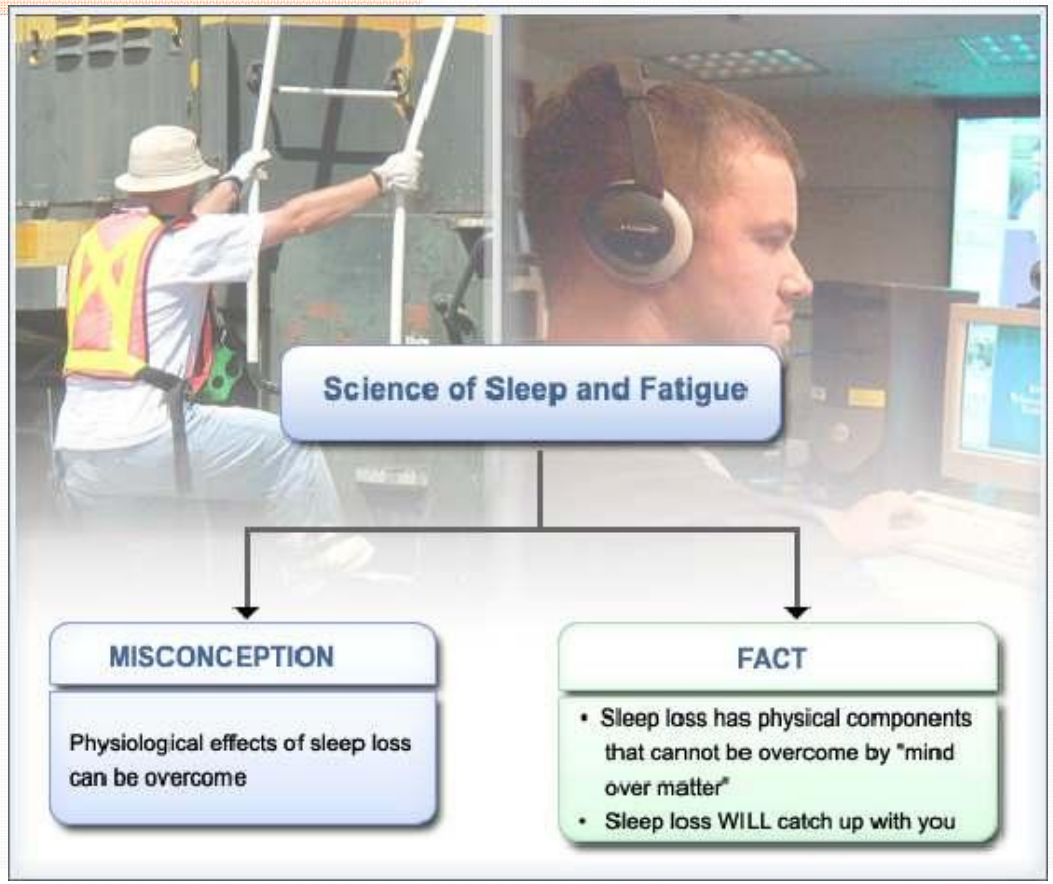
If you are not getting the prescribed amount of sleep, you should take steps to remedy the situation, because every time you go to work sleepy or fatigued, your performance and your safety are compromised.

For more information about science of sleep and fatigue, see Note below.

Note to construction/graphic: Note will be shown at the bottom of screen.

Note: Remember, most adults need 8 hours of sleep in every 24 hours. In addition, 9 hours in bed is equal to 8 hours sleep for the average individual.

Course name: The Science of Sleep and Fatigue



Script Text:

Science of Sleep & Fatigue (Cont.)

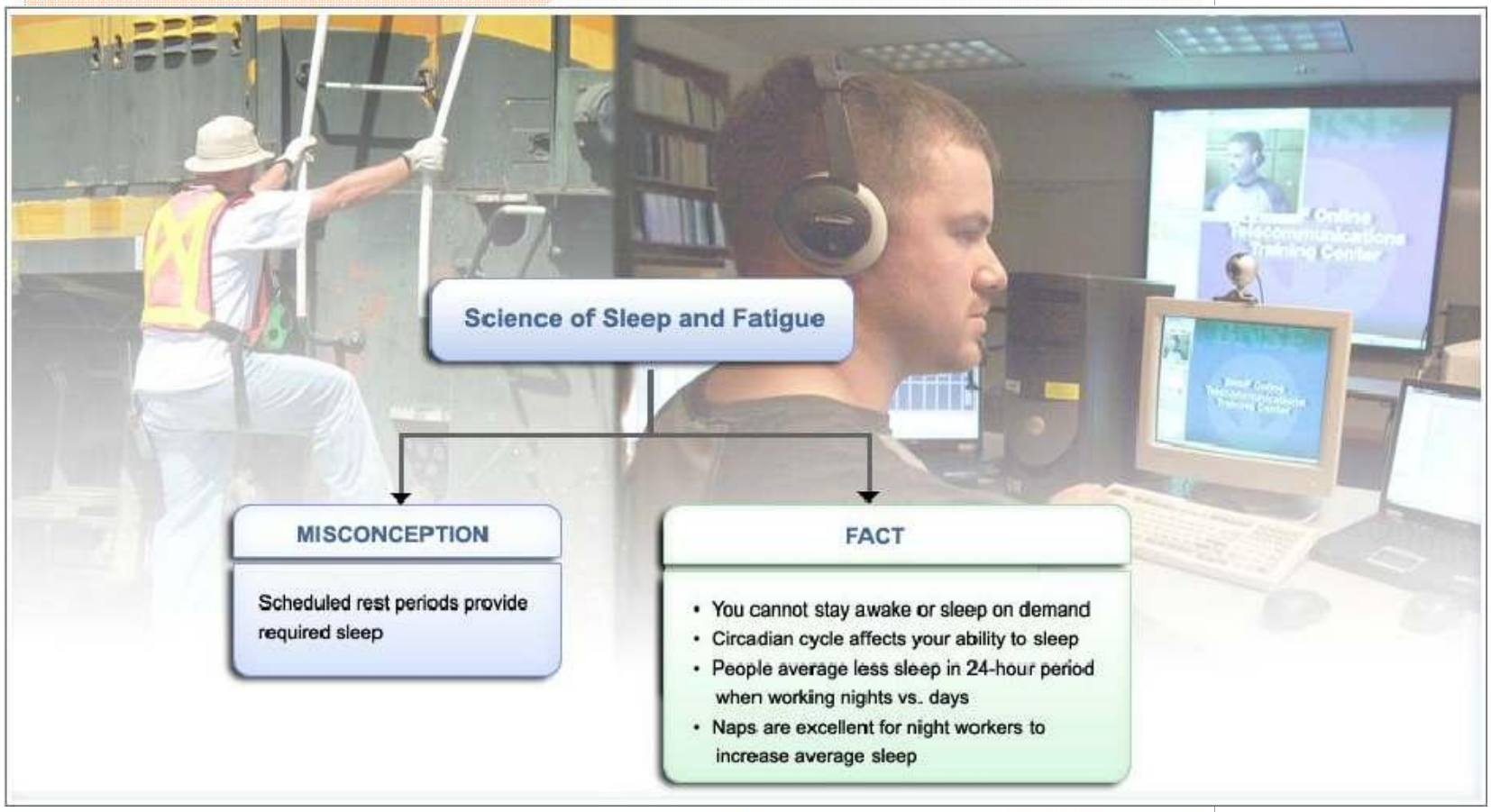
Another misconception is that you can overcome the physiological effects of sleep loss by determination, motivation, and experience.

The fact is sleep loss has physical components that cannot be overcome just by putting "mind over matter." In addition, you cannot determine that you won't be sleepy later since you are wide awake now.

Sleep loss will catch up with you, but you cannot predict when. You have to plan to get sufficient rest, so you will not succumb to fatigue.

Course name: The Science of Sleep and Fatigue

Script Text:



Course name: The Science of Sleep and Fatigue

•There are NO magic bullets.
•Be diligent about getting the rest you need

Script Text:

Science of Sleep & Fatigue (Cont.)

You should also be warned about believing in a "magic bullet" that will effortlessly alleviate the sleep loss and fatigue that is often associated with railroad operations.

Beware and be skeptical of any claims to a "cure" for fatigue. The best remedies remain the tried-and-true methods that require you to be as diligent about getting needed rest as you are about all the other responsibilities in your life.

Course name: The Science of Sleep and Fatigue

All adults have different daily sleep requirements.

*Select the correct option and click the **Check Answer** button.*

A. True
B. False

Correct Answer: Option B

<Feedbacks>
That's correct/ That’s incorrect. To be well-rested, most adults need eight hours of sleep in a 24-hour period.

Course name: The Science of Sleep and Fatigue

To obtain 8 hours of sleep, how much time must the average adult spend in bed?

*Select the correct option and click the **Check Answer** button.*

A.9 hours
B.8 hours

Correct Answer: Option A
<Feedbacks>
That's correct/ That's incorrect. For the average adult, 9 hours in bed is equal to 8 hours sleep.

Course name: The Science of Sleep and Fatigue

You can judge your own sleepiness and alertness by the way you feel.

*Select the correct option and click the **Check Answer** button.*

A. True
B. False

Correct Answer: Option B
<Feedbacks>
That's correct/ That’s incorrect. Research shows that people are unable to accurately judge their own states of sleepiness and alertness.

Course name: The Science of Sleep and Fatigue

The factors that most affect your level of fatigue and alertness are:

*Select the correct options and click the **Check Answer** button.*

A.Personal sleep requirements
B.Amount of sleep in a 24-hour period
C.Time of day

Correct Answers: Option B and C

<Feedbacks>

That's correct/ That’s incorrect. Your level of fatigue and alertness is affected by the amount of sleep you have had and the time of day.

Course name: The Science of Sleep and Fatigue

Script Text:

Which of the following is not a factor in aiding or disrupting sleep?

*Select the correct option and click the **Check Answer** button.*

A.Alcohol
B.Sleep environment
C.Will power
D.Medications

Correct Answer: Option C
<Feedbacks>
That's correct/ That’s incorrect. Alcohol and medications can disrupt sleep. A proper environment can aid sleep. You cannot force yourself to sleep or to stay awake by will power alone.

Course name: The Science of Sleep and Fatigue

Script Text:

Having a scheduled rest period will assure you of getting your required sleep.

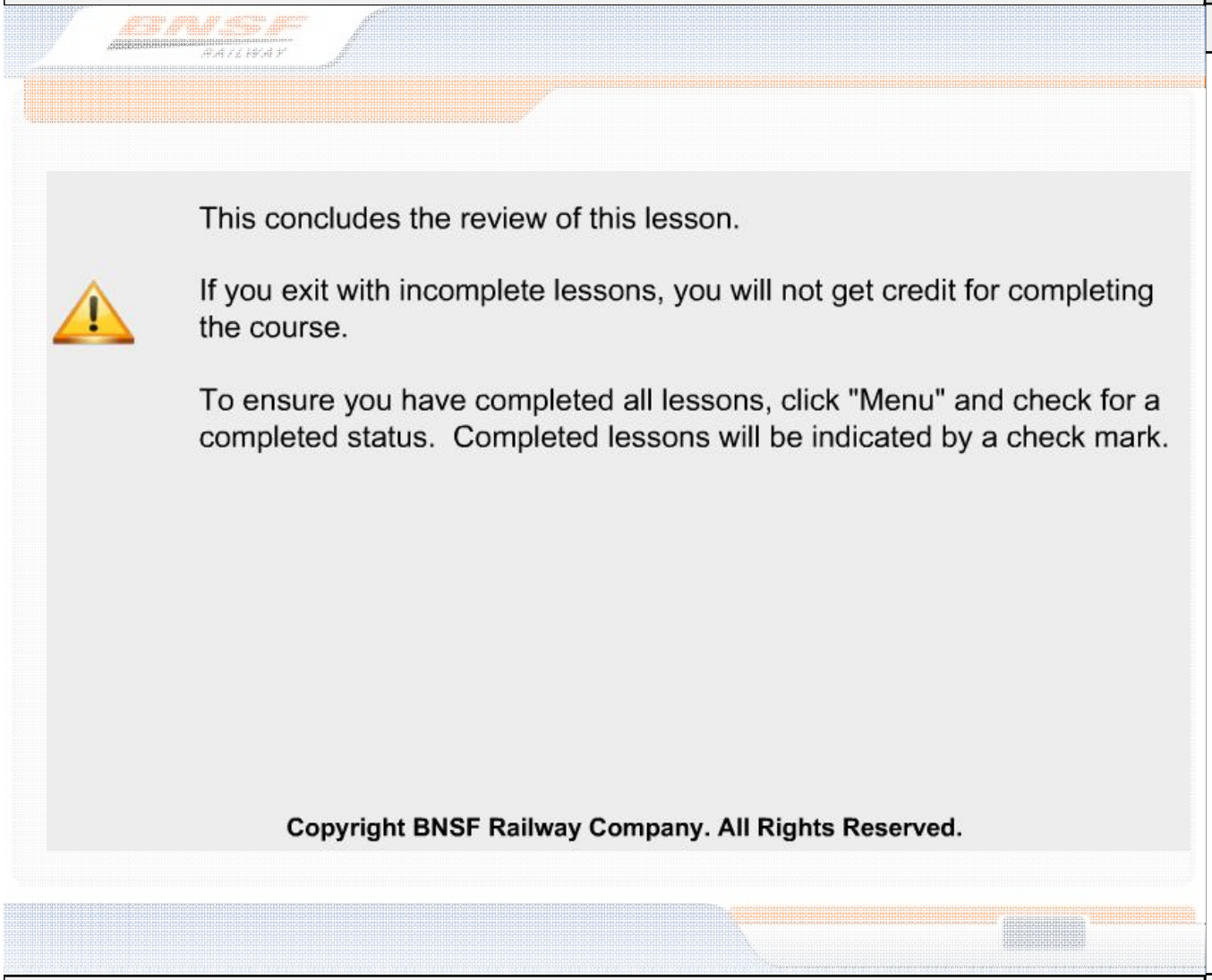
*Select the correct option and click the **Check Answer** button.*

A.True
B.False

Correct Answer: Option B
<Feedbacks>
That's correct/ That’s incorrect. Because of the Circadian Rhythms it may be difficult to get enough sleep if you work non-traditional hours.

Course name: The Science of Sleep and Fatigue

Script Text:

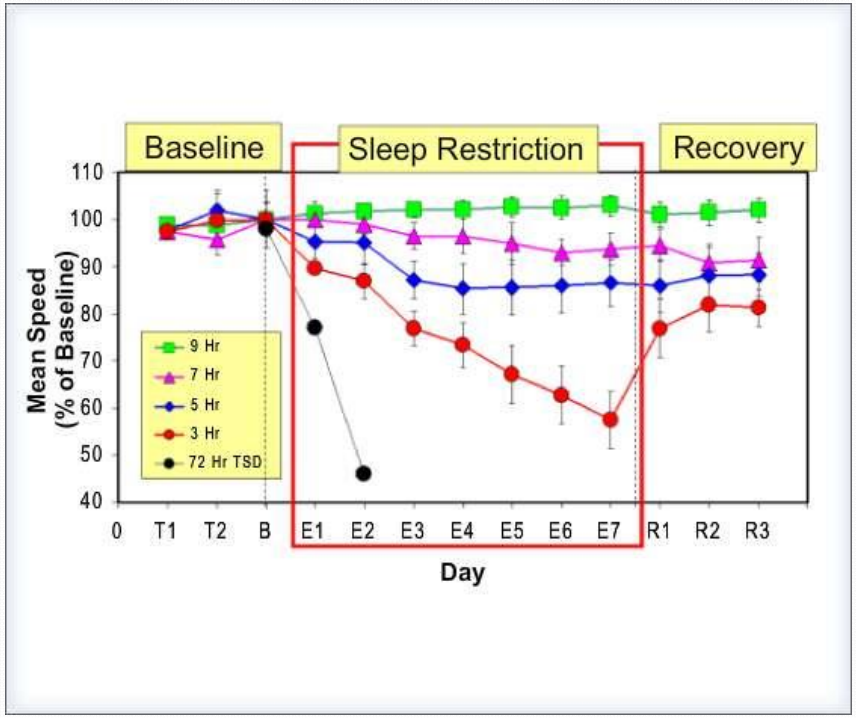


Course name:

The Science of Sleep and Fatigue

Part 3. Alertness Strategies & Sleep Disorders

Course name: The Science of Sleep and Fatigue



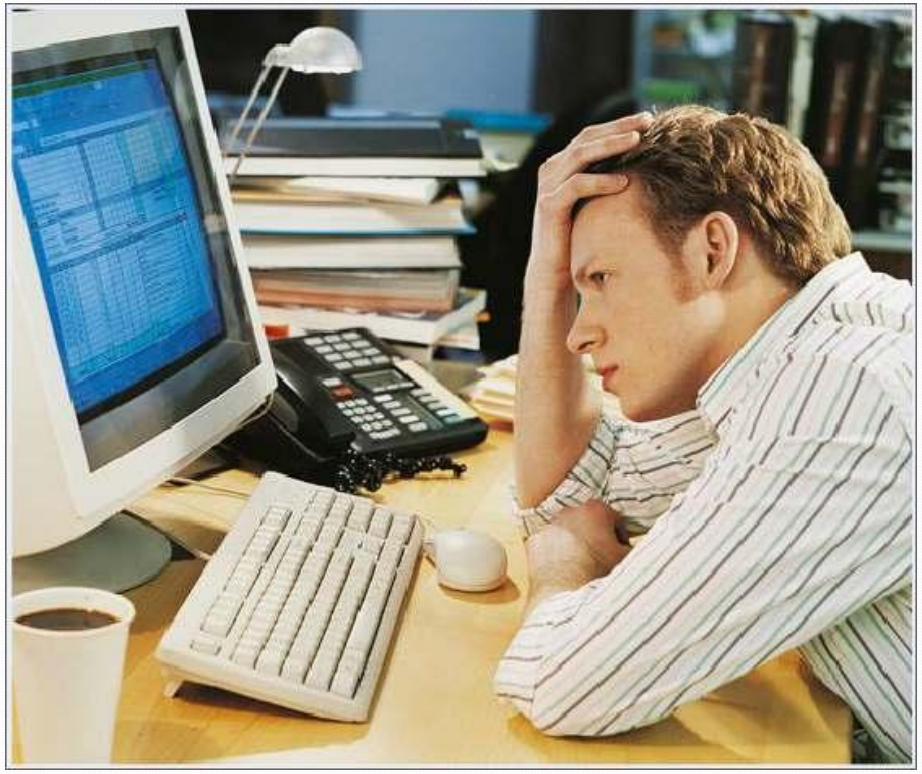
Script Text:

Effect of Sleep on Task Performance

As you have learned, the need for sleep is not something that can be overcome by will power. We know that everyone needs 6 to 8 hours of sleep in every 24 hours to maintain vigilance and research has shown that getting less than your required daily rest can affect performance.

Sometimes getting your needed rest can take careful planning of your off duty hours and require communication with family and friends to let them know how important it is for you to get your sleep. Be mindful of over-booking your at-home time with events that will cause you to reduce your sleep opportunity.

Course name: The Science of Sleep and Fatigue



Script Text:

Alertness Strategies

At some point in time you may find that you are tired when on duty and may need to use Alertness Strategies to help you in maintaining vigilance. None of these strategies can restore wakefulness as well as getting proper rest but Alertness Strategies can be an effective way to increase alertness if you feel fatigue may interfere with work performance.

Course name: The Science of Sleep and Fatigue

- Taking a Nap
  - Napping will increase alertness and performance as long as they are at least 10 minutes.
  - An approved nap as per GCOR 1.11.1 should last no longer than 45 minutes. Familiarize yourself with this rule and take advantage of it when possible.
  - Be sure to set aside up to 15 minutes to “wake up” after a nap period to dissipate the effects of “Sleep Inertia.”

Script Text:

Napping

Napping has been shown to restore alertness as long as they are greater than 10 minutes long.

GCCOR 1.11.1 Napping allows for TY&E employees to take a nap up to 45 minutes. Be familiar with this rule to be sure your circumstances qualify for an Opportunity Nap.

Be aware of “Sleep Inertia” that can make it difficult for some employees to wake up completely at the end of a nap. The length of Sleep Inertia varies according to each circumstance and can cause temporary disorientation that will gradually dissipate over time.

Course name: The Science of Sleep and Fatigue

Alertness Strategies

Caffeine

Here are some estimates of the amount of caffeine in typical beverages:

- Espresso 1 serving 1.5 oz 100 mg
- Brewed Coffee, 8 oz 80-200 mg
- Instant Coffee, 8 oz 27-173 mg
- Decaf Coffee, brewed, 8 oz 4-7 mg
- Decaf Coffee, instant, 8 oz 2-3 mg
- Tea, iced, 12 oz, 70 mg
- Tea, brewed, 8 oz, 40-120 mg
- Nestea Iced Tea, 12 oz, 26 mg
- Coca-Cola Classic, 12 oz, 35 mg
- Red Bull, 8.3 oz, 76 mg
- Monster Energy, 16 oz, 60 mg
- Hershey's Special Dark chocolate bar, 1.45 oz, 31 mg

Script Text:

Natural stimulants such as caffeine can decrease your short-term fatigue. Caffeine requires about 15-45 minutes to take effect dependent on individual sensitivity, and body mass. Although many sodas do contain caffeine, don't drink too much as you risk having a blood-sugar "crash" once your body begins to process the sugars. A key is to only have small amounts of sugar and caffeine to minimize any negative effects or avoid intake of sugar completely. The effects of caffeine can last 3 to 4 hours so do not consume caffeine if you are within 4 hours of your rest.

Course name: The Science of Sleep and Fatigue

Script Text:

Alertness Strategies

•Drink an ice-cold glass of water
•Sensible Snacks
•Expose yourself to bright light
•Get up and move around
•Stay cold by opening a window or splashing cold water on your face
•Brush your teeth and or chew gum
•Engage in conversation
•Medications

Course name: The Science of Sleep and Fatigue

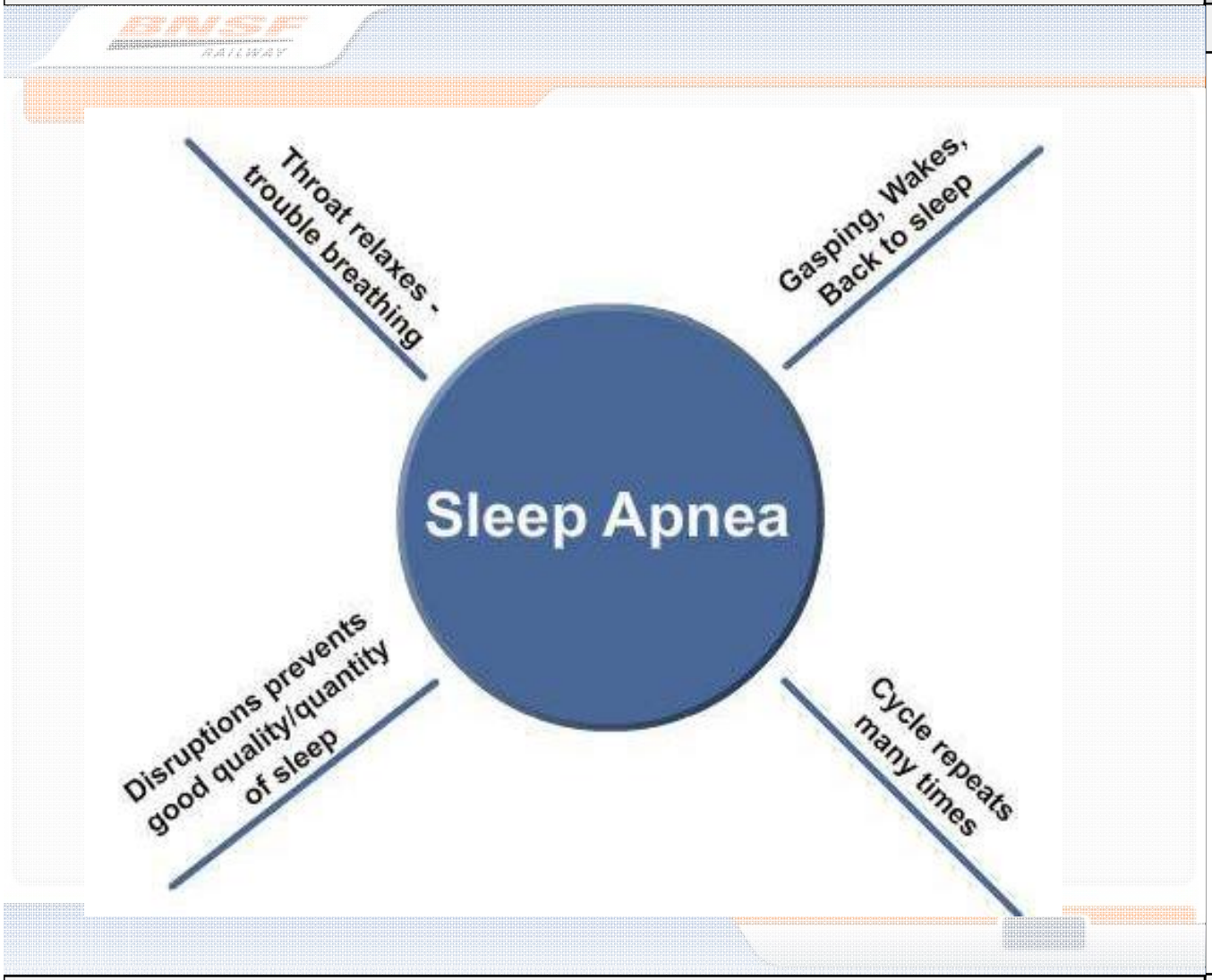
Script Text:

Sleep Problems

Sleep problems can be solved by lifestyle changes. But, sometimes, there is an underlying cause that must be identified and treated. If you have a history of sleep problems, you may have a sleep disorder.

Sleep disorders are medical problems that can disturb your sleep and impair your alertness; both on the job and in your life.

Course name: The Science of Sleep and Fatigue



Script Text:

Sleep Apnea

There are over 50 sleep disorders. One of the most common and most serious is Sleep Apnea.

Sleep Apnea:

•The sleeper's throat relaxes so deeply that it causes trouble breathing.

•The sleeper gasps, wakes up to breath, and then falls back to sleep, without ever realizing it.

This cycle of gasping, awakening, and going back to sleep can occur as many as 600 times during a sleep episode. Because of the constant disruptions, the person never gets enough sleep.

Course name: The Science of Sleep and Fatigue

Script Text:

Sleep Apnea (Cont.)

•Snoring loudly

•Gasping or choking in your sleep

•Spending 8 or 9 hours in bed, but still feeling sleepy

• Taking frequent, sometimes unintended, naps

• Falling asleep at inappropriate times

• Trouble getting to sleep or staying asleep

• Breathing problems reported by your sleep partner

Course name: The Science of Sleep and Fatigue

Sleep and Fatigue Self – Assessment

In the next section you have the opportunity to take a personal self-assessment of your sleep patterns and how it may affect your health. The questionnaire consists of 29 items and takes approximately 5-7 minutes to complete. This self-assessment is provided only for your personal benefit, **your responses are not recorded.** The purpose of this assessment is to help you determine if you should discuss sleep issues with your physician.

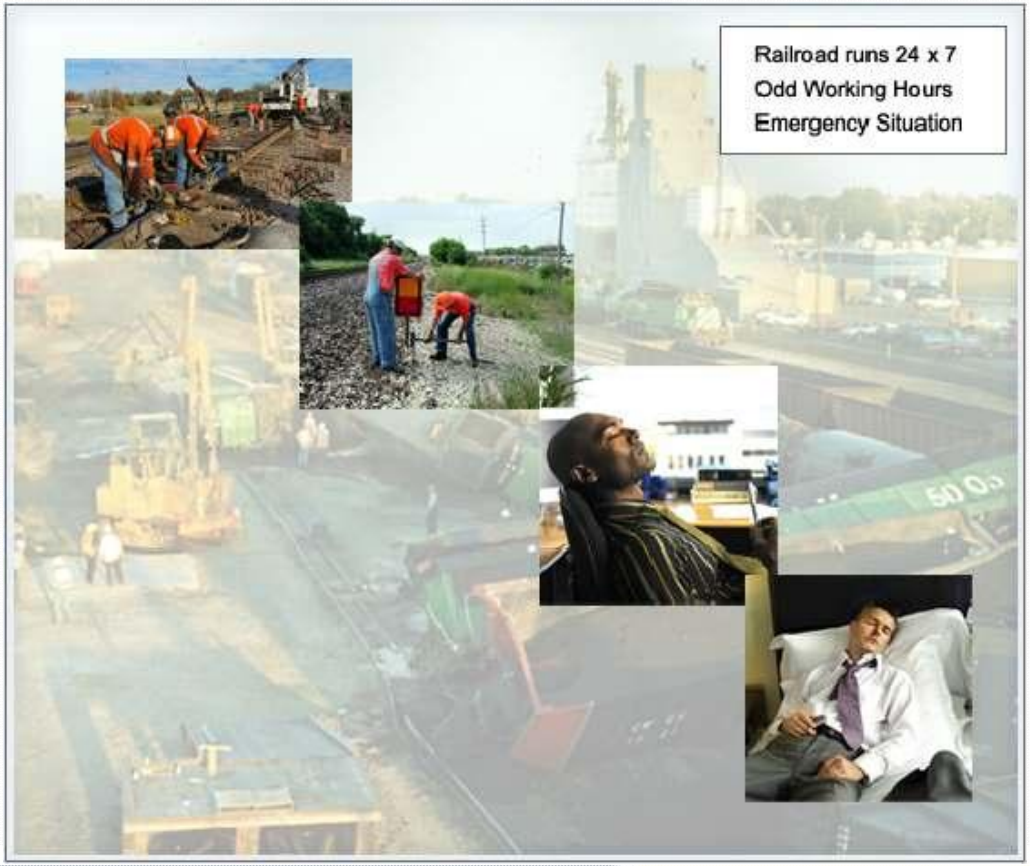
Course name: The Science of Sleep and Fatigue

Activity Page 23

<Note for construction/graphic: Create a questionnaire activity. Double-click the icon above to see the steps for constructing questionnaire activity>

Branching

Course name: The Science of Sleep and Fatigue



Script Text:

Job Requirements

The demands of railroad operations can present a challenge to railroad employees who need to be well-rested to perform their professional and personal responsibilities.

The railroad runs 24 hours a day, seven days a week.

Many employees are required to work at night, or during other unusual and unpredictable times. During emergencies and other situations, employees may also have to work long hours and extended schedules.

Course name: The Science of Sleep and Fatigue

Job Requirements (Cont.)

Job requirements makes it difficult to get the 8 to 9 hours of sleep in every 24-hour period.

Circadian Rhythms can make it difficult to achieve sound, sustained sleep episodes.

Fatigue develops and alertness declines when sleep loss persists.

Employees are in danger of making a mistake that could lead to an accident.

Employees should avoid sleep loss and stay alert and safe on the job.

Course name: The Science of Sleep and Fatigue

You can maintain your vigilance with less than 6 hours of sleep a night.

*Select the correct option and click the **Check Answer** button.*

A.True
B.False

Correct Answer: Option B
<Feedbacks>
That's correct/ That’s incorrect. You must get at least 6 hours of sleep in every 24 hours to maintain your vigilance.

Course name: The Science of Sleep and Fatigue

Which alertness strategies temporarily increase alertness:

*Select the correct option and click the **Check Answer** button.*

A. Napping
B. Caffeine
C. Drink cold water
D. Eat sensible snacks
E. All of the above
F. A and B

Correct Answer: Option E

<Feedbacks>

That's correct/ That’s incorrect. Additionally, you may get up and move around, splash water on your face or expose yourself to bright light, or engage in conversation to help keep you awake.

Course name: The Science of Sleep and Fatigue

Over the counter and prescription medications can make you sleepy.

*Select the correct option and click the **Check Answer** button.*

A. True
B. False

Correct Answer: Option A

<Feedbacks>

That's correct/ That’s incorrect. Both over the counter and prescription medications can make you sleepy. In fact they may have undesirable interactions when combined with each other. Consult your pharmacist to best understand which medications can make you sleepy and those with undesirable combined effects.

Course name: The Science of Sleep and Fatigue

If you continually have problems falling asleep and staying asleep you may have a medical problem.

*Select the correct option and click the **Check Answer** button.*

A.True
B.False

Correct Answer: Option A
<Feedbacks>
That's correct/ That’s incorrect. Chronic sleep problems may be caused by a sleep disorder that should be diagnosed and treated medically.

Course name: The Science of Sleep and Fatigue

This concludes the review of this lesson.

If you exit with incomplete lessons, you will not get credit for completing the course.

To ensure you have completed all lessons, click "Menu" and check for a completed status. Completed lessons will be indicated by a check mark.