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UNIT 4

HOW IS WELLBEING DEVELOPED AND MAINTAINED?

AREA OF STUDY 1:
HOW DO LEVELS OF CONSCIOUSNESS AFFECT MENTAL PROCESSES AND BEHAVIOUR?

AREA OF STUDY 2:
WHAT INFLUENCES MENTAL WELLBEING?

AREA OF STUDY 3:
PRACTICAL INVESTIGATION
KEY KNOWLEDGE

This knowledge includes:

- consciousness as a psychological construct that varies along a continuum, broadly categorised into normal waking consciousness and altered states of consciousness (naturally occurring and induced)

- the measurement of physiological responses to indicate different states of consciousness, including electroencephalograph (EEG), electromyograph (EMG), electro-oculograph (EOG) and other techniques to investigate consciousness (measurement of speed and accuracy on cognitive tasks, subjective reporting of consciousness, including sleep diaries, and video monitoring)

- changes in a person’s psychological state due to levels of awareness, controlled and automatic processes, content limitations, perceptual and cognitive distortions, emotional awareness, self-control and time orientation

- changes in levels of alertness as indicated by brainwaves patterns (beta, alpha, theta, delta) due to drug-induced altered states of consciousness (stimulants and depressants)

- the effects on consciousness (cognition, concentration and mood) of one night of full sleep deprivation as a comparison with effects of legal blood-alcohol concentrations.

Psychology Area of Study Key knowledge points derived from VCE Psychology Study Design 2016, pp. 28–9. © The Victorian Curriculum and Assessment Authority (VCAA). Used with permission.
WHAT IS CONSCIOUSNESS?

As you read this paragraph, you are aware of the words on the page. If you stop reading and pay attention to your body, you may notice that you are hungry or that you have sore eyes. If you pay attention to the environment around you, you may notice the sound of the heater or the buzzing of the light overhead, and if you listen hard enough you may hear voices coming from another room. As you listen, you may remember that tonight you have to study for tomorrow’s maths test. You might then change your focus to the air entering your lungs or to the sensation created by the feel of the watchband on your wrist. Before your attention was directed to these sensations, do you think you were aware of them?

The awareness of our internal and external environments is an ever-changing array of thoughts, feelings and sensations known as consciousness. Your consciousness consists of all the thoughts, feelings, sensations, perceptions and memories you are aware of at any given moment.

You can manipulate your consciousness very easily. For example, try to remember your last birthday. What did you do? What did you eat? What day of the week was it? Now try to remember the best holiday you have been on (see Figure 6.1). Where did you go? With whom did you go? By triggering these memories and bringing them into your thoughts, you have manipulated your consciousness.

![Figure 6.1](image1.jpg)

**Figure 6.1** Remembering where you went and the experiences you had on your favourite holiday requires manipulation of your consciousness.

Humans are well aware of their conscious state. Our awareness of our internal and external environments at any given moment in time is a function of consciousness.

Human consciousness has been described as being personal, selective, continuous and changing (see Figure 6.2).

Consciousness is personal because it consists of your understanding and perceptions of the world around you. It is unique for each individual.

Consciousness is selective because you pay attention to some things in the environment and ignore others. For example, while reading an interesting novel you are completely focused on it, so you don’t notice the TV on in the background or the birds chirping outside your window.

Consciousness is continuous because its contents are blended into one another with no specific beginning or end. Your consciousness is never empty; that is, there is never a time when you are not thinking.

Finally, consciousness is changing, as your thoughts are constantly moving from topic to topic. For example, one moment you may be thinking about how hungry you are, then your consciousness is filled with thoughts of what you are planning to cook for dinner, then you suddenly start thinking about the assignment that is due tomorrow.

Sometimes our consciousness is filled with personal thoughts and feelings, while at other times it is filled with sensations from the external environment. So, as you can see, although we all experience consciousness, the actual consciousness that we experience is unique to each individual. Try it yourself. 6.1 contains an exercise to help you explore your own consciousness.
represent a more scientific, accurate and reliable method of data collection that allows experiments to be replicated independently.

Something that cannot be seen and is unique to every individual is very difficult to conceptualise. However, this has not stopped people theorising about what consciousness actually is. One man who is well known for his views on consciousness is René Descartes. Descartes was born in 1596 in the town of La Haye in the south of France. He was well known in the fields of science and mathematics for his work on geometry and algebra. However, many believe that his most important works were his philosophical writings. In the process of trying to discover what, if anything, could be said to exist with certainty, Descartes came to the conclusion that the only thing he could be sure of was that he existed – he coined the Latin phrase *cogito ergo sum*, which means ‘I think, therefore I am’. Descartes therefore described himself as a ‘thinking thing’ (*cos regitans*). In a sense, what he was describing was his capacity for conscious thought, or what we call our self-consciousness.

Descartes was the first philosopher to clearly link the mind with consciousness and to identify it as a non-physical thing separate from the brain (Descartes, 1641). The resulting school of thought, which hosts a variety of views about the relationship between mind and matter, is known as dualism. Dualism claims that mental phenomena such as consciousness are in some respects non-physical (Hart, 1995).

American psychologist William James (1842–1910) adopted the philosophy of dualism as the underpinning of psychology (Mishlove, 1975). In the late 19th century, James was the first person to offer a course in Psychology at an American university. Throughout his career, James also taught anatomy, physiology and philosophy, but he is arguably best known for his views on human consciousness. He thought that the most appropriate way of defining human consciousness was to compare it to a stream, because, similar to a stream, consciousness is constant and continuously changing (see Figure 6.3). Consciousness consists of a random flow of thoughts, feelings, memories and sensations that pass fleetingly through our mind. James suggested that this flow is endless and that there is never a gap between the end of one thought and the beginning of another, which again parallels the movement of a flowing stream. Consciousness helps us to survive by allowing us to learn about, adapt to and deal with the environment around us.

---

**EXPLORING YOUR CONSCIOUSNESS**

If our consciousness is constantly changing, can we keep up with our own thoughts?

For five minutes, record everything that comes into your mind. Use a pen and paper, and a timer. Try to record all your thoughts, even if they occur at the same time – each time a new thought emerges, try to record it even if you haven’t ‘finished’ with your previous train of thought.

**QUESTIONS**

1. How did you go? Could you keep up?
2. Look at what you have written.
   a. What types of things are recorded?
   b. Can you identify emotions, plans, and information about the internal and external environments?
3. If you had to define what consciousness is, how would you describe it?

**INVESTIGATING CONSCIOUSNESS**

Studying consciousness is a difficult thing to do because it cannot be directly observed. We know whether a person is male or female, has blue or green eyes or is short or tall just by looking at them. Unfortunately, we cannot directly measure what a person is thinking or what state of consciousness they are in just by observing them. For this reason, consciousness is referred to as a psychological construct.

A psychological construct is a concept used to describe an entity that we believe to exist, because we can measure its effects, but we cannot directly observe or measure the entity itself. Behaviours can be measured objectively or subjectively. **Subjective data** are measurements that are collected through personal observations of behaviour. These are often influenced by researcher or observational biases, or may be influenced by the participant’s biased view of their own behaviour. In terms of consciousness, a researcher may make an assumption about a participant’s level of awareness of the things going on around them, or whether they are showing a reasonable amount of self-control. These data are subjective as they are based on opinion and observation of the individual’s behaviour, but are not scientifically measured. **Objective data** are measurements of behaviour collected under controlled conditions. They are easy to measure scientifically and can be compared to other data. Objective measures minimise many biases encountered in research and represent a more scientific, accurate and reliable method of data collection that allows experiments to be replicated independently.
To aid our understanding of the various levels of consciousness, psychologists use two broad categories: normal waking consciousness and altered states of consciousness. We will examine these next.

6.1 CHECK YOUR UNDERSTANDING >>

1. Describe why consciousness is considered to be personal, selective, continuous and changing.
2. Describe why consciousness is often considered a psychological construct. Use an example to support your response.
3. William James likened our consciousness to a stream because:
   A. consciousness stops and starts at different times.
   B. consciousness is always winding and turning in new directions.
   C. consciousness is continuously changing.
   D. consciousness is often on its way downhill.
4. Which of the following is not a term used to describe consciousness?
   A. Selective
   B. Stagnant
   C. Flowing
   D. Personal
5. Which of the following states is on the higher end of the consciousness continuum?
   A. Comatose
   B. Sleeping
   C. Meditative state
   D. Selective attention
6. In which of the following states of consciousness will a person have the highest level of attention?
   A. Daydreaming
   B. Anaesthetised
   C. Selective attention
   D. Sleep

---

states of consciousness

As consciousness varies throughout the day, so does the state of consciousness we experience. Your state of consciousness refers to your level of awareness of stimuli, both internal and external. There are no distinct boundaries to indicate where one state of consciousness begins and another ends.

Many psychologists believe that the best way to describe the different states of consciousness is to place them on a continuum (range) from complete lack of awareness (unconsciousness) to total awareness (focused attention). There are many different states of consciousness between the two extremes of the continuum. At the high end of the continuum (total awareness), your attention is focused and selective, and you are able to concentrate on specific tasks (such as exams) and ignore other, less important information (such as birds chirping outside). This tends to occur when someone is highly attentive to a situation; for example, when learning a new concept such as mathematical problem-solving, or learning a skill such as driving a car. At the low end of the continuum (lack of awareness), you may be unaware of thoughts, feelings and sensations. This may occur when you are fatigued, meditating, under the influence of drugs or alcohol, hypnotised, sleeping or anaesthetised.

Figure 6.4 shows the continuum from complete lack of awareness to total awareness.
NORMAL WAKING CONSCIOUSNESS

Each state of consciousness brings with it a different level of awareness of our internal and external environments. We spend most of our lives in normal waking consciousness (NWC), which is a state of clear, organised alertness to internal and external stimuli. We would experience NWC when reading a book, playing sport or talking with our friends (see Figure 6.5). Not surprisingly, we spend two-thirds of every day in NWC. This state of consciousness is at the high end of the continuum, where we perceive time, places and events as real, meaningful and familiar.

Although everyone has an individual consciousness that is personal and unique, there are a number of common psychological characteristics that are shown when an individual is experiencing normal waking consciousness. These include:

» moderate to high levels of awareness
» good memory and cognitive abilities
» focused attention on specific tasks
» an accurate perception of reality

» appropriate emotions
» a degree of self-control
» an accurate perception of time and sensations.
If we spend approximately two-thirds of our day in normal waking consciousness, then the other third is spent in an **altered state of consciousness (ASC)**. An ASC is any state of consciousness that is distinctly different from normal waking consciousness. An ASC may differ from NWC in a variety of ways, including the level of awareness and the quality or intensity of sensations, perceptions, thoughts and emotions. Characteristics of an altered state of consciousness may include:

- low levels of awareness
- memory difficulties and reduced cognitive abilities
- difficulty paying attention to specific tasks
- distorted perception of reality, such as delusions
- inappropriate or uncharacteristic emotions
- a lack of self-control
- difficulty in accurately perceiving time and sensations.

There are many different types of altered states of consciousness and all are varied in terms of awareness and experience. ASCs can occur naturally, or they can be induced.

**NATURALLY OCCURRING ASCs**

Naturally occurring ASCs involve physiological and psychological changes that occur automatically and are produced spontaneously beyond our conscious control. Naturally occurring ASCs include sleep, dreaming, daydreaming and even psychosis. The onset of naturally occurring ASCs can be due to a range of occurrences such as sleep deprivation, fever, trauma, sensory deprivation or overload, or a neurochemical imbalance.

One example of a naturally occurring ASC is daydreaming. Daydreaming is characterised by a shift in concentration from external stimuli to internal thoughts, feelings, memories and images. We are awake when we are daydreaming, but we are so focused on our internal state that we are unaware of everything going on around us. Daydreaming is a naturally occurring ASC because it is produced spontaneously without any conscious effort or decision-making and may be caused by sensory deprivation or overload. We all daydream many times each day. In fact, it is believed that teenagers spend approximately one-third of their waking day daydreaming.

**INDUCED ASCs**

An **induced ASC** involves physiological and psychological changes that have been intentionally produced. For example, a person makes a conscious decision to drink alcohol or take drugs and therefore will experience physiological and psychological changes because of this consumption. Other examples of induced ASCs include being hypnotised, practising meditation and being anaesthetised.

Some physiological changes a person will experience when drinking alcohol or taking drugs include a loss of self-control, slower reaction times and an inability to accurately perceive and judge the world around you. Psychological changes induced when practising meditation include a lowered awareness of external stimuli, and psychological changes associated with hypnotism include distortions in a person’s perceptions and cognition, for example a reduced experience of pain.
Physiological Responses Indicating State of Consciousness

As discussed earlier in this chapter, the state of consciousness someone is in is a psychological construct. A number of psychological characteristics provide subjective indications that may help determine whether somebody may be experiencing an ASC. However, it is also possible to objectively measure physiological changes that indicate an ASC. Some physiological changes are typically associated with ASCs, so measuring these physiological changes may provide evidence to more accurately determine the state of consciousness and level of awareness someone is in.

Objective data measure behaviour collected under controlled conditions, therefore they are free of bias. This is why researchers investigating consciousness generally use objective measurements. There are a number of physiological measures that objectively measure the electrical activity of a body part to gauge levels of alertness and therefore whether an individual is experiencing an ASC. These measurements include the electroencephalograph (EEG), electrooculograph (EOG) and electromyograph (EMG).

Measuring the Brain’s Electrical Activity: Electroencephalograph (EEG)

The human brain is always active. As we have learnt, consciousness is likened to a stream that continually flows. The brain is aware of our thoughts, feelings and sensations at all times. Our brain is made up of billions of neurons that use electricity to communicate and send signals to each other. As millions of signals are sent throughout the brain, this generates an enormous amount of electrical activity. The electroencephalograph (EEG) is a device used by researchers to detect, amplify and record the brain’s electrical activity, measured in the form of brainwaves. By knowing the particular electrical activity of the brain, we can determine a person’s level of awareness of their environment. An EEG recording shows the frequency and amplitude of brainwave activity and it provides a visual of distinctive brainwave patterns that are characteristic of various levels of consciousness.

The frequency of activity refers to the number of brainwaves per second. A pattern of high frequency refers to greater brain activity, meaning more brainwaves per second. A pattern of reduced frequency refers to slow brain activity, meaning fewer brainwaves per second.

Brain activity is also measured by amplitude, or intensity. Amplitude is measured by the size of the peaks and troughs in brain activity compared to a baseline of zero activity, as displayed on the EEG machine. High amplitude brainwaves have large peaks and troughs, and low amplitude brainwaves have small peaks and troughs. Different combinations of frequency and amplitude in an EEG recording indicate different types of brainwave activity, and thus varying states of consciousness (see Figure 6.7).

There are four types of brainwaves, known as beta, alpha, theta and delta waves. All have different combinations of frequency and amplitude, and all are named after letters of the Greek alphabet. When beta brainwaves are present, a person’s brain is alert and active, which is indicative of NWC. Any other brainwave pattern indicates a person is in an ASC. See Table 6.1 for a summary of each brainwave.

Measuring the Eye’s Electrical Activity: Electrooculograph (EOG)

The electrooculograph (EOG) is a device that detects, amplifies and records the electrical activity of the muscles surrounding the eyes as they move or rotate in their sockets. It records the activity through small electrodes that are attached to the skin around the eyes. When we are awake and alert during NWC, we are able to track moving objects; that is, move our eyes in all directions and either converge or fixate them. The speed of our eye movements, and therefore the electrical activity generated by the muscles controlling their movement, will vary according to the activity we are engaged in at the time. However, during an ASC our ability to control eye movement and the variations in the speed of eye movement do not occur.
MEASURING THE MUSCLES’ ELECTRICAL ACTIVITY: ELECTROMYOGRAPH (EMG)

An electromyograph (EMG) is a device that detects, amplifies and records the electrical activity created by active, skeletal muscles on a continuously moving chart paper (see Figure 6.8). During normal waking consciousness our skeletal muscles are tense enough to maintain normal posture. We can contract or relax these muscles on command, so we can stay upright and stabilised during movement. When we are in NWC, an EMG will show a pattern of electrical activity that is moderate to high. However, as we enter some ASCs, for example sleep, this pattern changes as skeletal muscles gradually relax and our ability to stay upright or control voluntary movement diminishes. Because an EMG detects and amplifies the electrical activity created by active muscles, it is able to record the degree of tension to the same degree. Therefore, by demonstrating the level of electrical activity of muscles that control eye movement, the EOG can help determine a person’s state of consciousness.

Electrooculograph readings are particularly helpful in determining whether someone is awake or asleep and, if asleep, which stage of sleep they are in. Sleep can be broadly categorised into two distinct stages – rapid eye movement sleep (REM) and non-rapid eye movement sleep (NREM). When in REM sleep, the EOG will detect a high amount of electrical activity because the eyes are moving rapidly beneath the eyelids. When in NREM sleep, the EOG will detect low electrical activity because the muscles surrounding the eyes will have little to no movement (see Figure 6.8).

**TABLE 6.1 Overview of brainwaves**

<table>
<thead>
<tr>
<th>BRAINWAVE</th>
<th>EEG RECORDING</th>
<th>AMPLITUDE ON EEG</th>
<th>FREQUENCY ON EEG</th>
<th>WHEN DOES IT OCCUR?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta</td>
<td>Low</td>
<td>High</td>
<td>Normal waking consciousness (e.g. awake and alert)</td>
<td>Beta-like waves can be experienced during REM sleep (discussed later), which is an altered state of consciousness</td>
</tr>
<tr>
<td>Alpha</td>
<td>Low–medium (higher than beta waves)</td>
<td>Medium–high (lower than beta waves)</td>
<td>Deeply relaxed or meditative state</td>
<td></td>
</tr>
<tr>
<td>Theta</td>
<td>Medium–high (higher than alpha waves)</td>
<td>Low–medium (lower than alpha waves)</td>
<td>Early or light sleep</td>
<td></td>
</tr>
<tr>
<td>Delta</td>
<td>High (highest of all brainwave types)</td>
<td>Low (lowest of all brainwave types)</td>
<td>Deep sleep</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 6.8** EEG, EMG and EOG recordings tend to be made simultaneously on continuously moving chart paper.

**measuring the muscles’ electrical activity**

**electroencephalograph (EEG)** A machine used to detect, amplify and record the brain’s electrical activity, measured in the form of brainwaves frequency (of brainwaves) The number of brainwaves per second amplitude (of brainwaves) The strength of a brainwave as measured by the size of the peaks and troughs from a baseline of zero activity beta waves Brainwaves characteristic of normal waking consciousness, with a low amplitude and high frequency alpha waves Brainwaves experienced during a deeply relaxed state, with a low-medium amplitude and medium-high frequency theta waves Brainwaves experienced during the early stages of sleep, with a mix of medium-high amplitude and a low-medium frequency delta waves Brainwaves experienced during the deepest stages of sleep, with high amplitude and low frequency electrooculograph (EOG) A machine used to detect, amplify and record the electrical activity of voluntary muscles
OTHER TECHNIQUES FOR INVESTIGATING CONSCIOUSNESS

As previously discussed, consciousness is often measured using devices such as the EEG, EMG and EOG, which record physiological responsiveness. These devices are not the only way to gauge consciousness – there are also cognitive measures such as measuring the speed and accuracy of tasks, subjective reporting and video monitoring.

SPEED AND ACCURACY ON COGNITIVE TASKS

A common way to measure speed and accuracy on cognitive tasks when a person is in an ASC is through the use of a psychometric vigilance test (PVT). The PVT is the most widely used test to measure behavioural alertness. It requires participants to respond to a visual stimulus and measures their speed and accuracy. For example, participants may be required to watch a computer screen that displays a box with fast-counting numbers in it. The participant will be provided with a particular number they must look out for.

TABLE 6.2 Summary of the objective methods used to measure physiological changes when in an ASC such as sleep

<table>
<thead>
<tr>
<th>DEVICE</th>
<th>WHAT IT MEASURES</th>
<th>HOW MIGHT IT DEMONSTRATE STATE OF CONSCIOUSNESS?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electroencephalograph (EEG)</td>
<td>The electrical activity of the brain</td>
<td>Brainwaves (alpha, theta and delta waves) can indicate an altered state of consciousness. Alpha waves may indicate a meditative or deeply relaxed state, whereas beta waves indicate a high level of alertness.</td>
</tr>
<tr>
<td>Electrooculograph (EOG)</td>
<td>The electrical activity of the muscles surrounding the eyes</td>
<td>The EOG gives us an indication of which stage of sleep a person is in and therefore their state of consciousness. When in REM sleep, the EOG will detect a high amount of activity because the eyes are moving rapidly beneath the eyelids. When in NREM sleep, the EOG will detect low activity because the muscles surrounding the eyes will display little to no movement.</td>
</tr>
<tr>
<td>Electromyograph (EMG)</td>
<td>The electrical activity created by active muscles</td>
<td>The EMG gives us an indication of which stage of sleep a person is in and therefore their state of consciousness. When in REM sleep, a person’s muscles will not be moving at all. When in a light stage of sleep, muscles may twitch.</td>
</tr>
</tbody>
</table>

or relaxation in the muscles. When this information is combined with EEG and EOG readings, we can gather fairly accurate information about the level of consciousness a person is experiencing.

When an EMG is used, electrodes are attached to the skin’s surface, overlying muscle. EMG electrodes are typically placed under the chin, arms and legs, because muscles in this area show changes that are associated with different levels of consciousness. For example, during sleep, our muscle tension changes as we move through the various sleep stages. EMG measurements show a gradual decrease in muscle tension as we enter the sleep cycle, from the moderate muscle activity detected during sleep experienced early in the sleep cycle to the atonia (muscle paralysis) present during REM sleep. Figure 6.8 shows EEG, EOG and EMG recordings of a young adult.
all the psychological and behavioural factors that can contribute to sleep disturbances. Subjective reporting to measure consciousness has some limitations. One is the accuracy of the recordings. Often people don’t remember all the things they did during the day or they forget to write them down, so when they try to remember later, their recollections may be incomplete or distorted. Also, we don’t recall what we do when we sleep, so estimations of how much sleep was experienced may be unreliable. People may also neglect to record things out of fear or embarrassment because they may be worried about how it will be interpreted and may only want to record what they believe the experimenter or sleep scientist will want to read.

**VIDEO MONITORING**

Video monitoring involves using infrared cameras to videotape a person while they are sleeping to record and then analyse any observable disturbances in their sleep. People who experience sleep disturbances may attend a sleep laboratory so their sleeping behaviour can be videotaped because they may not be aware of any disturbances and therefore will not report them in their sleep diary. For example, the recording may show frequent waking, such as in the case of a nocturnal sleep-related eating disorder, where sufferers wake several times during the night and visit the kitchen to eat whatever they can find. In this condition the part of the brain that controls urges and decision-making is not fully functional, so sufferers can report eating anything in this state, even frozen pizza. Video recordings are extremely useful in the diagnosis of sleep conditions, so much so that there are specialised services in Australia where you can order sleep equipment for your own home and then send the recordings online for an assessment. However, to accurately assess and diagnose sleep problems and disorders, video recordings must be used in conjunction with self-reports.

**SUBJECTIVE REPORTING OF CONSCIOUSNESS: THE USE OF SLEEP DIARIES**

Subjective reporting, or self-reports, are an effective way to measure different states of consciousness. **Self-reports** involve an individual keeping a record of their own subjective experiences (thoughts, feelings and behaviours). An advantage of using self-reports to measure consciousness is that they provide researchers some insight to covert thoughts that can’t be directly observed or measured through observational studies or physiological recording devices. A self-report may provide information about an individual’s thoughts. For example, if their comments on the self-report are coherent and linked to reality, this may indicate that a person is in a NWC; if their comments are incoherent, incomplete or unrelated to reality, this may indicate an ASC.

One example of a self-report is a sleep diary. To establish a person’s sleeping patterns over time, sleep scientists will often ask people who are experiencing sleep disturbances to keep a sleep diary. A **sleep diary** is a log of subjective behavioural and psychological experiences surrounding a person’s sleep. Some examples of experiences that may be logged in a sleep diary include general activities before bedtime; any consumption of food and drinks before bedtime; the amount of time it took to fall asleep; any sleep disturbances throughout the night, including the number of times the person woke; and their feelings on waking in the morning. See Try it yourself 6.2 for an example of a sleep diary.

Sleep diaries are a cheap and simple way for researchers to gain an insight into when sleep patterns are uncharacteristic, the degree to which they are affecting an individual’s daily routine, and
Some advantages of using video monitoring to measure consciousness include that the footage can be viewed at any time after a period of sleep, it can be given to a number of people to interpret, and it can be shown to the participants to increase their awareness and understanding of their sleep behaviour. Some limitations of using video monitoring include that results may sometimes be inconclusive, interpretation may be subjective, and if video recording have taken place in a sleep lab the artificial environment may affect the person’s ability to sleep normally.

### 6.2 TRY IT YOURSELF >>

**SUBJECTIVE REPORTING OF CONSCIOUSNESS**

Over a 7-day period spend some time subjectively reporting your consciousness through the use of a sleep diary. Copy the table below into your notebook. Fill it out every morning to identify any changes in your sleep patterns over the 7-day period. Then at the end of the 7-day period complete the analysis questions.

<table>
<thead>
<tr>
<th>DAY</th>
<th>TIME YOU WENT TO BED THE PREVIOUS NIGHT</th>
<th>TIME YOU WOKE UP</th>
<th>APPROXIMATELY HOW LONG IT TOOK YOU TO FALL ASLEEP</th>
<th>NUMBER OF HOURS SLEPT</th>
<th>ANY SLEEP DISTURBANCES OR AWAKENINGS</th>
<th>RATE YOUR STRESS LEVELS FROM THE PREVIOUS DAY (1–10)</th>
<th>WHAT ACTIVITIES DID YOU DO BEFORE BED? (E.G. EXERCISE, SCREEN TIME, CAFFEINE INTAKE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
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</tbody>
</table>

**QUESTIONS**

1. Calculate the total amount of sleep you accumulated during the week.
2. The recommended sleep for teenagers is 9–10 hours per night. Did you get your recommended 63–70 hours of sleep during the week?
3. Did you notice any relationship between the activities you did before you went to bed and the amount of time it took you to fall asleep? Explain.
4. Did you notice any relationship between your stress levels and the amount of time it took you to fall asleep or sleep disturbances? Explain.
5. How might stimulants such as caffeine affect your sleep?
controlled processes are actions that require high levels of attention, awareness and concentration in order to actively achieve a particular goal. When completing controlled processes, attention is focused completely on the task, with little or no awareness directed towards other, less important activities. This is known as selective attention. We can shift our attention quickly and intentionally between stimuli, such as when choosing to listen closely to a teacher giving hints about an upcoming exam, but listening less intently when that teacher describes a concept you already know about. Attention can also shift unintentionally. For example, if a mobile phone rings, our attention automatically shifts from what we were doing to focus on answering the phone call. Thus, it can be seen that attention is very selective in nature, making it difficult to pay full attention to more than one thing at a time.

Controlled processes are experienced in all areas of life. A good example of a controlled process is when someone is learning to drive a manual car. Here, the person needs to concentrate on controlling the steering wheel; coordinating the brake, clutch and accelerator when changing gears; and using the indicator when turning (not to mention the windscreen wipers when it is raining!). To top off this extraordinary process, the car needs to be navigated through highly variable traffic, road and weather conditions at all different times of the day and night (see Figure 6.9).

AWARENESS

As shown on the states of consciousness continuum (Figure 6.4), some activities require higher levels of concentration and attention than others. For example, someone reading a difficult chemistry textbook will devote a higher level of attention to their reading than someone who is reading a comic strip in a newspaper.

During NWC, you have a high level of awareness of internal and external stimuli. However, during an ASC, awareness is greatly reduced. During meditation or sleep, for example, your awareness of the outside world decreases. You may be watching the football on TV while someone sleeps on the couch in the same room, yet the sound of the screaming and cheering will not disturb the person’s slumber.

You can also be less aware of internal stimuli while in an ASC. This is why states such as meditation, hypnosis and, of course, going under anaesthetic, are used to reduce the experience of pain – they make you less aware of internal sensations. Because of this reduced awareness, it is difficult to focus your attention on a task that requires a high level of awareness when you are experiencing an ASC.

Activities that do require a high level of awareness include anything to which a person must devote attention in order to understand them, such as solving a difficult maths problem, learning a new dance-step or learning to snorkel. All these tasks need to be undertaken during NWC so that they can be efficiently processed and understood.

Activities that require an individual to be in NWC are known as controlled processes. Controlled processes are actions that require a high level of conscious awareness, attention and mental effort.

selective attention Attending to a particular stimulus while ignoring others; it requires a high level of awareness.
to music. It is difficult, however, to complete two controlled processes simultaneously, as they both require high levels of attention.

The ability to complete two tasks simultaneously is also influenced by the similarity of tasks. Two similar tasks are much more difficult to complete at the same time than two different ones.

Table 6.3 compares the features of controlled and automatic processes.

After some practice, driving a car requires much less concentration and awareness than when initially learning the skill. Experienced drivers are capable of simultaneously driving, holding a conversation, changing a radio station or finding their way around an unfamiliar suburb. As with many other complex skills, driving a car can become automatic with practice. When this happens, actions shift from being controlled processes to automatic processes. An automatic process is a set of actions that require little conscious effort or awareness, and do not interfere with performance on other activities. For example, it is possible to type out an essay while listening to music. When a behaviour is an automatic process, we are able to perform more than one activity at a time. Being able to distribute your attention in this way is known as divided attention.

Divided attention is when an individual focuses on two or more stimuli simultaneously. Research into divided attention suggests that we are capable of processing some information that is outside human consciousness. To illustrate this, think about whether you have ever been asked a question by your mother while you were watching television. Initially, you may not have heard the question because you were focusing your attention on your favourite show. You may have asked your mother to repeat the question, but before she finished repeating it, you answered her. The question was not directly in your consciousness, yet you still knew what she had previously asked, and were able to respond to it.

The ability to divide attention between two tasks depends on the types of tasks being performed. For you to be able to successfully divide your attention, both tasks must be automatic processes, such as watching TV and eating a meal. Alternatively, one may be a controlled process and the other an automatic process, such as doing maths homework while listening to music. It is difficult, however, to complete two controlled processes simultaneously, as they both require high levels of attention.

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<th>EXPLANATION</th>
<th>EXAMPLE</th>
<th>EFFECT ON COMPLETION OF OTHER TASKS</th>
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</table>
| Controlled process | An action that requires a high level of conscious awareness, attention and mental effort | » Completing homework  
» Learning a new task | » Performance on other controlled processes is compromised  
» Performance on automatic processes may or may not be affected |
| Automatic process | An action that requires little conscious awareness or mental effort | » Knitting  
» Watching TV | » Performance on controlled processes may or may not be affected  
» Performance on other automatic processes is unaffected |

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Check your understanding >>

1. Describe the difference between a controlled and an automatic process using an example that is not included in the text.

2. Describe the difference between selective attention and divided attention.

3. To be able to successfully divide your attention between two tasks, the tasks should be:
   A automatic processes that are different.  
   B automatic processes that are similar.  
   C controlled processes that are different.  
   D controlled processes that are similar.

4. ________ is an example of a controlled process, whereas ________ is an example of an automatic process.
   A Learning to ride a bike; solving a simultaneous equation  
   B Strolling in the park; performing a gymnastic routine on the beam  
   C Knitting a jumper you have knitted before; strolling in the park  
   D Solving a simultaneous equation; stirring soup in a pot

5. ________ requires selective attention, whereas ________ can be achieved using divided attention.
   A Talking to your friend on the phone; learning to drive a car  
   B Learning to ride a bike; watching TV  
   C Listening to music; playing the piano  
   D Watching TV; doing your homework
CONTENT LIMITATIONS

During NWC, our thoughts are usually controlled and limited to reality. Although our consciousness is ever-changing and flowing, the content is usually ‘normal’. Wildly bizarre thoughts do not often pop into consciousness, and we are usually able to control the themes of our thinking with relative ease. For example, we are often able to block or stop thoughts that make us feel embarrassed, upset, distressed, afraid or hurt. This is very useful, as it allows us to significantly control the content of our thoughts. This is not always the case during an experience of an ASC. Hypnosis is often used to try to bring uncomfortable or distressing thoughts into conscious awareness as a means of accessing ‘hidden memories’. Additionally, while dreaming we have little control over which thoughts do surface in our conscious awareness. As a result, we say that our content limitations are reduced when experiencing an ASC.

As well as being ‘controlled’, the content of thoughts in NWC is usually logical and organised. In NWC, we do not usually think about all our teeth falling out or about walking naked down the street; yet we may imagine these situations in a dream.

We also know that during NWC we can process a lot of information at one time; however, during an ASC the amount of information (or content) that can be processed is limited. Due to a reduced awareness of our surroundings and reduced cognitive functioning, there are limitations on how much content can be processed in an ASC.

PERCEPTUAL DISTORTIONS

Perceptual distortions refer to mistakes that we make when internally processing our external environment. During NWC we can accurately perceive the world around us. We feel pain when we are hurt and we see images and hear sounds that exist. However, the experience of sensation and perception in ASCs is often very different. In an ASC, sensations and perceptions can be dulled or blunted, or they can be sharpened.

Sensation and perceptions are dulled by pain medication, hypnosis, meditation or daydreaming. We discussed earlier how hypnosis can reduce the experience of pain by focusing attention away from the source of the pain. There are other states of consciousness where the experience of pain is further reduced. Being placed under anaesthetic not only dulls the experience of pain but completely blocks any sensation to the area that is being anaesthetised. This is obviously a useful tool in treatment of physical ailments.

Hallucinatory drugs such as LSD (lysergic acid diethylamide, an illegal hallucinogenic drug) or crystal meth (methamphetamine, an illegal amphetamine) can heighten and sharpen sensations and perceptions. Individuals in a drug-induced state may see images or hear voices that do not exist or are not real. This is known as a hallucination. Hallucinations can also be experienced during extreme sleep deprivation where the onset of these symptoms clearly indicates that an individual is in an ASC.

An individual’s perception of reality is also compromised during an ASC. An individual may believe they are being followed by the government or may be suspicious of people around them. These false beliefs are known as delusions and they can also be characteristic of an individual experiencing a drug-induced state.
On the other hand, during an ASC some people report that they are emotionless and feel empty. They have no feelings in situations that would in NWC produce intense emotional reactions. For example, it is normally upsetting to experience the death of a close friend, yet someone who has smoked a lot of marijuana might not experience these feelings in this situation.

During ASCs some people have inappropriate emotions or emotional reactions. They may laugh at a funeral, cry when given a present, or become angry and violent when someone smiles at them.

**SELF-CONTROL**

Self-control is characterised by a good sense of management of physical responses – such as coordination – and also as a demonstration of good judgment and physical restraint. During NWC we exhibit fine motor control and can coordinate very complex movements. We are also able to make decisions that consider the likely outcomes and implications of a particular behaviour and as a result we are less likely to engage in risk-taking behaviours.

During an ASC, however, self-control is often compromised. For example, during some stages of sleep we move around a lot, and may even sleep-talk. We are unable to control these behaviours, no matter how much we may want to. One test for sobriety is to walk along a straight line; during an alcohol-induced state our ability to coordinate movements is compromised (see Figure 6.11).

Alcohol can also reduce people’s inhibitions. Someone who is drunk is more likely to engage in extreme risk-taking activities – such as drink-driving, unprotected sex or drug use – because their self-control has been reduced.

**COGNITIVE DISTORTIONS**

The brain is bombarded with large amounts of sensory information from the internal and external environments. One of the brain’s many roles is to decide which information is useful, necessary or relevant. The brain then actively stores and retrieves this information in the form of memories.

In NWC, an effective memory system is required in order to function. For example, you need to remember how to use the washing machine, which roads will lead you home, which channel your favourite TV show is on, or how to make an omelette. To understand this textbook as you read it, you need to remember the last few sentences you read, in order for the next few sentences to make sense.

During an ASC, memory is often disrupted, and everyday tasks can be difficult to perform. Memory tends to be less accurate, with people storing less information and experiencing more difficulty in retrieving it. For example, when you have a dream at night, you may remember it in detail for a few seconds after you wake up, but forget most of it very quickly.

Memory is just one example of a cognitive function. Others are thinking, reasoning and problem-solving. During NWC, cognition is organised and logical. In ASCs, cognition is often disorganised, illogical, fragmented and lacking sequence. For example, have you ever tried to have a logical conversation with someone who is drunk? It is often very difficult to make sense of their arguments and reasoning. People who binge-drink alcohol (that is, who sporadically drink large amounts) often have trouble remembering what happened when they were intoxicated.

**EMOTIONAL AWARENESS**

The way people experience emotions is unique to every individual; however, we can say that during NWC the emotions are generally appropriate to the situation in terms of experience and intensity. In an ASC, emotions can be intensified, blunted or totally inappropriate to the situation. For example, people often become more emotional when they have been drinking alcohol, and usually cheerful people may report feeling sad or depressed after consuming it. Similarly, many people express their emotions more openly after a few drinks. Some people even become more aggressive when they are drunk; many bar fights between drunken patrons over minor disagreements would have not occurred if the patrons had been sober.
In NWC, people’s perceptions of time are generally accurate. This means that if a task takes an hour to complete, it also ‘feels’ as if it takes an hour. If you drop off a prescription at your local pharmacy and the pharmacist tells you to come back in 10 minutes, you are usually able to accurately guess roughly how long that is without having to look at a clock.

In ASCs, perception of time is often distorted. Time feels like it is passing either more quickly or more slowly than normal. For example, when people are intoxicated with alcohol and at a party, they are often surprised by the time when they look at their watch – it may feel like 10 or 11 p.m. when it is actually 3 a.m. In other ASCs, time seems to pass more slowly than usual. Have you ever fallen asleep and woken feeling as if you have been asleep for hours, only to find you have only been asleep for a few minutes? Or have you been woken by your alarm in the morning and felt as if you have been asleep only a few hours, when really you have had a full night’s sleep? Table 6.4 shows a comparison between the characteristics experienced in an ASC compared to NWC.

<table>
<thead>
<tr>
<th>TABLE 6.4 Differences in characteristics and behaviours between normal waking and altered states of consciousness</th>
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</thead>
<tbody>
<tr>
<td><strong>NORMAL WAKING CONSCIOUSNESS</strong></td>
</tr>
<tr>
<td>Awareness</td>
</tr>
<tr>
<td>High awareness of internal and external environments</td>
</tr>
<tr>
<td>Able to complete controlled and automatic processes</td>
</tr>
<tr>
<td>Attention</td>
</tr>
<tr>
<td>Selective attention on specific stimuli</td>
</tr>
<tr>
<td>Able to divide attention between two tasks</td>
</tr>
<tr>
<td>Content limitations</td>
</tr>
<tr>
<td>Able to control thoughts</td>
</tr>
<tr>
<td>Able to process many different pieces of information at the same time</td>
</tr>
<tr>
<td>Sensations and perception</td>
</tr>
<tr>
<td>Able to accurately perceive the world</td>
</tr>
<tr>
<td>Experience sensations that are real</td>
</tr>
<tr>
<td>Cognition</td>
</tr>
<tr>
<td>Able to think logically and clearly</td>
</tr>
<tr>
<td>Able to memorise and recall information accurately</td>
</tr>
<tr>
<td>Emotions</td>
</tr>
<tr>
<td>Experience emotions that are appropriate</td>
</tr>
<tr>
<td>Self-control</td>
</tr>
<tr>
<td>Able to coordinate a sequence of movements and include fine motor</td>
</tr>
<tr>
<td>skills</td>
</tr>
<tr>
<td>Perception of time</td>
</tr>
<tr>
<td>Able to fairly accurately perceive the amount of time that has passed</td>
</tr>
</tbody>
</table>

1. With reference to content limitations, what content do we tend to ‘block’ when in NWC, which we have less control over compared to when in an ASC?
2. Distinguish between perceptual and cognitive distortions using an example of each.
3. Which of the following emotions are more likely to be displayed during an ASC?
   A. Inappropriate or uncharacteristic emotions
   B. Emotionless
   C. Exacerbated or intensified emotions
   D. All of the above
4. Which of the following characteristics of self-control is likely when in an ASC?
   A. Unable to walk in a straight line
   B. Able to walk in a straight line
   C. Able to drive a car safely
   D. Being able to perform an acrobatic routine on a balance beam
5. Use an example to describe when you have experienced a distorted perception of time when in an ASC. Was time perceived to be going faster or slower?
6. Which of the following is not an example of a cognitive distortion that may be experienced when in ASC?
   A. Decreased memory ability
   B. Difficulty undertaking problem-solving tasks
   C. Illogical thought patterns
   D. Decreased perception of pain
6.3 TRY IT YOURSELF >>

PROGRESSIVE MUSCLE RELAXATION TASK

For this task you will try to achieve an ASC through a common meditative technique known as progressive muscle relaxation. The aim of this activity is for you to deliberately focus on and notice the difference between tension and relaxation, as you work through different parts of your body. Progressive muscle relaxation is an effective technique to reduce stress, anxiety and muscle tension.

Lay down or sit in a comfortable position with your eyes closed and let your body hang loose. Have your teacher or a friend read through the following script, guiding you through the exercise.

Take a deep breath in through your nose … hold your breath for a few seconds … and now breathe out … take another deep breath through your nose … Now pay attention to your body and how it feels … Starting with your right foot … squeeze all the muscles in your right foot. Curl your toes as tight as you can, now hold it … hold it … good … now relax and exhale … let your foot go limp … notice the difference between the tension and relaxation … feel the tension flow out of your foot like water … (then repeat with right lower leg and foot, entire right leg, then entire left side etc. …) (Anxiety BC, n.d.)

QUESTIONS

1. Do you believe you entered an ASC when completing this activity? How would you know?
2. Did you experience any of the following characteristics when completing the activity?
   - Disturbed sense of time
   - Perceptual distortions
   - Cognitive distortions
   - Lower level of awareness of external stimuli
3. Why might achieving this state of ASC be an effective way to reduce stress?

6.1 FOCUS ON RESEARCH

THE CASE OF TERRI SCHIAVO

On 25 February 1990 in Florida, United States, a 26-year-old woman named Terri Schiavo collapsed in her home after suffering cardiac arrest. The cause of her cardiac arrest is still unknown; however, it caused her to sustain severe brain damage due to a loss of oxygen supply to the brain. She was admitted to hospital and was in a coma and placed on life support. After several weeks she was taken off mechanical life support and was breathing on her own, but her conscious awareness did not improve and after several months she was diagnosed as being in a persistent vegetative state (PVS).

A PVS is characterised by a lack of responsiveness and awareness of the self or the environment. Sufferers of PVS have little to no activity in their brains cortex; however, their brain stem (keeping their autonomic physiological responses regulated) remains active. People in a PVS may remain awake or drift in and out of periods of sleep. When they are awake they show no evidence of voluntary motor responses, language comprehension or expressions, and suffer bladder and bowel incontinence. They may at times groan or blink when startled or display facial expressions such as smiling, but these are usually without apparent reason (Nicolussi, 2015).

There is much controversy around the diagnosis of PVS because consciousness is so subjective. This was certainly the case with Terri Schiavo. Following her diagnosis, her husband Michael Schiavo believed it would be Terri’s wish to remove her feeding tube, which was the only thing keeping her alive. This was not well received by Terri’s parents, Robert and Mary Schindler, because they believed their daughter was still conscious and wanted to try therapies to help rehabilitate her. After a gruelling 15 years of lawsuits, including the decision to remove Terri’s feeding tube in 2001, which was granted and removed for 60 hours, then appealed and reinserted, in 2005 the court made a final decision to disconnect her feeding tube. The tube was disconnected on 18 March 2005 and Terri died 13 days later on 31 March 2005. This case sparked much controversy and publicity about the diagnosis and prognosis of PVS and end-of-life decisions by ethical, political and religious activists.

In 2008, a team of researchers reviewed all the media coverage surrounding the case of Terri Schiavo (Racine, Amaram, Seidler, Karczewska, & Illes, 2008). They disseminated the 1141 relevant newspaper articles published in 1990–2005 about the case and found that most articles (31 per cent) described the legal aspects surrounding the case followed by end-of-life issues (25 per cent) and also political (22 per cent) aspects of the case. Some articles denied Schiavo was even in a PVS (6 per cent) and others claimed removing her feeding tube was murder (9 per cent). Surprisingly, less than 1 per cent of articles actually described the characteristics of PVS and other chronic disorders of consciousness. Overall the review found many articles printed in the media were conflicting, few provided information about the medical diagnosis and prognosis of PVS, and many gave the readers a false hope for Terri’s recovery. Research evidence suggests that after 1 year in a PVS sufferers seldom recover. From this analysis it was concluded that considering the media has such a powerful role in changing society’s perceptions and beliefs more should be done to accurately educate society regarding health issues such as PVS. It was suggested the need for greater communication between health professionals, patient communities and families and strategies will lead to greater internal agreement regarding the diagnosis of PVS (Racine et al., 2008).
As discussed earlier, one example of an induced ASC is being under the influence of drugs. Drugs are widely used by Australians to alter consciousness by changing a person’s moods, thoughts, perceptions, levels of alertness and behaviours. People use consciousness-altering drugs for a variety of reasons – to help them wake up in the morning, to feel more comfortable when socialising at a party, to be relieved of pain or to help them sleep at night. Some of these drugs are legal and used responsibly, others are illegal and often used recklessly. The type of drugs that affect consciousness are called psychoactive drugs. Psychoactive drugs are any class of drug that alters the brain’s chemistry, which subsequently changes a person’s perceptions, thoughts and behaviours. Psychoactive drugs are effective at altering consciousness because they cross the blood–brain barrier. The blood–brain barrier is a mechanism that prevents or slows the passage of potentially harmful molecules in the blood from entering the brain but allows other non-threatening molecules to enter. Psychoactive drugs enter the brain and therefore affect neural transmission. Some psychoactive drugs alter brain chemistry by mimicking the activity of neurotransmitters, others block neurotransmitters by binding to receptor sites.

Two characteristics of using psychoactive drugs is that they often produce effects of tolerance and dependence. Tolerance occurs when a person builds up a resistance towards using a specific drug and needs to take a higher dose in order to feel the drug’s effects. This tends to occur when a person has been abusing a drug or using a drug for an extended period of time. Extended drug use can also lead to dependence where the person’s drug use has become part of their bodily functions and if discontinued, symptoms of withdrawal may be experienced. Psychoactive drugs can be categorised as either stimulants or depressants.

**STIMULANTS**

Stimulants are a group of drugs that elevate mood, increase alertness and reduce fatigue. They do this by exciting neural activity in the brain, which increases bodily functions. Drugs in this category tend to increase blood pressure and heart rate, constrict blood vessels and increase blood glucose. Historically, because stimulants help asthma sufferers breathe by opening their airways, stimulants were medically used to treat asthma patients by providing temporary relief of respiratory difficulties. The medical use of stimulants today also includes sufferers of attention deficit hyperactivity disorder (ADHD) and narcolepsy (a sleep disorder discussed in Chapter 8). However, medical use of these drugs has diminished over the years as various dependence and addictive properties have been discovered. Medicinal drugs are not the only examples of stimulants, so are other commonly used substances such as caffeine and nicotine, as well as dangerous and illegal substances such as methamphetamines and cocaine.

**Caffeine**

Caffeine, which is found naturally in the seeds, nuts or leaves of a number of plants native to South America and East Asia, is a stimulant drug that affects the central nervous system. Caffeine can be found in coffee, tea, cocoa, cola soft drinks, energy drinks and chocolate bars. When using caffeine, people can build up tolerance and, like any other psychoactive drug, they will need to consume more in order to feel the same effects of the drug, such as higher levels of alertness and increased focus. Excessive amounts of caffeine can lead to anxiousness, sleeplessness, rapid heart palpitations and trembling. However, these extreme symptoms will usually not be experienced unless the recommended daily intake of caffeine is exceeded. Generally, 400 milligrams is considered to be an acceptable dose of caffeine per day, although individual differences such as

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**Questions**

1. In terms of levels of awareness, why is Terri’s condition an example of an ASC?
2. What other characteristics of ASC were relevant to Terri’s case?
3. Following the review of literature surrounding Terri’s case what did the results suggest?
4. In your opinion, do you believe Terri should have had her feeding tube removed? Explain.
metabolism, body mass and an individual’s state of health need to be considered when consuming caffeine (see Table 6.5).

**TABLE 6.5** Approximate caffeine levels per serve  

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<thead>
<tr>
<th>CAFFEINATED DRINK</th>
<th>AMOUNT OF CAFFEINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instant coffee</td>
<td>60–100 mg</td>
</tr>
<tr>
<td>Espresso coffee</td>
<td>90–200 mg</td>
</tr>
<tr>
<td>Decaffeinated coffee</td>
<td>3 mg</td>
</tr>
<tr>
<td>Energy drinks (e.g. Red Bull)</td>
<td>80–90 mg</td>
</tr>
<tr>
<td>Tea (depending on the type and brew)</td>
<td>30–100 mg</td>
</tr>
<tr>
<td>Cola drinks</td>
<td>35 mg</td>
</tr>
</tbody>
</table>

Source: Victoria. Department of Health & Human Services (2015b)

**Nicotine**

Nicotine is a stimulant drug that is the main chemical found in tobacco. When inhaled, nicotine-rich smoke surges through the lungs and into the brain where it activates several brain chemicals, which cause a range of effects such as feelings of euphoria, increased heart rate, and increased levels of arousal and alertness.

When nicotine reaches the brain, messages are sent to the adrenal glands to release adrenaline, which brings the body into a state of arousal and alertness. Simultaneously, another chemical in the brain, dopamine, is released and this results in the feelings of pleasure associated with smoking. In addition, another chemical, acetylcholine (associated with memory and learning), is released, which enhances the smoker’s concentration. Because smokers enjoy the effects of nicotine, it is relatively easy for them to become addicted to this drug. Many smokers say they would like to quit but find it extremely difficult to do so. Nicotine addiction is just as strong as heroin addiction and as a result addicts can suffer withdrawal symptoms as they build up tolerance to the drug. Some of the withdrawal symptoms include irritability, anxiety, loss of concentration and moodiness. When nicotine is introduced into the body in small controlled amounts, such as in the form of patches, gum or lozenges, it works by slowly releasing nicotine into the system. This helps the addict overcome their nicotine addiction without inhaling any of the harmful chemicals found in cigarettes.

**Amphetamines and methamphetamines**

Amphetamines and methamphetamines are another class of stimulant drug. Although they sound similar and have similar effects on consciousness, they are different in terms of the way each drug is manufactured, their use and their potency. Both amphetamines and methamphetamines increase your ability to stay awake and alert, and they increase your focus and attention. Amphetamines and methamphetamines affect the brain by stimulating the production of the brain chemicals noradrenaline and dopamine. These brain chemicals play a role in heightened activity and euphoria, which is why users often experience increased mood and energy levels.

Amphetamines were first developed in the late 1800s and, during the early 1900s, they began being used to treat illnesses such as asthma. Amphetamines were also used by soldiers in World War II to beat fatigue and increase alertness. These days, medical professionals use amphetamines to help sufferers of ADHD and narcolepsy. Although amphetamines can be useful, when administered incorrectly or abused they can have addictive qualities and serious side effects.

Methamphetamines derive from amphetamines. The difference between their chemical compositions is determined by how they are manufactured. Methamphetamines are more potent, so they have a stronger and quicker effect on the body than amphetamines. Street names for one type of methamphetamine include ‘ice’ or ‘crystal meth’ (a crystallised form usually smoked or injected by users).
Cocaine

Cocaine is a stimulant drug extracted from the leaves of a coca bush found in South America. Indigenous people from South America used to chew the leaves of the bush or use them to make tea to experience a suppressed appetite (Weiss, Mirin, & Bartel, 1994). Cocaine comes in several forms. The most common form of cocaine used in Australia is a white powder called cocaine hydrochloride. This form of cocaine is often ‘cut’ (mixed) with other chemicals, such as glucose or lactose, to boost the drug dealers’ profits. Cocaine is generally inhaled (snorted) or injected by users or rubbed onto their gums to produce an intense and rapid ‘rush’ of euphoria. This euphoric feeling can be experienced for 15–30 minutes, and is then followed by a powerful, devastating ‘crash’.

Some of the feelings and symptoms associated with the rush include:

» feelings of exhilaration or euphoria
» greater self-confidence
» an accelerated heart rate
» an increased urge in sexual activity
» loss of appetite
» dilated pupils
» increased energy.

The experience of the rush is due to the brain’s reward system being activated and abused. The neurotransmitters dopamine, serotonin and noradrenaline all have common mood-lifting properties. When they are released into the synapse, cocaine binds to the pre-synaptic neuron transporter inhibiting the process of re-uptake (the reabsorption of a neurotransmitter by a transporter of a pre-synaptic neuron after it has performed its function of transmitting a neural impulse). As a result these neurotransmitters remain in the synapse, intensifying their normal mood-elevating effects and this is what causes the euphoric rush (see Figure 6.16). The crash is produced when cocaine wears off, leading to an absence of these neurotransmitters in the synapse. When this occurs a person can experience:

» depression and anxiety
» bursts of anger
» nausea
» tremors
» total exhaustion.

Other long-term effects of cocaine include hallucinations, eating disorders, hypertension, paranoia and symptoms of psychosis. One recent study published also found a significant link between cocaine use and sudden cardiovascular-related deaths (Norentin, Ballesteros, Callado, & Meana, 2014).
Normal communication
Neurotransmitters
Pre-synaptic neuron
Post-synaptic neuron
Receptors
Transporter and the process of re-uptake

Communication when cocaine is present
Neurotransmitters
Pre-synaptic neuron
Post-synaptic neuron
Receptors
Transporter Cocaine blocking transporter and the process of re-uptake

FIGURE 6.16 The top image shows normal neural transmission at the synapse; the bottom image shows how cocaine influences normal neural transmission.

indicate levels of alertness. Brainwaves are detected by measuring the frequency and amplitude of peaks and troughs in brain activity. Generally, research has found stimulant drug use to be associated with higher levels of beta brainwaves, with some stimulants also associated with increased levels of alpha brainwaves.

Beta brainwave patterns are associated with NWC and are those most present during the day when we are awake. German psychiatrist Hans Berger (1873–1941), the creator of the EEG, first discovered the presence of beta brainwaves when patients were concentrating. Beta brainwaves are present any time you are conscious and alert and engaged in activities such as reading a book, solving a difficult maths equation or completing a puzzle. People who often think logically tend to have beta brainwaves activity. When we experience excessive levels of beta brainwaves we can experience feelings of stress and anxiety, which are also side effects of excessive stimulant drug use.

Alpha brainwaves are associated with a more relaxed and calm state. When we are peacefully relaxing, or in an ASC related to meditating or daydreaming, alpha brainwaves may be present. Alpha brainwaves have also been associated with creative states of consciousness; for example, when painting a portrait there may be an increase in alpha brainwaves. When you are stressed, alpha brainwaves diminish. Simply closing your eyes and taking a deep breath can start to increase the activity of alpha brainwaves. People who are addicted to nicotine often report a feeling of calmness and reduction in stress and anxiety when smoking cigarettes; this is due to the effects of alpha brainwaves present when inhaling nicotine. As well as reducing stress, alpha brainwaves can help balance our moods and emotions, leaving us in a positive state of consciousness.

Below is a brief summary of some of the research evidence to support the presence of beta and alpha brainwaves when affected by different stimulant drugs.

» Caffeine: After drinking a caffeinated drink such as coffee or a Red Bull energy drink, you will often report feeling more awake, alert and attentive. For this reason caffeine is associated with beta brainwave activity.

» Nicotine: Nicotine alters electrical brain activity. When inhaled, delta and theta brainwaves immediately decrease and alpha and beta increase. One research study compared two groups of participants: one who would smoke a real cigarette and the other who smoke a pseudo-cigarette (containing no nicotine).
Because alcohol is a depressant, it slows down messages between the brain and the body. Alcohol enters the bloodstream through the stomach and intestines. Its effects slow down if a person has a full stomach; however, someone who has just eaten will still experience the effects of the drug. Some of the effects of moderate alcohol consumption on consciousness include reduced inhibitions and feeling relaxed, calmer and more confident. People under the influence of alcohol may also experience a loss of self-control, impaired mobility and coordination, and slower reaction times. Excessive alcohol consumption or ‘binge drinking’ can lead to more severe characteristics on consciousness, including:

- blurred vision
- nausea and vomiting
- aggression
- confusion
- memory loss
- unconsciousness (passing out, which can lead to coma or in some instances even death).

There is no safe level of drinking as alcohol affects different people in different ways depending on a person’s weight, health, gender and amount of food in their stomach. The amount of alcohol in our bloodstream is measured as a blood alcohol concentration (BAC). The only way our BAC drops is when our liver metabolises the alcohol, which takes time – the liver metabolises approximately three-quarters of a standard drink in one hour. Drinking

**DEPRESSANTS**

Depressants are a class of drug that calm neural activity and slow down bodily functions. Depressant drugs are sometimes referred to as ‘downers’ because they reduce arousal when taken. For this reason, depressants have been used by medical practitioners to treat seizures and are still used to treat disorders such as insomnia and anxiety. Some of the effects of depressants include increased fatigue and drowsiness, lowered heart rate, reduced anxiety and calm nerves. Depressants drugs can be purchased legally or illegally. Some types include alcohol, barbiturates, benzodiazepines, opioids and cannabis.

**Alcohol**

Alcohol is the most widely used drug in Australia and it can be legally purchased by anyone over the age of 18 years. Many people do not consider it as a drug because it is widely accepted in social settings, despite alcohol being related to more problems in Australian society than any other drug. For example, alcohol was the reason for the majority of drug-related ambulance attendances in 2012–13, with 11 159 attendances compared to 3159 for benzodiazepines, 1901 for heroin, and 1112 for crystal methamphetamine (ice) (Lloyd, Matthews, & Gao, 2014) (see Figure 6.17).
black coffee, vomiting, taking a powernap or having a cold shower do not speed up this metabolic process despite what some people may believe.

**Barbiturates and benzodiazepines**

Barbiturates and benzodiazepines are both prescription drugs that depress the central nervous system functions. For this reason both classes of drugs are known as tranquilisers because they produce a calming effect on the body, including drowsiness, feelings of wellbeing or euphoria, reduced tension and decreased anxiety. Today, benzodiazepines are commonly used to treat people who suffer from anxiety disorders and sleep disorders such as insomnia. Medical practitioners will usually prescribe benzodiazepines before barbiturates for these types of disorders, because benzodiazepines have less addictive properties. Barbiturates are now more commonly used as an anaesthetic.

Benzodiazepines work by binding to the receptor site of post-synaptic neurons to increase the functioning of GABA (gamma-aminobutyric acid), the major inhibitory neurotransmitter found in the central nervous system (see Figure 6.18). GABA works by blocking neural transmission, therefore producing a calming effect on the body. People who experience anxiety disorders may have a dysfunctional GABA system, resulting in heightened arousal due to insufficient amounts of GABA being produced.

If people misuse barbiturates and benzodiazepines that have been acquired illegally they may develop a tolerance towards the drugs and experience symptoms of withdrawal when their supply runs out. Some people abuse the drugs to help with the ‘come-down’ experienced when the effects of stimulant drugs such as cocaine or methamphetamine wear off. Abuse of barbiturates and benzodiazepines can have serious side effects such as confusion, dizziness, impaired motor coordination, blurred vision and feelings of depression. If these drugs are mixed with alcohol, the combined depressant effects on a person can be lethal.

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**Check Your Understanding >>**

1. Beta brainwaves are present when you are ________ and alpha brainwaves are present when you are ________.
   - A painting a portrait; sleeping
   - B reading a book; solving a maths equation
   - C meditating; closing your eyes
   - D completing a logic puzzle; deeply relaxed

2. Summarise the research findings about stimulant drug use and associated brainwave patterns.

3. Describe some of the effects depressants have on consciousness as well as examples of this class of drug.

4. Which depressant drug is the most widely used drug in Australia?
   - A Ice
   - B Nicotine
   - C Alcohol
   - D Benzodiazepines

5. Compare some of the effects of moderate versus excessive alcohol consumption.

6. Describe how GABA is manipulated in the brain of someone taking benzodiazepines.

**Opioids**

Opioids are a group of depressant drugs that slow down CNS functions such as heart rate, breathing rate and thought processes. Opioids are derived from opium, which is found in a poppy plant. Opium poppy plants are primarily found in Afghanistan, but they are also found on a smaller scale in Pakistan and South-East Asia (see Figure 6.19). Because opioids also severely distort the perception of pain, ancient civilisations used opium for its pain-relieving properties. Currently, legal forms of opioids such as morphine and codeine are also used for this purpose.
Cannabis

Cannabis is a psychoactive drug that comes from the plant *Cannabis sativa*. These plants can be grown indoors or outdoors, given the correct conditions. People who use cannabis typically inhale the dried buds of the plant through smoking it. Cannabis is often difficult to classify because of the mixed effects of the drug. In smaller doses it is classified as a depressant; however, when taken in larger doses, cannabis has hallucinogenic properties. In smaller doses the effects of cannabis may include relaxation, drowsiness, spontaneous laughter and excitement, and an increased appetite. Larger doses of the drug often result in blurred vision, bloodshot eyes, hallucinations, delusions and paranoia. These later effects are known as psychotic symptoms, because they are experienced by people suffering from psychotic disorders such as schizophrenia. Research has shown that cannabis drug abuse during early age can lead to the development of a psychotic illness later in life. See Focus on research 6.2 for more on this issue.

Some activists argue cannabis should be legalised for medicinal purposes because it has provided pain relief for cancer suffers and improved symptoms of nausea as a result of chemotherapy. Cannabis is still an illegal drug in Australia.

CHANGES IN LEVELS OF ALERTNESS DUE TO DEPRESSANT USE

One way to measure how the brain and our state of consciousness is affected by depressants is through the use of the EEG. Because depressants slow down neural activity in the brain and calm the body, they have generally been found to be associated with the onset of alpha, theta and delta waves. Alpha waves have also been linked with stimulants (for example, nicotine) but they are also present when depressants (for example, alcohol) are consumed. Atypically, some depressants (such as benzodiazepines) can have a reverse effect on the brain, producing beta brainwaves on the EEG recording.

Theta brainwaves are often present when in deep relaxation such as meditation practices and also in the early stages of sleep. They are characterised by medium–high amplitude and low–medium frequency. When theta brainwaves are present, our consciousness of the external world is shut off and we become focused on internal signals. We may experience vivid imagery and be in a highly creative or deeply relaxed state of consciousness when theta waves are present. Theta waves can also make us more suggestible and

LEGAL OPIOIDS: MORPHINE AND CODEINE

Taken as prescribed, opioids can be extremely useful to effectively reduce pain. Morphine is often prescribed to help a person deal with severe pain (such as someone who is recovering after an operation), whereas codeine is often prescribed to help manage mild to moderate pain (such as having your wisdom teeth removed). Both codeine and morphine change the perception of pain in an individual so can make them feel more relaxed and pain free. However, because they both slow down a person’s breathing rate they must be avoided by people who suffer from respiratory illness such as asthma because they can cause them to stop breathing.

ILLEGAL OPIOIDS: HEROIN

Heroin is a far more potent and addictive opioid than morphine. Because its effects are so dangerous that they can lead to death, heroin is illegal. When a person takes heroin, their CNS becomes depressed and this causes a drop in their breathing rate, blood pressure, body temperature and heart rate. Sometimes, a person’s breathing may stop altogether, causing a coma, unconsciousness or even death. Other effects of the drug include an immediate rush of pleasure and diminished perception of pain, narrowing of the pupils, feelings of nausea and decreased sex drive. As a user’s brain gets used to the drug’s pleasurable effects, the brain is tricked into not producing dopamine, the neurotransmitter that delivers pleasurable sensations and contributes to voluntary movement. Because heroin is highly addictive, when the production of dopamine stops in the brain of a heroin addict they experience symptoms of withdrawal that are often excruciating.
Benzodiazepines and barbiturates: Low doses of barbiturates produce an increase in fast brainwave frequencies; however, in high doses brain frequencies slow dramatically (Salinsky et al., 2002). Barbiturates are often used as an anaesthetic. This causes total unawareness from the external environment, creating similar levels of awareness to deep stages of sleep. Therefore, brainwave patterns are also similar when in a deep stage of sleep and under the influence of a high-dose barbiturate medication. Both produce an increase in delta brainwave activity on the EEG (Saletu, Anderer, & Saletu-Zyhlarz, 2006).

Although benzodiazepines are sedatives, ironically they have the opposite effect on the brain and they are associated with an increase in beta brainwaves. This is known as a pharmacological dissociation (Jongsma et al., 2000; Lier, Drinkenburg, van Eeten, & Coenen, 2004).

Opioids: Research has shown that opioid use can increase slow brainwave activity, which is a combination of theta and delta brainwaves (Phillips, Herning, & London, 1994; Volavka, Zaks, Roubicek, & Fink, 1970).

Cannabis: Research has shown changes in EEG patterns for cannabis users consistent with the effects of the drug. Cannabis users report feeling carefree and calm when under the influence of the drug and therefore experience an increase in alpha brainwave activity (Iversen, 2003; Salinsky et al., 2002).

Delta brainwaves are the slowest frequency brainwaves and they are mostly associated with the deeper stages of sleep (Stages 3 and 4 NREM) that help restore and rejuvenate our body and mind. Typically, children experience more delta brainwaves during sleep than adults do, and the elderly experience fewer delta brainwaves during sleep compared to younger adults. In addition to the restorative effects of delta waves, they are also associated with increasing empathy and a decrease in the stress hormone cortisol, which in turn also helps boost our immune system. Delta waves are also associated with depressant drug use due to their relaxing properties.

Below is a brief summary of some of the research evidence to support the presence of alpha, theta and delta brainwaves when affected by different depressant drugs.

Alcohol: People often turn to alcohol when stressed or tensed because it helps them relax. It does this by boosting alpha brainwaves. Increases in alpha brainwave patterns are associated with alcohol consumption (Kaufman, 2001; Salinsky et al., 2002). It also helps to explain how alcoholics become dependent on alcohol. Alcoholics continue consuming alcohol to leave the normal, waking, alert beta brainwave state to return to this relaxed and tranquil alpha brainwave state.

Table 6.6 Summary of psychoactive drugs, their effects on consciousness and brainwave patterns

<table>
<thead>
<tr>
<th>PSYCHOACTIVE DRUG</th>
<th>EFFECT ON CONSCIOUSNESS</th>
<th>TYPES OF DRUG</th>
<th>BRAINWAVE PATTERNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulants</td>
<td>» Elevate mood</td>
<td>Caffeine</td>
<td>Increases beta brainwaves</td>
</tr>
<tr>
<td></td>
<td>» Increase alertness</td>
<td>Nicotine</td>
<td>Increases alpha brainwaves</td>
</tr>
<tr>
<td></td>
<td>» Reduce fatigue</td>
<td>Amphetamines and methamphetamines</td>
<td>Increase beta brainwaves</td>
</tr>
<tr>
<td></td>
<td>» Reduce appetite</td>
<td>Cocaine</td>
<td>Increases beta and alpha brainwaves</td>
</tr>
<tr>
<td></td>
<td>» Increase energy levels</td>
<td>Alcohol</td>
<td>Increases alpha brainwaves</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Barbiturates and benzodiazepines</td>
<td>Barbiturates in high doses increase delta brainwaves</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Benzodiazepines increase beta brainwaves</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Opioids</td>
<td>Increase theta and delta brainwaves</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cannabis (hallucinogen)</td>
<td>Increases alpha brainwaves</td>
</tr>
</tbody>
</table>
Depressants slow messages between the body and the brain

Signals from all senses reach the brain more slowly than usual

Heart rate decreases; the body has less oxygen

Breathing rate decreases; risk of infection in lungs

Messages to muscles are slower than usual

The body cannot sense or respond to stimuli quickly

Stimulants create false messages in the brain; the brain may not realise the body is under stress

Less blood is transported to the skin; the body cannot cool itself

Heart rate increases; blood vessels to the heart constrict

Liver releases sugar in the bloodstream; the body has less energy in storage

If real stress occurs, the body cannot respond

**FIGURE 6.20** The effects of depressants and stimulants on the body

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6.8 **CHECK YOUR UNDERSTANDING >>**

1 Opioids can be useful and helpful when:
   A administered to relieve pain.
   B administered as heroin.
   C taken with other stimulant drugs.
   D taken with other depressant drugs.

2 Why is heroin such a dangerous drug?

3 Why is cannabis considered a depressant and a hallucinogen drug?

4 Theta brainwaves are present when you are ________, and delta brainwaves are present when you are ________.
   A meditating; reading a book
   B under hypnosis; in a deep stage of sleep
   C in a deep stage of sleep; painting a portrait
   D solving a maths equation; in a deep stage of sleep

5 Summarise the research findings about depressant drug use and associated brainwave patterns.

6 ________ are examples of depressant drugs, whereas ________ are examples of stimulant drugs.
   A Methamphetamine and alcohol; cocaine and opioids
   B Alcohol and opioids; amphetamine and cocaine
   C Opioids and cocaine; methamphetamine and alcohol
   D Alcohol and nicotine; caffeine and benzodiazepines

---

**OUTCOMES OF OCCASIONAL CANNABIS USE IN ADOLESCENCE**

Cannabis was the most widely used illicit drug among 12 to 17-year-olds in Australia in 2011 (White & Bariola, 2012). Many adolescents engage in this risky drug-taking behaviour completely unaware of the long-term effects of the drug. Decades of research have supported the link between excessive cannabis use during adolescence and the onset of drug-induced psychosis such as schizophrenia. Symptoms of psychosis are characterised by someone who loses touch with reality. They may experience delusions (strongly held false beliefs) and hallucinations (visual – seeing things that aren’t really there – or auditory – hearing voices). One recent research study looked at the effects of cannabis use and early onset psychosis. This research found strong evidence that reducing cannabis use can delay the onset of psychosis or, in some cases, even prevent the illness altogether (Large, Sharma, Compton, Slade, & Nielesson, 2011).

One study conducted in Victoria investigated the effects of occasional cannabis use in adolescents and the potential psychosocial problems and subsequent drug use presented later in life. Much research had been done in the area around frequent cannabis use; researchers were interested in whether occasional use carried similar risks. The 1943 participants were Victorian mid-secondary
school students (around Year 9) who were selected as a representative sample. The experiment was conducted over a 10-year period (1992-2003), where the groups of participants were contacted over different phases of the experiment at various ages. For example, participants were interviewed at four 6-monthly intervals during their teens, with two follow-ups in young adulthood, at 20-21 years and 24-25 years. Adolescent cannabis use was categorised as either ‘no use’, ‘occasional use (less than weekly)’ or ‘weekly/daily use’. Some of the key findings of the study include:

» Weekly/daily adolescent users were less likely to have parents with low education, and were more likely to have attended a metropolitan school, than non-users.

» Depression/anxiety symptoms, alcohol use and cigarette smoking were more likely among both occasional and weekly/daily adolescent cannabis users compared with non-users.

» Of the 331 adolescent occasional users, 8 per cent abstained at 20 years of age, 71 per cent persisted with that level of use, and 20 per cent escalated to weekly/daily use.

» Adolescent cannabis users were less likely than non-users to have gained post-school qualifications by 24 years.

» Both alcohol and nicotine dependence at 24 years occurred more often among adolescent cannabis users, with occasional users intermediate in risk level between non-users and weekly/daily users. From these findings researchers concluded that even occasional use of cannabis in adolescence can cause psychosocial and drug dependence problems in adulthood (Degenhardt, Coffey, Carlin, Swift, Moore, & Patton, 2010).

**QUESTIONS**

1. Describe some of the symptoms of psychosis. Who is at risk of developing a psychotic illness?

2. What was the aim of this research study?

3. Summarise the key findings of occasional adolescent cannabis use.

4. What are some of the problems researchers may have faced carrying out a longitudinal study such as this one?

### SLEEP DEPRIVATION AND CONSCIOUSNESS

**Sleep deprivation** refers to going without or not getting sufficient amounts of sleep. **Partial sleep deprivation** occurs when a person does not get the recommended hours of sleep per night for their age group. For example, adults require approximately 8 hours of sleep per night, so the effects of partial sleep deprivation may be experienced when an adult only gets 4 hours of sleep per night. **Total sleep deprivation** occurs when a person goes without sleep altogether. This can be one full night or in some cases, such as those discussed below, this can be several nights without sleep.

In 1959, to raise money for charity, American DJ Peter Tripp (see Figure 6.21a) agreed to forgo sleep for 201 hours. After 100 hours, he began to have hallucinations: he saw cobwebs in his shoes, and he watched in terror as a tweed coat became a suit of ‘furry worms’. When Tripp went to a hotel to change his clothes, a dressing-table drawer seemed to burst into flames. After 170 hours, Tripp was in agony. He struggled with simple thoughts and reasoning, and had memory problems. His brainwave patterns looked like those of someone asleep, and he was no longer sure who he was. By the end of 201 hours, Tripp was unable to distinguish between his waking nightmares, hallucinations and reality (Luce, 1965).

Surprisingly there are more extreme cases of sleep deprivation. The world record is held by Californian Randy Gardner (see Figure 6.21b), who, at 17 years of age in 1964, went 264 hours (11 days) without sleep. At various times, Gardner experienced irritability, memory lapses, difficulty concentrating and difficulty in naming common objects. Surprisingly, Gardner needed only 14 hours of sleep to recover (Coren, 1996).

Gardner’s experience highlights that, to recover from sleep deprivation, it is not necessary to completely replace lost sleep as most symptoms of sleep deprivation are reversed by a single night’s uninterrupted sleep. People who have been sleep deprived may report sleeping for a longer period of time than normal in the few nights following deprivation, but they did not need to replace the total amount of sleep lost to recover. This may be because during periods of total sleep deprivation they were briefly refreshed by what is known as a microsleep. **Microsleeps** are short periods where the individual appears to be awake – their eyes may even be open – however, brainwave patterns indicate that they are asleep. Microsleeps are especially prevalent when people who are sleep deprived complete monotonous tasks. That is why drivers who feel tired are encouraged to take a break or a 15-minute powernap. It is also likely that when sleep-deprived individuals sleep the subsequent night, they experience **REM rebound**. REM rebound is when a person who has been deprived of REM sleep later ‘compensates’ by having extra amounts of REM sleep than they normally would in a typical night’s sleep.
developed the working memory model, working memory holds all the information needed for cognitive activities, such as thinking, planning and analysis. One key component of working memory is controlling and directing attention. The functions of both working memory and attention have been associated with frontal lobe activity. Research has shown that sleep deprivation dampens frontal lobe activity, and thus the capacity of working memory and attention systems. Specific attentional systems impaired include vigilance, auditory and visuospatial attention, serial addition and subtraction tasks, and different reaction time tasks as measured by the PVT (Alhola & Polo-Kantola, 2007).

Our long-term memory system is also thought to be affected by sleep deprivation, particularly our ability to process declarative memories. As discussed in Chapter 5, the encoding of declarative memories is highly dependent on the functioning of the hippocampus and medial temporal lobe brain structures. Research has found that during long-term memory tasks people who are sleep deprived show significantly reduced activity within the medial temporal regions compared to rested, wakeful people completing the same memory task (Killgore, 2010).

In one recent research study a group of participants were sleep deprived for one full night and then presented with a series of scenic photographs to encode (remember) while undergoing an fMRI. A second group of non-sleep deprived participants underwent the same task. Following two nights of normal sleep at home participants’ memory retention was measured. Neuroimaging technologies showed that when the sleep-deprived groups were trying to remember the photos, there was significantly less activation in parts of their hippocampus, resulting in worse retention of photos compared to non-sleep-deprived participants (Yoo, Hu, Gujar,

The need for sufficient amounts of sleep is clearly evident when looking at the psychological and physiological effects of sleep deprivation. The most typical physical reactions to sleep deprivation are trembling hands, droopy eyelids, increased pain sensitivity, headaches and general discomfort. Individuals who experience one night of full sleep deprivation are subject to a decrease in cognitive functions such as memory and concentration, a slowing of reaction times and changes to mood and emotional behaviour.

**EFFECTS OF SLEEP DEPRIVATION ON COGNITION**

One full night of sleep deprivation can affect a person’s cognitive abilities. Some cognitive capabilities that can be adversely affected during sleep deprivation include working memory, attention and executive functions such as planning, decision-making and problem-solving.

**Working memory** is a part of our memory system that temporarily stores and manipulates a limited amount of information needed to perform cognitive tasks. According to Baddeley and Hitch (1974) who...
disastrous because their safety and the safety of others may be in jeopardy. For this reason most emergency service workers are legally obligated to have a 10-hour break between rostered shifts. This gives them adequate time for a full night’s sleep between shifts so concentration while on the job is not impaired.

You may have done an ‘all-nighter’ before and be able to relate to what you felt like the next day in terms of your concentration levels, particularly if you had to go to school. Your concentration may be impaired and you may find it more difficult to listen to the teacher’s instructions, complete learning activities or even read the words in this textbook (see Figure 6.22).

**EFFECTS OF SLEEP DEPRIVATION ON MOOD**

The effects of sleep deprivation are also clearly evident on a person’s mood. You may recall that after a sleepless night you may feel more irritable, short-tempered and impatient. Research has shown that after just one night of sleep deprivation a person’s positive mood decreases while negative moods increase. Increased negative moods include feeling angry, hostile and argumentative, while positive moods include empathy, excitement and friendliness. Mood also affects emotional reactivity and concentration levels and performance on complex tasks seem to be less affected when sleep deprived. One study found that people who have not slept for 2 or 3 days and who may be experiencing an ASC show little impairment on relatively interesting or complex mental tasks (Binks, Waters, & Hurry, 1999). A subsequent study supported these findings and reported that, even after 24 hours of sleep deprivation, performance on a complex task was better preserved compared to performance on a simpler task (Chee & Choo, 2004).

High concentration levels are also paramount for many employees who do shift work, such as emergency service workers, doctors, nurses, police officers and taxi drivers. Shift workers are often required to work throughout the night and, if they are unable to sleep during the day, they may suffer from one full night’s sleep deprivation. If their concentration is impaired as a result of sleep deprivation, the consequences can be
Driving a car safely is a task that requires a high level of conscious awareness. When you’re behind the wheel you need to make important decisions on the road that require total concentration, rapid reflexes, good coordination and the ability to make good judgements. However, when a person is under the influence of alcohol their consciousness is impaired.

As discussed earlier, alcohol is a depressant that slows the activity of the CNS, and if a person drinks enough alcohol they may enter an alcohol-induced ASC. They may experience a lack of self-control, disturbed sense of time, distorted perceptions and cognition, and emotional instability, all of which are detrimental to their ability to safely drive a motor vehicle. When police need to determine whether a driver’s consciousness has been impaired by alcohol, they measure the amount of alcohol present in the bloodstream by determining their blood alcohol concentration (BAC). A breathalyser or saliva or urine sample will provide a BAC, with breathalysers being the most commonly used in Victoria. In Victoria the legal BAC when driving is under 0.05 for drivers with a full licence and 0.00 for probationary drivers and professional drivers (for example, heavy truck drivers, taxi drivers and bus drivers). A BAC of 0.05 indicates that every 100 millilitres of your blood...

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**CHECK YOUR UNDERSTANDING >>**

1. Total sleep deprivation involves ________, whereas partial sleep deprivation involves ________.
   - A. not getting the required amount of sleep; going without sleep completely
   - B. going without sleep completely; not getting the required amount of sleep
   - C. not getting the required amount of sleep; changes in sleeping habits and patterns
   - D. going without sleep completely; changes in sleeping habits and patterns

2. Describe the two longest recorded cases of sleep deprivation. What are some of the effects they both experienced?

3. When a person is sleep deprived they may move into periods of ________ where they temporarily fall into brief periods of sleep.
   - A. REM rebound
   - B. sleep paralysis
   - C. tranquilised state
   - D. microsleep

4. Which of the following is a physical effect of sleep deprivation?
   - A. Droopy eyelids
   - B. Irritability
   - C. Reduced attentions and alertness
   - D. Increase in stress and anxiety

5. Describe the effect sleep deprivation has on working and long-term memory with reference to change in areas of the brain.

6. When sleep deprived, concentration:
   - A. is better.
   - B. is impaired.
   - C. is the same as when not sleep deprived.
   - D. depends on how much sleep has been deprived.

7. Describe the link between sleep deprivation and mood disorders.

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**LEGAL BLOOD ALCOHOL CONCENTRATIONS AND CONSCIOUSNESS**

Driving a car safely is a task that requires a high level of conscious awareness. When you’re behind the wheel you need to make important decisions on the road that require total concentration, rapid reflexes, good coordination and the ability to make good judgements. However, when a person is under the influence of alcohol their consciousness is impaired.

As discussed earlier, alcohol is a depressant that slows the activity of the CNS, and if a person drinks enough alcohol they may enter an alcohol-induced ASC. They may experience a lack of self-control, disturbed sense of time, distorted perceptions and cognition, and emotional instability, all of which are detrimental to their ability to safely drive a motor vehicle. When police need to determine whether a driver’s consciousness has been impaired by alcohol, they measure the amount of alcohol present in the bloodstream by determining their blood alcohol concentration (BAC). A breathalyser or saliva or urine sample will provide a BAC, with breathalysers being the most commonly used in Victoria. In Victoria the legal BAC when driving is under 0.05 for drivers with a full licence and 0.00 for probationary drivers and professional drivers (for example, heavy truck drivers, taxi drivers and bus drivers). A BAC of 0.05 indicates that every 100 millilitres of your blood...
SLEEP DEPRIVATION AND LEGAL BAC

Going without sleep and drinking alcohol can both severely impair a person’s ability to perform higher-order cognitive functions such as driving a car. While there are laws imposed to prevent drivers from driving on the road when they have been affected by alcohol, no such laws exist for people who are sleep deprived. According to the TAC, approximately 20 per cent of fatal road accidents are due to driver fatigue. Over many years the TAC has attempted to curb the road toll by mounting campaigns that encourage drivers to stay off the road when sleep deprived and to remind drivers of the deadly effects of sleep deprivation.

Many research studies that have investigated the effects of sleep deprivation on driving ability have found that sleep deprivation has similar effects to those experienced by drivers over the legal BAC. One well-known study conducted by Williamson & Feyer (2000) involved investigating the

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EFFECTS OF ALCOHOL ON COGNITION, CONCENTRATION AND MOOD

When a person has a BAC over 0.05 their consciousness is impaired. The effects of alcohol on cognition, concentration and mood include:

» **Cognition** – Various aspects of a person’s cognition can be impaired with high BAC levels. These include an inability to problem solve or make decisions, impaired logic and reasoning, and impaired memory ability. When driving, these effects may result in not knowing when to give way to other drivers, not remembering basic road rules, and difficulty judging distance between surrounding cars.

» **Concentration** – A BAC over 0.05 causes a decline in concentration because a person may not be able to concentrate on the multifaceted aspects of driving a car, such as maintaining the speed limit or noticing the changing of traffic lights.

» **Mood** – When a person is under the influence of alcohol their emotions and mood may be exaggerated and intensified. A person may be overly emotional, displaying inappropriate emotions or experience a lack of emotions. A person’s moods may fluctuate or they may have little control over their moods and these mood changes may affect their ability to make safe decisions on the road. For example, thrill-seeking emotions may be exacerbated in a driver with a high BAC, causing their propensity for reckless driving to intensify.

When a person’s BAC increases so does the severity of symptoms experienced. See Table 6.7 for a summary of different BAC levels and the effects on consciousness and behaviour.

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TABLE 6.7 Levels of legal blood alcohol concentrations and their effects on consciousness and behaviour

<table>
<thead>
<tr>
<th>BLOOD ALCOHOL CONCENTRATION</th>
<th>EFFECTS ON CONSCIOUSNESS AND BEHAVIOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>Lowered alertness and judgement, lowered inhibitions, minor impairment of memory and reasoning; emotions may be intensified and exaggerated</td>
</tr>
<tr>
<td>0.10</td>
<td>Significant impairment in motor coordination and reaction times; less cautious</td>
</tr>
<tr>
<td>0.15</td>
<td>Reaction times further deteriorated, speech may be slurred, balance and vision have declined, anxiety and restlessness are common</td>
</tr>
<tr>
<td>0.20</td>
<td>Feeling dazed, disoriented, confused, depressed; may not be able to feel pain; may experience nausea and vomiting</td>
</tr>
<tr>
<td>0.25</td>
<td>All mental, physical and sensory functions are severely impaired; increased risk of asphyxiation (suffocation) from excessive vomiting</td>
</tr>
<tr>
<td>0.30</td>
<td>Stupor, no awareness or comprehension of the external environment</td>
</tr>
<tr>
<td>0.35</td>
<td>Unconsciousness or coma is likely; this is the equivalent level of surgical anaesthesia, a lethal dose for some adults</td>
</tr>
<tr>
<td>0.40</td>
<td>A lethal dose of alcohol for approximately 50% of adults</td>
</tr>
</tbody>
</table>

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SLEEP DEPRIVATION AND LEGAL BAC

Going without sleep and drinking alcohol can both severely impair a person’s ability to perform higher-order cognitive functions such as driving a car. While there are laws imposed to prevent drivers from driving on the road when they have been affected by alcohol, no such laws exist for people who are sleep deprived. According to the TAC, approximately 20 per cent of fatal road accidents are due to driver fatigue. Over many years the TAC has attempted to curb the road toll by mounting campaigns that encourage drivers to stay off the road when sleep deprived and to remind drivers of the deadly effects of sleep deprivation.
Because alcohol consumption results in an altered state of consciousness, much research has been conducted on the effects of alcohol when driving. Road trauma is the most common cause of premature death among young adults in Australia. Figure 6.24 shows a graph of the number of drivers and motorcyclists killed on Victorian roads who recorded a BAC of 0.05 g/100 mL or higher between 1987 and 2012.

Focus on research 6.3 provides more statistics on BACs and road accidents.

### Focus on Research 6.3

**The Effect of Alcohol**

Because alcohol consumption results in an altered state of consciousness, much research has been conducted on the effects of alcohol when driving. Road trauma is the most common cause of premature death among young adults in Australia. Figure 6.24 shows a graph of the number of drivers and motorcyclists killed on Victorian roads who recorded a BAC of 0.05 g/100 mL or higher between 1987 and 2012.

Drivers/riders killed with a BAC at or over 0.05

**Figure 6.24** The number of drivers and motorcyclists killed in Victoria with a BAC over 0.05, 1987–2012

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6.3

**Consciousness**

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**Figure 6.23** TAC fatigue campaigns are used to remind drivers of the dangerous consequences of driving when sleep deprived.

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The results of the study found that going without sleep for 17–19 hours is the equivalent of having a BAC reading of 0.05. The study showed that, compared to drivers who were well rested, sleep-deprived drivers are twice as likely to have an accident because their reaction times are 50 per cent slower, with research showing 24–28 hours of sleep deprivation is the equivalent of a BAC reading of 0.10. These drivers are seven times more likely to have an accident on the road (Williamson & Feyer, 2000).
Some reported TAC alcohol road statistics are summarised below (TAC, 2015).
» The proportion of drivers and motorcycle riders killed with a BAC greater than 0.05 g/100 mL declined from 38 per cent in 1987 to 24 per cent in 2012.
» Close to one in four drivers and riders killed in 2008–12 had a BAC greater than 0.05.
» Drink-driving offenders are predominantly male (84 per cent).
» The age demographic of drink-driving offenders follows a linear pattern downwards from 21–29 onwards. In other words, the older the person, the less likely they are to be caught offending.
» Since 1997, Victoria Police have breathalysed more than 20 million drivers and riders during Booze Bus operations, catching close to 70,000 drivers and riders with an illegal BAC over this period.

**Questions**

1. Write a possible hypothesis that may investigate the effect of alcohol on driving ability.
2. What types of statistics are provided in this piece of research and what is the purpose of using these types of statistics?
3. What possible conclusion could be made from the data shown in Figure 6.24?
4. Suggest some of the reasons why the number of drink-drivers and riders with a BAC of 0.05 who were killed on Victorian roads has decreased since 1987.

**Check Your Understanding**

1. What is a BAC and how is it measured?
2. What is the legal BAC for different types of drivers in Victoria?
3. When a person is experiencing vomiting because of consumption of alcohol, what is their likely BAC?
   - A 0.00
   - B 0.05
   - C 0.10
   - D 0.20
4. Being deprived of 17–19 hours of sleep is equivalent to what BAC?
   - A 0.00
   - B 0.03
   - C 0.05
   - D 0.10
5. What was the aim of the study conducted by Williamson and Feyer (2000)?
6. Write a possible hypothesis for the study conducted by Williamson and Feyer (2000).
7. Summarise the results of the study conducted by Williamson and Feyer (2000).
Consciousness

- Human consciousness is defined as all the perceptions, sensations, memories, thoughts and feelings one is aware of at any given moment.
- Human consciousness is divided into two main levels of consciousness: normal waking consciousness (NWC) and altered states of consciousness (ASCs).

Measuring consciousness

- Human consciousness is a psychological construct, which means it cannot be directly observed or measured. Thus, it has to be indirectly measured.
- Consciousness is measured indirectly using a variety of physiological devices, such as the electroencephalograph (EEG), electromyograph (EMG) and electrooculograph (EOG).
- An EEG detects, amplifies and records the brain’s electrical activity and tells us which brainwaves are prominent at any given moment. The four types of brainwaves are beta, alpha, theta and delta waves. These brainwaves differ in their amplitude and frequency. Delta waves indicate deep sleep; beta-like waves indicate an awake and alert state.
- The EMG detects, amplifies and records the electrical activity of active muscles in the body.
- The EOG detects, amplifies and records the electrical activity of the muscles around the eyes. It can be used to detect whether an individual is experiencing NREM or REM sleep.
- Sleep research is typically conducted in a sleep laboratory. It is a controlled environment that uses participants’ self-reports, video recordings and electronic recording devices to measure sleep.
- A psychometric vigilance test (PVT) may also be used to measure the speed and accuracy on cognitive tasks when a person is in an ASC such as a sleep-deprived state.

Difference between NWC and an ASC

- Examples of ASCs include states of hypnosis, meditation, daydreaming, sleep, anaesthesia, coma and being under the influence of alcohol or drugs.
- An ASC can occur naturally without any conscious effort or decision-making (e.g. daydreaming) or can be intentionally induced (e.g. being under the influence of drugs or alcohol).
- NWC is characterised by selective attention, controlled processes, automatic processes and divided attention.
- During NWC, humans have high levels of attention and awareness; high content limitations; a reliable memory; logical, controlled and rational thoughts; reliable emotional awareness; good self-control; good awareness of sensations and a realistic sense of time.
- During ASCs, humans may have lower attention and awareness of internal and external stimuli; reduced content limitations; poor memory; illogical and bizarre thoughts; heightened, blunted or inappropriate emotional experiences; poor self-control; blunted or sharpened sensations; and an inaccurate sense of time.

Stimulants and depressants, and how they affect brainwave patterns

- Psychoactive drugs are any class of drug that alters the brain’s chemistry, which subsequently changes a person’s perceptions, thoughts and behaviours. Two classes of psychoactive drugs include stimulants and depressants.
- Stimulants are a group of drugs that elevate mood, increase alertness and reduce fatigue. They do this by exciting neural activity in the brain, which increases bodily functions. Commonly used stimulants include caffeine and nicotine. Dangerous and illegal stimulants include amphetamines, methamphetamine and cocaine.
- Stimulant drug use affects brainwave patterns. Caffeine increases beta brainwave activity; nicotine increases levels of alpha brainwave activity; amphetamines and methamphetamine increase beta activity; and cocaine increases levels of beta and alpha brainwaves, with higher doses of the drug more associated with beta brainwave activity.
- Depressants are a class of drugs that calm neural activity and slow down bodily functions. Some of the effects of depressants include increased fatigue and drowsiness, lowered heart rate, reduced anxiety and calm nerves. Some types of depressant drugs include alcohol, barbiturates, benzodiazepines, opioids and cannabis.
- Depressant drug use affects brainwave patterns. Alcohol increases alpha brainwaves; barbiturates in high doses increase delta brainwaves; benzodiazepines increase beta brainwaves; opioids increase theta and delta brainwaves; and cannabis increases alpha brainwaves.

Sleep deprivation effects and comparison with legal BACs

- Partial sleep deprivation is when one does not get the recommended hours of sleep per night, whereas total sleep deprivation is when a person goes without sleep altogether. Both total and partial sleep deprivation can affect a person’s cognitive abilities, concentration levels and mood.
- Cognitive capabilities such as working memory and attention are adversely affected during sleep deprivation. Concentration on tasks when sleep...
When experiencing a high BAC, cognitive impairments include an inability to make decisions, impaired logic and reasoning, and impaired memory ability. Concentration declines and moods can become exaggerated and intensified, possibly causing reckless driving.

Going without sleep for 17–19 hours is the equivalent of having a BAC reading of 0.05, while going without sleep for 24–28 hours is the equivalent of a BAC reading of 0.10.

deprived deteriorates the more sleep deprived we are, with simple and routine tasks being more difficult for the sleep deprived. Negative moods such as anger and hostility increase when sleep deprived.

Blood alcohol concentration (BAC) refers to the amount of alcohol present in the bloodstream, which can affect a person’s cognitive abilities, concentration levels and mood, therefore affecting their driving ability.

### APPLY YOUR KNOWLEDGE AND SKILLS

**SECTION A: MULTIPLE-CHOICE QUESTIONS**

Answer the following questions by writing the correct letter in your workbook. Only one answer is correct for each question.

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Which of the following is not an ASC?</td>
<td></td>
</tr>
<tr>
<td>A Reading</td>
<td>B Sleeping</td>
</tr>
</tbody>
</table>

| 2 Beta waves are found during: |
| A deep sleep | B light sleep | C hypnosis | D normal waking consciousness |

| 3 NWC is different from an ASC because: |
| A in NWC, thoughts are logical and controlled, but in an ASC thoughts are rational and illogical. | B in an ASC, memory is often good but in NWC memory is often impaired. | C in NWC, hallucinations may occur, but in an ASC this is unlikely. | D in NWC, thoughts are logical and rational, but in an ASC thoughts may be illogical. |

| 4 Which of the following is the best example of selective attention? |
| A Driving a car while talking and changing the radio | B Playing a difficult computer game | C Watching cartoons on television | D Having a shower and washing your hair |

| 5 Lauren underwent hypnosis as a treatment to lose weight. Afterwards, she was surprised to learn that she had been hypnotised for 40 minutes, yet it seemed to her that only 5 minutes had passed. Lauren had most likely experienced: |
| A a state of NWC. | B an ASC. | C stream of consciousness. | D an automatic process. |

| 6 Stimulant drug use typically increases _________ and _________ brainwaves. |
| A alpha; theta | B theta; delta | C beta; delta | D beta; alpha |

| 7 The task of learning how to drive a car can be considered a controlled process because: |
| A it is likely to interfere with performance of other tasks. | B the level of mental effort required is much less than for other skilled performance tasks. | C the driver must use the controls at all times. | D it allows the driver to have more control of their life. |

| 8 Which of the following drugs is an example of a depressant drug? |
| A Opioid | B Cocaine | C Methamphetamine | D Amphetamine |

| 9 Craig was having problems sleeping, and spent a night in a sleep laboratory on his doctor’s suggestion, so that his brainwaves could be measured. Craig took a long time getting to sleep, but he finally fell into a deep sleep. The doctor used a device called an _________ to determine Craig’s brainwave activity. When Craig was in the deep sleep, his brainwaves became _________ and were _________ waves. |
| A EEG; faster; delta | B EEG; slower; beta | C EEG; slower; delta | D ECG; faster; beta |

| 10 The sleep laboratory asked Craig to subjectively report his sleeping experiences. Craig might do this through the use of _________. |
| A a sleep diary | B an EMG | C an EOG | D a psychometric vigilance test |
11 Craig had electrodes placed around his eyes when he was in the sleep laboratory. What device would this have been?
   A EEG  
   B EOG  
   C EMG  
   D ECG

12 Which of the following drugs slows down neural activity, making us feel sedated and calm?
   A Cocaine  
   B Caffeine  
   C Nicotine  
   D Cannabis

13 What is the lethal BAC for most adults?
   A 0.20  
   B 0.40  
   C 0.60  
   D 0.80

14 One of the effects of sleep deprivation is:
   A increased positive mood.  
   B increased negative mood.  
   C increased concentration.  
   D faster reaction times.

15 Going without sleep for 24 hours is the equivalent of what BAC reading?
   A 0.00  
   B 0.05  
   C 0.10  
   D 0.15

SECTION B: SHORT-ANSWER QUESTIONS

1 What are controlled processes? Provide an example to support your answer.

2 Name two devices that can be used to monitor consciousness and explain what they measure.

3 List three characteristics of an altered state of consciousness.

4 Describe the effects stimulant drug use has on the body and the brain.

5 Distinguish between selective and divided attention, using an example of each.

6 Explain the differences between amplitude and frequency in relation to brainwaves.

7 Explain how the electromyograph (EMG) and electrooculograph (EOG) are used.

8 Describe the measurement devices that will be used when spending a night in a sleep laboratory.

9 Describe the effects depressant drug use has on the body and the brain.

10 Explain the effects of sleep deprivation and why it is important not to drive when sleep deprived.

SECTION C: EXTENDED-RESPONSE QUESTION

You are part of a research team interested in the different ways drugs affect brainwave patterns as measured by an EEG. You want to test the difference in brainwave patterns between stimulant drug use and depressant drug use. For this study, you intend to compare three groups of participants. One group will be given a stimulant drug (such as caffeine), one group will be given a depressant drug (such as alcohol) and one group will not be given any stimulant or depressant drugs. The EEG recordings of all three groups of participants will be compared.

You are now required to design this investigation and write an introduction and method section of a scientific investigation report for this study. In your answer include the following:

INTRODUCTION

➜ a description of the key terms relating to the background of this research

➜ identification of the independent and dependent variables

➜ an aim and testable hypothesis

METHOD

➜ participants

➜ apparatus

➜ procedure.

This question is worth 10 marks.

SECTION D: ASSESSMENT TASK

DATA ANALYSIS

An important component of psychology is the conducting of research to learn more about the field. To understand the research you need to analyse the data that you collect. Complete the task below and answer the questions regarding the findings of each experiment.

TASK

Find a small group of participants. You could use some friends or your family. You will conduct two sessions (a meditation and a presentation) on two separate occasions with this group of participants.
**QUESTIONS**

1. Draw a graph that illustrates the results for accuracy of time.
   a. Discuss the differences between NWC and ASC in terms of time perception.
   b. What are possible reasons for this difference?
   c. What are other contributing factors or extraneous variables that may have brought about this change?
   d. Was the data as expected? Explain your answer.

2. Draw a graph that illustrates the results for accuracy of memory.
   a. Discuss the differences between NWC and ASC in terms of memory.
   b. What are possible reasons for this difference?
   c. What are other contributing factors or extraneous variables that may have brought about this change?
   d. Was the data as expected? Explain your answer.

3. Look at the way your data has been presented. Is this data an objective or subjective way to determine an individual’s state of consciousness? Explain your answer.

**MEDITATION SESSION**

1. Find a guided meditation recording that you could use for a meditation session. You could use a CD or download a meditation track from the Internet. The session should last for 10 minutes, so make sure your track is long enough. (If you cannot find a track, you can conduct the session in silence.)

2. Listen to the track and write down four questions about the material your participants will hear. The questions should help you identify whether the participants were concentrating on the track during the session. (If you are conducting the meditation session in silence, write down four noises you will make during the session.)

3. Run a 10-minute meditation session with your participants, playing the track. (If you are conducting a silent session, make sure you make the planned four noises during the session.)

4. At the conclusion of the meditation session, ask participants to record how much time they feel has passed and to answer the questions you wrote about the guided meditation session. (If you conducted a silent meditation, ask them to identify the four noises you made.)

**PRESENTATION SESSION**

1. On a separate occasion, present information to your participants on a topic of your choice. It could be something you have learnt at school or the latest storyline in your favourite TV show. Your presentation should last for approximately 10 minutes.

2. At the conclusion of the presentation, ask participants to record how much time has passed and to answer questions about the lecture.

   Collate your data from the questions asked after both the meditation and the presentation. Work out the average number of minutes participants thought had passed for each condition and the number of questions correct for each condition.