Entertainment Industry

**Mandatory Focus Area: Audio**

Welcome: this module will assist you to review and revise the content of the mandatory focus area ‘Audio’. Each focus area prescribes the scope of learning for the HSC and is drawn from associated units of competency.

You will have studied the competency [CUASOU301 Undertake live audio operations](http://training.gov.au/Training/Details/CUASOU301) which addresses the scope of learning (see HSC Focus Areas).

This module is broken up into:

* Important notes
* Key terms and concepts
* Activities
* Putting the theory into practice
* HSC focus areas

How to use the resource

Work through the notes and the suggested activities in any order. Great revision techniques include working through how a problem is solved, explaining the concept, testing yourself and retrieving information from your memory. Spread your revision over a number of sessions rather than sitting at one subject for lengthy periods.

Discuss your responses with your teacher, fellow students or an interested family member.

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# Important Notes

You should use the information here as a prompt and guide when revising your study notes or text-book information or other resources provided by your teacher.

You can also access industry specific information at [SafeWork NSW](https://www.safework.nsw.gov.au/), [Live Performance Australia](https://liveperformance.com.au/resource) and [Media Entertainment and Arts Alliance](https://www.meaa.org/).

The unit [CUASOU301 Undertake live audio operations](http://training.gov.au/Training/Details/CUASOU301) describes the performance outcomes, skills and knowledge required to interpret audio production requirements, participate in technical run-throughs and operate professional audio equipment during live performances in the screen, media, entertainment and events industries.

The outcomes of the HSC mandatory focus area ‘Audio’ require that the student:

* demonstrates knowledge of audio equipment and accessories used in the entertainment industry
* demonstrates an understanding of techniques used to produce and manage sound
* interprets documentation and applies this information to set up and operate audio equipment to meet production requirements
* describes the relationship between audio and other technical and creative aspects of live performances and events
* applies the troubleshooting process to solve common faults and problems in audio equipment and operations.

## Audio system information

1. [**Components of a typical system**](http://web.archive.org/web/20110411222113/http%3A/hsc.csu.edu.au/entertain/industry/core/audio/3217/information.htm#components)
2. [**Some important audio terminology**](http://web.archive.org/web/20110411222113/http%3A/hsc.csu.edu.au/entertain/industry/core/audio/3217/information.htm#terminology)
3. [**Microphones**](http://web.archive.org/web/20110411222113/http%3A/hsc.csu.edu.au/entertain/industry/core/audio/3217/information.htm#microphones)
4. [**Cables and Connectors**](http://web.archive.org/web/20110411222113/http%3A/hsc.csu.edu.au/entertain/industry/core/audio/3217/information.htm#connectors)
5. [**Mixing desks**](http://web.archive.org/web/20110411222113/http%3A/hsc.csu.edu.au/entertain/industry/core/audio/3217/information.htm#mixingdesks)
6. **Audio Cues**
7. **Workplace Practices and Procedures**
8. **Production Context**
9. **Communication Protocols**
10. **Audio Concepts**
11. **Trouble Shooting and problem solving**

### 1. Components of a typical system

Most public address (PA)/audio/sound systems in live theatre, productions and events have the following components. Note that the components are listed in 'signal flow' order, that is, the order in which the devices interact with the signal (sound) in a typical system.

* **Sound sources:** equipment that generates sound as an analogue, electrical or digital signal. Examples include microphones, Laptop computers, USB drives, mobile phones, iPod, CD players (just about phased out now), DIs (Direct Injection Boxes), electric guitars, synthesisers, keyboards and samplers.
* **A mixing desk:** a device with which to control, balance and treat the various sound sources. The mixer may have a series of inputs which allow most types of sound sources to be connected and routed to the next part of the signal chain.
* **Signal processors:** devices used to treat or manipulate the signal from the sound sources so as to make it conform to the desired effect. Examples include compressors, reverb units and equalisers. Some of these may be in the mixing desk and some may be external devices.
* **Amplifiers:** devices designed to increase the level of the mixed and treated signals to the point at which they can be transmitted to a loudspeaker to create sufficient volume.
* **Loudspeakers (or speakers):** these convert the electrical signal from an amplifier into sound waves and direct the resultant sound into the auditorium. Active speakers, also known as powered speakers, are becoming more popular in the industry as the technology used in them improves. They are convenient and quicker to bump in, but they are heavier than passive speakers as they have their amplifier built into them.

### 2. Some important audio terminology

A few basic terms are used frequently when dealing with audio and sound reinforcement system:

* **Amplitude:** the 'height' of a waveform, heard by the ear as volume. Increasing the amplitude of a noise will make it sound louder.
* **dB or decibels:** these are figures used to express the volume or Sound Pressure Level (SPL) of a noise. O dB is at the threshold of hearing - only just audible. 40 dB is at normal conversation level. 100 dB is equivalent to the sound of a train passing nearby. 130 dB is the threshold of pain and 150 dB is a jet engine at one metre.
* **Frequency:** the 'speed' of a waveform, heard as pitch, that is, how high or low sounds are to the ear.
* **Ohms:** the unit of electrical resistance. For example, the higher the ohm rating of a speaker, the greater the level of signal required to create the same volume from a lower ohm rated speaker.
* **SPL:** Sound Pressure Level is literally loudness, often expressed in dB.
* **Watts:** the unit of electrical power derived from the current (or 'quantity' of electricity) multiplied by the voltage (or 'pressure' at which the current is delivered). A small practice amp for a guitar may only provide ten watts, whereas a loud amplifier for a small theatre may be 400 watts per side and a large amplifier for an arena rock concert may be many thousand watts.

Except for **frequency** (which is heard as pitch), all of the terms explained above are either directly or indirectly concerned with signal level. This is due partly to the fact that sound operators are constantly trying to achieve the perfect balance of signal levels, but also because different components are designed to work optimally at very different levels microphone level, line level or loudspeaker level.

* **Microphone level:** microphone (or mic) level is a very low level of voltage, measured in thousandths of a volt, which is present at the output of a microphone. Microphone signals must be amplified at a pre-amp or at the microphone input on a mixing desk.
* **Line level:** equipment such as CD players, laptops, signal processors and mixing desks transmit (and receive) their audio signals at line level. This is still a relatively low level, with the standard set at 0.775 volts, usually referred to as 0dBu, which is equivalent to the softest sound audible to a young person with excellent hearing.
* **Loudspeaker level:** loudspeaker (or speaker) level is significantly higher than line level. Signals at line level would not produce enough power to make loudspeakers move and would therefore not produce sound. Line level signals are increased by power amplifiers which increase the voltage of the signal. This then becomes an increase in amplitude and thus SPL at the speaker.

### 3. Microphones

Microphones are the most frequently used audio device in live theatre, productions and events. They convert sound wave energy into electrical energy and are therefore the exact opposite of speakers. There are several different types of microphone:

**Dynamic microphone**: a small movable induction coil, positioned in the magnetic field of a permanent magnet, is attached to the diaphragm. When the diaphragm vibrates, the coil moves in the magnetic field, producing a varying current in the coil. Dynamic microphones are robust and relatively inexpensive and are used in a wide variety of applications.

Check out various [microphones](https://www.videocraft.com.au/audio/microphones) using the link (courtesy of [videocraft](https://www.videocraft.com.au/audio/microphones))

* **Condenser microphone** (also known as a capacitor microphone): the diaphragm acts as one plate of a capacitor, and vibrations produce changes in a voltage maintained across the capacitor plates. Condenser microphones are expensive and require an external power supply but give a high-quality sound signal and are used in laboratory and studio recording applications.
* **Foil or back electret microphone:** a relatively new type of condenser microphone which is now one of the most widely used. They are used in many applications, ranging from high-quality PA to built-in microphones in small sound recording devices. Like other condenser microphones they require an external power supply or a battery. They are frequently phantom-powered in sound reinforcement applications.
* **Ribbon microphones:** a thin, corrugated metal ribbon is suspended in a magnetic field. Vibration of the ribbon in the magnetic field generates a changing voltage. Ribbon microphones detect sound in a bi-directional pattern and this characteristic makes them useful in applications such as radio and television interviews, where it cuts out much extraneous sound.
* **Boundary microphone:** is mounted on a flat plate which acts as a reflective surface directing sound into the microphone capsule. They are used for general pick-up over a large area without as many reflected sound waves to interfere.
* **PZM (Pressure Zone Microphone):** an omnidirectional boundary microphone for picking up sound from all around.
* **Piezo microphone:** uses the phenomenon of piezoelectricity - (that is, the tendency of some materials to produce a voltage when subjected to pressure) to convert vibrations into an electrical signal. This type of microphone is often used to microphone acoustic instruments for live performance (most acoustic/electric guitars use piezo pick-ups) or to record sounds in unusual environments, for example underwater.

##### Directionality

This is the phenomenon by which a microphone is more sensitive to sounds coming from particular directions.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Omnidirectional | Bi-directional | Cardioid | Hypercardioid | Shotgun |
| omnidirectional microphone pickup pattern - circle with red dot in the centre representing the mic | **bi-directional microphone pickup; two adjacent circles with red dot where they join (the mic)** | **cardiod microphone pickup diagram; heart shaped pattern with red dot indicating position of mic** | **hypercadioid microphone pickup pattern; semi circle with some pickup behind the mic** | **shotgun microphone pickup pattern; pickup from all four sides of the mic** |

Depending on various aspects of a microphone's construction, it may be equally sensitive to sound coming in all directions (an omnidirectional microphone), or it may be more sensitive to sound coming from a particular direction (a unidirectional microphone). The most common of the unidirectional microphones is sometimes called a cardioid microphone because the sensitivity pattern somewhat resembles the shape of a heart. Most vocal mikes are cardioid or hyper-cardioid (similar to cardioid but with a tighter area of front sensitivity and a tiny lobe of rear sensitivity). Some microphones have more complex sensitivity patterns. Most ribbon microphones are bi-directional, receiving sound from both in front of and behind the element. This type of response is also known as a figure-8 pattern, because of its shape. Shotgun microphones, the most directional form of studio microphone, reserve most of their sensitivity for sounds directly in front of, and to a lesser extent, the rear of the microphone. Shotgun microphones also have small lobes of sensitivity to the left and right.

### 4. Cables and Connectors

##### Cables

**Microphone cables**

A balanced microphone cable consists of three main components—the conductors (internal wires, or cores), which carry the signal; the shielding, which helps protect the integrity of the information passing through the conductors; and in the case of a microphone cable, three-pronged connectors (XLR) that allow connection of the cable at either end. As the length of the cable increases, there is greater chance that there will be an increase electromagnetic and other noise interference.

**Instrument Cables**

Instrument cables are usually unbalanced cable consisting of two connectors with two conductors each, connected by two wires inside the cable—a signal wire and a ground wire. A standard TS (or “tip-sleeve”) guitar cable is an example of an unbalanced cable. Standard RCA cables used for many AV components are also unbalanced cables. An instrument cable is low power and high impedance. I tis designed to transfer a weak unamplified signal from an instrument to an amplifier, where it’s boosted up to a useable level.

**Speaker Cable**

A speaker cable is high power and low impedance. It is designed to carry a strong signal from the amplifier to the speakers. A relatively high AC current and voltage. Different to the instrument cable, it has two wire conductors, both with a large diameter which allows greater signal flow from amplifier to speakers. The connectors on speaker cables have changed to make them safer as you can get an electric shock from a speaker cable.

**Multicore**

An audio multicore cable a thick cable which usually contains between 4–64 individual audio cables inside a common, sturdy outer jacket. Using a multicore means that you only have to run one large cable rather than multiple cables. It is neater and more cost effective.

Audio multicores are used to transfer audio signals between two locations, such as the stage and the mixing console at the rear of the venue. Multicores often route many signals from microphones or musical instruments to an audio console and can also carry signals from a mixing console back to speakers. They are also used in recording studios to route signal from the recording booths to the mixing consoles in the control room. They have a ‘stage box’ om one end where the leads from the instruments, amplifiers and microphones are plugged into and ‘tails’ at the other end where they are connected to the mixing desk.

Many venues are now using Digital Multicores which are less made from Cat 5 cable. They are less bulky and much easier to manually handle. An analogue multicore is extremely heavy.

**Research**: Try to find an illustration of each of the cables described above.

##### Connectors

There is an extremely large number of different types of connectors used in the audio world. The most frequently encountered and therefore the most important types of connector are:

**Three-pin XLR or Canon connectors**

These are used for audio gear destined for the performance stage or recording studio. The three-pin XLR connector utilises a 'balanced' circuit, which consists of two phase-opposite signals on discrete conductors and a third conductor that provides a ground reference. Noise (such as induced hum) will appear equally - but out of phase - on both conductors where it can then be easily cancelled. It is very common for microphones to connect to mixers with a male three-pin XLR to a female three-pin XLR cable.

**RCA (phono) plug**

This is the most common connector type on consumer video, as well as for both digital and analogue audio devices. It is not a very good connector, but it is unfortunately what equipment manufacturers choose to use. It was originally designed to connect turntables and amplifiers inside phonographs made by RCA. It is an unbalanced connector and best used over only short distances. Most hi-fi gear and consumer/domestic audio gear use pairs of RCA phono to RCA phono cables, with both devices having sockets.

**1/4 inch 'phone' plug or jack**

Not to be confused with the RCA phono plug, this was developed by AT&T for use in early manual telephone switchboards, hence its name 'phone plug'. It can interconnect three conductors, referred to as tip, ring, and sleeve (TRS), and is therefore still a balanced connector. ¼ inch jacks are more commonly associated with semi-professional and project studio gear although the smaller size of the connector compared to the three-pin XLR plug has meant they are becoming more popular on professional gear. Most signal processors use ¼ inch jacks to connect with mixers. Many small amplifiers connect to speakers with ¼ inch jack to ¼ inch jack cables, with both devices having sockets.

**Speakon Connectors**

Speakon connectors have replaced XLR connectors in passive speaker systems. A Speakon cannot be accidentally removed and the casing shields the technician’s fingers from accidental electric shock if the system is accidentally turned on while the cables are being connected. The signal from an amplifier is strong enough to give an electric shock.

Speakon connectors are made in two, four and eight-pole configurations. The four-pole connector is the most common at least from the availability of ready-made leads, as it allows for things like [bi-amp](https://en.wikipedia.org/wiki/Bi-amping)s (two of the four connections for the higher-frequency signal, with the other two for the lower-frequency signal) without two separate cables. Likewise, the eight-pole connector could be used for [tri-amp](https://en.wikipedia.org/wiki/Tri-amping)s (two poles each for low, mid and high frequencies with two unused), or quad-amps (two poles each for high, mid, low and sub).

An additional use for the four-pole cable is to carry two channels of amplified signal from an amplifier to a pair of speakers using a 'combiner' Y-lead connected to the two output channels, and a 'splitter' Y-lead to supply the speakers.

**PowerCON**

Designed to replace the IEC connector, PowerCON connectors were originally made by Neutrik for connecting [mains power](https://en.wikipedia.org/wiki/Mains_power) to equipment in a small space. It looks and works in a similar way a [Speakon](https://en.wikipedia.org/wiki/Speakon) connector, with the connector inserted in the chassis connector and twisted to make contact and lock. The connectors are fully insulated even when disconnected.

The original PowerCON is designed for20 Amps. It is designed to stop people connecting two different mains supplies together. Type A is blue and used for power sources (power flows out of a blue-ended cable, into a chassis socket). Type B is grey and used for power drains (power flows from a chassis socket into a grey-ended cable). Couplers are available with one chassis socket of each type mounted on the ends of a plastic tube to extend cables.

Later on, Neutrik developed a larger 32 Amp version of the PowerCON. It only comes in one variant and is only intended to be used as a source.

A new version has also been developed for use outdoors which is resistant to dust and water.

**TOSLINK**

Short for Toshiba Link and called ADAT Optical by Alesis, TOSLINK is also a CD 'red book' standard that allows for digital audio (both left and right channels or multi-channel sound) to be transported between components using an optical conductor and light as the carrier. Contrary to popular belief, TOSLINK does not use laser light but instead relies on the output of a simple LED. The Achilles heel of TOSLINK is the optical quality of the interface. The plastic conductors used in cheap cables can damage data and compromise performance. TOSLINK connection performance is somewhat limited by the bend radius (bending a light conductor causes internal reflections and signal loss) of the conductor design. Additionally, the TOSLINK interface is length sensitive with maximum performance available only with runs of less than 20 feet. TOSLINK is used by Alesis and many other companies to connect digital multitrack recorders, digital mixers and other digital peripherals

**IEEE 1394 or FireWire or MLan or i.Link**

IEEE 1394, also named Firewire by Apple, MLan by Yamaha and i.Link by Sony, is a standard I/O interface designed to service the demands of the emerging multimedia bus requirements. 1394 is unique in its ability to carry video and audio with outstanding quality, based on its high bandwidth capabilities. This simple to use, peer-to-peer connection system can carry a dense multimedia data stream between computers, video cameras, high-fidelity audio products and imaging devices at a maximum speed of 400Mbps. The hot plugging capabilities of 1394 make it ideal as a consumer interface as well as a professional protocol, allowing users to daisy chain devices together on the fly

**Research**: Try to find an illustration of each of the connectors described above.

### 5. Mixing desks

A mixing desk, also called a mixing console, audio console, mixing board, sound board or simply mixer, is designed to manage the many and varied sound sources, sound effects, signal processors, amplifier and speaker configurations required for more complex productions, events or live theatre.

The overall job of a mixer is to combine many input signals into fewer output signals. Despite the huge number of possible input channels (desks typically have 8, 12, 16, 24, 32 or up to 128 inputs), each channel is almost always identical, and the sound sources are usually mixed down to a few stereo pairs of output.

The process of mixing can be simplified as follows: signals are sent to an input, levels are increased/altered, signals are treated, equalised and balanced then sent out to amplifiers and subsequently speakers. Mixers can be understood as plumbing for audio signals. Through a series of pipes and taps (circuits and pots/faders) the material is routed to where it is needed and sent on its way.

**Digital Mixers**

Digital mixers use electronic sound transmission to operate. They are expandable, so you can connect a greater number of external devices than you can with the same size analogue console.

A big advantage is that you can pre-program a controls ahead of time and bring them up when needed. Single controls can have multiple functions. This enables you to have a smaller mixer with greater functionality.

Digital mixers come with a large amount of on onboard processing equipment, often having a Graphic EQ (Equaliser), Parametric EQ, Sweepable EQ, Notch EQ and Shelving EQ. Plus, large libraries of editable audio effects such as reverb, delay, pitch shifting, chorus etc.

It can be more economically feasible to purchase a digital console due to the large variety of onboard effects and controls that come standard with the console.

One of the biggest advantages of a digital mixer is that ‘scenes’ can be set up and saved during rehearsals. This includes the fader levels for each input, the individual channel EQs for each channel, Effects used for each channel and the overall EQ for the item. All these adjustments done and controlled by one button.



**Analogue Mixers**

Analogue mixers use analogue sound transmission instead of digital sound transmission.

The benefits of an analogue mixer instead of a digital mixer is that the layout is simpler. Each control has only one function which makes it easier for a beginner to use. Less confusion with assigning multiple functions to one button. For fast live mixing where there has been no rehearsal time, you can mix easily without having to ‘change pages’ on the console. A disadvantage is the physical size of the console, a 32 channel digital console can have the same ‘footprint’ as a 16 channel analogue console. But on an analogue mixer, all the channels are there in front of you. You don’t have to change pages to get to different channels.

Analogue mixers are less expensive than digital mixers. It is considered that analogue mixers have a ‘warmer’ sound than a digital mixer.

### 6. Audio Cues

Audio Cues are the instructions that tell the audio operator what cue to play and when to play it.

All cues for the performance are recorded in the Prompt Copy Book. Often the audio operator will be given a version of the cues that only has the audio and lighting cues in it as all the other information contained in the prompt copy book will make it confusing and difficult to follow. Often audio and lighting cues have to be synchronised, so it can be an advantage for both lighting and audio operators to see each other’s cues. Colour is often used to help differentiate between Lighting and Audio, plus they are prefixed by LX or SX or audio or lighting. Something to make it clear who the instruction is referring to.

The stage manager will give a ‘Standby’ for the cue followed by a ‘Go’. The Standby allows the operators time to prepare for the cue.

During the rehearsal, the cue sheet may be modified a number of times. The lighting operator should note these changes in their own copy of the script. But it will be also recorded in the prompt copy of the script. Traditionally, cue sheets were updated after the rehearsal and new ones issued to the operators at the next rehearsal or performances. The development of digital prompt copy book software is now allowing the prompt copy and cue sheets to updated in real time.

**Research** Theatre Crafts provides excellent information about the use of [The Prompt Book](http://www.theatrecrafts.com/pages/home/topics/stage-management/the-prompt-book/) Read through the information and carefully examine the example of a ‘cue layout for a play’, ’cueing for a musical’ and ‘blocking notation’.

In corporate work or concerts the Prompt Copy book may be substituted for a ‘Run Sheet’. The show caller or stage manager may say Item One “Go’ and the audio operator will just operate the pre-programmed cues. In a corporate event, these cues may be turn on MC microphone, play presenter’s entrance music, turn up volume for the PowerPoint presentation etc. In a live concert, the audio operator will mix the band and other performers upon being given a Go”.

**Input List**

This is list is for the audio technician to let them see which microphones, DIs and other equipment is patched into the console. It will show which channel it is patched into on the stage box for the onstage multicore and which channels on the console the multicore is plugged into.

### 7. Workplace Practices and Procedures

|  |  |
| --- | --- |
| Production Roles |  |
| Director | Overall, in charge of all artistic content |
| Producer | Responsible for the financial and contractual side of a production. Employs crew, manages budgets, liaises with venues etc |
| Audio Director | An audio designer for television is known as a sound director |
| Audio Designer | Member of the production team for a show who is responsible for the overall sound of the production. The Audio Designer (or AD) is responsible for liaising with the director about how microphones will fit with the look of the production, also with the costume designer as microphones often need to be ‘hidden’ in costumes, wigs or jewellery. Also needs to consult with the set designer as speakers or microphones may need to be ‘hidden’ in the set.  |
| Audio technician | Audio technicians are involved with rigging speakers and hanging microphones (often known in the industry as ‘flying the speakers and mics) on stage. They also operate the audio mixing console or fold back console.  |
| Production electrician | The production electrician is responsible for all lighting elements of production, including (but not limited to) tech tables, running lights and any other elements as defined by the L&S Supervisor |
| Technical manager*(Technical Director)* | The TD (Technical Director) is the person responsible for supervising set up and maintaining the technical parameters of the production's audio equipment and operation. |
| Venue manager | In charge of the venue overall. Oversees bookings, venue security, venue staff |
| T.O.D.(Technician On Duty) | Employed by the Venue Manager to assist technicians hired for the event with their knowledge of the venue and its technical equipment |
| Wireless microphone technicians | Positions wireless microphones on performers, checks batteries, checks connections. |
| Location Sound Recorder | A location sound recorder is responsible for recording all sound which needs to be recorded whilst on set during film making. |
| Foldback engineer | A foldback engineer is a specialised job as the only audio the musicians hear is from the foldback. A foldback or monitor engineer operates the foldback speakers or monitors |

**Corporate and live performance events.**

Prior to bumping in an event, the client and the production company representative, TD (technical Director) Production Manager, or Sales Consultant etc will meet to discuss the event. The client will provide the production company with a ‘brief’. This brief will contain the details of the production. Details such as venue, date time, equipment required, type of event, bump in times and bump out times. During the initial meeting, the production company representative will need to clarify details and often ask the client to make changes. Often the amount of equipment the client requires bumped in will need more time than the client has budgeted for. Sometimes the client will have specified certain equipment be used, but it may not be appropriate to the venue eg speaker system too small, too big. Often the Production Company representative, will take the brief away, consult with the company’s technicians and prepare a brief that will suit the needs and budget of the client and is within the scope of the company.

Production companies will often have their own warehouse where they store their equipment between events. When equipment is returned from an event, it is cleaned, tested and checked for damage. Any damage is noted on the equipment register and the equipment is either repaired or disposed of according to company policy. Prior to being loaded for the next event the equipment is tested to ensure that it is working and that its test tag is in date. Malfunctioning equipment is very costly on a bump in.

They sometimes need to hire additional equipment for specific events, eg additional wireless microphones. When equipment is hired, it is tested and checked for damage on arrival. This is recorded on the hire sheet. When the equipment is to be returned any tape is removed from it and it is once again tested and checked for damage. Any damage is noted on the return hire form.

**Theatre events**

The Producer will organise a production meeting. This first production meeting is where a director communicates the production concept to set, costume, lighting, and audio designers, stage managers, producers, technical directors, and publicity managers. The audio designer will be able to glean from the discussion what equipment is going to be required from audio. From there an audio budget will be able to be produced. This budget will go to the Producer for approval. If the audio budget is too expensive, the Producer, Director and Audio Designer will need to discuss appropriate substitutions to bring the cost of audio down to the available budget. Sometimes, the show budget will have to be increased as the Director’s audio requirements will be critical to the success of the event. Most large theatres have an ‘in-house’ P.A system and wireless microphone systems, so this keeps the cost down for each production.

Sometimes the Director’s ‘concept may not be achievable due to the physical constraints of the venue. Once again negotiations between the audio Designer, Producer and Director need to take place.

Most theatres have onsite secure storage rooms. When equipment is bumped out after a production, it is cleaned, tested and checked for damage. Any damage is noted on the equipment register and the equipment is either repaired or disposed of according to the theatre’s policy. Prior to being prepped for the next event the equipment is tested to ensure that it is working and that its test tag is in date. Malfunctioning equipment is very costly in terms of time on a bump in.

**Bump In/Bump out**

During the early production process, the venue must be booked with a suitable amount of time for the Bump in and Bump Out. Sometimes if only a short amount of time for bump in is possible, more crew will be hired to complete the task. The producer has to work out the most economical way to bump in the event – the cost of additional crew versus the venue hire cost.

### 8. Production Context

Audio has wide and varied contexts in many different areas of the Entertainment Industry. Traditionally we think of audio in the context of a rock concert or theatre, but it is used in many more commercial contexts.

**Corporate Audio**

Corporate events are one of the largest areas of employment in the Entertainment Industry. Businesses use audio in their product launches, trade shows, public meetings and large corporate celebrations. Political parties employ audio companies to make their campaign speeches and public announcements heard. Corporate events are often as lavish as major rock concerts with large PA systems, moving and effects lights, haze, fog and pyrotechnics used to increase the excitement for the new product.

**Film**

Audio plays an integral part of the film industry. Whether the film is be being shot (filmed) indoors or outdoors, audio recording is used. An outdoor scene requires voices to be recorded while background sounds are filtered out. Before filming starts, the background sound (ambient sound) is recorded, this allows it to be removed postproduction. Often, the audio for a scene has to be re-recorded in a studio after the scene has been filmed as the ambient sound was not able to be fully filtered out, or the actor’s voices could not be heard properly.

**TV (Television)**

A large percentage of TV is shot indoors. Therefore, the audio crew are required to record the dialogue of the scenes being filmed. Recording in a studio is much easier as there is no ambient sound to be filtered out. In post-production additional sounds are added such as bangs, footsteps etc. This is known as Foley.

**Theatre and Opera**

Audio is used in theatre and opera for the following reasons

Sound reinforcement: Required so that the audience can hear the actors and singers

Mood: Music is played to set the mood of the scene. Is it a happy or a sad scene? Music is used to affect the audience’s mood

Time/Place: Music is used to set a time and place for the scene to occur

**Concert Audio**

Audio for Theatre and Opera is designed to subtly enhance the production. It is not intrusive. Live concert audio is different. It is meant to be loud and quite obvious. Speaker stacks are usually visible, and microphones are either hand-held or on stands.

**Ballet**

The audio for Ballet is often pre-recorded soundtrack played by the audio mixing console operator. Sometimes there will be a live orchestra and depending on the size and venue type, may need some audio reinforcement.

**Interrelationship with other technical and creative areas in live production**

Audio is used to assist setting the mood of production. It may be very obvious, loud and exciting for a live rock concert, or a beautiful soundtrack for a classical ballet. Or setting a mood and time of day for a theatrical production.

**Costume**

During the production process, the lighting designer will be consulted regarding costume design and where the wireless microphones can be fitted. Often the microphone will be hidden in the costume or may be set into a piece of stage jewellery.

**Filming**

If the production is going to be filmed, an audio feed will be provided to Vision Systems, this will used to put a soundtrack onto the film being made of the event.

**Electricity**

While Lighting is the biggest consumer of electricity in a live production event. Adequate power needs to be reserved for the audio system. Large amplifiers may require Three phase power. Available power needs to be carefully allocated. In large venues which regularly hold events. Lighting usually has its own dedicated circuits. Big outdoor events use generators and often Audio and Lighting will have their own dedicated generators. But sometimes generator power needs to be shared by all areas. The most difficult events are events where there is not a lot of power available and there are no allocated circuits for Lighting Audio and Vision. For this type of events, the three areas must discuss their needs and negotiate the allocation of power. If the event is in a small hall, the power requirements for dressing rooms eg hair straighteners, blow dryers etc can easily take up an entire circuit. The kitchen may also have urns, which also take up a circuit each.

Discussions between Lighting and Audio need to be held to decide where the cable runs will be. If the audio cables are run too close to the lighting cables, every time the lighting changes state there will be a buzz through the speakers. Lighting and Audio must never be on the same circuit unless you want ‘buzz’ coming out of your speakers.

**Industry Jargon**

Every industry has its own jargon, it is important to learn the jargon so that you can communicate easily with other crew members. Some examples:

‘The Talent’ - this refers to anyone performing or presenting – the reason for the event. So, the talent might be a person giving a speech or someone doing a dance. It is not meant to be judgemental.

The ‘Gig’ - the ‘gig’ is the event, whether it be a wedding, a corporate event or a major musical event, it is referred to as the ‘gig’

Bump In/Bump Out - refers to setting up and packing up of the event

Cans - Industry jargon for a communication system

Mic - abbreviation of Microphone

Wet or Dry Mix - this refers to whether there is any audio processing on the sound. A dry mix has no processing, a wet mix has processing on the sound

Snake - refers to an audio multicore

Digital Snake - refers to a digital multicore

Gender Bender - adapter connectors to change plugs from male to female. Also known as sex changers.

Specs - an abbreviation of specifications. As a new employee you might be told to check the specs for a piece of equipment. In other words, look up the manual. It also has a slightly different meaning. If you are told to “Go spec the job”, you are being asked to find out what the client wants in terms of equipment and labour - the client’s specifications.

Aux - an abbreviation of auxiliary. Most audio consoles have one more auxiliary channels (often referred to as aux channels). This feature allows you to send a secondary feed of an [input channel's](http://www.mediacollege.com/audio/mixer/channel.html) audio signal to another destination, independent of the channel's main output. It might be to an effects processor, stage monitors or a sub speaker. They are a

**Difference between Audio and Sound**

Audio is anything audible that has been produced, recorded, or processed by something electronic or digital. Sound is anything audible, from any format or instrument. Music would also be in this category, where some audio would also include digital audio, for example beats or samples.

An Audio technician would oversee running the technician side of the processes, making sure all the equipment works and that the recording and playback levels are a good quality. A sound designer would focus on the design, style and creative "look" to the sound. This might be a mix of digitally produced audio, but also live and real-world music.

**Difference between a PA system and a sound reinforcement system**

A sound reinforcement system has many similar features and often the two types of systems can be interchangeable. A sound reinforcement system is primarily designed for the reproduction of music and will have a mixing console which allows for multiple sound sources and a variety of sound processing equipment for modifying the sound. A PA system is primarily designed to reproduce speaking voice and will often be permanently installed in a venue. But quite often in the industry people will call a sound reinforcement system a PA system.

### 9. Communication Protocols

The client usually communicates with the director, producer or technical director, rather than with the crew members. The technical director communicates with the crew supervisor eg Audio Director in larger events, the Audio team supervisor. If there is a technical issue, a crew member should report directly to their supervisor, rather than the technical director (the technical director’s role is more ‘big picture’ overseeing role, not dealing with a broken lead.

At all times, the client must be treated respectfully and made feel confident in the ability of the crew.

Prior to the production meeting, the client will have supplied a document outlining their requirements A Pre-production meeting with the client and the director, producer and technical director will occur where the client will discuss their requests and any issues pertaining to these requests will be discussed. In some events, the client is also the director.

During the live production, communication between crew is usually over comms or ‘cans’ as they are known in Entertainment Industry jargon. During the live production, the stage manager is in charge and will give cues to audio, lighting and vision. In corporate events, the stage manager is called the ‘show caller’.

Postproduction: the client has a meeting with the director, producer and technical directors. This is where the production is evaluated and improvements for the next event are discussed. In corporate work, the client may not attend the meeting. They may provide feedback to the director instead.

Meetings are held within production areas pre-production and post-production, these are usually run by the Head Technician of each area, eg Audio director

### 10. Audio Concepts

**Characteristics of sound in different environments**

Sound is affected by the environment. If you sing in the shower, you will have a rich reverberant sound to your voice. But if you sing the same song at the same volume in an open paddock, it will sound very different – quite weak and thin.

Sound waves need surfaces to vibrate. If there is just open space, there are not the surfaces for the sound waves to vibrate so the sound is weak and thin. This means that if you are designing a PA for an outdoor event, you will need a much more powerful system than you would for an indoor event.

The type of surface also affects sound. Recording studios use soft furnishings and soft coverings on walls to dampen the sound down and to minimise echoes. Traditional churches made of stone are usually very ‘live’ this means that a lot less sound reinforcement will be required than if the event was held in the open air.

**Measuring sound**

Sound energy travels in waves and is measured in terms of frequency (Hertz)and amplitude (force). The energy in a sound wave is measured in Decibels. A decibel metre is used to measure sound levels.

**Balancing and adjusting sound**

A mixing desk or audio console is used to mix and balance sound. But to get optimal results the levels of sound coming into the mixing desk need to be of a suitable level. Some audio inputs are very strong such as line level sound and some are much weaker such as mic level sound. Good mixing desks have gain controls near the inputs that allow the operator to decide how much signal is going to be coming into the console. Some have pads which immediately drop the incoming level 20dB (decibels). This is important because if some signals are too ‘hot’ (strong, loud) the weaker signals are lost, which means a well-balanced audio mix will not occur.

An Eq (Equaliser) is used to either make louder or softer certain frequencies. This affects the tonal balance of the sound and is also used to remove feedback.

Most audio consoles have on board audio effects. The most common are echo, delay, reverb and chorus. Operators should use effects minimally unless a very special effect is required for a performance. Reverb is often added to a singer’s voice to make it sound richer and fuller. A chorus slightly detunes the instruments sound and plays it with the original sound, once again making the sound richer and fuller, but if it is taken too far, the instrument can sound like an out of tune ‘Honky Tonk’ piano. Echo and delay are created by copying the original signal in some way, then replaying it a short time later. An echo can be set to repeat whole words or just the last syllable. It is quite useful for special effects if used carefully. short delays up to 120ms can be used to create vocal doubling effects, normally set with little or no feedback. Overuse of effects can lead to feedback.

Digital mixing consoles usually have a large range of editable effects. If you need a lot of effects for a production and you have an analogue console, you can use an external effects processor to provide the effects.

An auxiliary output on the mixing desk allows you to send a secondary feed, of an [input channel's](http://www.mediacollege.com/audio/mixer/channel.html) audio signal to another destination, independent of the channel's main output. This could be an effects processor, additional foldbacks or a sub-woofer speaker.

**Signal Flow**

Signal Flow Diagram

A signal flow diagram is used to show the path the signal will take from sound source (input) to speakers (output). This is used to show how the system is going to patched and which items are connected to which item.



A simple signal flow diagram for a small PA system

### 11. Trouble shooting and problem solving

If equipment is not working correctly, trouble-shooting procedures need to take place. Often the problem will be a damaged lead or connector which can usually be quickly rectified.

If this is not the case, check the company equipment log to see if this piece of equipment has any know faults and fixes. If that does not help, check the equipment manual, sometimes a problem may be a simple thing that has been overlooked. You can also look online to see if other’s have had the same problem with the equipment. Also check with workplace colleagues. Some equipment can be a little ‘temperamental’ and other colleagues may be able to show you how to fix it.

Equipment malfunctions can cost a lot of time at a bump in and can cause considerable stress to the technician. Sometimes, if it is within your level of authority, it is just quicker to get another piece of equipment from stores to substitute the malfunctioning piece of equipment. It is important to log any equipment faults, otherwise, you may be facing the same problem at the next event. If a piece of equipment gives you an electric shock, do not continue using it, label it and log it and find a substitute piece of equipment.

**Hums and Buzzes**

If you hear hums or buzzes in your system, the first thing to do is check if there is anything else on the same circuit that might cause interference. You may need to check the switchboard schedule to ensure that the same circuit is not providing power to another place, for example, the kitchen. Power outlets should have their circuits labelled on them. Multi-function venues may have circuits shared by stage, kitchen and dressing rooms. An intermittent buzz might be caused by a performer using a hair dryer in the dressing room. If this happens, organise and safely run an extension lead from a power outlet on a different circuit. Tape up the power outlet that is shared so that it is not used by another performer. It is often worth putting an Electrical Powered Outlet Device (EPOD) on the extension lead so that other performers are not tempted to remove the tape to use your circuit.

Another major cause of hums and buzzes is the lighting rig. If the lights and audio are sharing power, every time the lights are raised or lowered in intensity there will be a loud buzz through the speakers. You do not get the buzz it the lights are on full power or no power, but you will definitely get it at half power. To avoid buzzes and hums from lighting, run your lighting power leads well away from your audio cables. If they have to cross, cross them at right angles. This minimises the induction between the wires.

Lighting systems may work by changing the shape of electric waves from dimmers. These changing waves and voltages can induce small electric currents in audio leads and that grows to buzzes in amplified signals.

# Key terms and concepts

You can use the following information to revise the key terms and concepts from this unit of competency. Perhaps you could:

* Copy the table into your own file, remove all the key terms, then fill in the blanks (without peeking at the original file) with your own answers.
* Copy the table into your own file and remove the definitions. Write a definition in your own words – it doesn’t have to word perfect but should show you understand the concept.
* Add additional words and definitions as you work through your revision notes and activities. Add a row to the table by pressing ‘tab’ in the last box of the table.
* You could add an example of this term or concept which is relevant to the entertainment environment. If the key term was ‘safety hazard’ your Entertainment Industry example might be ‘double adaptors, piggy-back plugs, un-switched power boards and the daisy chaining of power boards is prohibited’.

|  |  |
| --- | --- |
| Key term or concept | and Definition |
| Audio equipment and accessories | This includes audio desks (mixers), amplifiers, CD players, input source equipment, loudspeakers (both front of house and monitor/foldback), microphones, signal processing equipment and audio accessories such as Minidisc, cassette, direct injection units, cables, multi-cores, power supplies and RF units. |
| Audio installation plans | These are usually 'ground plans' or 'bird's eye views' of the equipment and its position in a venue. They include representations of all installed audio equipment, signal flow and possibly some peripherals or accessories. |
| Audio operations | Those tasks which involve operating audio equipment. These include operating a PA system, input sources, microphones, mixer, amplifiers and loudspeakers. |
| Audio technician | A person who has the skill, expertise and knowledge to undertake audio operations. |
| Cables | All electrical components in a sound system are interconnected with cables - wiring which has been temporarily rigged to carry electrical current. |
| Decibel levels (dB) | A relative measurement for the volume (loudness) of sound. One dB is the smallest variation in loudness that the human ear can detect. It is also used to measure the difference between two voltages, or two currents. Zero dB (0dB) is the common reference point when discussing sound levels. Levels above 0dB are expressed as positive (+5dB) and those below as negative (-20dB). 0 dB represents the threshold of normal human hearing; 130 dB represents the threshold for pain; 140 dB causes irreparable hearing damage; 150 dB can cause instant deafness. Anything greater than about 192 dB can cause death. |
| Electricity | Conductive objects are always full of movable electric charges (electrons), and electric currents are motions of these charges. Voltage pushes the conductors' own charges along. A conductor has a certain amount of electrical resistance or 'friction' and friction with the flowing charges heats up the resistive object (the cable or filament). The flow rate of the moving charges is measured in Amperes, while the transfer of electrical energy (as well as the rate of heat output) is measured in Watts. The electrical resistance is measured in Ohms. Electrical power is used to drive all components in an audio system - even the potential energy in the magnetic field inside a microphone results in electrical energy. |
| Hertz (Hz) | A measurement of the frequency of sound vibration. (replaced the old measurement: cycles per second) One hertz is equal to one cycle per second. Frequency is heard as pitch (high or low in sound) and the extremes of human hearing are lowest at around 20 Hz and highest at around 20 kHz (20, 000 Hz). 10 Hz is the cyclic rate of a typical car engine at idle (equivalent to 600 rpm). 100 Hz is the cyclic rate of a typical car engine at redline (equivalent to 6000 rpm |
| Mixer (mixing desk, sound desk, sound board) | A desk comprising a number of input channels, where each sound source is provided with its own control channel through which sound signals are routed into two or more outputs. Many mixing desks can also change the quality of the sound through equalisation. A powered mixer has an amplifier built into it. Sound sources of varying levels are accepted which can be amplified if necessary. |
| Phase and phase cancellation | Two identical waves are said to be 'in phase' whereas two identical sound waves which are slightly apart in time are said to be 'out of phase’. Two identical waves in opposite phase (one is up while the other is equally down) cancel each other out acoustically. This has significant repercussions for an audio operator. If one speaker is out of phase with the other in a PA (the negative cable is connected to the positive input on one speaker) then several sounds will not actually be reproduced. This can be a problem in live sound and a blessing in recording where a copy of an unwanted signal can be put out of phase and removed completely. |
| Positioning and equalising techniques | Positioning of microphones and loudspeakers with regard to performers and the walls/floor/surfaces of the venue will have a significant effect on the overall sound of a PA. Particular frequencies may be increased or reduced and standing waves and feedback may be created. Equalisation (EQ) is the process of decreasing or increasing particular frequencies that are altered by the acoustic properties of a room or theatre. |
| Problems and faults | Audio is one of the hardest features of live theatre and events to control. If something is not working properly (a problem) or not working at all (a fault) the audio technician is expected to find the offending device, cable or connection and rectify the situation. |
| Rigging and positioning | Rigging and positioning of audio equipment is essential to its optimal operation. Amplifiers must be positioned in cool, dry positions; loudspeakers must be directed to the ear-height of the audience; microphones must be directed at (or near) the sound source; and cables should be rigged above the audience or placed carefully so as to avoid trip hazards or disconnection. |
| Signal processing equipment | Those devices in a PA/sound system designed to modify or alter the electronic signal from a microphone, instrument or any other signal input source like a CD player. Signal processing equipment includes reverb units, equalisation units, distortion pedals, compressors, limiters, expanders and effects units. |
| Sound in a circuit | A circuit is a complete path that allows electrical current from one terminal of a voltage source to pass to the other terminal, creating a complete electrical 'loop' around which current can flow. If 'sound' is in a circuit, it is an electrical 'analogue' of that sound which is being passed through a conductive material from one device to another. |
| Sound Pressure Level measurement | Sound Pressure Level (SPL) is the loudness of an acoustic wave stated in dB that is proportional to the logarithm of its intensity. It is a measurement of the loudness or 'volume' of a sound. |
| Sound system signal flow chart | A signal flow chart of a sound system outlines the direction of signal flow between the devices in a sound system. This usually includes (at least) sources (mics, CD players instruments etc.), mixer, amplifiers and loudspeakers. |
| Work Health and Safety (WHS) issues | There are many WHS issues with regard to audio operations but the most common are actually related to excessive volume (SPL) in the workplace. Excessive exposure to high levels can cause permanent hearing loss. Other common WHS issues are injuries of lifting incorrectly or lifting weights beyond safe lifting limits, Electric shock for using damaged cables or equipment and the stress of having to deal with a highly stressful occupation with often unrealistic time frames, faulty equipment and nonstandard venues. |

# Activities

**Activity 1: Short answer questions**

* 1. What are the advantages of using a multicore?
	2. Why is the compulsory use of a Technician on Duty (TOD) a contentious issue?
	3. Why is it useful to have an Auxiliary output on your console?
	4. What is the difference between a Sweepable and a Parametric Equaliser?
	5. What is a decibel?
	6. What is the role of a foldback or monitor engineer?
	7. What is the difference between a Public Address system (PA system) and a sound reinforcement system?
	8. What happens when you use multiple microphones on one sound source?
	9. What is a location sound recorder responsible for?
	10. Write a short description of each of the following roles in ‘audio’

director

producer

audio designer

audio engineer

audio technician

radio technician

technical manager

venue manager

**Activity 2: Signal flow**

Assume that each of the boxes (labelled a – e) represent a signal flow diagram.
Insert the correct component name in each box.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| Amplifier | Mixing desk | Signal processor | Sound sources | Speakers |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| a. |  | b. |  | c. |  | d. |
|  |  |  |  |  |  |  |
|  |  | e.  |  |  |  |  |

**Activity 3: Directionality**

Match the directional name to each diagram below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Use these names |  |  |  |  |
| Bidirectional | Hypercardiod | Omnidirectional | Shotgun | Cardiod |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Label each diagram |  |  |  |  |
| omni | bi | cardioid | hyper | shotgun |
|  |  |  |  |  |

**Activity 4: Scenarios**

A client wants your production company to provide the audio for their corporate event. Write a list of the questions you would ask each client to ascertain their needs so as to be able to plan for the event.

* 1. Client one - a shareholder’s meeting for about 50 people
	2. Client two - a product launch for their new car. Approximately 1000 people in attendance.
	3. Client three - an awards evening for the company’s highest achievers, approximately 500 people in attendance

**Activity 5: Designing a cue sheet**

You are in charge of the audio for one of your larger school events. This might be

* A special assembly which includes musical items
* A presentation by a guest speaker
* A variety night

Design an audio cue sheet for one of these events.

**Activity 6: Research project**

The local community hall owned by the council, is planning to install a new audio system. The hall is an ‘end on hall’ which seats 900 people, it has a 15 metre by 10 metre stage. Events held at the hall include weekly rock concerts, children’s ballet concerts, children’s ballet lessons, council meetings, art exhibitions, local theatre society musicals and dramas, chamber music recitals, piano recitals and functions such as weddings.

A large budget has been allocated to this project as the council wants the hall to have a ‘state-of-the-art’ audio system.

* 1. Research what audio equipment would need to be purchased to make this venue suitable for all of the above activities. The council expects a wireless microphone system, lectern microphones, suitable foldback speakers and an appropriate mixing desk to be part of this major upgrade to its audio system.
	2. Write a list of the equipment that will be purchased.
	3. Draw a signal flow diagram to show how the equipment will be connected.
	4. Justify why you have selected each item of equipment

**Activity 7: Audio at a rock concert**

Make a list of the equipment you would need to hire if you were the audio designer for the rock concert pictured.

Draw a signal flow diagram to show how it all would link together.



[‘rock concert"](https://www.flickr.com/photos/14627312%40N06/16036394656) by [jeancliclac](https://www.flickr.com/photos/14627312%40N06%22%20%5Ct%20%22_blank) is licensed under [CC BY-NC-SA 2.0](https://creativecommons.org/licenses/by-nc-sa/2.0/?ref=ccsearch&atype=rich)

**Activity 8: Word Search**

****

**Activity 9: Maintenance of equipment**

Locate at least five examples of activities which might take place in relation to maintaining audio equipment. Describe why this activity is important. The table will ‘grow’ as you enter information.

|  |  |
| --- | --- |
| Housekeeping practices | Why this is important |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

# Putting the theory into practice

The following questions are from [past years’ NSW HSC examination papers](https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/resources/hsc-exam-papers) for this subject. HSC exams are intended to be rigorous and to challenge students of all abilities. To better understand a question, you should look for key words and identify the aspect of the course to which these relate. You are then in a position to formulate your answer from relevant knowledge, understanding and skills.

All questions in ‘Putting the theory into practice’ are acknowledged © [2019 NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales.](https://educationstandards.nsw.edu.au/wps/portal/nesa/mini-footer/copyright)

## Multiple Choice

1. What does a dynamic microphone do?
	1. Amplifies sound
	2. Generates sound
	3. Converts sound into electrical signals
	4. Balances signals from the sound source
2. In an audio system, which of the following is the most powerful signal level?
	1. Amplifier
	2. Line
	3. Microphone
	4. Speaker
3. What cable is used to connect the audio desk to the amplifiers in a digital audio system?
	1. CAT 5
	2. HDMI
	3. Speakon
	4. XLR
4. What is the primary function of a compressor in an audio system?
	1. To graph the wavelengths
	2. To process the audio signal
	3. To input the sound to the system
	4. To monitor the decibel level of the output
5. While running a sound check the audio technician notices a ‘buzz’ coming from the speakers. What action should the audio technician take to solve this problem?
	1. Reduce the volume of live inputs
	2. Increase the low frequency of the live inputs
	3. Check that audio cables are not running parallel to lighting cables
	4. Check that audio cables are not running perpendicular to lighting cables
6. Which signal flow diagram will provide the best quality audio signal?



1. At which level can an audio signal present an electrical hazard?
	1. Mic level
	2. Line level
	3. Preamp level
	4. Speaker level
2. What Sound Pressure Level (SPL) would an audio operator expect from a heavy rock band?
	1. 60–75 dB
	2. 80–110 dB
	3. 120–140 dB
	4. 150–170 dB
3. What is the unit of measurement used to identify the frequency of a sound?
	1. Decibels
	2. Hertz
	3. Ohms
	4. Watts
4. Which function on the console would an audio operator use to monitor the audio signal?
	1. Preferred line
	2. Pre-fade listen
	3. Post-fade listen
	4. Priority fader listen
5. What documentation would be most useful when performing a line check on an audio system?
	1. Input list
	2. Cue sheet
	3. Equipment list
	4. Signal flow diagram
6. What is the function of +48v in an audio system?
	1. It increases the decibel level.
	2. It allows additional inputs.
	3. It provides phantom power.
	4. It adjusts gain appropriately.
7. To comply with a venue’s noise restrictions, what specific audio equipment should be used to control decibel levels? (
	1. Gate
	2. Delay
	3. Reverb
	4. Compressor
8. What does X represent in the soundwave diagram?



* 1. The amplitude
	2. The compression
	3. The frequency (
	4. The wavelength
1. A cable used to connect devices is shown.



* 1. a speaker to an amplifier.
	2. a camera to a vision mixer.
	3. a dimmer to a lighting desk.
	4. a microphone to the sound desk

## Questions from Section II

These questions should be answered in the suggested number of lines (handwritten) as it gives a guide to the length of your response.

Plan out your answer and key points before you commence writing

Question 1

* 1. Identify the specific equipment required to send a signal from a radio microphone to an audio mixing console. (2 marks)

* 1. Describe the functions of the pre-fade and post-fade auxiliary channels on an audio mixing console. (4 marks)

Question 2

A school entertainment crew has been advised it will need to set up audio and portable staging equipment on a basketball court for a formal school assembly with a guest speaker.

The following audio equipment is required for this assembly.

* + 1 × wired microphone
	+ 4 × passive speakers
	+ 1 × audio mixing desk
	+ 1 × laptop
	+ 1 × amplifier
1. Draw a labelled signal flow chart for this audio set-up. (2 marks)

|  |
| --- |
|  |

Question continues over

1. Draw and label a stage plan showing how the audio and portable staging equipment could be positioned for the set-up of this formal school assembly. (3 marks)

|  |
| --- |
|  |

Question 3

* 1. How would stagehands prepare the stage for a touring dance performance? (3 marks)

* 1. There is a change to the order of dance items during a rehearsal for the touring dance performance.

What steps should the audio department take to ensure this change is clear for future rehearsals and performances? (2 marks)

Question continues over

* 1. An item of hired audio equipment is damaged during a dance performance while on tour.
	Describe how the audio department should rectify this situation.? (3 marks)

Question 4

Use the audio cue sheet shown to answer parts (a) and (b).



Audio cue sheet from 2016 HSC Entertainment Industry exam

* 1. Describe what would be heard when Cue 3 is actioned. (2 marks)

* 1. The audio operator does not detect a signal from Stacey’s microphone. Describe the steps in the troubleshooting and problem-solving process to restore the signal to Stacey’s microphone. (4 marks)

Question 5

Identify an application for each of the three different microphone directionalities shown. (3 marks)

|  |  |
| --- | --- |
| omnidirectional microphone illustration |  |
| unidirectional microphone illustration |  |
| bi-directional microphone illustration |  |

Illustrations from 2015 HSC Entertainment Industry exam

Question 6

* 1. Identify the essential components of a sound system to be used in a school hall. (4 marks)

* 1. Identify an audio fault which could occur in a school hall sound system and describe the procedures to rectify it. (4 marks)

## Questions from Section III

The Section III question in the HSC is worth 15 marks -

* there will be one structured extended response question.
* the question will have two or three parts, with one part worth at least 8 marks.
* the question will have an expected length of response of around four pages of an examination writing booklet (approximately 600 words) **in total**.
* You may be guided to answer different parts of a question in SEPARATE writing booklets.

## Questions from Section IV

There will be one extended response question in Section IV (15 marks) of the HSC. This will provide you with the opportunity to:

* demonstrate knowledge and understanding relevant to the question
* communicate ideas and information using relevant workplace examples and industry terminology
* present a logical and cohesive response

The expected length of response for questions in Section IV is around four pages of an examination writing booklet (approximately 600 words).

You should allow about 25 minutes for a question in Section III and the same for Section IV of the exam.

You will note that these questions usually require you to bring together knowledge from several areas of study/competencies to do justice to the answer.

In each of the following, map out your answer using post-it notes or a sheet of paper. Pay particular attention to incorporating a variety of aspects of your Entertainment Industry curriculum into the plan. Consider why we have included this question within this staging module and what other areas of study you would need to draw upon.

**Question 1**

You are employed to coordinate an outdoor ANZAC Day Dawn Service which will be attended by a large crowd including numbers of elderly and less mobile people. The event includes a live vision feed from Gallipoli, production lighting and a speaker from the Australian Defence Force.

1. How will you ensure equitable access to this service for all attendees? (5 marks)

Students were instructed to answer part (b) in a SEPARATE writing booklet.

1. Describe the technical production requirements for this service. (10 marks)

**Question 2 (15 marks)**

The department structure for a new regional performing arts centre is shown.



Explain the responsibilities of at least ONE department and its relationship with production management to ensure the effective and efficient functioning of the performing arts centre.

**Question 3 (15 marks)**

Discuss current and emerging technologies used in different areas of the production of a live, televised talent quest.

**Question 4 (15 marks)**

An industry trade show is to be held in a convention centre with a 1000 person capacity. The event includes keynote speakers on the main stage, audio visual displays and supplier stands.

Describe the technical requirements and safety considerations for this event.

**Question 5 (15 marks)**

1. Use the information provided to construct a labelled audio installation diagram for a rock concert. (5 marks)



1. How should the sound designer work with internal and external customers in order to satisfy the audio requirements for this concert? (10 marks)

# HSC Focus Areas

For the purposes of the HSC, all students undertaking the 240 HSC indicative hours course in Entertainment Industry must address **all of the mandatory focus area** **content.**

The scope of learning describes the breadth and depth of the HSC Content and has been grouped together into key ideas/areas. The scope of learning describes the minimum content that must be addressed, and the underpinning knowledge drawn from the associated unit(s) of competency.

Entertainment Mandatory Focus Areas include:

* Audio
* Customer service
* Lighting
* Safety
* Staging
* Vision
* Working in the entertainment industry

The unit of competency associated with the focus area ‘Audio’ is [CUASOU301 Undertake live audio operations](http://training.gov.au/Training/Details/CUASOU301).

How to use the scope of learning for ‘Audio’ (which follows over).

* draw up your own mind map showing the connection between the various concepts listed; examples appear on the last page of this module
* use the key terms and concepts to add to your mind map
* add examples or case study prompts to show how the concept is applied in the entertainment working environment

The following information is taken directly from page 22 ff of [Entertainment Industry Curriculum Framework Stage 6 Syllabus (NSW Education Standards Authority) for implementation from 2020.](https://educationstandards.nsw.edu.au/wps/wcm/connect/82b1b2cb-f656-448a-9068-5716c4189897/vet-entertainment-industry-11-12-syllabus-based-on-CUAv4.1.pdf?MOD=AJPERES&CVID=) © [2019 NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales.](https://educationstandards.nsw.edu.au/wps/portal/nesa/mini-footer/copyright)

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| **production context** |
| * difference between ‘audio’ and ‘sound’
 |
| * industry-accepted terminology and commonly used jargon in the entertainment industry:
* specific to audio
* variations:
	+ - between analogue and digital audio systems
		- across different production environments/contexts and workplaces
 |
| * general scope of audio operations across different production contexts
 |
| * role and responsibilities of personnel in relation to audio operations:
* director
* producer
* audio designer
* audio engineer
* audio technician
* radio technician
* technical manager
* venue manager
 |
| * protocols for communicating with the customer/client, colleagues, a performer/presenter and supervisor about audio operations:
* pre-production
* during production
* post-production
 |
| * documentation commonly used in audio operations:
* audio cue sheet/plot
* signal flow chart/input list
 |
| * for each of these documents:
* purpose
* standard format(s) and common features
* content
* abbreviations, terms and conventions
 |
| * modifying/updating documentation:
* personnel with authority to modify/update
* processes
 |
| * importance of ensuring currency of version and the status of any amendment
 |
| * application of documentation for audio operations to specific job roles and work tasks
 |
| * read and interpret documentation for audio operations to obtain and convey information
 |
| **production context cont/d** |
| * how audio requirements vary across different:
* live performances and events
* indoor and outdoor venues
* various media (such as film, television and theatre)
 |
| * interrelationship between audio operations and other technical and creative areas in the production of live performances and events
 |
| **audio concepts** |
| * characteristics of sound in different environments
 |
| * measurement of sound/sound pressure level:
* decibels
* frequency (Hertz)
 |
| * fundamentals of sound in a circuit
 |
| * balancing and adjusting audio and signal levels
 |
| * tonal balance and equalisation
 |
| * audio effects and how and when to use them
 |
| * how signal flows through the audio chain and application when undertaking audio set-up tasks
 |
| * features and meaning of a signal flow chart for a typical sound system
 |
| * phase and phase cancellation
 |
| * power isolation
 |
| * application of audio concepts to the set-up and operation of sound systems
 |
| * music amplification techniques and their application to suit various production environments/contexts
 |
| **equipment** |
| * analogue and digital audio equipment commonly used in the entertainment industry including:
* audio accessories
* audio mixing console/desk
* cables and connectors
* input sources
* output sources
* signal processing
 |
| **equipment cont/d** |
| * for a range of audio equipment:
* name and general features
* purpose/function
* operation/use during live performances and events
 |
| **audio cues**  |
| * purpose/function of audio cues
 |
| * standard procedures used in the entertainment industry to plot, record, modify and operate standard audio cues
 |
| * sequencing, timing and speed of audio cues in accordance with production requirements
 |
| * how audio information is recorded and used within the prompt copy
 |
| * use of documentation for audio operations, including the cue sheet/plot, during a technical rehearsal
 |
| **safe work procedures and practices**  |
| * safe work procedures and practices when:
* undertaking audio operations
* positioning and rigging equipment
* working with:
	+ - cables and electricity
		- noise
* dealing with unexpected situations or unplanned events
 |
| * risk management when undertaking audio operations
 |
| **workplace procedures and practices** |
| * workplace procedures and practices for:
* determining and confirming technical and performance/event requirements for audio
* set-up, cabling and power-up of audio equipment and accessories
* conducting audio checks
* power-down and disconnection of audio equipment and accessories
* re-setting audio equipment and accessories
* checks, functionality tests and routine maintenance of audio equipment and accessories
* packing, storing and transporting audio equipment and accessories
* security of audio equipment and accessories
* dealing with hired, lost and damaged audio equipment and accessories
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| **troubleshooting and problem-solving**  |
| * sources of information for reference when troubleshooting and solving problems:
* manufacturer/supplier
* equipment manual
 |
| **troubleshooting and problem-solving cont/d** |
| * workplace documentation
* colleagues and supervisor(s)
 |
| * typical issues and challenges and common faults and problems that arise during audio operations for a live performance or event
 |
| * importance of considering:
* potential effect on production and performance schedules
* level of authority and approval to proceed
* work health and safety
 |
| * troubleshooting and problem-solving process:
* identify the fault or problem:
	+ - investigate likely cause(s)
		- eliminate unlikely options
		- conduct tests
* consider possible solutions
* take remedial action:
	+ - in accordance with:
		- manufacturer/supplier recommendations
		- colleague and/or supervisor instructions
		- within scope of responsibility:
		- rectify
		- refer to appropriate personnel
* evaluate effectiveness of action taken
 |
| * known solutions to a range of common/predictable problems in relation to audio operations for live performances and events
 |
| * workplace practices for recording and reporting
 |

Creating a mind map is a great way to organise your knowledge and understanding of the content of a topic.

You could use software such as a hierarchy chart, download ‘MindNode’ or similar or use a large sheet of paper (or several A4 sheets taped together)! It is important to try to include all the detail you can, so add definitions, case studies or examples to prompt your memory. Include the information downloaded from the unit of competency and also from the Scope of Learning and Key Terms and Concepts.