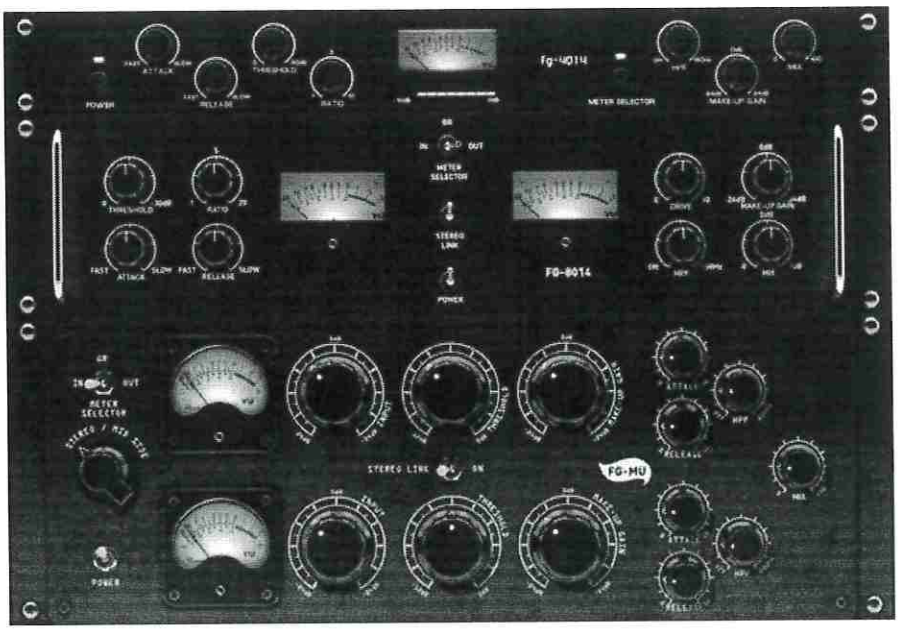
REVISION MATERIAL

Dynamic Processing



DYNAMIC PROCESSING

SHORT QUESTIONS

Which control on a compressor adjusts the level at which the compressor starts to react?

Which control on a noise gate controls how quickly the gate opens?

What name is given to the process of sending a signal from a compressor for further processing in order to change the way the compressor reacts?

A gate has been used on vocals. Briefly describe what a gate does

.....

.....

.....

.....

What would a compressor do to help this vocal part sit better in the mix?

.....

.....

.....

.....

GRIDS

Explain what the following compressor parameters do.

Parameter	Explanation
Example: Threshold	Signals above this setting are reduced in level
Ratio	(2)
Attack	(2)
Release	(2)
Make-Up Gain	(2)
Knee	(2)

DIAGRAMS

(a) Compression with a high ratio has been applied to the vocal to reduce the dynamic range. Illustrate this compression on the graph below using the following steps:

(i) Complete the labelling of both axes.

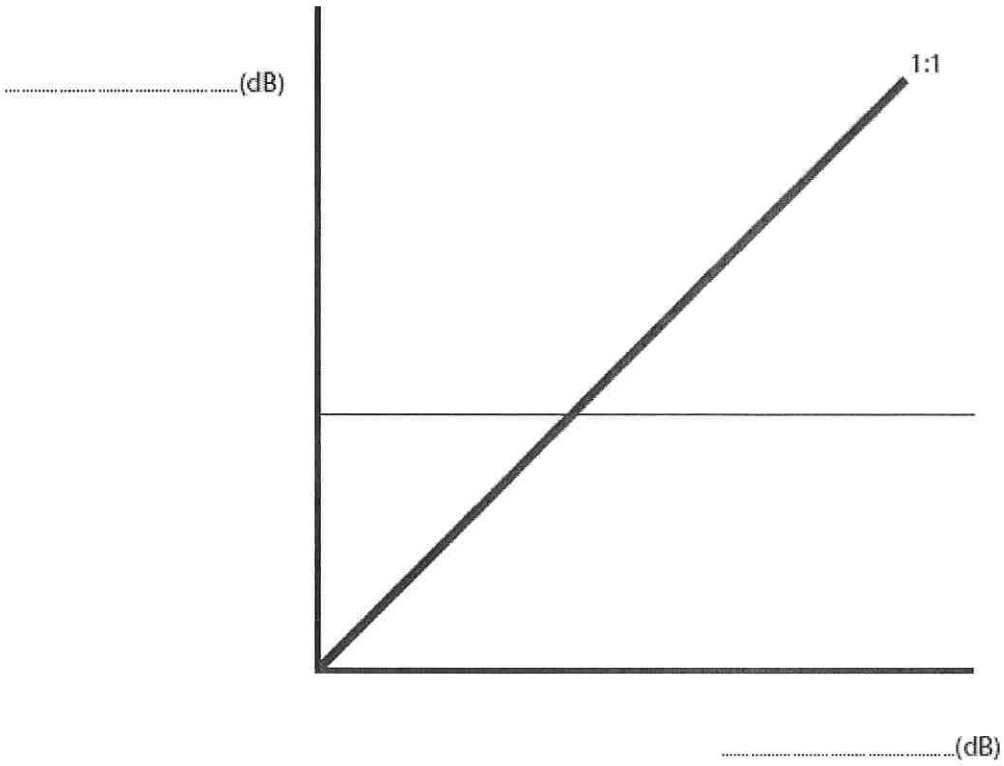
(2)

(ii) Label the threshold.

(1)

(iii) The unprocessed signal is shown with a ratio of 1:1. Draw a line to represent high-ratio compression. Label it with a suitable compression ratio.

(2)



SHORT QUESTIONS

Which control on a compressor adjusts the level at which the compressor starts to react?

Threshold

Which control on a noise gate controls how quickly the gate opens?

Attack

What name is given to the process of sending a signal from a compressor for further processing in order to change the way the compressor reacts?

Side-chaining

A gate has been used on vocals. Briefly describe what a gate does

Cuts out/turns down sound(1)below the threshold(1)

What would a compressor do to help this vocal part sit better in the mix?

Reduces the dynamic range(1)for a more consistent/even level(1)

MULTIPLE CHOICE

1. What are Dynamic Processors?

☐ A processor that alters the dynamic range of audio signals

(1)

2. Which is NOT a type of dynamic processor?

☐ Filter

(1)

3. Which processor reduces the signal below a set threshold?

☐ Expander

(1)

4. Which processor mutes the signal below a set threshold?

<table>
<tr><th>Question Number</th><th>Question</th><th>Mark</th></tr>
<tr><td>1(f)</td><td>Compression has been applied to the vocal. The table below shows the settings that were used. Explain why these settings were chosen.
Acceptable Answers
<table>
<tr><th>Parameter</th><th>Setting</th><th>Explanation</th></tr>
<tr><td>Ratio</td><td>15:1</td><td>High ratio / 15dB in, 1dB out / heavy compression (1)
Reduce dynamic range / evens out the volumes / avoid quiet sections being masked / avoid loud sections jumping out of the mix (1)
To match the narrow dynamic range of the sequenced parts / suits (electronic music) style/genre (1)</td></tr>
<tr><td>Gain make-up</td><td>+15dB</td><td>High gain make-up (1) because of high ratio / 15dB in, 1dB out / heavy compression (1) to compensate for loss of volume (1)</td></tr>
</table></td><td>4</td></tr>
</table>

PICTURES

Question Number	Question	Mark
3(c)	The settings below were used on the gate on the vocal recording. Why has the gate not completely removed the background noise?	3
	Acceptable Answers	
	Threshold too low / not set high enough / needs to be higher (1). Release set too long (1). Range too narrow / too low / not set high enough / needs to be higher/wider/increased (1). Some loud noises / paper rustle as loud as the vocal (1), so high threshold would cut vocal (1).	

DYNAMIC PROCESSING

ESSAY QUESTIONS

Figure 1 shows a valve compressor. Many of the controls are similar to those of a software plug-in. Explain the function of the controls and specifications that can be seen in the picture.

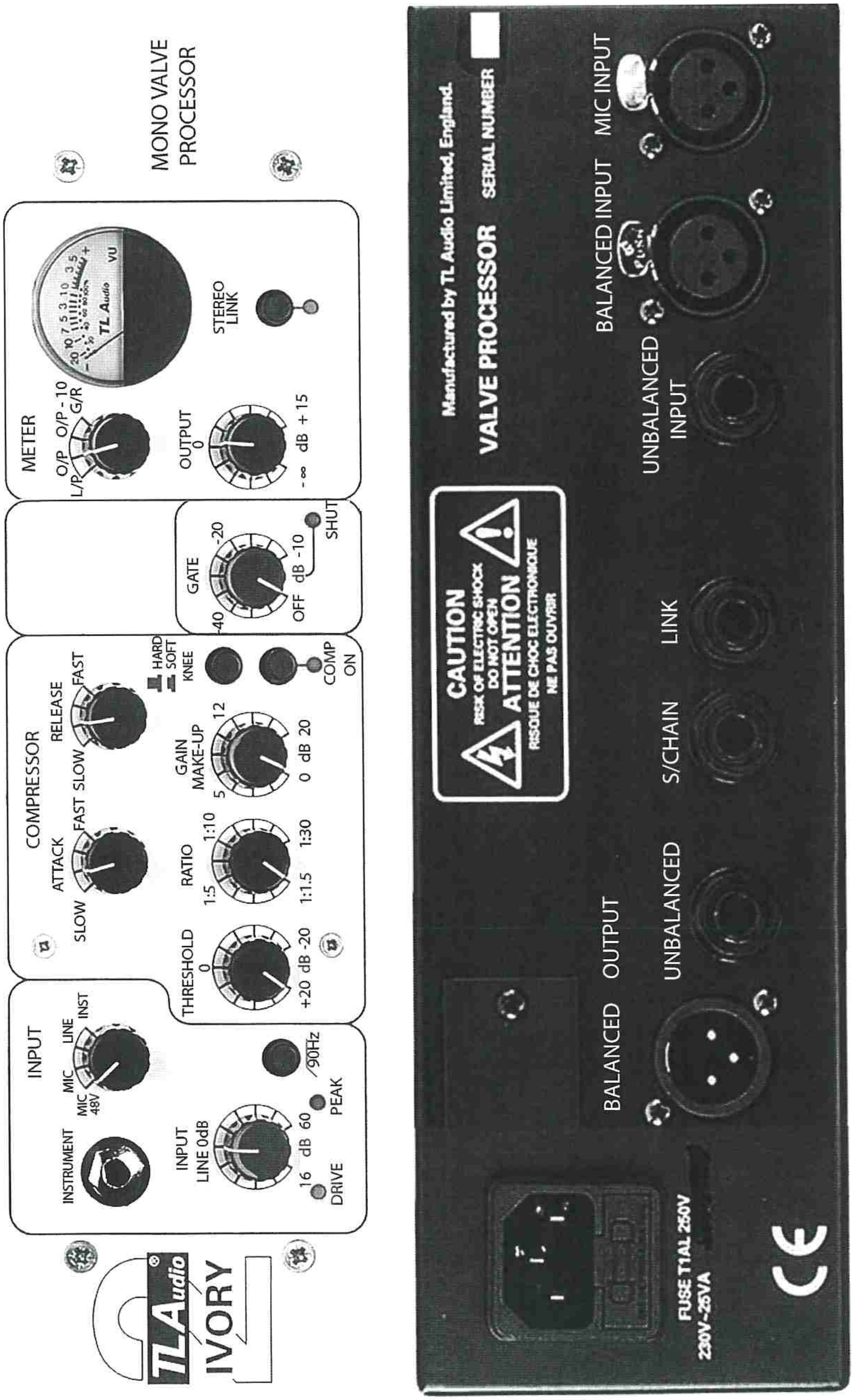

MONO VALVE PROCESSOR
METER
I/P
O/P
O/P - 10
G/R
TL Audio
VU
OUTPUT
0
- ∞ dB + 15
STEREO LINK
GATE
-40
-20
OFF dB -10
SHUT
COMPRESSOR
ATTACK
SLOW
FAST
RELEASE
SLOW
FAST
HARD
SOFT
KNEE
THRESHOLD
0
+20 dB -20
RATIO
1:5
1:10
1:1.5
1:30
GAIN MAKE-UP
5
12
0 dB 20
COMP ON
INPUT
INSTRUMENT
MIC 48V
MIC
LINE
INST
INPUT LINE 0dB
16 dB 60
DRIVE
PEAK
90Hz
TL Audio
IVORY
Manufactured by TL Audio Limited, England.
VALVE PROCESSOR
SERIAL NUMBER
MIC INPUT
BALANCED INPUT
UNBALANCED INPUT
CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN
ATTENTION
RISQUE DE CHOC ELECTRONIQUE
NE PAS OUVRIR
LINK
S/CHAIN
BALANCED OUTPUT
UNBALANCED
FUSE T1AL 250V
230V~25VA
CE

Figure 1

*Question 13

Compression

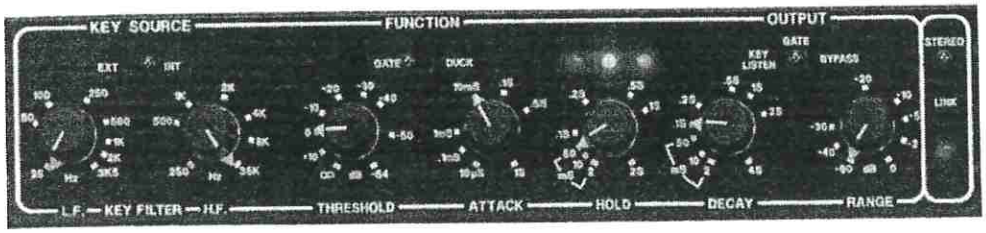
Evaluate the suitability of settings on the compression plugin below to control the volume of a vocal part in an electronic dance track.

Total for AS Level: 16 marks/Total for A Level: 20 marks

Question 7

Dynamics processing

The picture below shows a noise gate.



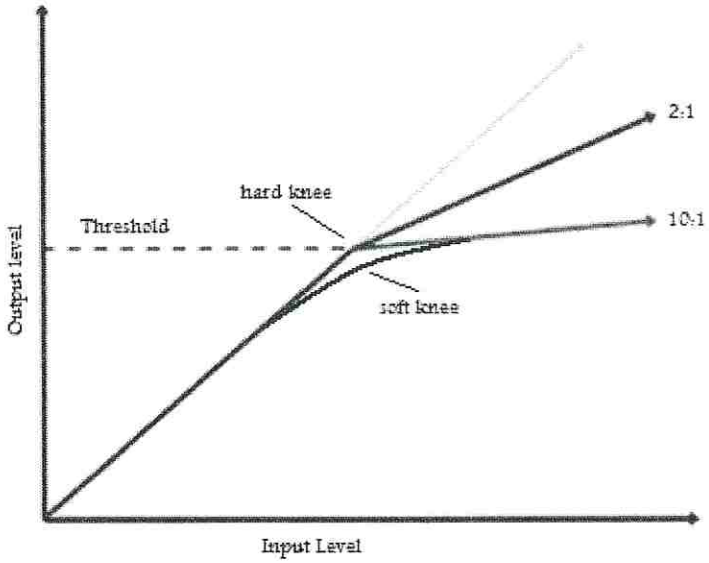
***a.** Describe the function of a noise gate. (2)

b. Describe the functions of the following noise gate controls. (3)

Control	Function
*Threshold	(1)
Gate/duck	(1)
Attack	(1)

***c.** Explain how you could use the controls on this gate to set up a synth part to play at the same time as the snare drum in a recording. (5)

Total for AS Level: 8 marks/Total for A Level: 10 marks

Question Number	Question	Mark
4b	Figure 1 shows a valve compressor. Many of the controls are similar to those of a software plug-in. Explain the function of the controls and specifications that can be seen in the picture.	16
	Acceptable Answers	
	Underlined technical terms must be spelt correctly All comments must relate to the correct knob/socket. **GENERAL DESCRIPTION OF COMPRESSOR** Reduces dynamic range/automatic volume control/evens out volumes (1)  Output AND Input correctly labeled (1) Threshold correctly labeled (1) Ratio correctly labeled (1) (*allow examples, e.g. 3:1*) Hard knee / Soft knee correctly labeled (1) **INSTRUMENT** Jack / TS / tip-sleeve (1) usually used for instruments such as electric guitar/synths / DI (1). **INPUT** Pre-amp (1). MIC 48V: Phantom power (1) used to supply power to condenser microphones (1) or DI boxes (1). MIC: Used for dynamic / ribbon (1). Credit any reference to impedance / resistance / sensitivity (1)	

	Gain knob (1) Turn down to prevent distortion / distorted if too loud (1) Reduce noise / good signal to noise ratio (1) Drives valve: saturation / soft clipping / harmonic distortion (1); colours the signal / warm (1) gain structure (1) HPF / high pass filter / low cut filter / rumble filter (1) **COMPRESSOR CONTROLS** **ATTACK:** time taken for the compressor to reduce the gain / start compressing (1). A longer attack time preserves the transients of the signal / A shorter attack time reduces the transients of the signal (1). **RELEASE:** time taken for compressor to stop working (*after* signal falls below the threshold) (1). Long release used to reduce pumping / make compression sound more natural (1). Affects sustain (1). **THRESHOLD:** Sounds **above** threshold are compressed / compresses **louder** sounds (1). Lower threshold gives more compression (1). **RATIO:** Amount of compression (1). Gives the ratio between the input signal and the output signal / specific example e.g. "2:1. For every 2 decibels (above threshold) only 1 decibel would be output" (allow ratio other way around) (1). A higher ratio gives more compression (1). Infinite / very high ratio / 30:1 gives limiting (1). **GAIN MAKE-UP:** Used *after* compression (1) to compensate the compressor reducing the gain / level (1). The amount of gain (make-up) required can be established by looking at the gain reduction meter / by ear (1). **COMP ON:** Bypass / in-out / wet-dry / a-b / compare the effect of the compressor before and after compression (1). **KNEE:** controls the bend in the response curve (1). A soft knee reduces the audible change from uncompressed to compressed / gradual onset of compression (around the threshold) (1). **GATE** Knob = threshold (1) Signal below the threshold (1) cuts out noise / quiet sounds (1). **METER** Switches between different metering modes (1) Volume unit meter (1) (not VU) Gain reduction (1). *[No credit for input/output]*	

	OUTPUT Master / after processing signal (1) **STEREO LINK** Links two mono compressors together to make one stereo compressor (1). Same gain reduction applied to both channels (1). Prevents image shift (1). **REAR** XLR (1) locking tabs (1) Line (1) for synthesiser / allow electric piano / credit any other line signal (1) not 'guitar/bass' Balanced signals have less noise / better signal to noise ratio (1). Accept any explanation of how a balanced signal works: two opposite polarity signals / cancelling out noise / destructive interference (1). Jack / TS / tip-sleeve *[don't double credit]* Credit any reference to impedance / resistance / sensitivity (1) *[don't double credit]* Side chain (1) allows compression amount to be controlled by external / different signal (1). Accept any valid example e.g. de-esser / pumping synths with kick drum (1). Kettle socket (1) IEC /C14/C13 (1). Internal power supply is more reliable than external power adaptor (1).	

*Question 13

Compression

Total for AS Level: 16 marks – AO3 4 marks, AO4 12 marks
Total for A Level: 20 marks – AO3 5 marks, AO4 15 marks

Marking instructions
Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below.

Responses that demonstrate only AO3 without any AO4 should be awarded marks as follows:

AS Level:

- Level 1 AO3 performance: 1 mark
- Level 2 AO3 performance: 2 marks
- Level 3 AO3 performance: 3 marks
- Level 4 AO3 performance: 4 marks.

A Level:

- Level 1 AO3 performance: 1 mark
- Level 2 AO3 performance: 2 marks
- Level 3 AO3 performance: 3 marks
- Level 4 AO3 performance: 4 marks
- Level 5 AO3 performance: 5 marks.

Content shown below is for AS and A Level. Content specific to A Level only is shown in italics.

Indicative content guidance
The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited.

Relevant points may include:

AO3	AO4
The compressor is being used to control the dynamic range of the vocal part/push down the peaks/ make the overall volume more even	A vocal part would require more compression when combined with electronic parts with a narrow dynamic range. The vocal part would naturally have a wider dynamic range than the electronic parts so compression would help the vocal to cut through the mix and maintain the intelligibility of the words
Low threshold value means there is likely to be a lot of compression Ratio is set at 5:1. This is the input volume compared to the output volume	A low threshold has been set because there are quiet phrases in the vocal part. The compressor is being used to add a lot of compression to increase the volume of these quiet sounds. If set incorrectly, this would create a ducking effect/be overcompressed. The input gain is adding about 2dB, meaning that the signal going into the compressor is probably slightly quiet. The make-up gain is used after compression to compensate for the compressor reducing the gain/level. It is set at around 2dB, which might not be enough given the low threshold. The ratio might need to be set higher; in electronic dance music heavy compression is often used, and 5:1 is not very heavy

The attack is the time taken for the compressor to reduce the gain/start compressing and the release is the time taken for the compressor to stop working (after the signal falls below the threshold)	*The fast attack is appropriate as it means it will prevent transients being too loud/because of the high amount of gain reduction. A fast release means that the volume will be consistently sustained across each word that is compressed. However, a fast release will also mean that the compressed vocal will duck/pump. A longer release time might make the sound more natural*
Knee is the bend in the response curve near the threshold	*Soft knee will make the vocal sound more natural, as the compression will be applied more gradually. This will reduce the audible change from uncompressed to compressed/ gradual onset of compression (around the threshold). If the vocal needs a significant amount of compression, the hard knee setting would make the compressor act more aggressively when the signal goes above the threshold*
There is a limiter function	The limiter is switched on but the threshold is quite high so is likely to control wayward peaks as opposed to 'brick walling'. This will give a natural sounding vocal but will prevent the odd peak slipping through the compressor. However, if there are lots of loud peaks, the threshold may be set too high and would benefit from being lower. Soft clipping is selected; this recreates the sound of analogue equipment and is often desirable when creating a natural vocal sound

The AS Level and A Level levels based assessment grids are given on pages 73-74.

Question 14 (A Level only)

Synthesisers

AO3 (5 marks)/AO4 (15 marks)

Marking instructions

Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below.

Responses that demonstrate only AO3 without any AO4 should be awarded marks as follows:

- Level 1 AO3 performance: 1 mark
- Level 2 AO3 performance: 2 marks
- Level 3 AO3 performance: 3 marks
- Level 4 AO3 performance: 4 marks
- Level 5 AO3 performance: 5 marks.

Indicative content guidance

The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited.

Music Production Terminology

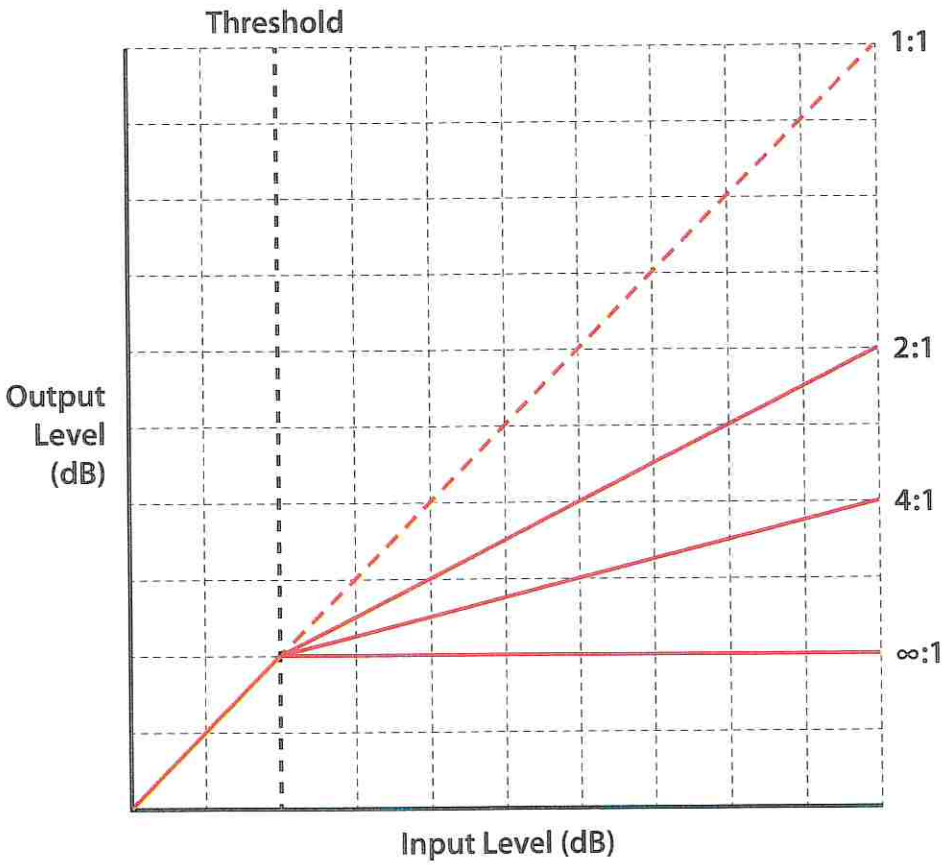
Compressors

A compressor is used to reduce the dynamic range of a recording. It will make the loud parts and quiet parts closer in level. This can be very useful if the level of a recording is inconsistent or if you want to make the recording sound louder and fuller.

The controls you will find on a compressor are:

Threshold
This is the level at which the compressor will start to act. When the signal level is below the threshold, it does nothing but as soon as the signal level is higher than the threshold it will reduce the level proportionally, defined by the ratio.

Ratio
This is the amount of compression that will be applied when the threshold is passed. For example, if the ratio is set to 5:1, then for every 5dB of signal that goes over the threshold at the input, only 1dB will be heard from the output.

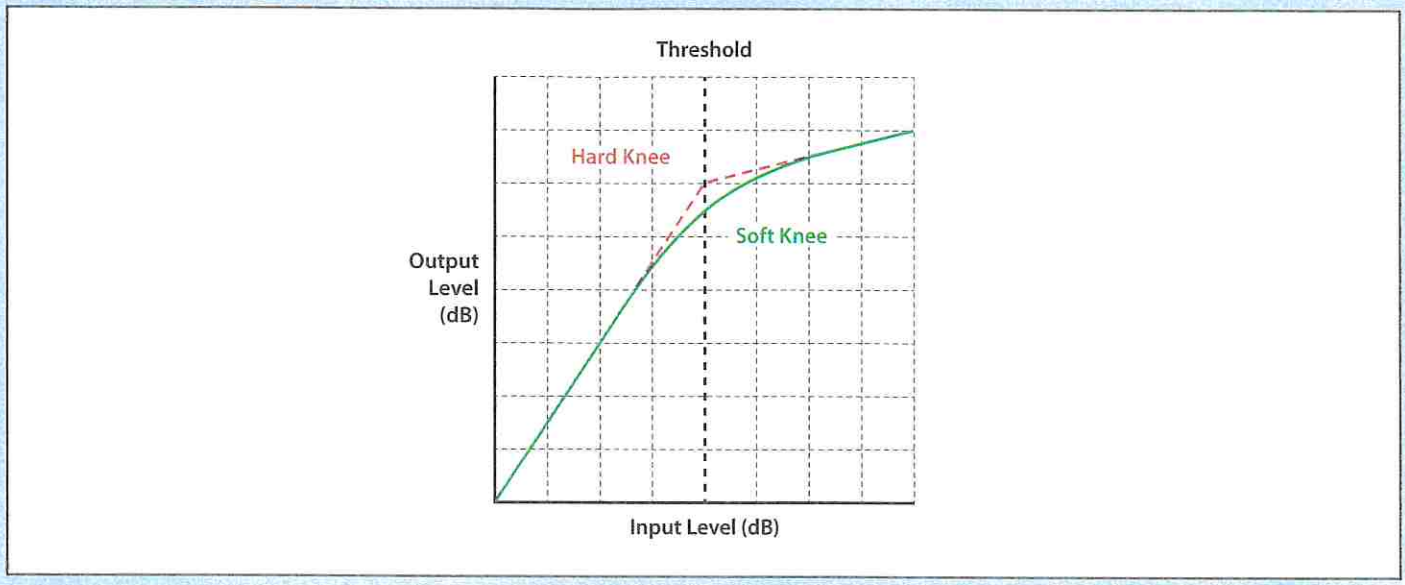


Attack
This is how quickly the compressor reacts when the signal passes the threshold. Adjusting this setting to make the attack slower makes it possible to allow signals with fast transients (such as drums) to pass through the compressor unaffected.

Release
This is how quickly the compressor returns to it's normal state after the signal level returns below the threshold.

Knee

This adjusts how harshly the compressor reacts when the threshold is passed. A 'hard knee' causes the compressor to immediately apply the ratio as soon as the threshold is passed, whereas a soft knee will gently ease from no compression to the full ratio as the signal increases. A soft knee can be useful for natural instruments where you want the compression effect to be subtle.



Sidechain

The Sidechain is an insert loop on a compressor which can be used to send the signal for further processing. See '*Sidechains and Key Inputs*' (p.22).

Bypass

This is a very useful button as it enables you to quickly switch the compressor on and off. Using this function you'll be able to check whether you're actually improving the sound.

Example Compressor:

Alesis 3630 Compressor (showing single channel in detail).

Limiters
A limiter is very similar to a compressor but with a much harsher effect on the dynamics of the recording due to it's very high compression ratio.

The controls you will find on a limiter are:

Threshold
This is the level at which the limiter will start to act. When the signal level is below the threshold, it does nothing but as soon as the signal level is higher than the threshold it will limit the output level.

Ratio
This is generally fixed at a ratio of 80–100:1, but some limiters may provide some flexibility.

Attack
This is how quickly the limiter reacts when the signal passes the threshold. Adjusting this setting to make the attack slower makes it possible to allow signals with fast transients (such as drums) to pass through the limiter unaffected.

Release
This is how quickly the limiter returns to it's normal state after the signal level returns below the threshold.

Knee
This adjusts how harshly the limiter reacts when the threshold is passed. A 'hard knee' causes the limiter to immediately limit the signal as soon as the threshold is passed, whereas a soft knee will gently ease from no limiting to the full ratio limiting as the signal increases. A soft knee can be useful for natural instruments where you want the limiting effect to be a little more subtle.

Bypass
This is a very useful button as it enables you to quickly switch the limiter on and off. Using this function you'll be able to check that you're actually improving the sound.

Example Limiter:
Universal Audio 1176LN

Gates

A gate is used to remove unwanted sound from a recording, it works by listening to the sound level of the recording and removing anything that is quieter than the wanted signal.

Here are the controls you will find on a gate:

Threshold
This is the level at which the gate will start to act. When the signal level is below the threshold, the gate 'closes', stopping any signal getting through. When the signal level is above the threshold, the gate opens allowing all the signal through.

Range
Rather than having a ratio control like a compressor, a gate will have a range control which specifies the amount the output signal is to be reduced by when the gate is closed. This is an absolute value in decibels which can be adjusted all the way down to minus infinity, meaning the gate is completely closed.

Attack
This is how quickly the gate reacts when the signal passes the threshold. Adjusting this setting to make the attack slower makes it possible to allow signals with fast transients (such as drums) to pass through the gate unaffected.

Hold
In addition to attack and release, a gate will also include a hold control. This determines how long the gate will stay open once the threshold has been passed. Once the hold time has elapsed, the release phase will start.

Release
This is how quickly the gate returns to it's normal state after the signal level returns to above the threshold.

Key Input
It is possible to use a signal other than the one you are affecting to make the gate react by feeding that signal into the key input.

Duck
The duck control on a gate reverses the way it responds to the key input. Normally if a signal is quieter than the threshold it will reduce the level. However, with the duck function active, the gate reduces the volume when the signal is louder than the threshold. This is a common function used by DJs to make the music reduce in level when they are speaking over the top.

Bypass
This is a very useful button as it enables you to quickly switch the gate on and off. Using this function you'll be able to check that you're actually improving the sound.

Example Gate:
Drawmer Powergate DS501 (channel 1 shown in detail).

Expanders

An expander is very similar to a gate and uses many of the same controls, but rather than use a range control it uses a ratio like a compressor. This means that when the gate is closed the signal is reduced by the ratio, rather than an absolute number of decibels. This enables the effect to be a little more natural sounding.

Example Expander:
Dedicated hardware expanders are rare as the feature tends to be incorporated with other units such as gates and compressors. Most DAWs include a dedicated expander such as the one shown below found in Logic Pro X.

Sound Formats

You're no doubt already familiar with the two most common audio formats, mono (one channel) and stereo (two channels). However, there are numerous other formats out there for enhancing the listening experience.

2.1 Sound

The next most basic format is known as 2.1. This features the usual stereo left and right channels but adds a subwoofer. This '.1' reference to a subwoofer is a common convention which you will see in numerous other formats.

In addition to the above, more channels can be added to enhance the experience for the listener. These formats can collectively be grouped as 'surround sound':

4.0 Quadraphonic Sound

This is a format which uses four equally spaced speakers, located in the corners of a room. This made it very convenient for the home listener and some albums including the classic 'Dark Side of the Moon' by Pink Floyd were released in this format.

Quad (as it's sometimes abbreviated) was an early version of surround sound, which remains to this day, but has largely been superseded by the following surround sound formats.

Sidechains & Key Inputs

Sidechain
The Sidechain is an insert loop on a compressor which can be used to send the signal for further processing. The signal received at the sidechain return is used as the trigger for the compressor but not sent to the output of the compressor – so it's never heard.

This makes it possible to make the compressor react in a different way. For example, if you want a compressor to compress more of the 'S's and 'T's in a vocal performances, you can use an EQ in the sidechain to boost those frequencies. This will make the compressor compress the sound more when those frequencies occur.

Sidechain Listen
Similar to a solo, this function allows you to hear what the compressor is reacting to at the sidechain return which may help you adjust the settings more accurately.

Key Input
The key input is similar to the sidechain of a compressor, except that it is just an input and not a loop.

It is therefore possible to use a signal other than the one you are affecting to make the gate react by feeding that signal into the key input. For example, you could feed a kick drum into the key input of a gate on a bass guitar so that the bass guitar is only heard when the kick drum triggers it.

Key Listen
Like a solo, this function allows you to hear what the gate is reacting to which may help you adjust the settings more accurately.

- **Delay** can be used to create a wider stereo image. Our brains don't perceive very short delays (a few milliseconds) as echoes or repeats, but as alterations in the position of a signal
- Setting complementary EQ settings on left and right channels or duplicates can create a sense of stereo width
- Stereo **reverb** can be used to give **mono** tracks some sense of stereo width
- **DAWs** often integrate plug-ins to achieve stereo widening, such as 'Stereo Spread' in Logic and 'Mono to Stereo' in Cubase
- Stereo widening can have a negative effect on mono compatibility, so it is important to check this before **bouncing down** if your mix is likely to be played back on a mono system.

PANNING LAW

There are two methods used by mixers and DAWs to control a track's position in the stereo field:

- **Reducing the levels of the left and right output channels as the pan control on a track is moved towards centre**
- **Raising the level of the left or right channel as the panned track moves towards that side.**

Both methods raise issues when considering levels in relation to pan position.

- **If you want the panned sound to seem like it stays at a constant volume regardless of the pan position, the centre attenuation needs to be 3dB. This is because the combination of the left and right signals from the two speakers will increase the perceived volume by 3dB**
- **However, because of this, if you want the sound to seem like the level stays constant when played back in mono, this value needs to be 6dB because when the left and right signals are combined, the new signal has an amplitude of 6dB**
- **Many mixers and DAWs compromise around 4.5dB (for example SSL), which reaches a rough compromise between the two.**

Many DAWs allow you to change the specific panning law used in a session; however, not all DAWs will default to the same 'method'.

Dynamic processing

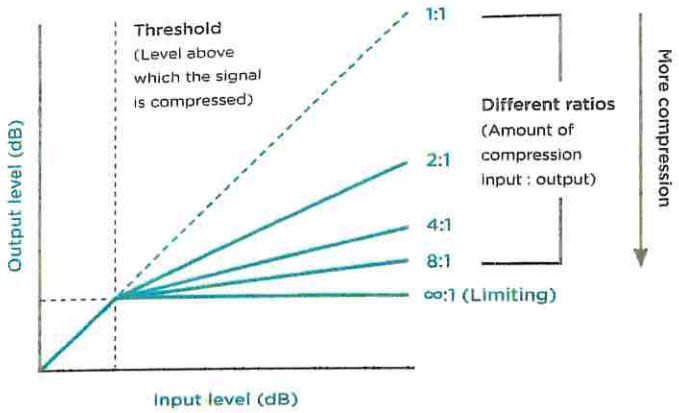
Dynamic processing is often rather difficult to hear in isolation – our ears can be more forgiving of changes in dynamics than changes in frequency – so examples of the following dynamic range processors will need to be rather extreme. By far the best way to become familiar with the sound of dynamic range processors is to experiment with them using your audio software or hardware units, adjusting the different parameters to see how they interact and change the sound of the music.

Compression

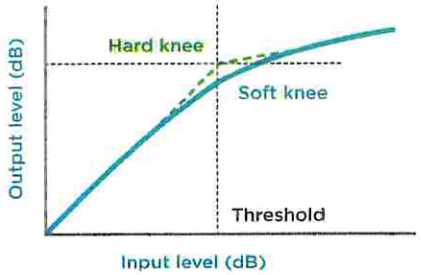
- A compressor reduces the dynamic range of music
- The most basic way of compressing the sound is to 'ride the fader' – when the volume gets too high, reduce the level of the fader and when it gets too low, increase the fader level
- This 'manual **compression**' was one of the ways engineers would originally have controlled the dynamic range of music
- However, it is not ideal as it takes time for the hand to respond to what the ear hears, so some peaks and troughs in volume will slip through
- A compressor automates this process by setting a level (the threshold) above which the compressor acts, reducing the volume of the signal by a certain amount (the **ratio**)
- After the **peaks** in the dynamic range have been reduced, the make-up gain boosts the whole signal
- Overall, this process 'squashes' or evens out the dynamic range of the music
- Extreme compression is audible, but when subtle, it is only really identifiable when comparing the two signals
- There is still a lot of 'riding the fader' used by engineers, but usually in the form of **automation**
- The engineer can graphically draw in changes that will then control the level of the track.

To find out more about automation and editing using a DAW, turn to page 47.

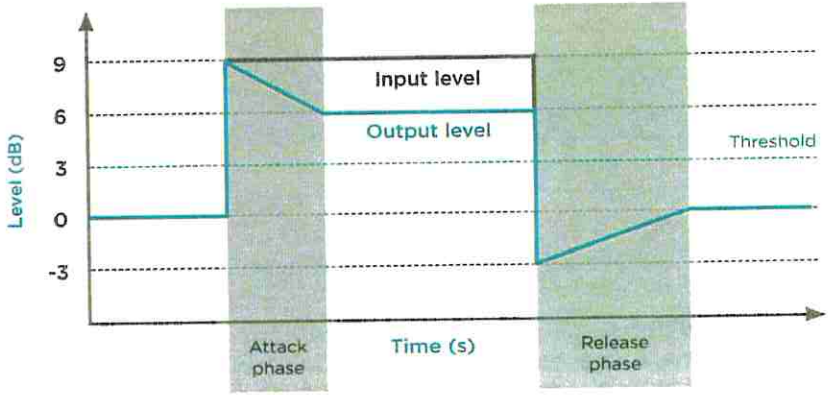
Compressor controls/parameters



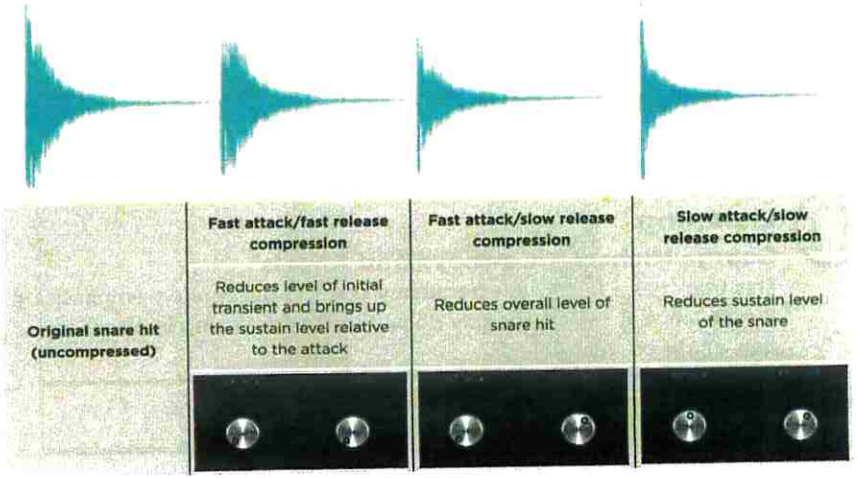
Threshold	The volume above which a compressor begins to compress.
Ratio	**Ratio** of input volume:output volume; how much the compressor will reduce the signal by once the signal is above the threshold; the amount of **compression**.
Make-up gain	Compensates for the reduction in volume that occurs as part of the compression process; increases the overall volume after compression.
Knee	The characteristic bend in the response curve when the signal crosses the threshold. A soft knee compressor gradually applies the **ratio**, whereas a hard knee compressor will apply the ratio instantly once the signal is above the threshold.



Attack	How quickly compression is applied once the signal is above the threshold.
Release	How long it takes for the compressor to stop compressing once the signal has fallen below the threshold value.



The effect of attack and release controls

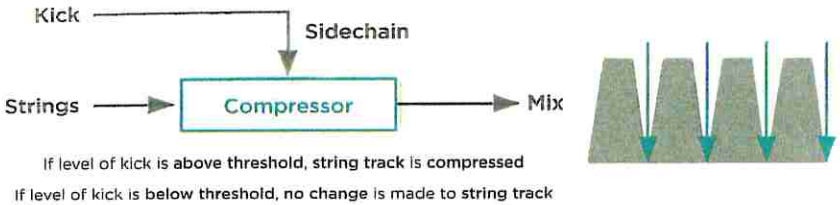


- When set too fast, **release** times can introduce 'pumping' or 'ducking' effects.

Listening
Kylie Minogue – 'Wow'
In the opening of this track, overcompression is used as a creative effect on the piano.

Sidechain compression

- **Sidechain** compression is where a compressor is triggered by the volume of one track, but the **compression** is applied to another
- In the diagram below, the strings will duck in time with the kick drum.



If level of kick is **above threshold**, **string track** is **compressed**
If level of kick is **below threshold**, **no change** is made to **string track**

Listening
Daft Punk – 'One More Time'
When the kick drum enters, the compressor is used to create a 'pumping' or 'ducking' effect on the **sustained** brass chords from 0:48.

De-essing

- Sibilant sounds such as 'sss', 'sshh', 't', and 'oh' can be distracting in a recording
- These sounds generally exist at frequencies between 5kHz-10kHz
- De-essers can control these specific frequencies within the mix and thus reduce this sibilance.

Listening
George Michael – 'Cowboys And Angels'
This track has a lot of high-**frequency** content, deliberately emphasising the sibilance. It could probably do with a little de-essing in places (e.g. at 1:14 on 'wish').

Limiting

- **Limiters** are compressors with extreme settings. They will have a **ratio** set as close to ∞:1 as possible (in practice this tends to be approximately 20:1). The term 'brick wall limiting' is used to describe this
- They are used to prevent signals from increasing beyond a certain level to avoid damaging equipment or increasing beyond an acceptable limit (e.g. 0**dB**), controlling the **peaks** a compressor might have missed.

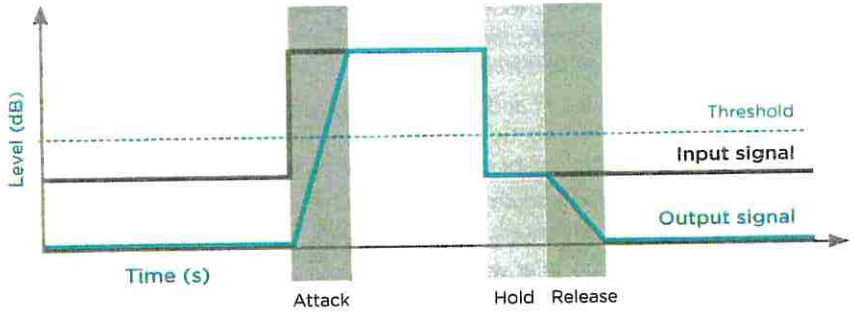
Compressors can work in peak or RMS mode. To find out more about these modes, turn to page 102.

Expansion and gating

- **Expanders** work in the opposite way to a compressor – they reduce the level of signals that fall below a set threshold, expanding the dynamic range instead of reducing it
- They are most commonly used as **noise** reducers, by setting the threshold for the quiet sections of the music so that the background noise is reduced in level, but when the vocalist begins singing, the level rises above the threshold and is unaffected.

Noise gates

- Noise **gates** are extreme **expanders** (in the same way that limiters are extreme compressors) – they have a ratio set as close to 1:∞ as possible, reducing any signal to silence when it passes below the threshold
- Noise gates can be used to remove background noise as long as nothing else is playing at the same time.



Threshold	The volume below which a noise **gate** silences audio. When the signal goes above the threshold, it opens the gate. An **expander** will reduce the volume of audio that is below the threshold.
Reduction/ range	The amount of volume the signal is reduced by. An expander will reduce the volume of **noise** below the threshold, a gate will completely silence it.
Attack	The amount of time it takes for the gate to open once the signal goes above the threshold.
Hold	The amount of time the gate stays open for after the signal drops below the threshold level.
Release	The amount of time it takes for the gate to close once the signal has dropped below the threshold level and the hold time has passed.

Sidechains and expansion/gating

- A noise **gate** or **expander** can also be controlled by a **sidechain**. This is also known as a 'keyed gate', and the gate will only open when the level of the sidechain trigger exceeds the threshold
- This can be used in electronic dance music to create short and choppy synth notes that play in time with rhythm parts.

Dynamic processing and mastering

- The use of **compression** and limiting on a whole mix increases the perceived loudness and average volume level of a track
- This has led to the so-called 'loudness wars', where there has been a trend over the past 20 years, particularly in remastered music, to create very loud masters with a very narrow dynamic range
- This can be tiring for the ear and means that musical interest needs to be generated using other production methods such as frequently varying the instrumentation, creative use of effects, filtering and so on
- When using **analogue** technology like tape and vinyl, having a loud track helps to mask the **noise** inherent in those formats
- Loud masters are also popular when releasing music for playback on equipment with small speakers, e.g. in mobile phones and tablets

- Some streaming services now use a process called loudness normalisation. This analyses the average volume of a song and applies an offset to avoid you having to constantly change the volume to compensate for louder or quieter masters. Whilst you can make your mix stand out on a CD through heavy compression and limiting, the opposite is true in the case of streaming services; longer, quieter sections often lead to a larger volume offset, and thus potentially a mix that stands out more
- Engineers will often use a reference track to ensure consistency between album tracks for EQ and dynamic range.

Equalisation

Equalisation (or EQ) was originally invented to compensate for tonal inadequacies in audio equipment. It was used exclusively to correct deficiencies in the sound, thus 'equalising'. As studio equipment became more sophisticated there was no longer the same need to compensate for its inadequacies, so EQ was used more creatively.

- Equalisation is the process by which different **frequency** ranges are increased or decreased in volume
- An EQ unit will give the user a combination of various filters that can be used in conjunction with each other
- Hardware EQs are limited by the components used in the manufacture and design of the unit, including the space on the front panel for the necessary controls, but have many desirable sonic qualities
- Plug-in EQs, used in audio production software can offer almost limitless features and combinations of filter types.

Filters

- A filter lets some of the audio signal through without changing it, but will cut or boost the signal level of a specific **frequency** range
- Examples of filters are: low pass (LPF), high pass (HPF), band pass (BPF) and shelving filters
- Parametric EQ can also be used to boost and cut different frequency bands
- Strictly speaking, a filter just takes something away from the signal
- In practical terms, most of the filters we would use for musical applications allow us to boost as well
- It is common to see individual filters as **DAW** plug-ins; like other effects, **automation** can be used to control their individual parameters.