

Exposure - Introduction

Exposure – What is it ?

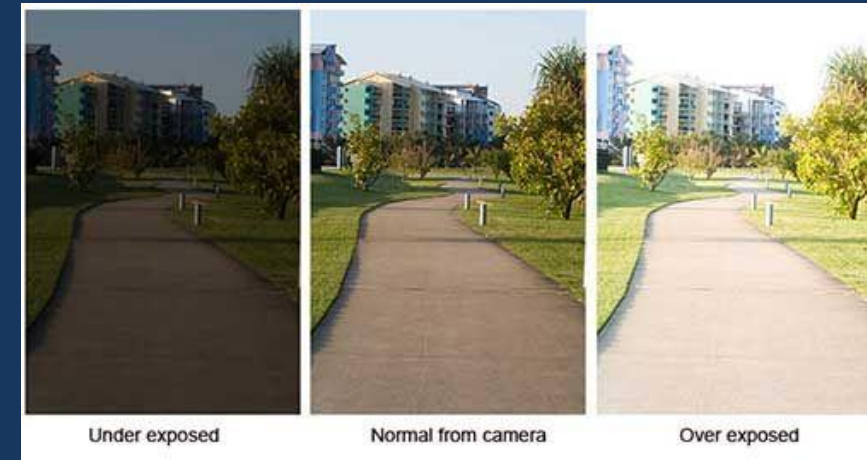
Exposure is simply how much light is allowed to reach the camera sensor or film.

This controls the overall brightness or darkness of a photograph.

The more you expose the film or camera sensor to light, the lighter your photo will be. The less light, the darker your photo will be.

Photos which are too dark (black) are said to be **under-exposed**.

Those that are too light (white) are called **over-exposed**.



Why is Exposure important ?

In my opinion.... A good image is correctly exposed and in focus

However, Photography is Art, so if you want to break this rule.....

- **Think about the context** – e.g. dark photos of people, out of focus birds/animals can look wrong
- **Make the effect clear and obvious, not just slightly out...**e.g. a blurry crowd scene works well
- **Don't use it all the time and Tell others what you've done !**
- **It is easier to correct wrongly exposed than out of focus images**



Exposure – how is it determined ?

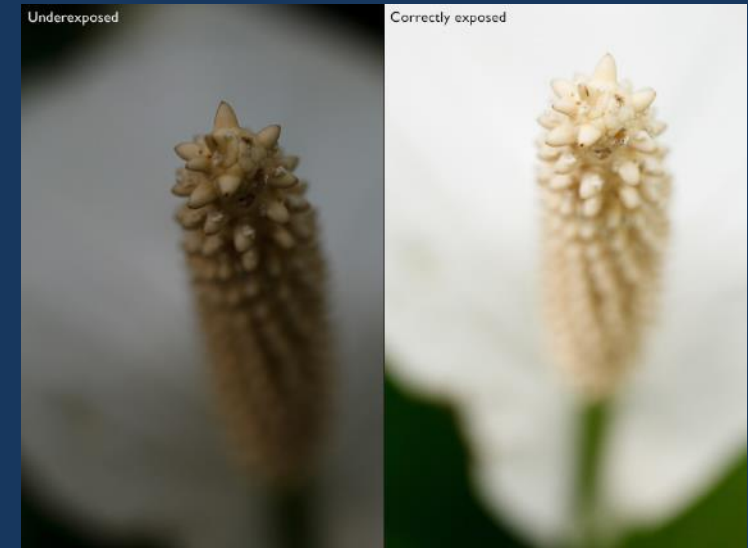
Inside the camera, a light meter automatically measures how much light there is coming into the sensor.

From this, the camera calculates settings which it believes will lead to a correctly exposed image.

As you move the camera around, e.g. from a light sky to darker ground, the settings automatically change.

The photographer can intervene and adjust these settings.

The camera expects a mix of light and dark areas in every image.



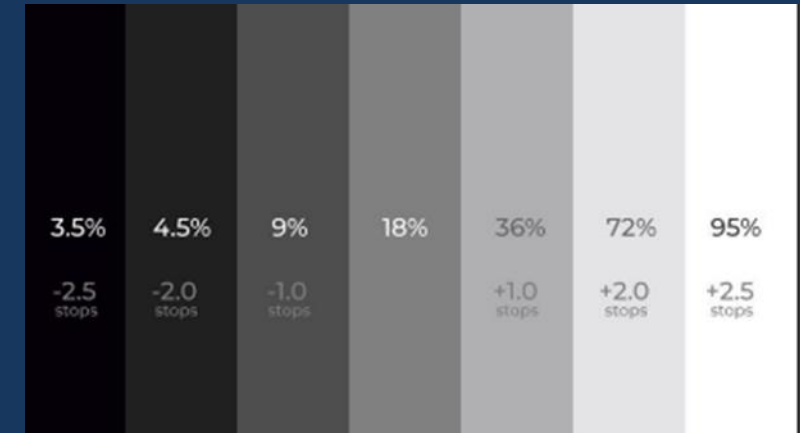
Camera's Light meter

The camera light meter sees the scene as points of different brightness, but as if the image was all black and white.

Each point is evaluated against the camera's base setting, the middle grey shade.

In simple terms, the camera checks if the average brightness of the image is more or less than the middle grey colour.

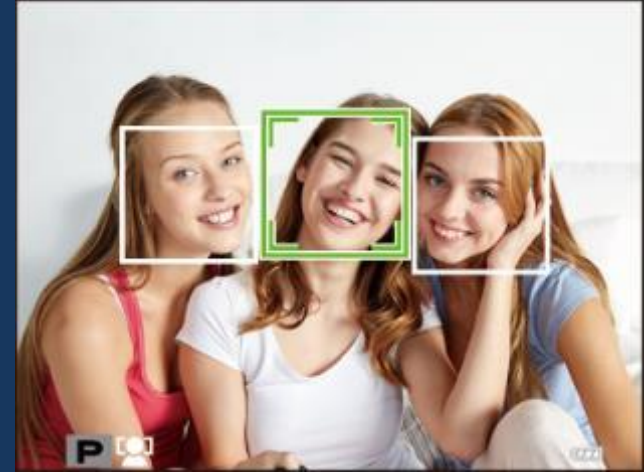
If the majority of pixels are darker than middle grey, the camera increases exposure and if the majority are lighter, it decreases exposure.



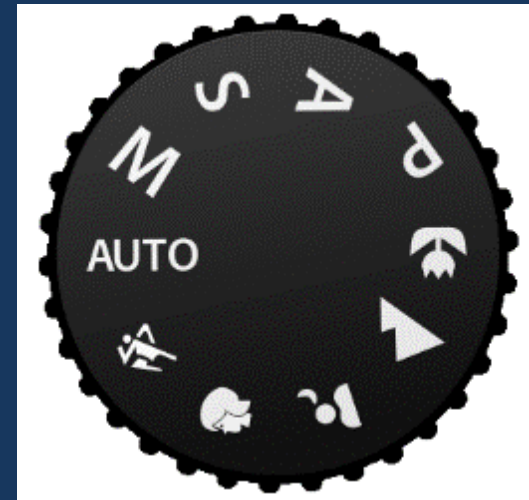
Camera's Light meter

Instead of the middle grey approach, some modern cameras can identify a scene and make exposure adjustments to fit the scene.

For example, they can recognise a face and base the entire exposure on this.



You can also do the same if you choose a scene setting on your control dial. You are telling the camera the sort of image you want to take.



However,...the light meter can get it wrong !

The Camera's auto exposure settings are designed to average the tones in an image to a middle grey.

Normally, the camera exposure settings work well...

However, the auto exposure can make very white scenes too dark and very dark scenes too light

Some examples.....



Camera Meter



Exposure Biased to the Background

Clothing example



Light clothing =>
Camera thinks too much light coming in =>
Camera under-exposes image



Dark clothing =>
Camera thinks not enough light coming in =>
Camera over-exposes image

Snow example



White snow =>
Camera thinks too much light coming in =>
Camera under-exposes image back to grey



Photographer needs to corrects by over-exposing

Dark examples



Music gig, black stage =>
Camera thinks not enough light coming in =>
Camera over-exposes image
Photographer corrects by under-exposing



Night scene =>
Camera thinks not enough light coming in =>
Camera over-exposes image
Photographer corrects by under-exposing

Backlit example



Light coming in from window =>
Camera thinks too much light coming in =>
Camera under-exposes image
Subject now too dark



Photographer compensates
Over-exposes auto setting
Subject now correct – but window is too light !

John – recent examples



Night challenge :
Camera thinks image is too dark
Tries to increase exposure.
I've corrected this to retain the dark areas.



Shooting into the sun :
Camera thinks image is too bright
Tries to darken exposure.
I've corrected this to retain the white areas.

What Affects Exposure ?

3 different camera settings affect the image exposure

1) The shutter speed

If the shutter is opened and closed quickly, only a small amount of light reaches the sensor.

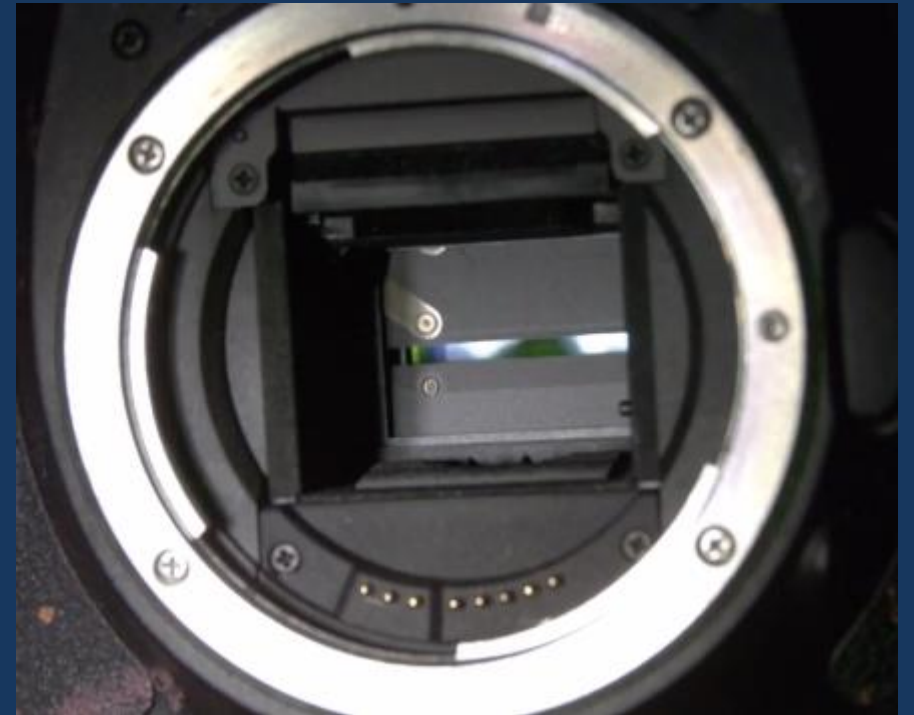
If the shutter closes more slowly, more light can enter.

Think of a door opening and closing.

The slower the door closes, the more light can enter.

Fast shutter = less light

Slow shutter = more light



What is the Shutter ?

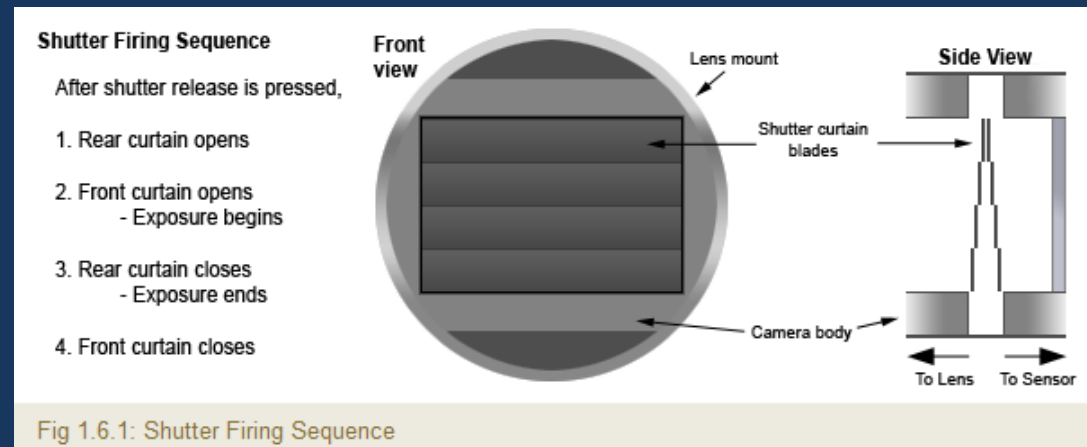
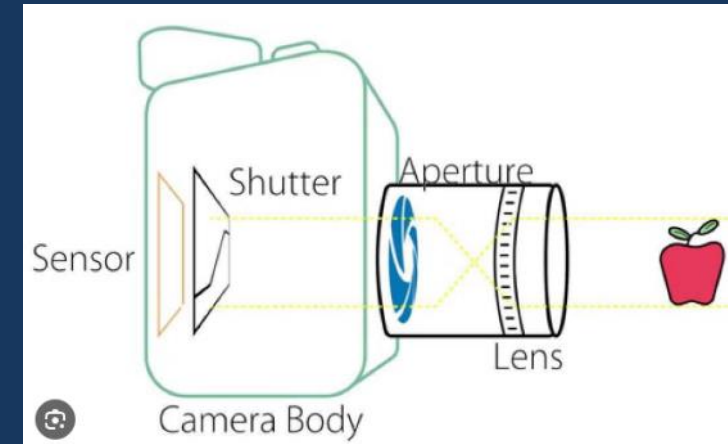
The shutter is a mechanical or electronic device that controls how long a camera's sensor is exposed to light.

With the mechanical shutter, there is a “curtain” in front of your camera sensor. This curtain usually stays closed until you take a photo.

When you press the shutter button, the curtain opens and fully exposes the camera sensor to the light that is coming through your lens.

At the end of the exposure, the shutter curtain closes, stopping any further light from reaching the sensor.

With an electronic shutter, the camera electronically signals the sensor to start and stop recording.



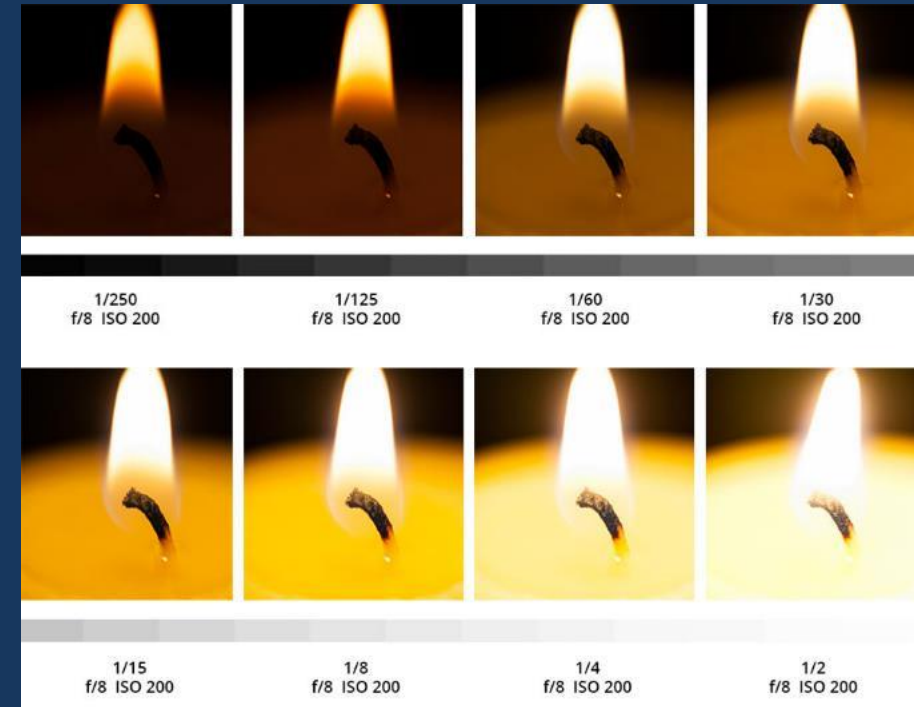
What do the shutter settings mean ?

So, a longer shutter speed lets in more light and a faster shutter speed lets in less light but...

Each time we move from 1 speed setting to the next, we are doubling or halving the amount of light which reaches the sensor

Move to a lower fraction = doubling the light

Move to a higher fraction = halving the light



The shutter affects our image in another way...

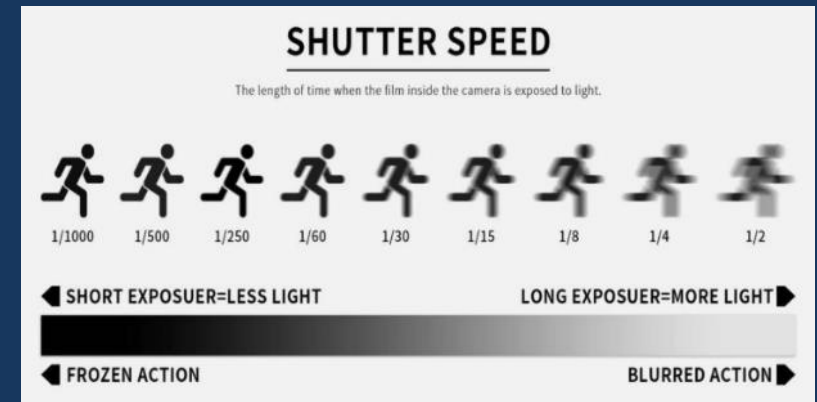
It controls the amount of blur in the image.

A slower shutter has a more chance of blur, than a faster shutter speed.

The amount of blur also depends on how fast the subject is moving.

So, for Sports, a sharp image may be preferred = faster shutter.

For Light-trails or blurry images, we need to use a slower shutter.



What Affects Exposure ?

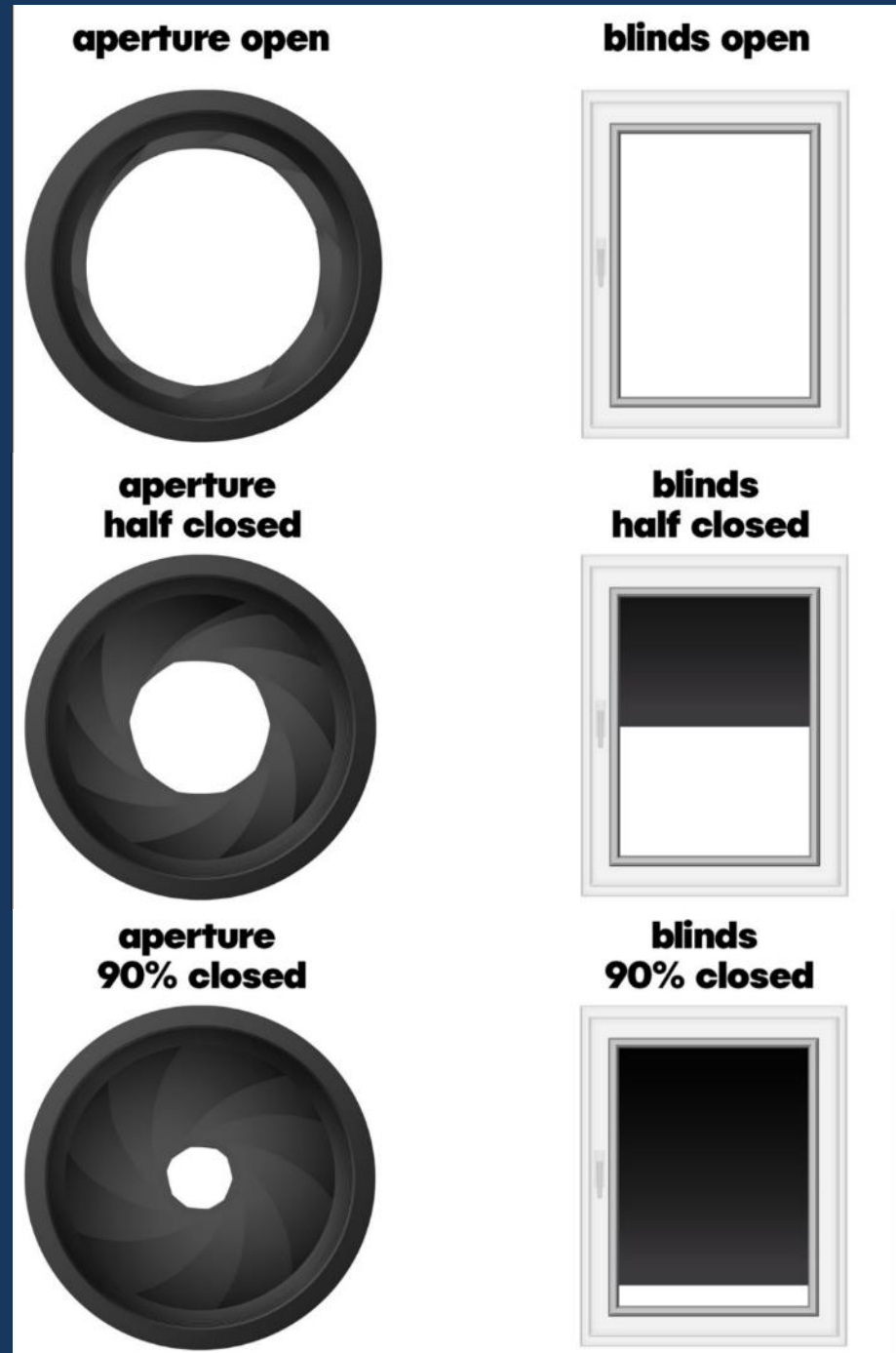
2) The Aperture

A large aperture lets in more light; a smaller aperture lets in less light.

Think of a big window vs a small window.

Small aperture = less light

Large aperture = more light

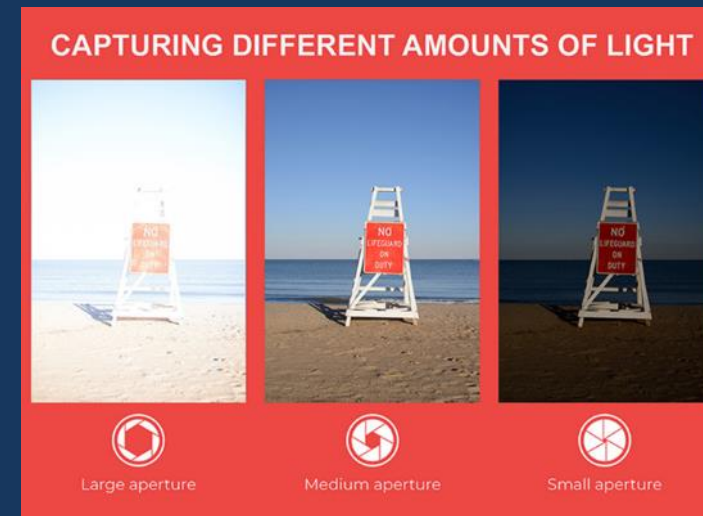


What is the “Aperture” ?

The Aperture is the opening in the lens through which light passes to enter the camera.

On most cameras, you can shrink or enlarge the size of the aperture to allow more or less light to reach your camera sensor. It is possible to see this in action, if you have a camera which allows you to remove and change the lens.

However, all lenses use the same mechanism, even compact cameras and smartphones.



What do the Aperture settings mean ?

Aperture settings on the camera are called “f-stops”.

They are the set of numbers you see with a “f” in front of them.

They actually refer to how big the aperture opening is.

In old cameras, the aperture could only be set at specific positions.

Photographers turned their aperture ring and when the aperture reached the next pre-set position, the ring would stop, with a click.

In modern cameras, we can smoothly open and close the aperture at any position, but the term “f-stop” is still used.



What do the Aperture settings mean ?

One confusing aspect of f-stop numbers, is that the widest apertures have the lowest f numbers.

This is because the f numbers are actually fractions.



A $1/4$ is bigger than $1/16$ – remember your old arithmetic ?

$1/4 = 4/16$ which is more than $1/16$

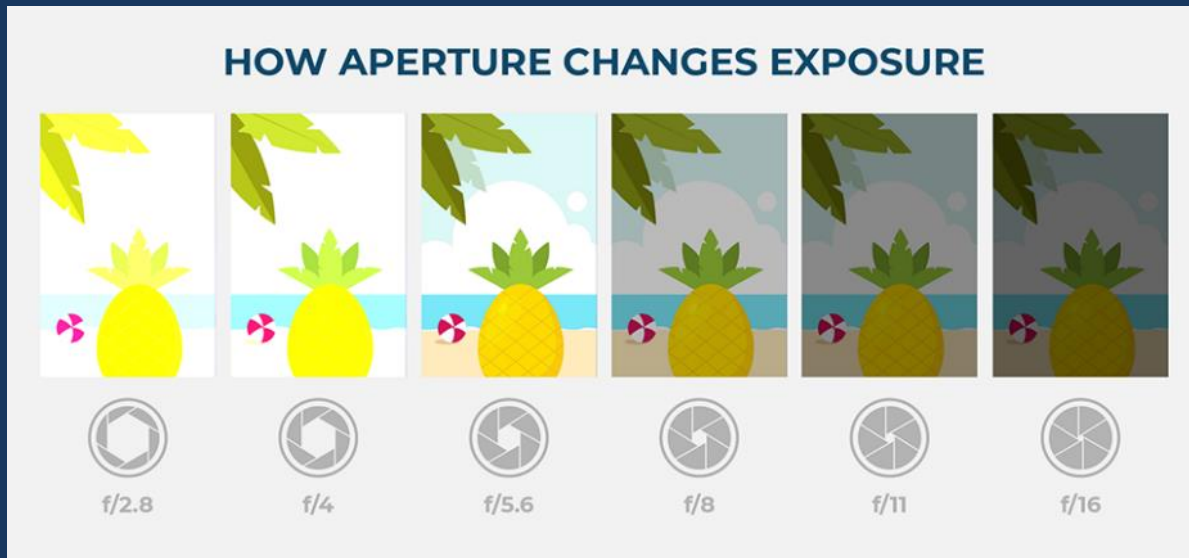
What do the Aperture numbers mean ?

Don't worry about the maths !

But do remember when you close the aperture, you are reducing the amount of light reaching the sensor.

As you move from 1 full-stop to the next, the amount of light reaching the sensor is halved.

For example, choosing f5.6 instead of f4 will halve the amount of light !



The aperture affects our image in another way...

The Aperture setting also affects another property of your image, the “*depth of field*”.

The depth of field is the amount of your photograph that appears sharp from front to back.

Some images have a shallow depth of field, where the background is completely out of focus.

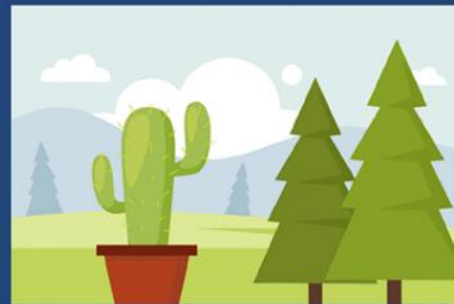
Other images have a high depth of field, where both the foreground and background are sharp.

DEPTH OF FIELD AT DIFFERENT APERTURES



f/2.8

Shallow depth of field



f/16

Large depth of field



Large aperture



Small aperture

What Affects Exposure ?

3 different camera settings affect the image exposure

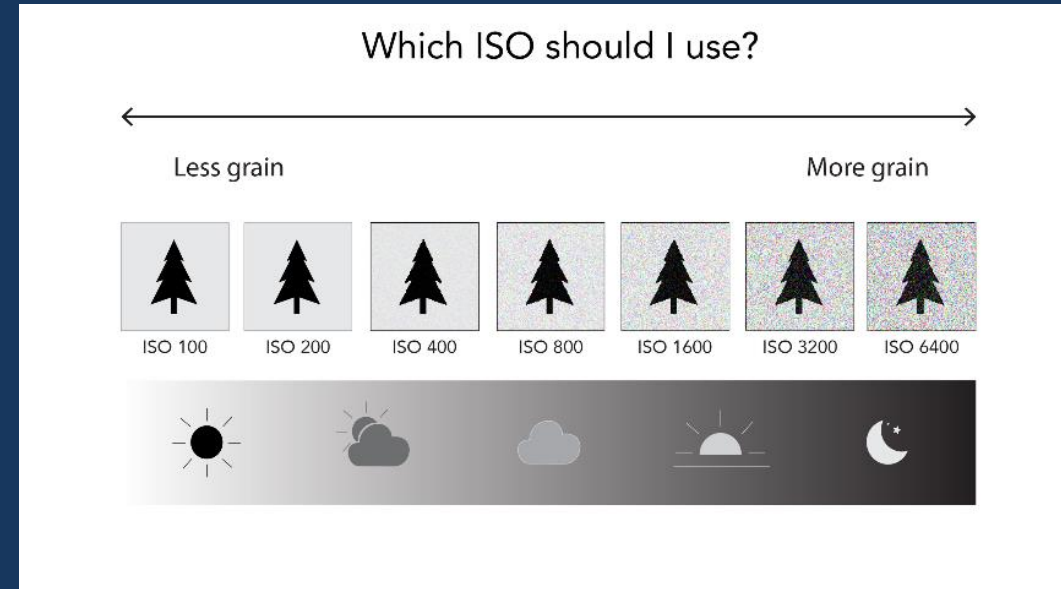
3) ISO value

The ISO setting boosts the signal coming from the sensor.

It can be thought as changing the sensor's sensitivity to light.

Low ISO setting = darker image

High ISO setting = lighter image



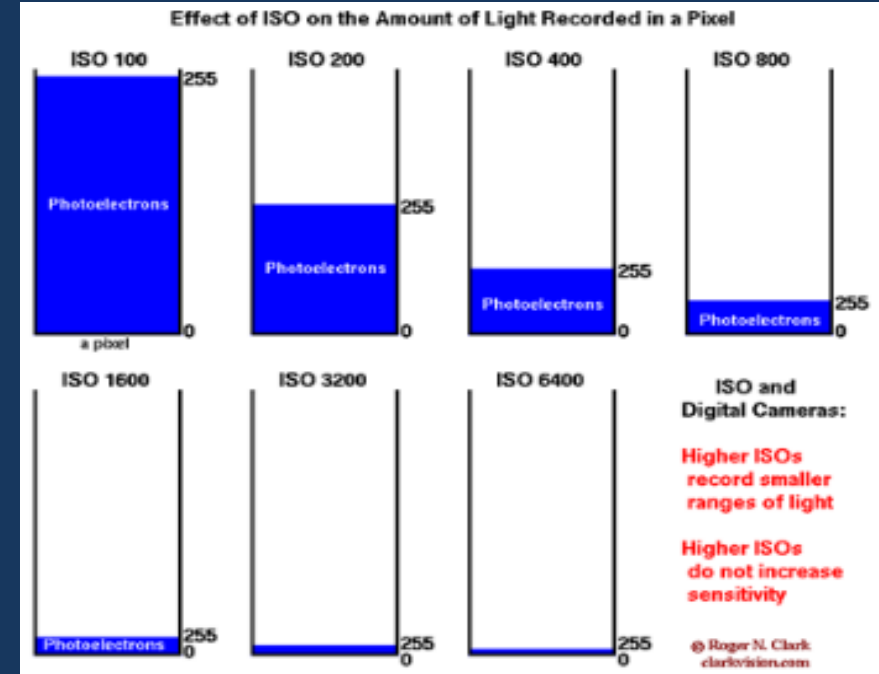
What is ISO ?

Increasing ISO increases the amplification signal of the light, which **brightens** the image.

The effect is **similar** to opening the aperture, or reducing shutter speed.

However, it doesn't actually change the physical exposure of the image.

The camera sensor is covered with millions of “photo-sites” (pixels).
By increasing ISO, we need fewer photons (light particles) to “fill up” the sites.



What is ISO ?

The ISO setting amplifies the signal from the camera's sensor.

For our convenience, each ISO value also represents a “stop” of light, and each ISO number (up or down) can be thought as a doubling, or halving, of the light.



But...increasing ISO has a drawback

Increasing ISO increases digital “noise” in the photo

Think of playing a record on your old stereo. As you turned up the volume, the music got louder, but so did the background noise (hiss, etc)

The same is true for your camera, turning up ISO can lead to a grainy picture.

(Due to their physical construction, larger sensor cameras can support a larger ISO without noise, than a smaller sensor)



“Exposure Triangle”

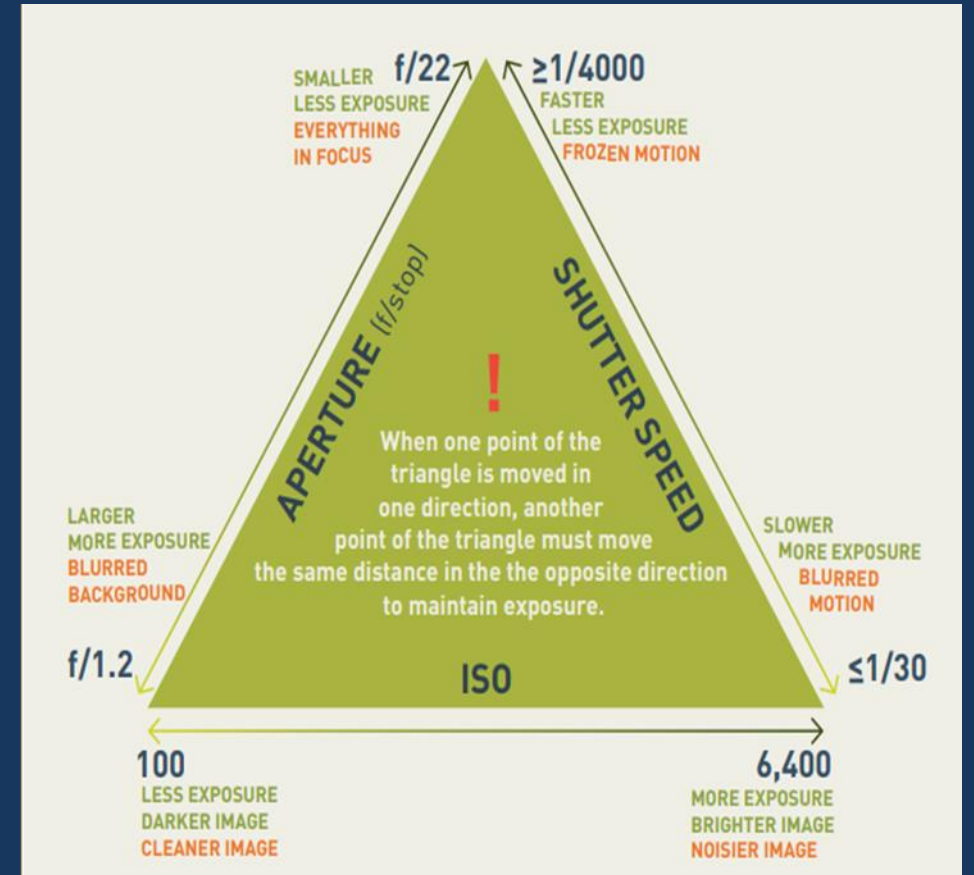
The key thing to remember is that all 3 settings are linked.

The correct exposure will be a combination of Aperture, Shutter and ISO.

We call this combination the “Exposure Triangle”.

There is more than 1 combination which will give the correct exposure.

If we change 1 setting, one or both of the other settings must change to get back to the correct exposure.



How do I know if my exposure is correct ?

Look at the screen/viewfinder (not in an SLR) and check if your subject looks ok. For most cameras, what you see on screen is how the image will turn out. This is sometimes called “Live View”.



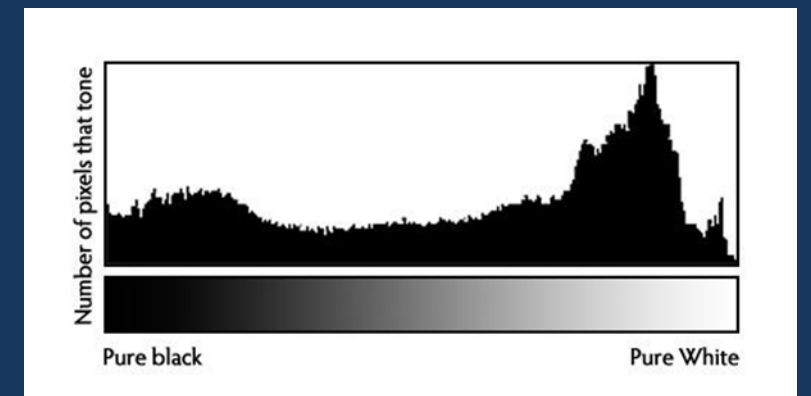
- Screens can make the image look brighter than it is, so be careful about darkening the exposure just based on the screen.
- Sometimes you can't help but have parts of the image too light or too dark, but make sure the subject is correctly exposed.

If your camera has a light meter visible, the exposure the camera would choose is in the middle of the meter.



How do I know if my exposure is correct ?

- If your camera has “blinkies” you can turn these on, to highlight over exposed areas in the image
- Or if it has “zebra” patterns, you can turn these on, to highlight wrongly exposed areas in the image
- If your camera has a histogram, you can turn this on for a visual graph of the exposure. Dark tones are on the left; white tones on the right. Try to avoid too many pixels at either edge.



How do I change the exposure ?

- It all depends on the camera mode you are using....
- **In full Auto mode, the camera makes all the decisions for you.** You will find you can't change Aperture/Shutter or ISO and if you do, nothing happens to the exposure. The camera is adjusting it back to what it thinks you need.
- **In manual mode, you have to do all the work (but the camera can make suggestions), so your combination of Aperture/Shutter/ISO settings will affect exposure.**
- **If you use the "Scene" modes, choosing a different scene, for example, Night scene, or Snow will tell the camera to use a different set of Auto settings. This is an easy way to get the camera to do what you want.**
- **Finally, if you are in a semi-Auto mode (P,S,A), you can use "exposure compensation" controls.**

P **Programmed Auto / Program Mode**
Camera Pairs aperture and shutter speed but you can change the settings

A OR **Av** **Aperture Priority Mode**
You set the aperture, and the camera sets the shutter speed

S OR **Tv** **Shutter Priority Mode**
You set the shutter speed, and the camera sets the aperture

M **Manual Mode**
You set shutter speed, aperture, and ISO but the camera still gives a meter reading



 **Night Portrait Mode**
Combines flash with a slow shutter speeds, but fixes other settings


 **Macro Mode**
Sets a wide aperture to blur backgrounds

 **Sports Mode**
Sets a fast shutter speed to freeze action

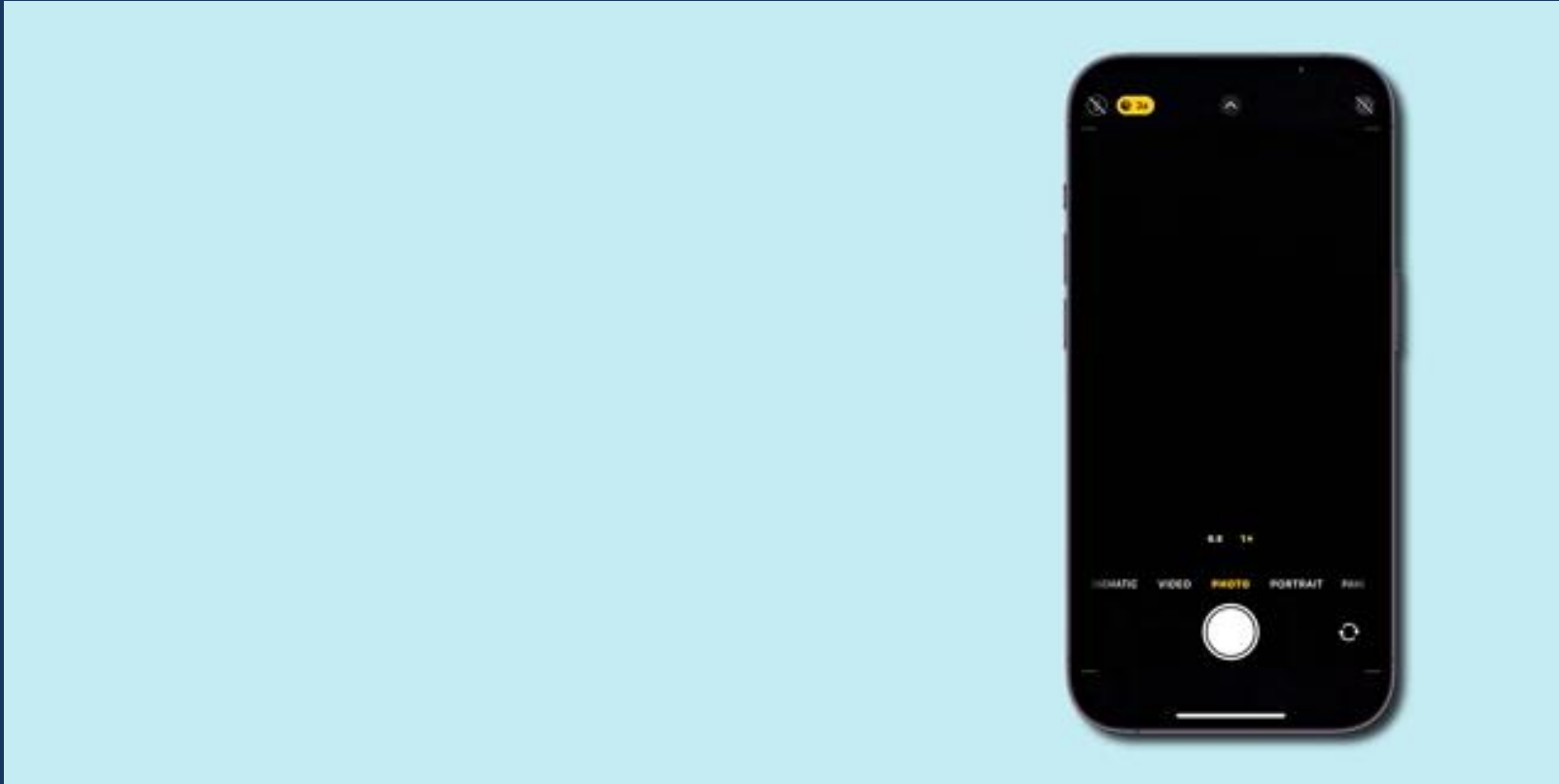
 **Flash Off / Auto Flash Off Mode**
Fully automatic mode that ensures flash does not fire

 OR  **Full Automatic Mode**
Sets all camera settings automatically

 **Portrait Mode**
Sets a wide aperture to blur backgrounds, but overrides other settings

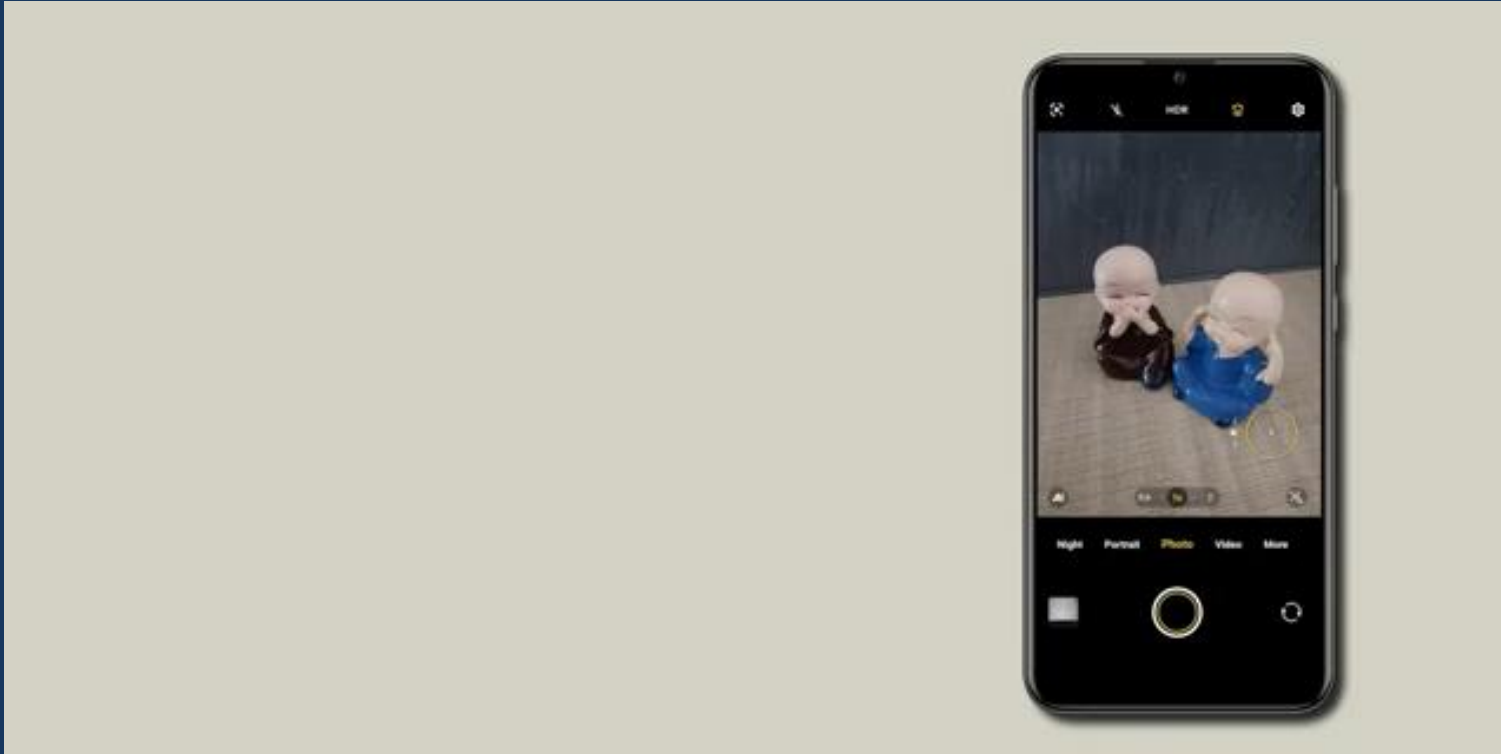
 **Landscape Mode**
Sets aperture to maximize depth of field and the built-in flash is switched off.

How do I change the exposure on my iPhone ?




<https://www.youtube.com/watch?v=3mO6wWzvcMI>

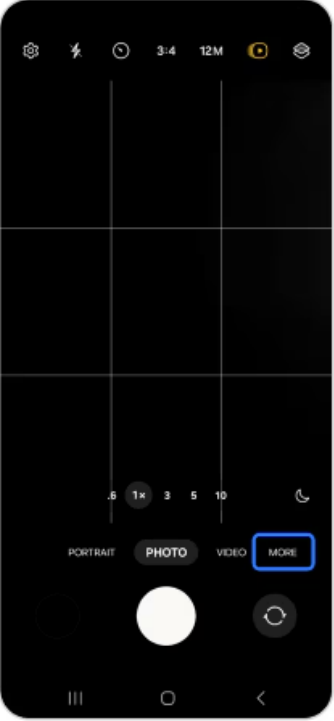
How do I change the exposure on my Android Phone ?




<https://www.youtube.com/watch?v=D3wIG81XLoc>

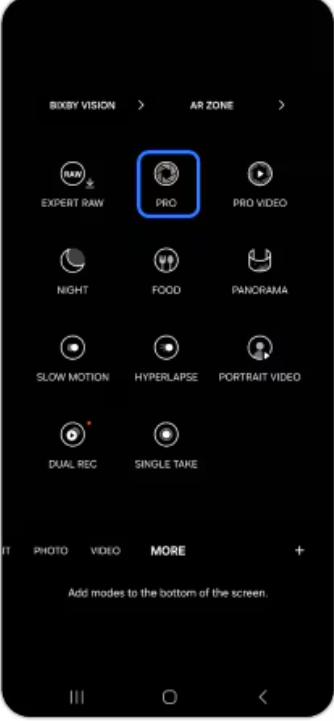
Or, for Android Phones only....

1 Open the  Camera and swipe to **More**




The screenshot shows the camera app interface with a grid overlay. At the bottom, the 'MORE' mode is highlighted with a blue box. The top status bar shows settings like '3-4' and '12M'.

2 Select  **Pro Mode**



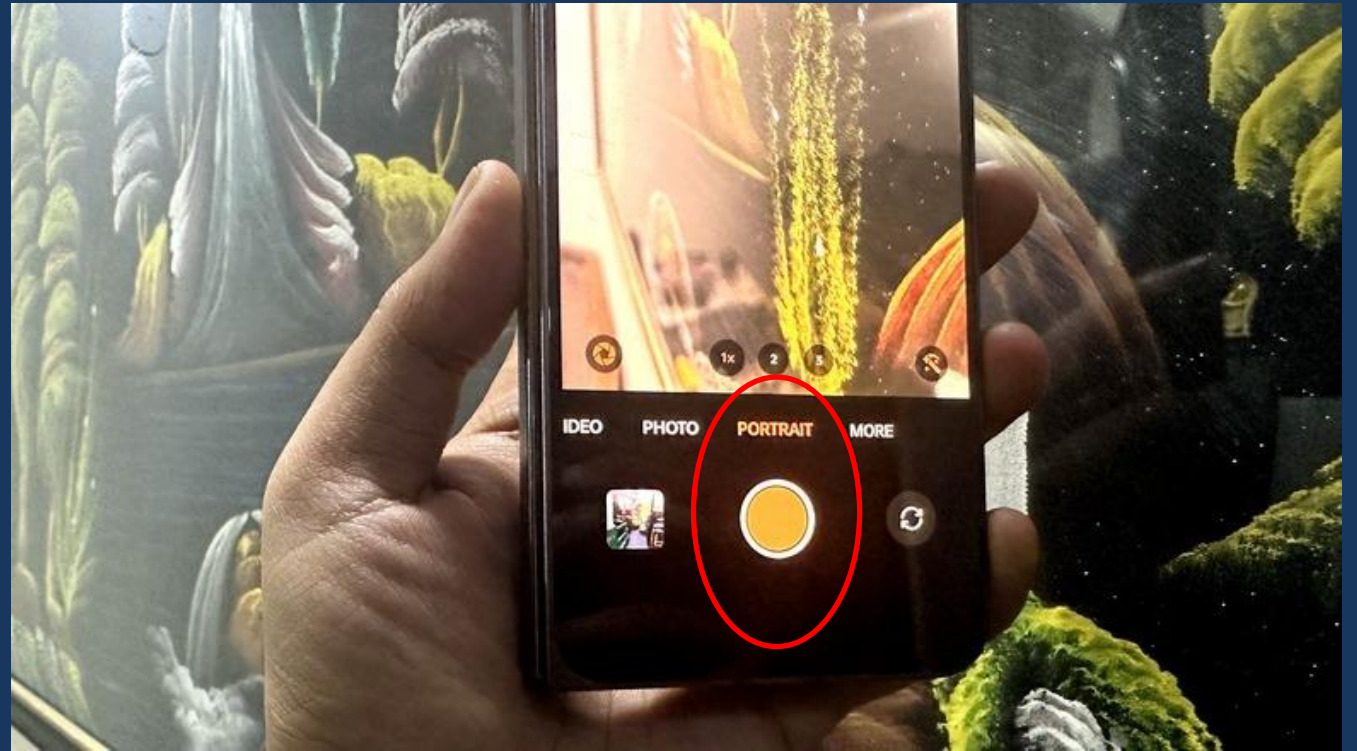
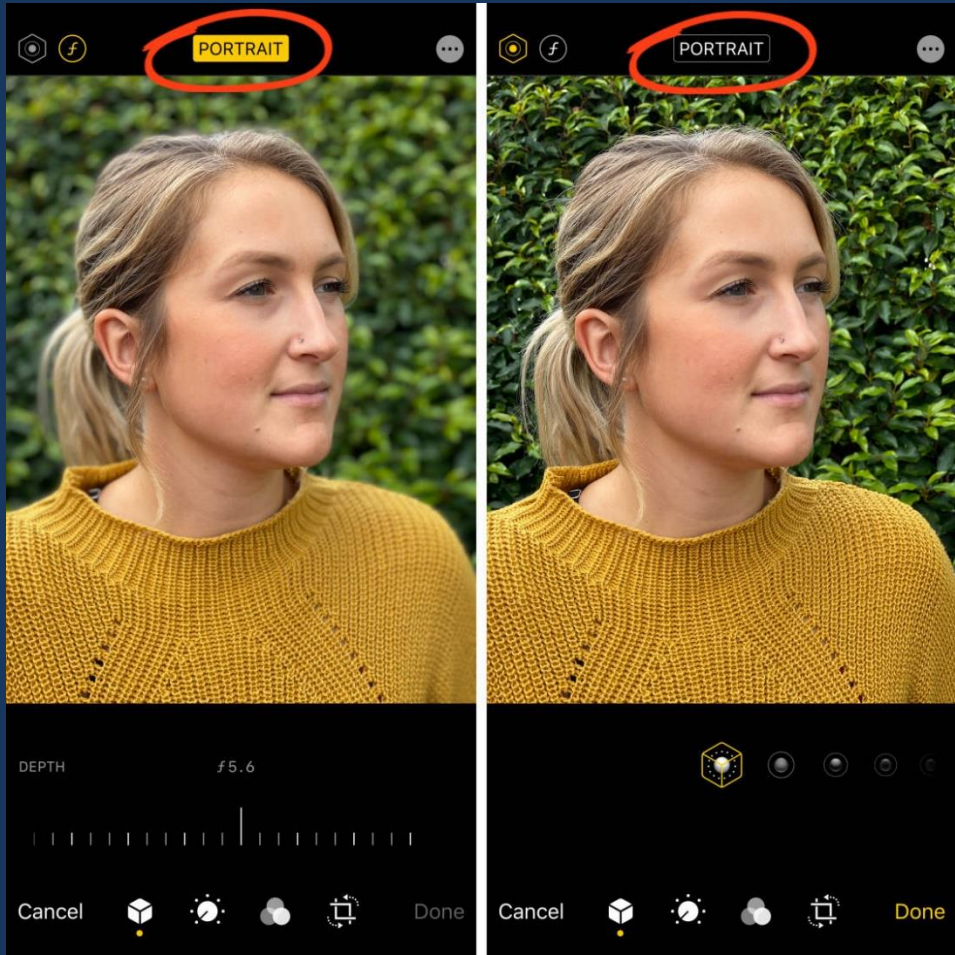
The screenshot shows the 'More' menu with 'PRO' mode highlighted by a blue box. Other modes like 'EXPERT RAW', 'PRO VIDEO', 'NIGHT', 'FOOD', 'PANORAMA', 'SLOW MOTION', 'HYPERLAPSE', 'PORTRAIT VIDEO', 'DUAL REC', and 'SINGLE TAKE' are visible. At the bottom, there is a note: 'Add modes to the bottom of the screen.'

3 Tap on the available **Camera settings** and adjust to suit your preference.



The screenshot shows the 'PRO' settings menu with a blue box highlighting the settings: 'ISO A 3200', 'SPEED A 1/10', 'EV 0.0', 'FOCUS CENTER', and 'WB A 5500K'. The top status bar shows '3-4' and '12M'. The bottom of the screen shows the camera controls and a '< PRO' label.

And try out Portrait Mode for blurry backgrounds !



How much adjustment do I need ?

It depends - on the scene, your subject and your camera !

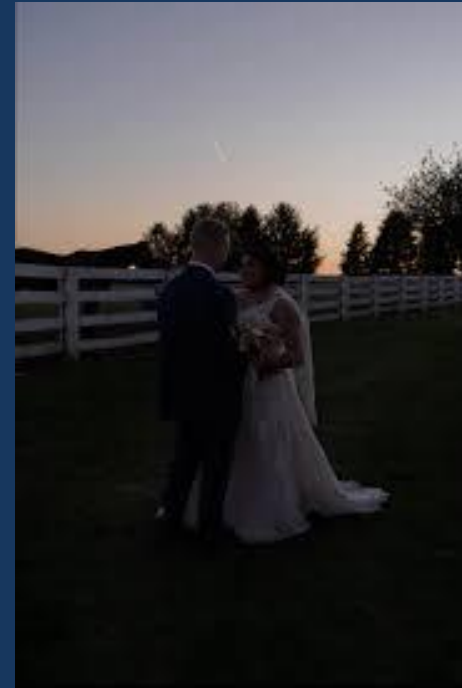
I'm afraid it is a case of trial and error.

Getting to know your camera and its limitations is very important.

However, if your image contains a mix of light and dark areas, you can usually trust the camera to work out the exposure for you.

With slow moving subjects you could take a shot, look at the result, and then reshoot with a different amount of exposure to ensure you get the effect you want.

This is especially true if the image is an important one – such as a wedding shot, or an image of a loved one.



How much adjustment do I need ?

On some cameras, you can set the camera to take a series of images in a “burst”, at different exposure settings.

This is called “Exposure bracketing”.

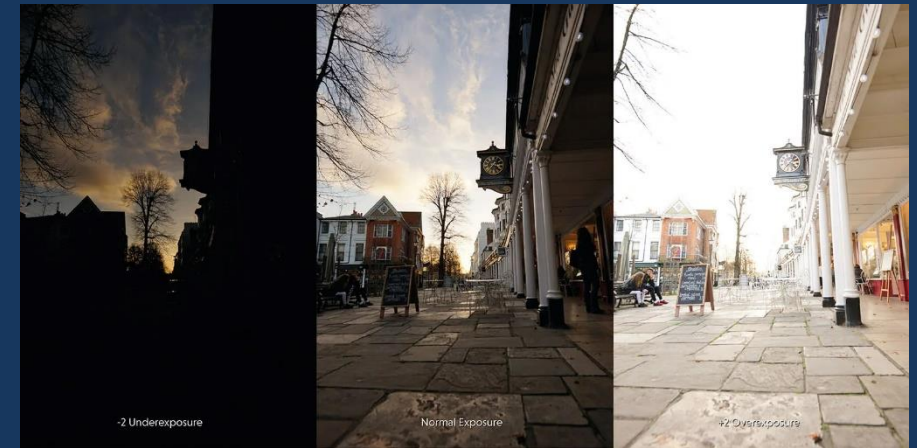


The idea is you choose the one you like when you review them later.

The only disadvantage is you end up with multiple copies of the same image, at different exposure settings.

You can normally tell the camera how many images to take and what exposure settings to use.

It should remember your choices, so that you can turn this option on/off as required and it will recall your settings.



Summary

Exposure means how much light is allowed to reach the camera sensor or film.

This controls the overall brightness or darkness of a photograph.

This is important because images incorrectly exposed can look odd, or not at their best.

Exposure is set by a combination of the Shutter Speed, the Aperture and the ISO setting.

The in-built camera light meter can be fooled by extreme situations.

We may need to override the camera's exposure choice.