

Today:  
Today: End of GW critique, then Focus

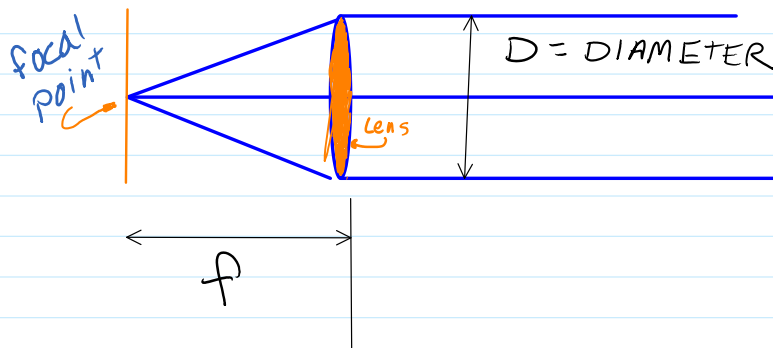
## PHOTOGRAPHY FUNDAMENTALS

- 1) Framing
- 2) Camera
- 3) Lenses
- 4) Exposure Control
- 5) Resolution

### 4.3) LENSES

Lenses are defined by FOCAL LENGTH and APERTURE and Diameter

$f$  = focal length = distance from center of lens system to sensor when focused at infinity



Symbol for center of lens  
Or sensor location



Symbol for thread diameter

Variable focal length = ZOOM lens.

Now is default. Non-zoom are called 'prime' lenses.

10 years ago, 35 mm film cameras were standard, and the standard lens was 50 mm.  $f > 50$  mm = telephoto *long*

$f < 50$  mm = wide angle *short*

$$f = 18 - 55$$

$$f: 3.5$$

$$f/D = 3.5 - 5.6$$

Aperture defined as  $f/D = f/$  = f number =  $f\#$

INVERSELY related to diameter.

Nondimensional. More about aperture later.

1:3.0

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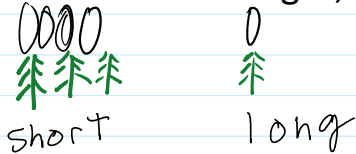
PHDs have small sensors, so focal lengths and diameters are smaller:

Common values for PHD cameras:

$$f = 5 - 60 \text{ mm}, \quad f/\# = 4 - 8$$

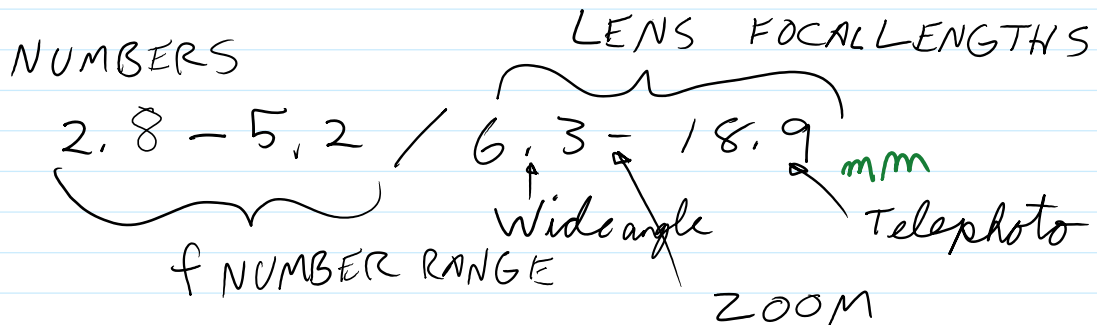
28-336 mm equivalent to 35 mm, i.e. same FOV

w = wide T = tight, or telephoto



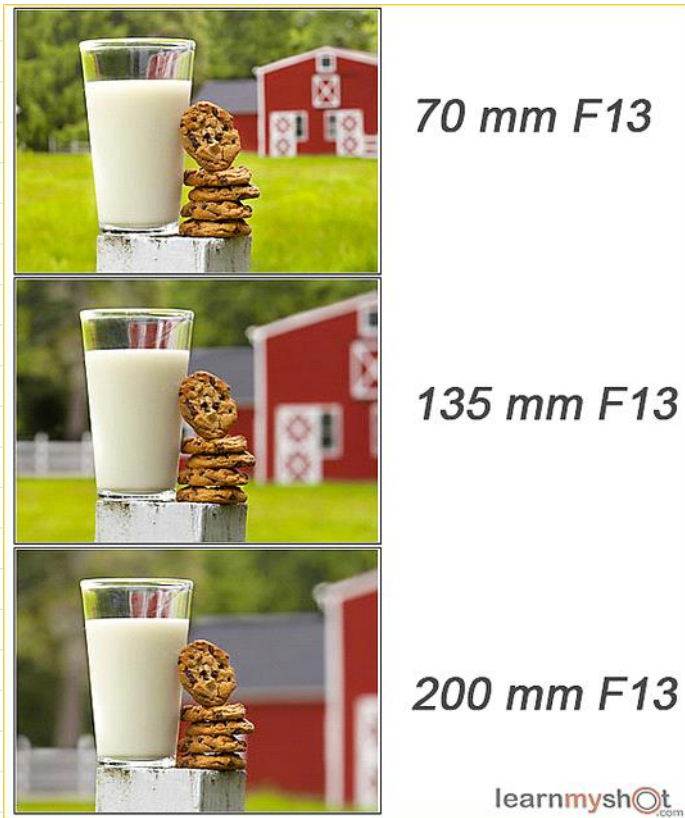
For DSLR, bigger sensors, up to 'full frame' 35 mm

$$f = 18 - 60 \text{ mm}, \quad f/\# = 1.8 - 22$$

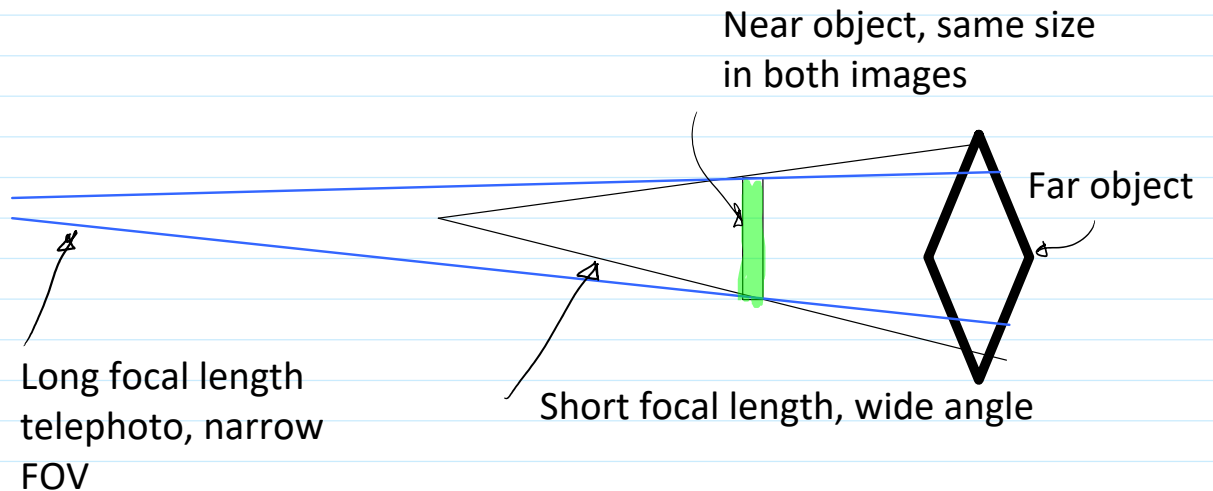


### Impact of focal length on framing:

As  $f$  increases (longer lens), field of view narrows  
 'Telephoto compression' happens too



[https://www.youtube.com/watch?v=4yyFKNfRq\\_M](https://www.youtube.com/watch?v=4yyFKNfRq_M)



**TRY THIS NOW**

Make images at different lens focal lengths (zooms) and note the image compression effect.

## FOCUS

'In focus' when all collected light from a point on the object shows up at a single point in the image.

