



COLORADO STATE UNIVERSITY
EXTENSION

LOW-LIGHT PHOTOGRAPHY

UNIT 5

ACKNOWLEDGMENTS

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EXTENSION

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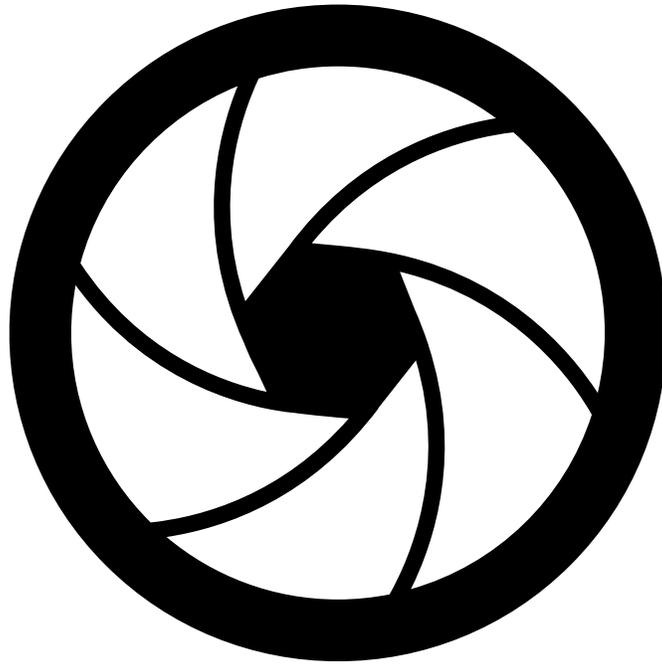
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PART I

INTRODUCTION

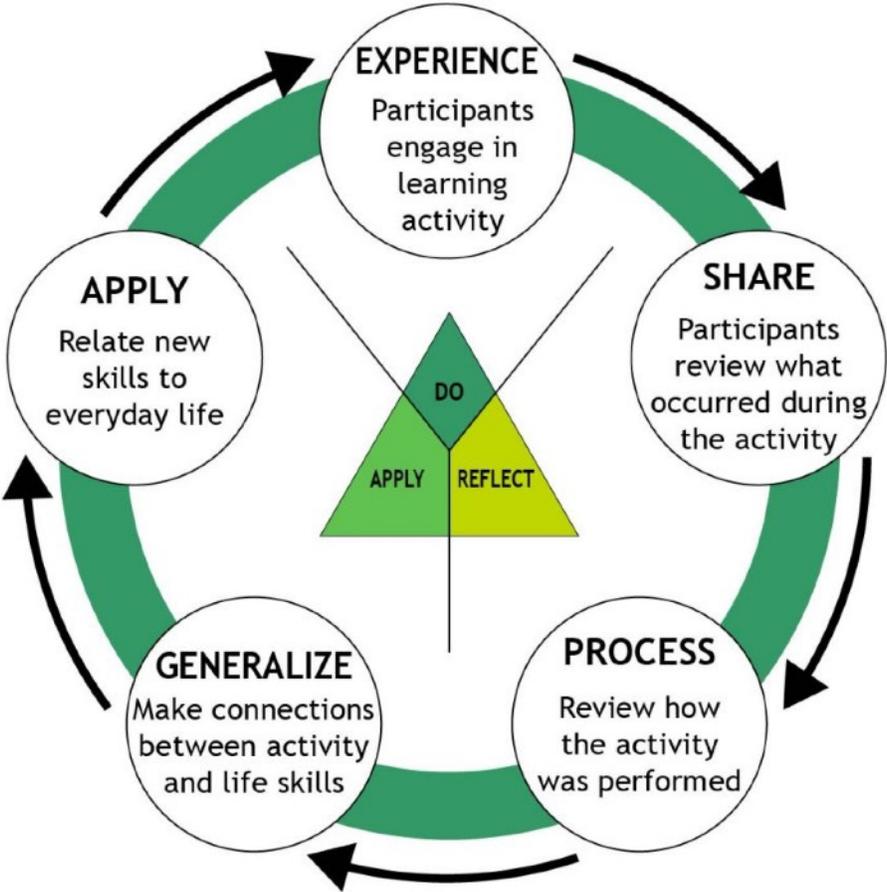
**BEFORE YOU BEGIN THE UNIT 5
PROJECT, READ THIS SECTION.**

BY DOING THIS, YOU WILL BE
SETTING YOURSELF UP FOR
SUCCESS! THIS WILL ALLOW YOU TO
LEARN THE MOST YOU POSSIBLY
CAN FROM THIS PROJECT.

EXPERIENTIAL LEARNING PROCESS

The 4-H program utilizes a process where adult leaders ask open-ended questions that challenge youth to think. Through this inquiry, youth can propose hypotheses and determine their own solutions. The Experiential Learning Model developed by Pfeiffer and Jones (1985) and modified by 4-H includes five specific steps that can be summarized into three main processes: **Do, Reflect, and Apply.**

The Experiential Learning Model encourages discovery with minimal guidance from others. A situation, project, or activity is undertaken for individual thought and problem-solving. Minimum outside assistance is provided, but support is offered to the individual by questioning at each stage. The youth participating in an activity reflect on what they did and then assess how what they learned can be applied to a life situation. Below are questions that might help during each stage of learning.



1 - EXPERIENCE (DOING)

Questions: What sources of information are available? What is possible? What do you expect to see? How is it working? What else might you try?

2 - SHARE (REFLECTING ON WHAT OCCURRED)

Questions: What was your goal for this project/activity when you began? What happened? What were the results? What was most difficult? How do you know? What did you learn? What surprised you? How did you share this project/activity with others?

3 - PROCESS (REFLECTING ON WHAT'S IMPORTANT)

Questions: What problems seemed to reoccur? How did you solve them? What similar experiences have you had? How was the experience like or unlike experiences others had? Would you do anything differently? What did you learn about making decisions? What suggestions would you have for someone else who wanted to do a similar project/activity? What life skills were you developing through your project? Why are life skills important? What new questions do you have about yourself, others, and future goals?

4 - GENERALIZE (SO WHAT?)

Questions: What did you learn about yourself or about the activity? What key points have you learned? How did you decide what to do? What else could you have done? How does this relate to something else in life? Where have you faced similar challenges in your life? Where might this situation occur in the future? Why is it important to have plenty of information before making decisions? What did you learn about your own skill in communicating with others?

5 - APPLY (NOW WHAT?)

Questions: How does this project/activity relate to your everyday life? Why is this project/activity important to you? Where else can this skill be used? How will you use this in the future? What will you do differently after this experience? How can I make an impact? What will I create next? In what ways do people help each other learn new things? What are qualities you think are important in a leader? If someone helped or mentored you in this project, what would you tell them you learned and what difference it has made in your life? How would you express your appreciation?

ABOUT THE 4-H THRIVING MODEL

The 4-H Program Leaders' Working Group developed the 4-H Thriving Model to advance and support the accomplishment of the 4-H Youth Development 2025 National Strategic Plan. They describe the 4-H Thriving Model as follows:

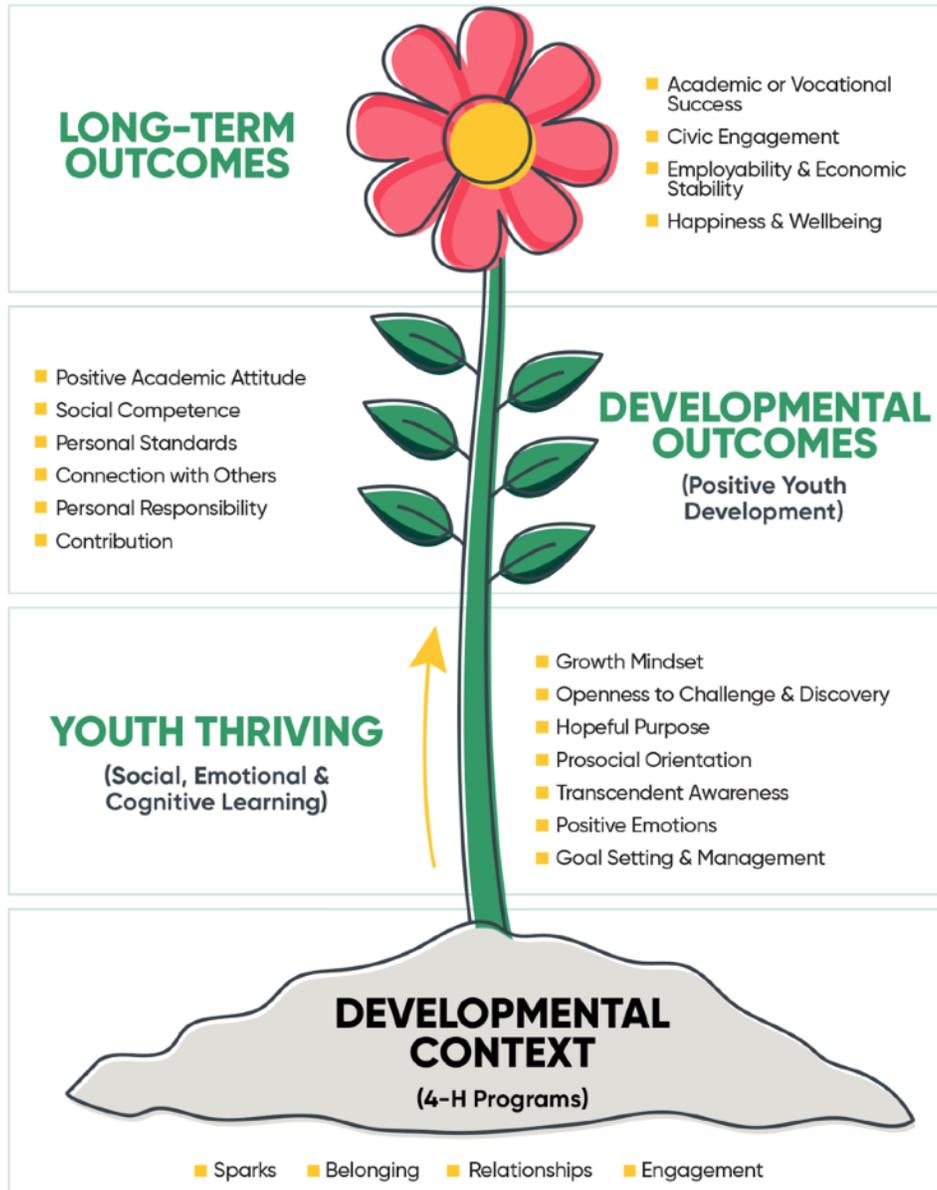
The 4-H Thriving Model illustrates the process of positive youth development in 4-H programs by connecting high-quality program settings to the promotion of youth thriving.

High-quality 4-H program settings provide youth a place to belong, matter, and explore their personal spark. High-quality settings foster developmental relationships with youth, relationships that express care, challenge growth, and share power. These components help ensure that 4-H programs provide a nourishing developmental context – a place where youth can belong and grow.

High-quality 4-H programs contribute to Positive Youth Development (PYD) through the intentional promotion of social, emotional, cognitive, and behavioral habits of mind. In the 4-H Thriving Model, this process of PYD is described by seven indicators of thriving: openness to challenge and discovery, growth mindset, hopeful purpose, pro-social orientation, transcendent awareness, positive emotionality, and self-regulation through goal setting and management.

Youth who experience high-quality developmental settings in 4-H with an emphasis on these key social-emotional skills achieve key positive youth development outcomes, including academic motivation and success, social competence, high personal standards, connection with others, personal responsibility, and contribution to others through leadership and civic engagement.

Youth who achieve positive developmental outcomes are more likely to also achieve long-term outcomes marked by vocational or academic success, civic engagement, employability and economic stability, and happiness and wellbeing.



Learn more:

helping-youth-thrive.extension.org



TARGETING LIFE SKILLS

A skill is a learned ability. Life skills are those abilities that assist individuals to lead successful, productive, and satisfying lives. In 4-H, we use the Targeting Life Skills Model to help youth become competent and prepared for adulthood. The Targeting Life Skills Model categories are based on the four H's from the 4-H Clover (Head, Heart, Hands, and Health). Under each of these main categories, there are four categories and eight subcategories listing specific skills youth learn in 4-H. The main goal in 4-H positive youth development is to provide developmentally appropriate opportunities for youth to experience life skills and to be able to use them throughout a lifetime. By understanding the importance of the 4-H framework and its structure, 4-H members, parents, professionals, and leaders will know the expectations and will be able to effectively use 4-H delivery methods to help youth learn these life skills.

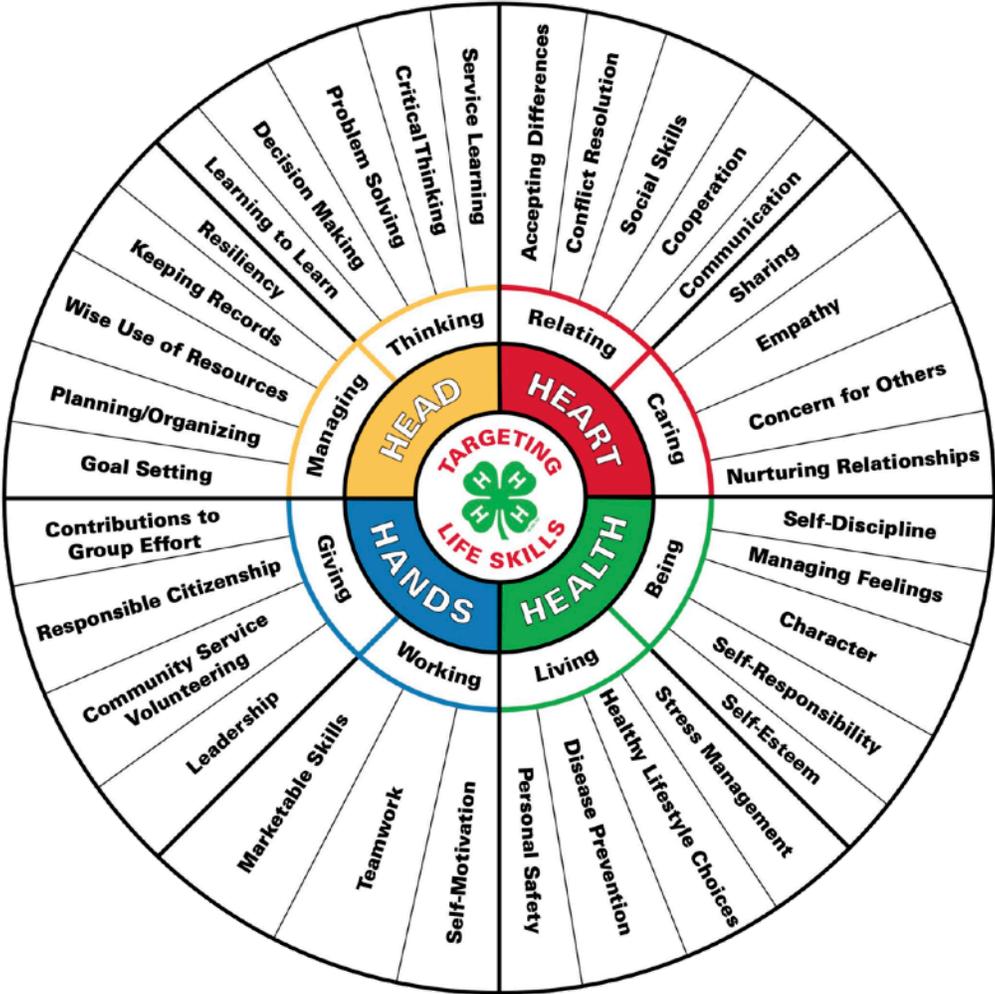


Image credit: Hendricks, P. (1998) "Developing Youth Curriculum Using the Targeting Life Skills Model" (<https://store.extension.iastate.edu/product/16427>)

WELCOME TO UNIT 5

Low-light photography can be a challenge. It requires lots of planning and preparation, but it's not impossible. The key is to know what camera settings work best for your situation. To accomplish this, you need to understand how each setting affects exposure. Settings include manual or priority modes to adjust ISO, shutter speed, and aperture. Mastering these settings will ensure better results when shooting at night or in other low-light conditions.

This project may seem intimidating, but don't worry! Part II will cover any basics you need to know before capturing low-light photos. For the best learning experience, thoroughly read Part II before doing the activities.

Once you finish reading Part II, find all the activities in Part III. The activities are where all the fun begins! **Unlike other 4-H photography units, you are not required to complete all activities.** Just go through the activities and participate only in the ones you are interested in and are able to finish.

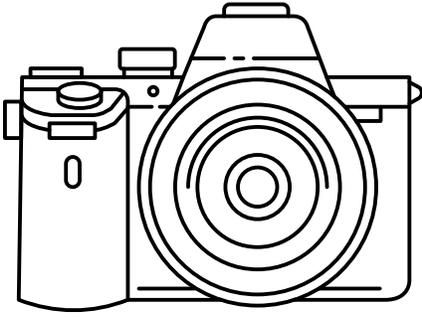
WHAT TO COMPLETE FOR THIS PROJECT

- Completed record book:** write about your challenges and accomplishments in your story.
- Portfolio of at least twenty 4" x 6" prints:** photos you took while doing the project.
- Three display photos:** 5" x 7" print with an 8" x 10" matted-only frame. Each display photo needs to be a different subject.

Label each picture in your portfolio with the following information. Ensure you include ISO, aperture, and shutter speed in the "Exposure details."

Camera used:	
Exposure details:	
Photo number:	
Activity from the manual:	
Date photo taken:	

Additionally, for display photos: attach your name, county, and the above label to the back of each frame.



You will need special equipment to capture low-light photos during this project. For the best experience throughout the year, there are some essential photography tools. At a minimum, this includes a camera and a tripod. However, please review the complete recommended equipment list below.

RECOMMENDED EQUIPMENT

- ❑ **Camera:** DSLR or mirrorless
- ❑ **Lenses:** lens with aperture f/4 or wider
- ❑ **Small flashlight:** red light (to see at night)
- ❑ **Stabilizer:** tripod, GorillaPod, or grip clamp
- ❑ **Interval:** intervalometer or camera with built-in interval
- ❑ **Remote trigger:** phone app or camera with built-in timer delay
- ❑ **Planning app:** HeliosPro, timeanddate.com, or clearoutside.com
- ❑ **Weather app:** MyRadar Pro or weather.gov
- ❑ **Printing lab:** local printing lab or nationsphotolab.com
- ❑ **Optional supplies:** external flash, telescope, and pinhole cap

CAMERA ALTERNATIVE: MOBILE PHONE

You should have a DSLR or mirrorless camera, but you can use your phone or action camera if that is not possible. Just ensure you can change exposure settings or utilize an app to control the exposure. Controlling exposure should allow you to adjust ISO, shutter speed, and aperture.

HOW TO DO THE ACTIVITIES

There are 15 activities in Part III of this manual. Each activity is designed for you to learn how to capture low-light images. In this photography unit, you will create a portfolio of twenty images plus three display photos from these activities. Images do not need to be from every activity; they should only be from the activities you decided to participate in.

However, you are allowed to do more than these activities. There is also a custom activity (#16) on page 41. Get creative, experiment, and have fun!

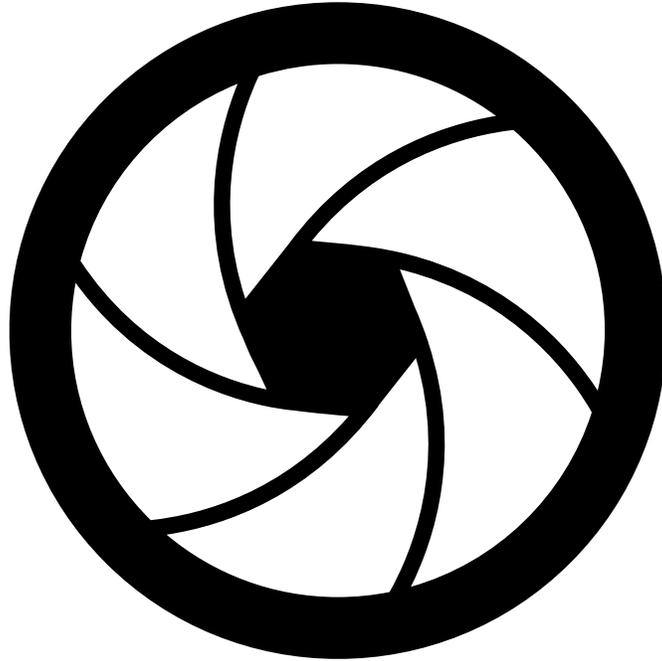
DIFFICULTY

For guidance, each activity has a difficulty level. Don't let this decide whether you do an activity or not. Try easy, moderate, and challenging ones, as there is always something you can learn. Plus, it will best prepare you for "Unit 6: Advanced Photography."

Note: if you submit your project to county or state fair judging, you will not be scored based on the difficulty of the activities you choose to do.

LEVEL	DESCRIPTION
1	An easy activity with instructions that may not be necessary to read. These are also great activities to do with a mobile phone camera.
2	A moderately difficult activity. These activities often require using advanced settings with manual or priority mode. Thoroughly reading the activity's preparation, camera setup, and instructions is highly encouraged.
3	The most challenging low-light activities. Using manual mode and much preparation is vital for successful images. Experimentation and further research will also be essential steps to discover what works and what doesn't work.

Some activities may require special equipment, access to a location, or could be dangerous. Look for these beneath the difficulty level in the "Special Notice" row.



PART II
CAPTURING
LOW-LIGHT
PHOTOS

**AT FIRST, LOW-LIGHT
PHOTOGRAPHY MAY SEEM
INTIMIDATING OR CONFUSING.**

THERE IS A LOT TO UNDERSTAND,
BUT BY UTILIZING THE INFORMATION
COVERED IN THIS SECTION, YOU
WILL SOON GAIN THE ABILITY
TO CAPTURE BEAUTIFUL
LOW-LIGHT IMAGES!

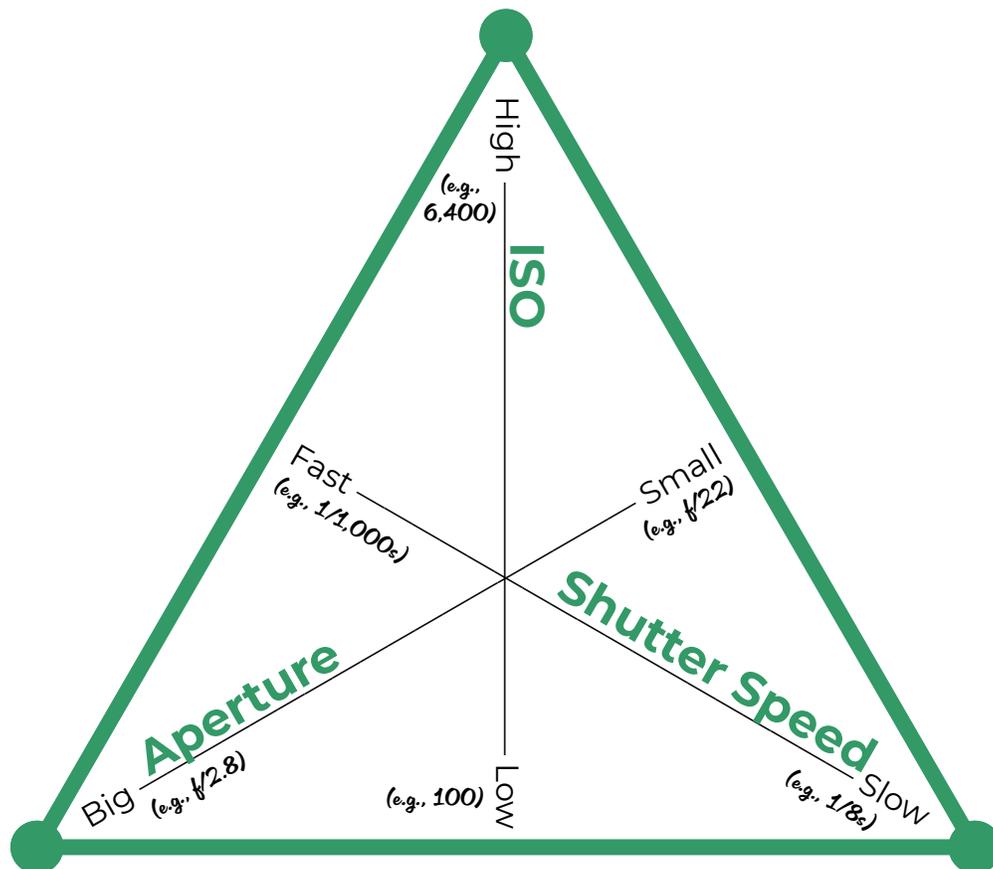
HOW TO EXPOSE YOUR IMAGES

Each exposure setting (ISO, shutter speed, and aperture) individually affects exposure and creativity. By balancing these three settings, it is possible to get a very creative picture that is evenly exposed.

EXPOSURE TRIANGLE

A reference that photographers commonly use to help guide them is the exposure triangle of ISO, shutter speed, and aperture. This diagram helps you initially choose the settings for accurate exposure.

Typically, all your settings would stay on one edge of the triangle. For example, if you want to capture a landscape at an aperture of $f/22$, your shutter speed will need to be slow, and your ISO needs to be somewhat high.



1. SHUTTER SPEED

Control both the factors of time and motion with shutter speed.

LIGHT CONTROL: TIME

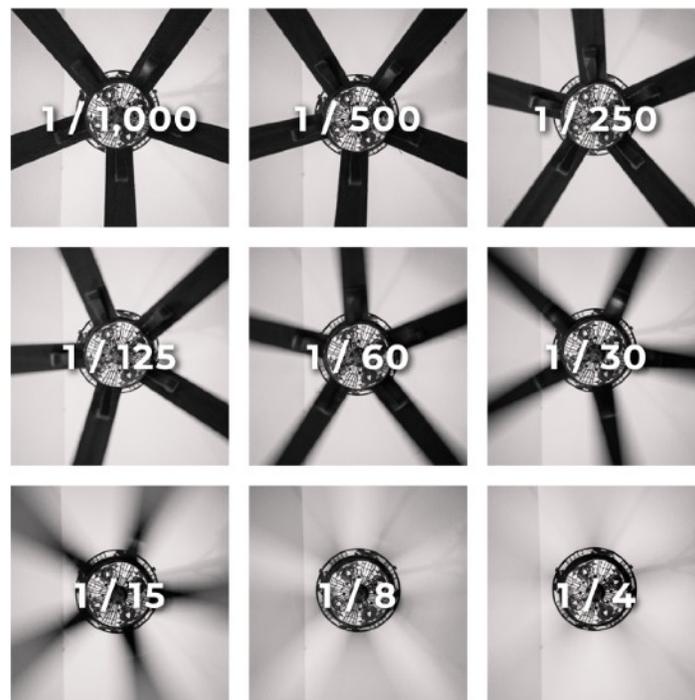
Shutter speed is the amount of time that your camera's sensor is exposed to light. The longer your sensor is exposed to light, the brighter your image.

- ❖ **Faster speed (e.g., 1/1,000 sec) = less light**
- ❖ **Slower speed (e.g., 1/15 sec) = more light**

CREATIVE CONTROL: MOTION

Shutter speed doesn't just impact brightness. Once the shutter opens, all movements are captured on the sensor until it closes. For example, taking a picture of a fan requires at least 1/500 sec to freeze the motion of the blades.

- ❖ **Faster speeds = less motion captured (sharp)**
- ❖ **Slower speed = more motion captured (blurry)**



2. APERTURE

Control both the factors of size and depth of field with aperture.

LIGHT CONTROL: SIZE

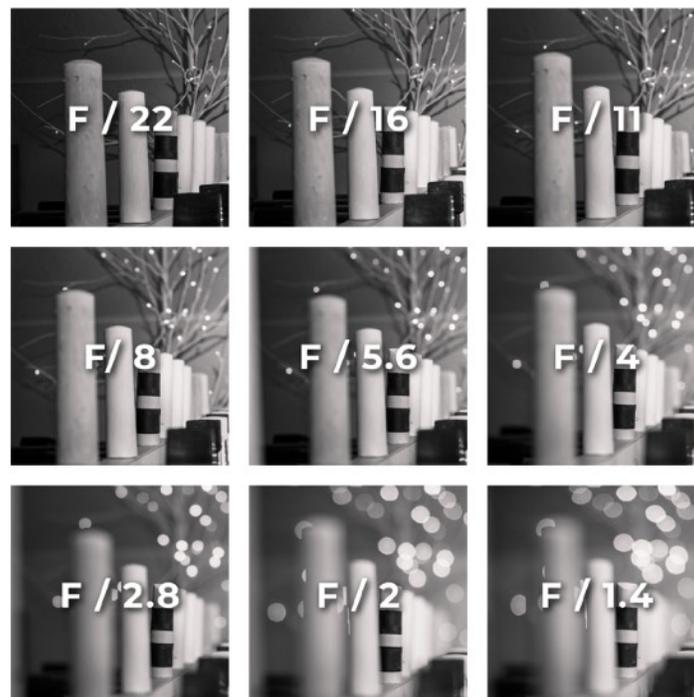
The aperture can be adjusted to different sizes to control how much light reaches the sensor. Let in as much light as possible for low-light images is usually best. This includes using your lens at $f/4$, $f/2.8$, or wider.

- ❖ **Smaller aperture (e.g., $f/22$) = less light**
- ❖ **Bigger aperture (e.g., $f/2.8$) = more light**

CREATIVE CONTROL: DEPTH OF FIELD

Depth of field caused by the aperture can control what should be in focus and what doesn't need to be in focus. Big apertures are commonly used on portraits to blur out the background, and small apertures are used with landscapes to achieve absolute sharpness in everything.

- ❖ **Smaller aperture = more depth sharpness**
- ❖ **Bigger aperture = less depth sharpness**



3. ISO

Control both the factors of sensitivity and grain with ISO.

LIGHT CONTROL: SENSITIVITY

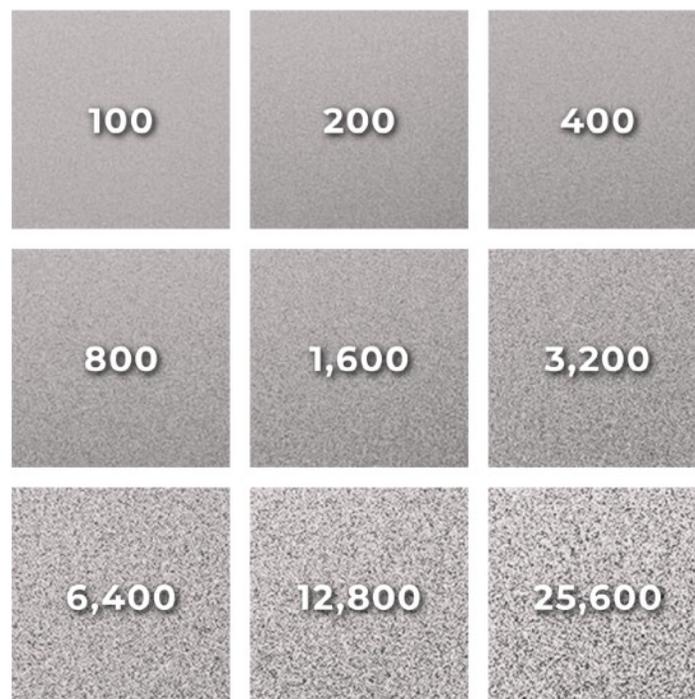
The ISO can be adjusted to control how fast the sensor should react to light. It is best practice to keep the ISO low, but it must be very high for low-light photographs.

- ❖ **Lower ISO (e.g., 100) = less reactive to light**
- ❖ **Higher ISO (e.g., 6,400) = more reactive to light**

CREATIVE CONTROL: GRAIN

The higher you bring up the ISO, the more you notice noise grain in your image. It can be used creatively, but it will usually decrease sharpness as the grain becomes more prominent than the texture in your image.

- ❖ **Lower ISO = excellent grain quality**
- ❖ **Higher ISO = poor grain quality**



CHOOSING THE RIGHT MODES

Your camera has modes to help you control the outcome of your pictures. Each of these modes can be utilized to help you capture low-light photographs:

- ❖ **Shooting modes:** allows you to adjust camera settings
- ❖ **Metering modes:** set how exposure is measured
- ❖ **Focusing modes:** manages the way your lens focuses
- ❖ **Release modes:** how the shutter responds when the trigger is pushed

SHOOTING MODES

The ultimate mode of your camera controls how you can change necessary settings when taking pictures. The following four modes are essential to learn if you want to master photography.

Manual (M) - this allows you to adjust all settings freely. This is the ideal shooting mode for low-light because any auto setting will not allow you to achieve a desirable result. Using your in-camera exposure indicator or a light meter can be helpful.

Aperture Priority (A/Av) - allows you only to adjust the aperture as everything else will be set on auto. This is a great mode to learn with before using manual mode.

Shutter Speed Priority (S/Tv) - allows you only to adjust the shutter speed as everything else will be set on auto. This is also a great mode to learn with before using manual mode.

Program Auto (P) - completely automatic, except you can use exposure values (EV) to increase or decrease the brightness. Some cameras may also allow you to turn off auto ISO, so you can manually adjust only that setting.

METERING MODES

Your camera uses different methods of measuring light through the lens. The metering can help set the exposure settings automatically. They can also display an indication to help customize the settings when shooting with manual mode.



Evaluative / Matrix: this method measures the light intensity from divided zones to find the best overall exposure across the entire image. This is the most popular metering choice.



Center-weighted: a way to meter a scene that excludes the peripheral area of the image and progressively becomes more sensitive toward the center.



Spot: only measures the light in a tiny spot at the center or a specific point within the viewfinder.

RELEASE MODES

The release modes can determine how the shutter responds when pressing the shutter release trigger.

Single frame: the default setting captures only one photograph as you press your trigger. This is a good default choice for low-light images.

Continuous shooting: hold down on the trigger, and your camera will start taking pictures rapidly without stopping. There is usually a low fps (frames per second) and a high fps mode for this.

Quiet shooting: for moments that require you to be silent, the camera can decrease and sometimes eliminate noises caused by the camera's operation. This can be useful for low-light event photography when you need to be quiet.

Timer delay: set the camera to take a picture a certain amount of time after you press the trigger (e.g., 10 seconds). This can be utilized when shooting low-light landscapes to reduce any possible vibrations that may ruin your picture.

FOCUSING MODES

The various focusing options ensure you efficiently capture an image with perfect focus without missing the moment.

Autofocus - Single Servo (AF-S) - autofocus stops operation once the camera confirms that the object is in focus. Usually, the camera will prevent you from taking any pictures until it locks the focus.

Autofocus - Continuous (AF-C) - autofocus only stops when you release your finger from the trigger; otherwise, the camera will constantly refocus. Unlike “single servo,” pressing the trigger will always activate the shutter.

Manual Focus (MF) - manual focus is the best option for low-light photography because autofocus is unreliable when working in dark areas. Setting the lens focus to infinity (∞) or at the farthest focus distance will ensure sharp low-light images when capturing landscapes or faraway objects.

AUTOFOCUS AREA OPTIONS

Although you may be using manual focus most of the time, there may be times when autofocus is a better option. When using autofocus, you will also need to choose a method for focus point selection.

 **Single Point:** choose the exact point you want the camera to focus on. This is the most accurate but is also not efficient. For low-light images, this will be the best option.

 **Dynamic Area:** similar to single, except if the subject moves away, the camera will adjust within the specific amount of chosen points.

 **Tracking:** select an object with a single point, and the camera will track the movements.

 **Auto:** uses technology to identify unique features such as faces and high contrast points.

IMAGE STABILIZATION

When taking pictures of low-light, you will often need to use slow shutter speeds. This causes a problem known as camera shake, which can make your image look blurry and low-quality.

IMAGE STABILIZATION

When shooting handheld, keep the shutter speed at least the reciprocal of the focal length. For example, your shutter speed would need to be at least 1/85 sec if using an 85mm lens.

However, you can also use Image Stabilization (IS) or Vibration Reduction (VR). This camera/lens feature compensates for the movement of your hands when taking a photo. It allows you to use slower shutter speeds, sometimes down to $\frac{1}{4}$ of a second.

TRIPODS

Some of the most exciting forms of low-light photography require prolonged shutter speeds (sometimes up to 15+ seconds). Using your built-in IS or VR features will not work for this. Instead, you must place your camera on a tripod or a clamp.

Tripods allow your camera to be completely steady and prevent blur caused by camera shake. Just make sure to turn off any image stabilization features because it will confuse the camera and might destabilize your images.

Tripods can be expensive, but a tabletop tripod, Joby GorillaPod, or a super clamp is a much more affordable option. You can find some very creative ways to stabilize your camera.

If you are careful enough, even setting your camera on something (e.g., a rock, table, or chair) without touching it can work. Try different ways to stabilize your camera to find ways that work best for you!

TRIGGERING YOUR CAMERA

Simply pushing the trigger button on your camera is not always the best way to take a low-light photo. More often than not, you will want to remotely or interval trigger your camera.

TOUCHLESS TRIGGERING

The purpose of using a remote is to avoid touching your camera as you click the shutter button. This helps avoid any vibrations that you cause by pushing the trigger. There are three different ways you can trigger your camera without touching it:

- ❖ **Remote** - you can buy a cord, infrared, or radio remote trigger. This may be a good investment if you plan on doing lots of long-exposure photography. However, for occasional use, other options may be better.
- ❖ **Phone app** - some cameras allow you to connect your phone via Bluetooth or wifi to trigger your camera remotely. This is a great option, as the app sometimes lets you change the settings remotely.
- ❖ **Countdown release** - the most accessible and affordable method is using the timer delay feature when taking pictures. Once you press the shutter button, there will be a 2 to 20-second delay. You can generally change this duration in your camera menu.

INTERVAL

For some types of low-light photography (such as fireworks, lightning, and night sky), interval shooting makes capturing great shots easier.

Interval shooting is when your camera continues taking pictures on its own for long periods of time, capturing many photos. This allows you to increase your odds of capturing photos of unpredictable moments such as lightning.

To use interval shooting, most cameras have an interval function built into the camera. You can also buy an intervalometer remote if your camera does not have this feature.

HOW TO EDIT YOUR PHOTOS

When capturing low-light photos, editing your images is more important than ever. The unedited images from your camera may be good, but you can make them way better!

SHOOT IN RAW

The default camera file format is JPEG, which captures 16.8 million colors (8-bits). You may think that is a lot, but you can capture more. By changing to a RAW file format, you can capture up to 4.4 trillion colors (14-bits) in one image! Just be careful because the file sizes will be a lot bigger. You should shoot in RAW because the massive amount of colors allows you to make impressive edits.

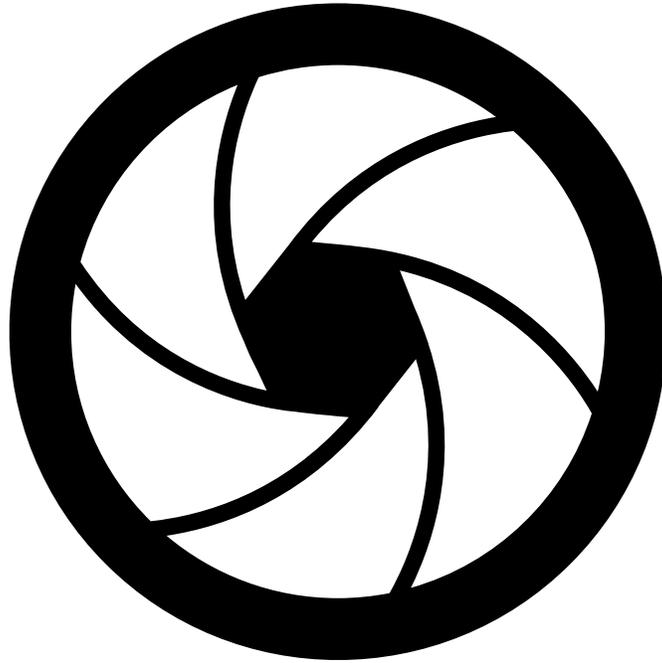
EDITING APPLICATIONS TO USE

You can use a free editing app on your computer or mobile phone. For example, the Apple Photos app has lots of great editing features. If you want to use an advanced editing app with many features, subscribe to Adobe Lightroom Classic.

MAKING IMAGE ADJUSTMENTS

Once you have an editing application picked out, it is time to start editing! The most crucial adjustment tools are exposure, white balance, and cropping. However, also try adjusting contrast, saturation, highlights, and shadows. This process is very interactive, so have lots of fun and experiment!





PART III

PROJECT

ACTIVITIES

**THIS IS NOT A LIST OF REQUIRED
ACTIVITIES BUT RATHER
INSPIRATION FOR HOW
YOU CAN CAPTURE
LOW-LIGHT
PHOTOS.**

CHOOSE THE ACTIVITIES YOU
WANT TO DO AND LEARN
FROM THEM!

#1 - CHEERFUL HOLIDAY LIGHTS



DIFFICULTY	① - Easiest
SPECIAL NOTICE	A string of holiday lights needed
LEARNING GOAL	Understanding depth of field and bokeh

PREPARATION

Find some holiday decorations or a Christmas tree with ornaments. If you aren't in the holiday season, temporarily set up a string of lights.

RECOMMENDED CAMERA SETUP

Use manual or aperture priority mode (A/Av) and set the aperture as wide as possible. The wider, the better! If you use a prime lens, you can get the aperture to f/1.8 or wider! The shutter speed and ISO aren't critical and can be at any value.

SUGGESTED INSTRUCTIONS

Try photographing the decorations by getting bokeh in the background. Bokeh is an aesthetic quality and is the effect of many individual lights becoming big blurry circles.

You can do this by keeping the F-stop number low and staying as close to the subject as possible. Experiment with different angles and distances to figure out what works best.

#2 - CREATIVE LIGHT PAINTING



DIFFICULTY	② - Moderate
SPECIAL NOTICE	A flashlight or sparkler needed
LEARNING GOAL	Understanding moving light with long shutter speeds

PREPARATION

Plan to do this activity outside during dusk or at night. You will need a flashlight, sparkler, or anything else that emits light. Just be careful if you decide to use a sparkler. Having an adult with you to supervise is recommended.

RECOMMENDED CAMERA SETUP

Set your camera on manual mode and place it on a tripod. Use a lens with a wide or medium focal length. As a starting point, try these settings: ISO 200, f/7.1, 30-second shutter. You may also need to manually adjust your focus to where you plan on doing the light painting.

SUGGESTED INSTRUCTIONS

Once your camera is all set, push the release trigger. Now, for the duration of the shutter being open, any light you move in front of the camera will be captured. This is what we call light painting!

Want a fun challenge? Try writing your name with a flashlight!

#3 - SUNSETS AND SUNRISES



DIFFICULTY	② - Moderate
SPECIAL NOTICE	Caution: the sun viewed through a lens is dangerous!
LEARNING GOAL	Controlling exposure with precision

PREPARATION

Find an open location where you want to capture a sunset or sunrise. Next, check your weather forecast for clear cloud coverage and when the sun will rise or set.

RECOMMENDED CAMERA SETUP

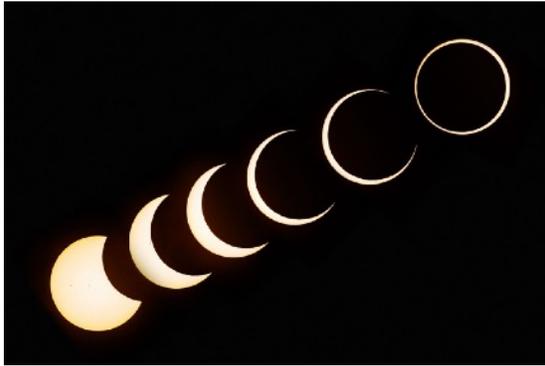
Any combination of settings will work. It all depends on the type of picture you want to capture. A typical low-light sunset picture will likely use the following settings: ISO 100, 1/25 sec, and f/22.

SUGGESTED INSTRUCTIONS

Sunsets or sunrises are cliché and are easy to capture in auto mode. What is not easy is deliberately composing and adjusting your settings. The latter is what you will be doing because it allows you to capture a unique photo.

Experiment with unique angles and different settings to discover what works best. For a low-light sunset or sunrise photograph, ensure the sun is near or covered by the horizon.

#4 - DEEP SPACE WONDER



DIFFICULTY	③ - Challenging
SPECIAL NOTICE	Telescope or super telephoto lens needed
LEARNING GOAL	Low-light photography for scientific purposes

PREPARATION

The equipment needed for doing deep-space photography is expensive. To do this activity, you will need access to a telescope or a super telephoto lens. You could borrow one from a friend or use a school telescope.

RECOMMENDED CAMERA SETUP

You must get a T-adapter to attach your camera to a telescope. Because there will be no electronics to communicate between the camera and telescope, you must set it on manual mode. The only settings you can change are ISO and shutter speed. You cannot adjust the aperture because it will be a fixed value on the telescope. A fast shutter will work, but if you are using a tracking mount, a long-exposure is best.

SUGGESTED INSTRUCTIONS

The easiest object in the sky to photograph is the moon. You can also take pictures of planets, stars, galaxies, or nebulae if your telescope is powerful enough. However, ensure you understand how to use the telescope, as this will be the most challenging part of taking any pictures of space.

#5 - LIGHTNING MADNESS



DIFFICULTY	③ - Challenging
SPECIAL NOTICE	Caution: lightning photography is dangerous!
LEARNING GOAL	Using interval shooting and capturing lightning

PREPARATION

The first step to taking lightning pictures is knowing when there will be an electrical storm. Make sure to check your weather forecast for potential thunderstorms in your area! For this activity, adult supervision is strongly recommended for safety.

RECOMMENDED CAMERA SETUP

The approach for lightning pictures is to maximize your odds of capturing a strike! Do this by using a tripod, wide angle lens, long shutter speed, and taking lots of pictures. The best settings are 24mm focal length, focus set to infinity, ISO ≥ 800 , 15-second shutter, f/22, and an interval timer.

SUGGESTED INSTRUCTIONS

Lightning is very dangerous! Never be outside during a thunderstorm. Always take photos from a secure area. This includes taking pictures from inside a garage, out your house window, or from inside a car. Remain in a safe zone until 30 minutes after the last thunder is heard.

Once you are all set, activate your interval and watch nature's show! Make sure you frequently check your camera to ensure the interval is working.

#6 - ANIMALS OF THE DARK



DIFFICULTY	① - Easiest
SPECIAL NOTICE	A pet or access to an aquarium
LEARNING GOAL	Adjusting white balance for low-light photos

PREPARATION

For this activity, you can go to an aquarium or use your pet (such as a cat or dog). Aquariums are usually very dark, so it is an excellent opportunity for practice. If you also have access to a macro lens, you can capture photos of insects, too! Any option is acceptable. Do what interests you the most.

RECOMMENDED CAMERA SETUP

Shoot your pictures using manual or Aperture Priority (A/Av) mode. Set the ISO at about 1,600 and the aperture at f/5.6 or wider. The shutter can be about 1/125 sec, but choose the speed based on getting the best exposure and sharpness.

SUGGESTED INSTRUCTIONS

Photographing animals in dark areas is easy. Just make sure you correctly expose the images. However, when at an aquarium, place the lens very close and perpendicular to the glass. Doing this will prevent your camera from capturing any reflections or refractions. For different looks, try manually adjusting your white balance.

#7 - DRAMATIC PORTRAITS



DIFFICULTY	② - Moderate
SPECIAL NOTICE	A person to pose for you is needed
LEARNING GOAL	Capturing portraits with low-light

PREPARATION

Capture a silhouette or low-light portrait. You may also use a single light source, such as a candle, flashlight, or speedlight flash. For the subject of your portrait, have a friend or family member pose for you.

RECOMMENDED CAMERA SETUP

Choose the widest aperture you can use to create a dramatic portrait. A $f/1.8$ prime lens is a perfect choice, but any lens will work. For the shutter speed, keep it fast at about $1/125$ sec. The ISO will depend on the other settings you choose and how dark the area you are in is. An ISO of 320 may work but don't be surprised if you need to go up to ISO 6,400.

SUGGESTED INSTRUCTIONS

Experiment with different lighting angles. Try taking pictures of your subject with the light coming from the side, behind, above, below, and directly. You may also have the subject hold the light source (e.g., a candle or a phone screen) to add creativity.

#8 - MIDNIGHT ABSTRACT



DIFFICULTY	① - Easiest
SPECIAL NOTICE	Camera flash and a rainy night are needed
LEARNING GOAL	Creating bokeh with flash

PREPARATION

To do this activity, wait for precipitation of snow or rain. You can check the weather forecast to help you get ready for this.

RECOMMENDED CAMERA SETUP

You can set your camera on either manual or priority mode. Set the ISO at around 800, aperture at $f/4$ or wider, and your shutter speed at $1/100$ sec or slower. Also, use a flash aiming in the same direction as your lens. A higher-powered external flash head is best, but your camera's built-in flash will also work.

SUGGESTED INSTRUCTIONS

From a dry area, aim your camera and flash at the rain. You might need to change the flash power or ISO to get an accurate exposure. If a flash isn't available, a powerful flashlight will also work. Try experimenting with manual focus and various focal lengths to get different results.

#9 - MAJESTIC FIREWORKS



DIFFICULTY	③ - Challenging
SPECIAL NOTICE	A remote trigger is needed
LEARNING GOAL	Using a remote and a bulb shutter

PREPARATION

Fireworks happen during Independence Day or New Year's. It is possible to both enjoy and photograph these fantastic shows. All you need to do is arrive early and set up your camera accordingly.

RECOMMENDED CAMERA SETUP

You must set up your camera on a tripod, GorillaPod, or a clamp. Use a wide-angle lens ($\leq 24\text{mm}$) or keep your distance away from the show so you can use a medium-length lens. Best settings: infinity focus, ISO 500, f/13, bulb (aim for a shutter between 5 and 10 seconds), and remote trigger.

SUGGESTED INSTRUCTIONS

Arrive at the firework show viewing area very early. Doing this allows you time to set up your camera and determine where the best view of the fireworks will be. Once the show begins, you can remotely activate and deactivate the bulb shutter. The goal is to capture the right amount of the fireworks. Not enough will be unsatisfying, and too much will be chaotic.

#10 - BLUE HOUR MAGIC



DIFFICULTY	② - Moderate
SPECIAL NOTICE	Night travel may be necessary
LEARNING GOAL	Capturing low-light landscapes

PREPARATION

Blue hour is a favorite time of day among most photographers. It usually starts about 20 minutes after sunset. Research when blue hour happens in your area and find a location where you would like to take pictures. Urban areas and parks are fantastic options.

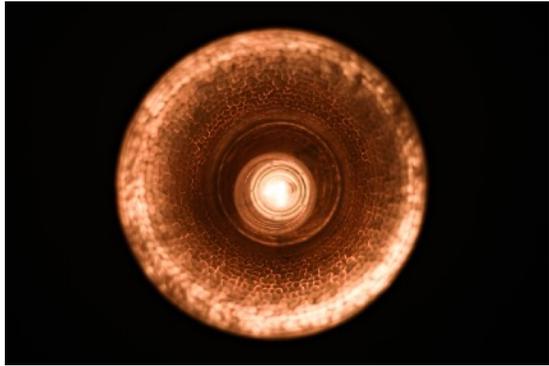
RECOMMENDED CAMERA SETUP

Any combination of settings will work for blue hour pictures. However, don't use auto as you won't get a balanced exposure. Use manual mode or shutter speed priority (S/Tv) mode. Typically, a wide-angle lens, tripod, narrow aperture (f/16 or f/22), and a slow shutter speed (1 to 5 seconds) work best.

SUGGESTED INSTRUCTIONS

Scout for the best spot and angle to capture a blue hour picture. Looking for different shades of blue and unique clouds is a good start. Once you have your spot and angle selected, set up your tripod and camera. Remember, experiment with your settings and composition to discover what will work best.

#11 - DAZZLING OBJECTS



DIFFICULTY	① - Easiest
SPECIAL NOTICE	Decorative object needed
LEARNING GOAL	Low-light product photography

PREPARATION

Choose an object that fascinates you, such as a flower, light fixture, toy, or decoration. Set up this object in a room with little light.

RECOMMENDED CAMERA SETUP

Every object will need different camera settings. You can use center-weighted or spot metering with any shooting mode, and you should get a good photo. Generally, the settings will be f/4, slower than 1/100 sec (sometimes down to 1/5 sec), and ISO at about 640.

SUGGESTED INSTRUCTIONS

Some objects are more challenging to photograph than others. You may need to adjust the settings or use EV (exposure values) if using program auto. You should also use a flash or a continuous light to control the lighting of your object.

#12 - CRAZY CAMPFIRES



DIFFICULTY	① - Easiest
SPECIAL NOTICE	Caution: don't play with fire
LEARNING GOAL	Selecting the perfect shutter speed

PREPARATION

All you need is your camera, a fire, and adult supervision. A campfire is the best choice, but candles can also work. For safety, follow all local regulations and be prepared to extinguish the fire at any moment.

RECOMMENDED CAMERA SETUP

Use long focal lengths for safety and shallow depth of field. Set your camera on manual, shutter speed priority, or program auto. You can either use a fast shutter (e.g., 1/320 sec) for a sharp fire effect or a slow shutter (1/20 sec) to blur the movement of the fire. Also, be ready to use high ISO values up to 8,000. Try a variety of different camera settings, especially different shutter speeds. The goal is to determine what settings will get you the best photos.

SUGGESTED INSTRUCTIONS

Warning: fire can cause severe burns! Keep a safe distance from the fire and experiment with different perspectives. You could capture the entire fire or just a tiny detail within the fire. Also, try using different white balances to get exciting flame colors.

#13 - SPECIAL EVENTS



DIFFICULTY	② - Moderate
SPECIAL NOTICE	External flash heads needed
LEARNING GOAL	Capturing photos with artificial light

PREPARATION

Capturing event photos is a way to preserve meaningful moments! However, events are often dark, and having low-light photography skills is a must. You can capture low-light event photos at weddings, dances, concerts, conferences, family gatherings, club meetings, and county fairs.

RECOMMENDED CAMERA SETUP

Taking pictures of events requires high ISO values, wide apertures, and slow shutter speeds. It is not always practical to take pictures using that combination of settings. Instead, using flash units is a great way to go! Simply place a flash in the hot shoe of your camera. If you want a tough challenge, try OCF (off-camera-flash) by using the commander mode in your camera to fire your flash heads remotely via infrared.

SUGGESTED INSTRUCTIONS

When using a flash, try not to aim the units at the people. Instead, aim them at the walls or ceiling. Doing this will reflect the light to appear soft and more natural. This technique is called bounce flash.

#14 - CITIES AT NIGHT



DIFFICULTY	② - Moderate
SPECIAL NOTICE	Stay safe at night and bring someone with you
LEARNING GOAL	Low-light composition and storytelling

PREPARATION

Cities have lots of opportunities to capture great low-light pictures. You can photograph architecture, the city skyline, cars as they drive by, or the nightlife of all the people.

RECOMMENDED CAMERA SETUP

There are many elements in a city that you can capture handheld. Recommended settings for handheld: ISO 6,400, f/2.8, 1/25 sec. However, if you need to use a slower shutter speed and a more narrow aperture, be prepared and bring a tripod with you. It would be best to use a tripod for pictures of the city skyline or a street of cars driving by.

SUGGESTED INSTRUCTIONS

Bring a friend or family member with you and explore a city. Find interesting elements in the street or buildings that will make a great photo. Exposure is necessary, but don't use all your energy to determine the best settings. Composition and creating a story with your images is much more important!

#15 - STARRY NIGHT



DIFFICULTY	③ - Challenging
SPECIAL NOTICE	A dark sky viewing area recommended
LEARNING GOAL	Planning and advanced manual controls

PREPARATION

Preparation is crucial for the success of a night sky picture. Three conditions must be considered when planning a night shoot:

1. **Shoot during a new moon:** light from the moon can pollute the skies
2. **Shoot during a clear sky:** clouds can block the view of stars
3. **Shoot in a dark sky area:** stay away from cities causing light pollution

RECOMMENDED CAMERA SETUP

The best approach to capture a starry night is stabilization and maximizing exposure. First, use a wide-angle lens and set your camera on a tripod. Use manual mode and shoot with the following settings: focus set to infinity, ISO $\geq 6,400$, 15-second shutter, and f/4 or wider. The shutter can be longer than 15-seconds, but you will start to notice star trails.

SUGGESTED INSTRUCTIONS

When navigating at night, use a red flashlight to preserve your night vision. Just ensure that you turn off all lights before you press the shutter button. Any visible light could ruin your photo.

#16 - CUSTOM

Create your own low-light photography activity. The pictures you capture from this activity can be included in your journal/binder.

Activity name:

How challenging was this activity? (circle one)

①

②

③

What did you learn or discover?

How did you prepare?

What was your camera setup?

How did you take the pictures?



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My hands to larger service,
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