

The image features five bird wings of different sizes and patterns, arranged around the central text. The wings are rendered in a grayscale, semi-transparent style. One wing is at the top left, one at the top center, one at the top right, one at the bottom left, and one at the bottom right. Each wing shows distinct feather patterns, including primary feathers and wing coverts.

Lesson 6 Part 1

A COLLECTION OR FIELD GUIDE:

PATTERNS

PATTERNS

- Nature is full of patterns and scientists often use patterns to group or categorize species, or as clues to underlying processes or forces at work.
- A pattern exists when a set of numbers, colors, shapes, or sounds are repeated. Patterns can be found everywhere: in animals, plants, and even the solar system! Some specific patterns are called fractals or **spirals**. Fractals are patterns that repeat at different scales.



How to Study Patterns

- As yourself these questions when you are doing an observation:
 - What patterns do you notice?
 - How can you describe the pattern?
 - Are there exceptions to the pattern?
 - What might be causing the pattern?
 - What does the pattern remind you of?



Some things with a Pattern

- Spirals
- Branching patterns
- Things found under rocks
- 120 degree angles
- Patterns made by melting snow
- Animal or plant camouflage
- Tracks in the mud
- Signs of the season
- Flowers
- Orb Spider webs
- Bird Feathers





Collection or Field Guide: Patterns

In this lesson, you will create a field guide of 3-5 things focusing on the concept of **Patterns**.

- Here's what you'll do:
 1. Make a field guide of your chosen subject that shows patterns.
 2. Include three to five things in your field guide.
 3. Arrange the page so that you show drawings with words next to them.
 4. Record observations with words, pictures, and numbers, paying attention to similarities and differences and PATTERNS.

Field Guides

are
useful tools for
identifying and
learning about
plants, animals
and other parts of
nature in a specific
area.

- Look at the following field guide pages.
- Notice what kind of information is included and how it is arranged on the pages.
 1. Typically, a field guide will have pictures or drawings for each subject, sometimes showing different stages or forms for each subject.
 2. Written information describing key points, and maps.
 3. Subjects are arranged in an order that helps compare similar species.

Pocket Guide to Dragonflies and Damselflies

- Small foldable pamphlet you can take in the field to quickly identify your subject.
- Very little information about the animal, just enough to identify it, but you'll need to do more research on it when you get back home.



Description One of our most common and widespread dragonflies. Unmistakable pied males always notable but different from spotted females. Hair. Eyes and face dark brown. Thorax dark brown with two faintly indicated pale stripes on each side. Abdomen white (some see it as pale blue) with pruinosity when mature. Wide black crossband near tip and black streak at base of each wing, white behind basal streak at maturity. Immature with spotted abdomen as female but typical male wing pattern; becomes gradually bluish-white, then white. Female: Eyes and face brown. Thorax brown with two white stripes on side of thorax, turning yellow at lower ends. Abdomen brown with white to pale yellow spots along each side, forming lines on S₂-3 and extending diagonally on S₄-6. Pale spots outlined in black. Three dark spots on each wing, quite different from male. Just-emerged individuals show only very faint wing spots, but distinctive abdominal pattern obvious.



422-1
Common Whitetail
male—Fillsborough
Co., NJ, July 1956,
Henry Smith



422-2
Common Whitetail
female—Barnes Co.,
TX, July 1956



422-3
Common Whitetail
immature
male—Bluffton, SC,
CA, OR, June 1956,
Jay Withgott

Identification Sexual differences in wing color pattern greater than in almost any other dragonfly. Male like nothing else except closely related **Dwarf Whitetail**, which has much white on wing bases. More distant from **Band-winged Dragonlet** and **Four-spotted Pennant**, both of which have similar black bands on each wing but no white on wing bases and abdomen slender and black. Female wing pattern much like that of female **Testate spotted Skimmer**; differs in abdomen pattern. Skimmer has yellow squams at outer edge of each segment that make abdomen appear banded along edges. **Whitetail** pale yellow white slashes that make abdomen appear spotted along edges. **Whitetail** commonly perches on ground and logs, skimmer usually on branches and leaves, but this is indicative, not definitive. See **Banded Pennant** and **Prince Baskettail**, with similar wing patterns but otherwise very different.

Natural History Most of perching away from water is on ground, rocks, or logs, usually very low and in more open areas than where most skimmers perch. Capture small insects that pass by in flight. Males perch at waterside and fly up and down shore, very aggressive to other male whitetails and other somewhat similar-looking species. Strongly territorial, defending an area 12 feet on either side of an oviposition site. Territorial males remain at a breeding site for several hours each day, not necessarily every day, at maximum for 16 days. Larger males defend larger territories and mate more times. Subordinate males may be allowed in dominant male territories, but dominants mate. Perch flight typically very low, just above water. Broad white abdomen extended in face to face display to fight one turn and lowers abdomen (still displayed), or both may fly in parallel flight for up to a minute or more. Females visit breeding sites only every few days, peaking in midday but second peak in late afternoon, presumably fertilized females returning to water. Ovipositor (anal) is erect in flight, followed immediately by oviposition. Female usually guarded by male, often hovering about a foot above her. Where common, especially at small ponds, both guarding and territorial defense ineffective, female often snatched up by second male or leaves water. Some females drop to ground at waterside when harassed, then apparently invade water. Females oviposit by flapping water near floating vegetation or on clump of mud or vegetation with glaucous surfaces, with frequent position changes as mud. They remain in same spot for up to several minutes with male in attendance. Often flick water droplets forward with eggs, laying 25-30 eggs at each spot. Females fly around near egg trail at around 25/sec. Reproductive adults can live up to 28 days.

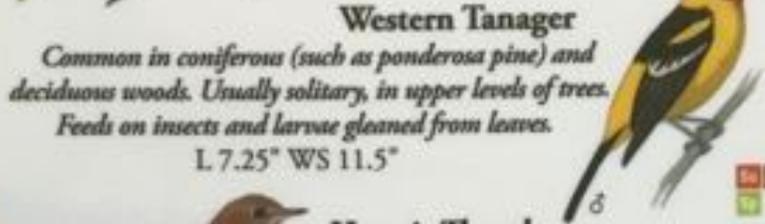
Field Guide
to
Dragonflies
Two pages
on one
species.



Hooded Oriole

Uncommon in open woodland or brushy habitats, often near fan palms. Solitary or in small groups. Bill curved. Male has orange crown, black face; female drabber overall.

L 8" WS 10.5"



Western Tanager

Common in coniferous (such as ponderosa pine) and deciduous woods. Usually solitary, in upper levels of trees. Feeds on insects and larvae gleaned from leaves.

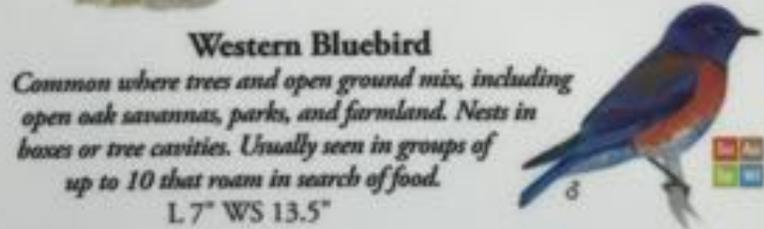
L 7.25" WS 11.5"



Hermit Thrush

Common in brushy understory of forests, especially pine-oak woods. The only thrush likely to be seen in winter.

L 6.75" WS 11.5"



Western Bluebird

Common where trees and open ground mix, including open oak savannas, parks, and farmland. Nests in boxes or tree cavities. Usually seen in groups of up to 10 that roam in search of food.

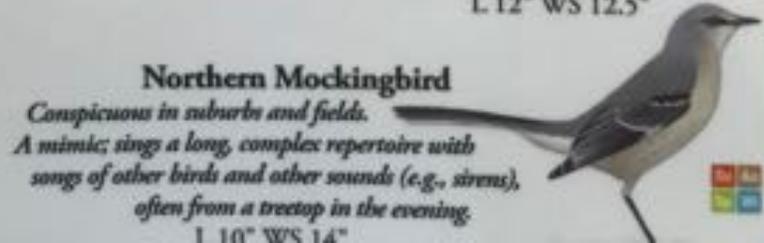
L 7" WS 13.5"



California Thrasher

Common but difficult to see in chaparral and other dense brush. Large, long-billed, and long-tailed. Song rather low and harsh, with scratchy note and very high thin notes.

L 12" WS 12.5"



Northern Mockingbird

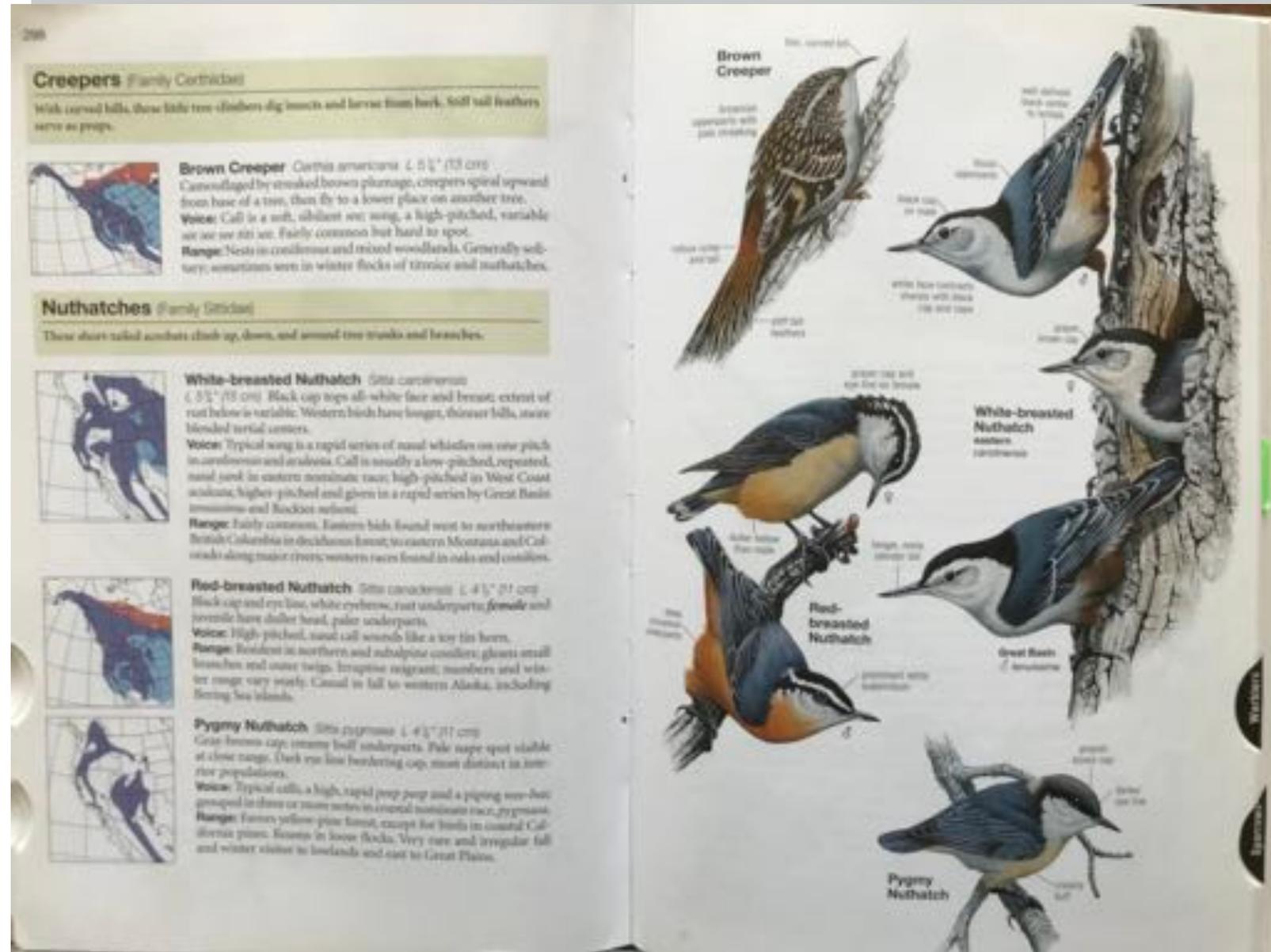
Conspicuous in suburbs and fields. A mimic; sings a long, complex repertoire with songs of other birds and other sounds (e.g., sirens), often from a treetop in the evening.

L 10" WS 14"

Pocket Guide to Backyard Birds

Field Guide to Birds

- 450-page book with more information on each of the related species.
- Maps of distribution are important in helping to identify the species you're studying.



Field Guide to Insects

Two different sections of the same book. How is this book organized?

203

PAPILIO MACHAON Old World Swallowtail

Family Papilionidae
Order Lepidoptera
Length Wingspan is 80–85 mm.
Recognition marks Hind wing has a dark area along the inner margin not extending into the discal cell area, and tails only two or three times as long as wide. (A closely related species, *P. orgonius* has tails much longer.)
Habitat Unknown, but in Europe larvae feed on Umbelliferae. Oviposition has been reported on *Artemisia arctica* (Compositae).
Distribution Alaska and Canada and in the northern part of Europe. Rare.
Note This species is one of about twenty-eight species of swallowtail butterflies, so-called because they almost always have tails on the hind wings. Among the most beautiful of butterflies with over 500 species worldwide, most of them tropical, they are highly prized by collectors. One common species, the pipevine swallowtail (*Battus philenor*), lacks tails on the hind wings. This species is widely distributed in the United States. The larvae feed on wild ginger, pipevine, and other plants. It is mimicked by the red spotted purple (*Limenitis astyanax* (see illustration 250).



W



204

PAPILIO CRESPHONTES Giant Swallowtail

Family Papilionidae
Order Lepidoptera
Length Wingspan is 100–140 mm.
Recognition marks Black with a yellow "X" on the front wing and basal and subapical bands on hind wing. Distinguished from *P. thoas* by the larger spots forming in the lower left leg of the "X" on the front wing. This is the largest butterfly in the United States and Canada.
Habitat Larvae feed on a variety of trees and plants including cilantro, prickly ash, and hop trees. The ommatidium (see larvae, next species) is orange.
Distribution Eastern North America to Mexico.



O



82

CICINDELA SPLENDIDA Splendid Tiger Beetle

Family Cicindelidae
Order Coleoptera
Length 12–15 mm.
Recognition marks Elytral margins are metallic blue or green, strongly contrasting with the disk of the elytra which is brilliantly copper-red or malachite green.
Habitat Usually in sandy areas, particularly in evergreen forests.
Distribution Eastern North America west to the Rocky Mountains.
Note The larvae of tiger beetles are all carnivorous. They make a vertical burrow in the soil, 300 mm (1 foot) deep. The head and thorax is modified to form a plug at the top of the tube. The larva swims, with open jaws, until a passing insect touches the larva, whereupon the jaws snap closed and a struggle follows. The dorsal surface of the fifth abdominal segment has two pairs of hooks that help prevent larvae from being dragged from the hole.



W



83

OMUS DEJEANI Dejean's Omus

Family Cicindelidae
Order Coleoptera
Length 15–21 mm.
Recognition marks Black; elytra have numerous very large scattered pits among smaller punctures; rest of the body is nearly smooth.
Habitat In rotten stumps. Adults will bite if handled.
Distribution Common in the Pacific Northwest. Other very similar species occur throughout the western states.
Note Genera of species of the genus *Omus* have been described, but relatively few are valid names representing natural species. These beetles, except for this species, are relatively rare. Very little is known about their habits or their life history.



W



White Dead-nettle

Lamium album L.

The white dead-nettle with leaves similar to those of the common stinging nettle (*Urtica dioica* L.*), often grows in similar places, which have a high content of nitrogenous substances in the soil, such as wasteland, thickets, hedgebanks, roadsides and thin woods. The blossoms are adapted to the visits of insect. The upper, hooded lip shields two long and two short stamens. Nectar is secreted at the bottom of the corolla-tube, which is covered internally with fine hair, and which prevents small insects from reaching the nectar. When bees or bumble-bees pollinate the flowers, they touch the anthers, shake the pollen on to their hairy bodies, and in this way transfer it to other flowers.

The white dead-nettle contains various medicinal substances, but usually only the white flowers are collected. This, and the subsequent drying process can be quite painstaking work, because the flowers easily turn brown. Nevertheless, its medicinal effects are reputed to be considerable, as it can be used as a sedative for neuritis, to regulate bowel activity, to soothe coughs or to cure inflamed wounds. The young leaves in spring can also be used as a spinach-like vegetable.

The dead-nettle
and mint family
Labiatae

IV—IX; 2;
20—40 cm.

Rhizome:

Creeping.

Stems: Erect,
unbranched,
square in cross
section.

Leaves: Opposite,
petiolate, cordate,
ovate, serrate.

Flowers: In the
axils of leaf-like
bracts.

Calyx: White,
bell-shaped
with narrow
pointed teeth.

Corolla: 2-lipped
with 4 stamens.

Fruit: 4 achenes.

Eu., As.:

secondary N. Am.

1 — longitudinal
cross-section of
the corolla



Field Guide
to Plants

2 TOES



Mountain Goat

Oreamnos americanus
To 6 ft. (1.8 m)

Distinguished by its long, white coat and black, dagger-like horns. Tracks are 2.5-3.5 in. (6-9 cm) long. Toes may be spread in front, making the tracks look square.



Elk

Cervus canadensis
To 10 ft. (3 m)

Male has large antlers and a shaggy brown neck. Tracks are 3.5-4.5 in. (9-11 cm) long. Dew claws are often evident in soft soil, snow, and when running.



Bighorn Sheep

Ovis canadensis
To 6 ft. (1.8 m)

Distinguished by its coiled horns. Tracks are 2.5-3.5 in. (6-9 cm) long. Hoof prints are splayed when running.



Pronghorn

Antilocapra americana
To 5 ft. (1.5 m)

Told by its 'pronged' horns and white side and rump patches. Tracks are 2.5-3.5 in. (6-9 cm) long and wider at the base.



Pocket Guide to Tracks
Another small, foldable pamphlet. Easy to carry with you.
Limited information and limited number of species.

This field guide on animal tracks goes into great detail about each animal, its behavior, habitat and even its gait. Four pages on the pocket gopher.

POCKET GOPHER Track ID

TRACK Claw marks sharp and prominent (F)



LEFT FRONT LEFT HIND

If track slightly smaller than F, shorter claws.

COMMON SIGHTS A. Not common

Front Hind

Walks, with the hind feet falling behind or partially on top of the fore on each side, are also recorded.

TRACK MEASUREMENTS

	Average, inches	Average, cm
Front width	1/4	1.1
Front length	1/4	2.4
Hind width	1/4	1.0
Hind length	1/2	2.1
Trail width	2 1/4	6.0
Stride*	2 3/4	10.0

*Top

Track ID POCKET GOPHER

In clear prints pocket gophers show five toes on both the front and hind tracks, unlike most other rodents, which show four and five. The front claws, adapted for a life of digging, are long and very prominent, extending farther away from the toes than any other rodent's. Clear prints are, however, rare because of how seldom gophers venture aboveground. The typical track pattern is a flat walk or trot, as shown in the diagram on the opposite page and in photos A and D here. Gophers have not been recorded to my knowledge, so together the track pattern, long claw marks, and size of the tracks should allow a positive ID. Note that pocket gophers are entirely different from the "gophers" or woodchucks of the Midwest and East, which are about eighteen times larger (see "Mammals").

RODENTS

A. Testing pattern crossing a human footprint

B. A Boba's pocket gopher left front foot

C. A left hind foot

D. Detail from a trotting pattern, left front track at bottom and left hind track at top

POCKET GOPHER Track Windows

Trackers share an affinity for dirt with the pocket gopher, who spends most of its life moving within it and bringing it to the surface. While gopher tracks are fairly rare to find, their **mounds of dirt** are seemingly everywhere, and this digging can be read to illuminate the behavior of this fantastically well-adapted animal. In a day, a gopher may move five to eighteen pounds of soil, using its claws and its teeth to excavate. (That's a lot of dirt for a 0.1 kg/one-third-pound animal, equivalent to a medium-size man moving one to four tons!) Gophers dig to reach roots that they eat and to make underground chambers for sleeping, birthing, rearing young, storing food, and defecating. A lot of fresh digging within a relatively small area may mean that a gopher has taken over a new area and is renovating or expanding a tunnel system. This takes place especially in late summer or fall, when the young disperse. Alternatively, a lot of digging in the spring may indicate that a gopher is sating much new plant growth to prepare for breeding and raising young. In areas where it snows, look for mounds of dirt that gophers push up into snow mounds and that later settle to the ground when the snow melts. Old nesting material and scats may be found in some of these.

RODENTS

Aboveground travel is a good window to a gopher's life because it is done for such limited reasons. A juvenile will travel on the surface to disperse from its mother's tunnel system. Each system is occupied by an individual gopher and is unconnected to any other. A gopher looking for a new home somehow knows where vacant tunnels are, because a vacant system is usually unoccupied within minutes or hours. Gophers also travel aboveground to find mates. Whatever the purpose, gophers almost always leave running tracks aboveground because they are so vulnerable. Finally, new spring plant growth often lures a gopher to graze aboveground. It will pop out of its burrow, cautiously move a few steps to munch a plant, then run back, waddling into its burrow, looking like it was attached to a bumper car. Look for backward-facing tracks and evidence of browse all around a burrow entrance.

Gophers are enormously important as a **food source for predators**. Coyotes, rattlesnakes, gopher snakes, badgers, weasels, and owls all depend upon gophers as a staple food. You may be able to watch a coyote or bobcat poised over current digging activity, waiting for the gopher to pop up. In an active gopher area, look for predator tracks. Look for gopher skulls and incisors in scats and owl pellets. These signs are more prevalent in seasons when gophers venture aboveground. Pocket gophers also contribute significantly to the local ecosystem by moving tons of soil to the surface, increasing plant germination and decreasing erosion.

In Its Habitat POCKET GOPHER

F. A gopher has pushed soil from its tunnel digging into a snow tunnel, leaving a solid core that stays on the ground after the snow melts. Part of a tunnel just at ground level is also exposed.

G. Gophers usually push soil out in new direction, in contrast to moles, which push soil straight up to form volcano-shaped mounds. This location shows the gopher's fresh excavation as well as soil of those of several ages from previous diggings.

RODENTS

Species, Geomys, and Pappogeomys spp.

18 species in North America

Usually 46 to 300 g (1.6 to 11 oz.)





Your Turn

1. Make a field guide of your chosen subject that shows patterns.
2. Include three to five things in your field guide.
3. Arrange the page so that you show a drawing with words next to it.
4. Record observations with words, pictures, and numbers, paying attention to similarities and differences and **PATTERNS**.

Remember to begin with your metadata



Date, Day, Time



Location, habitat



Weather

Temperature

Wind

% Cloud cover

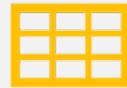
Plan your page



Heading first
Then Title



If you're studying three objects, create enough space for all three things.



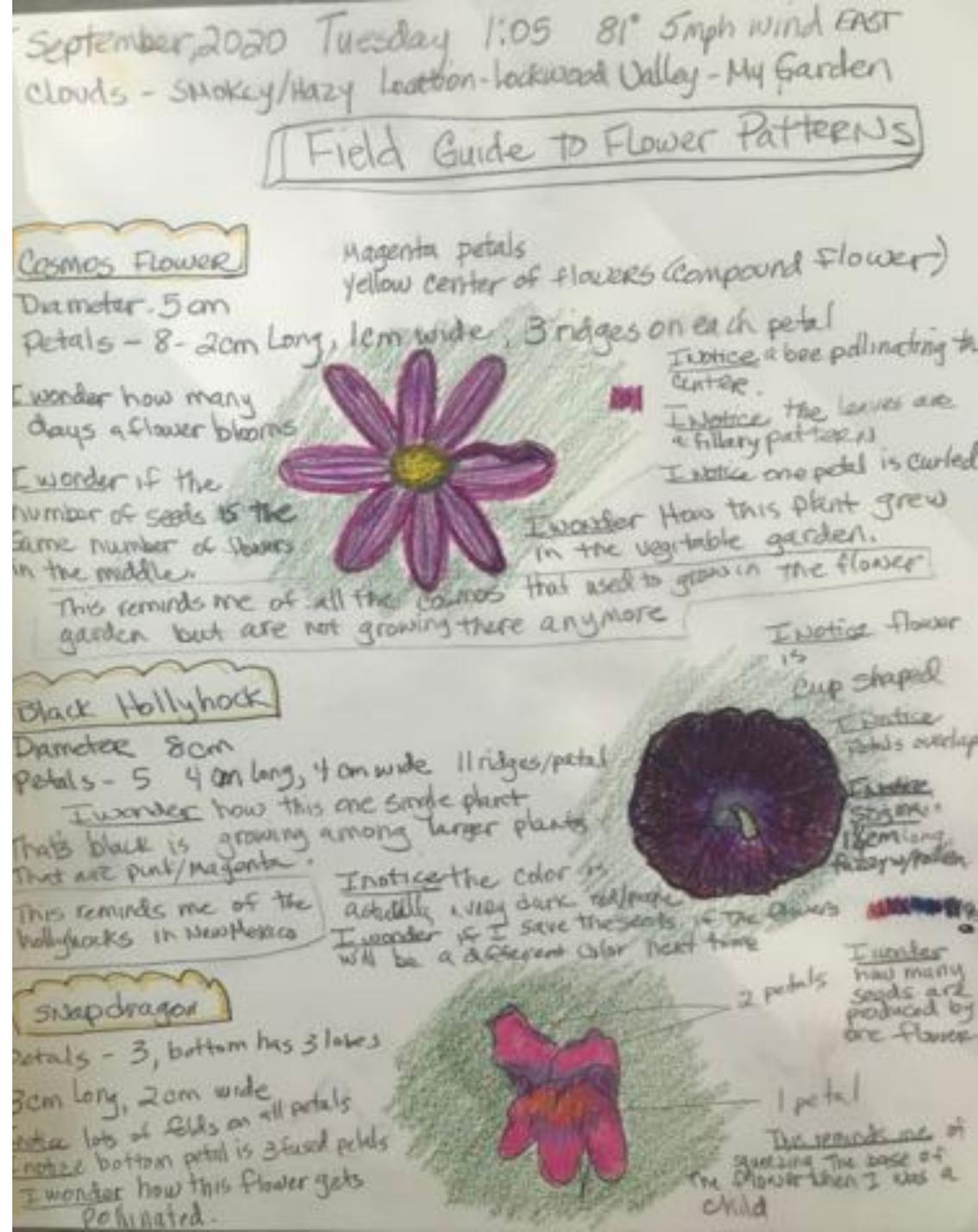
Remember to include ABC's, 123's and drawing/sketch/diagram.



Use the next page for your reflection questions/paragraph.

Plan your layout the way you want it.

- Here's mine:
 - 3 sections
 - Lots of measurements (123's)
 - Each subject treated the same way
 - Name of flower
 - Measurements
 - I notice, I wonder, this reminds me of



Now do your
own field
guide.

Focus on
PATTERNS



Take 45 minutes to 1 hour to
work on all your studies (3-5).



Come back and do your
reflection questions on your
next page.



Question/Answer form (Put as many words from the question into your answer.)



Answer all questions, then put them in an order that makes sense for a paragraph.



Begin with a topic sentence (“I created a field guide focusing on patterns.”)



End with a closing sentence (“It was interesting to discover the similarities and differences in each of the subjects I studied.”)

REFLECTION

REFLECTION QUESTIONS

- What did you notice that was interesting to you as you made your field guide?
- What cool questions did you come up with?
- What are some similarities and differences among the subjects you recorded in your field guide?
- What are some possible explanations for the similarities and differences you saw?
- Are there any features or structures that are shared by your subjects? Describe them.



Looking Forward

Next time, we'll
create a field guide
focused on **CAUSE
AND EFFECT.**

Start looking
around for
interesting
subjects.

BYE FOR
NOW.

THANKS FOR
JOINING ME.

