

Appendix B

Plant Illustration Cards

 Leaf and Flower Card

 Seed Test Card

Setting Up Your Experiment

Photosynthesis Game, directions, board and pieces

The following illustrations show a sample of some of the plants you can find in the Aleutian/Pribilofs. Not all of these plants are found everywhere in this region. Nor are all plants in the region illustrated here.

The *FLORA OF ALASKA* illustrations (numbers 1-60) show a proportional scale. A 1/3 scale means, for example, that the drawing could be multiplied 3X and would show the plant at actual size.

Names are given in this order, alphabetized by species/genus:

Latin

Unangam Tunuu when available (UT page number from the *Aleut Dictionary/Unangam Tunudgusii*)
(common name, *Unangam Tunuu*)

Common name


This symbol, ☹️ means the plant is considered very toxic. A range of toxic effects are known in some plants in this region. Never eat any unknown plant or berry. Be certain of the identity of a plant before you eat it. Taste a wild plant only under the supervision of a parent or a caregiver.


This symbol 🍄 means this plant is recommended for use in ACTIVITY TWO, Section Three.

Illustrations 1-60 were drawn by Mrs. Dagny Tande-Lid. They have been provided by Stanford University Press by permission from the book *FLORA OF ALASKA AND NEIGHBORING TERRITORIES*, by Eric Hultén, copyright (c) 1968 by the Board of Trustees of the Leland Stanford Junior University, and reproduced with the permission of the publishers, Stanford University Press. Further reproduction of the material requires the publishers' permission.


Stanford University Press
521 Lomita Mall
Stanford, CA 94305-2235
Tel. 650-725-0845
Fax 650-725-3457
<http://www.sup.org>


Plant drawings 61-66 were provided by R. W. Tyler and used by permission.

1 



$\times \frac{1}{3}$
Achillea borealis
 Chngaatudax E (UT 148)
 Saahmikaadax W (UT 351)
 (hairy, shaggy)
 Northern yarrow

2 




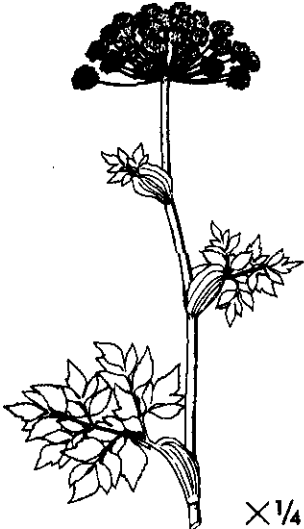
$\times \frac{3}{8}$
Aconitum maximum
 Aanasnaadam ulaa E (UT 71)
 Maamanuuŕidaŕ W (UT 273)
 (bumblebee's house)
 Monkshood

3 




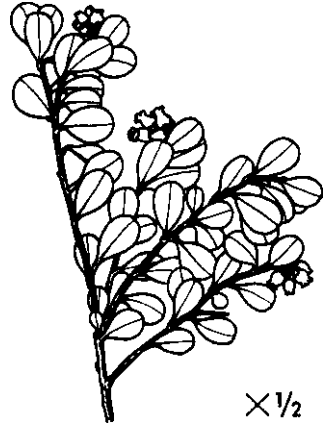
$\times \frac{1}{3}$
Anemone narcissiflora
 Chiŕudangiŕ (aahmaaŕii) E
 (Golodoff)
 Slukam aahmaaŕa W (UT 369)
 (seagull flower, white flower)
 Narcissus-flowered anemone, May
 flower, white flower

4 




$\times \frac{1}{4}$
Angelica lucida
 Saaqudiigamax E (UT 353)
 Saaqudaŕ W (UT 353)
 Angelica, St. Paul Putchki, Wild
 parsnip

5 




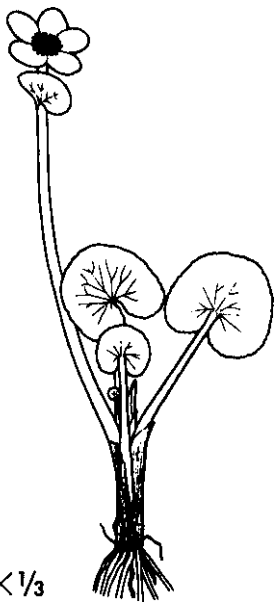
$\times \frac{1}{2}$
Arctostaphylos uva-ursi
 Ulaŕin E (UT 434)
 Winterberry, kinnikinnick, bearberry

6 



$\times \frac{1}{3}$
Artemisia unalaskensis
 Sixsiqaŕ (UT 358)
 Wormwood

7 




Caltha palustris
Anim kangaa
 (Golodoff)
 (lake top)
 Marsh marigold, cowslip

8




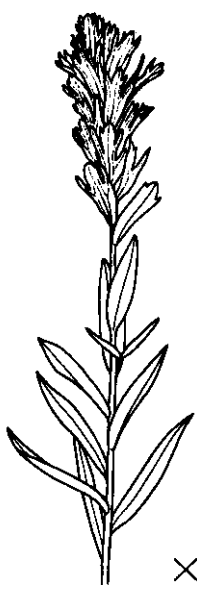
Campanula chamissonis
Kulukalaŋ E (UT 248) [r]
Kulukuliŋ W (UT 248) [r]
 (little bells)
 Bluebell, harebell

9





Campanula lasiocarpa
Kulukalaŋ E (UT 248) [r]
Kulukuliŋ W (UT 248) [r]
 Bluebell, harebell

10 



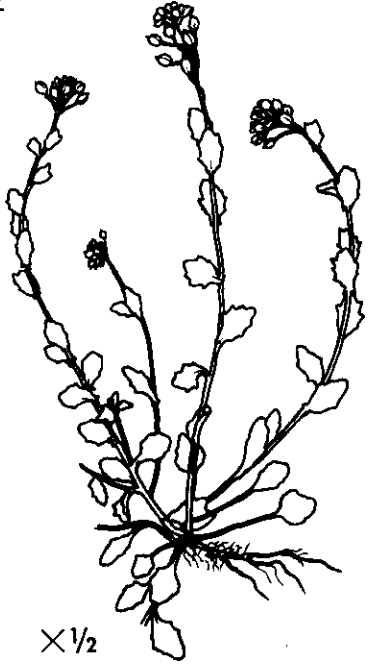
Castilleja unalaschcensis
Aanisnaadam qaatingin
 E (UT 71)
 (bumble bee's favorite food)
 Coastal paintbrush, honey flower

11 



Claytonia sibirica
Chiŋtam chiŋuudngii
 E (UT 139)
Chiŋtam aahmaaŋii
 W (UT 138)
 (rain flower in some places)
 Spring beauty

12



Cochlearia officinalis
 Scurvy grass, spoonwort

13 ☹️



Conioselinum chinense

Chikigluḡ E (UT 141)
 Chikilḡuḡ W (UT 141)
 Qalngaaḡim saq(u)daa E
 (UT 353)
 (raven's parsnip)
 Hemlock parsley

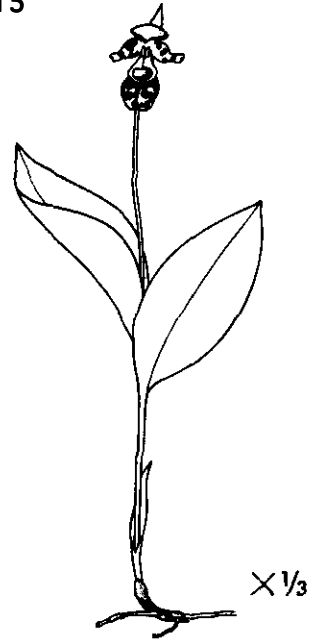
14 ☹️



Cornus suecica

Aḡdiikam aahmaaḡii W (UT 37)
 (Ptarmigan's flower)
 Dwarf dogwood, bunchberry, Lapland
 or Swedish dwarf cornel

15



Cypripedium guttatum

Lady's slipper

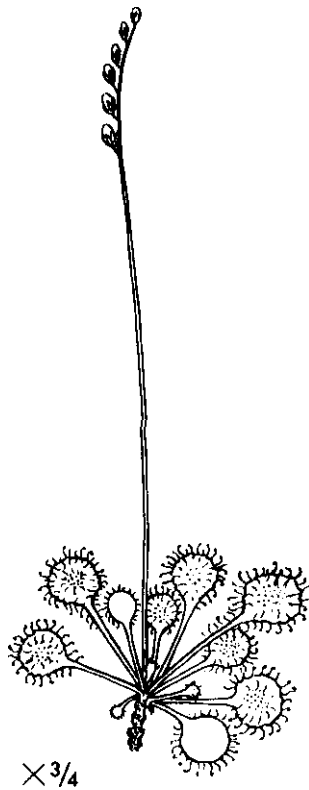
16 ☹️



Dactylorhiza aristata

Key flower, purple orchid

17



Drosera rotundifolia

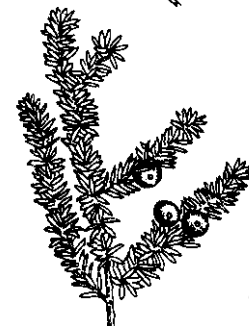
Sundew

Empetrum nigrum

Qaayum qaxchikluu E (UT 314)
 (blackberry)
 Aangsuḡ W (UT 90)
 Qaayuḡ (UT 314)
 Kidnam qaayuu (UT 237)
 (bush of moss)
 Crowberry, mossberry, blackberry



X 1/2




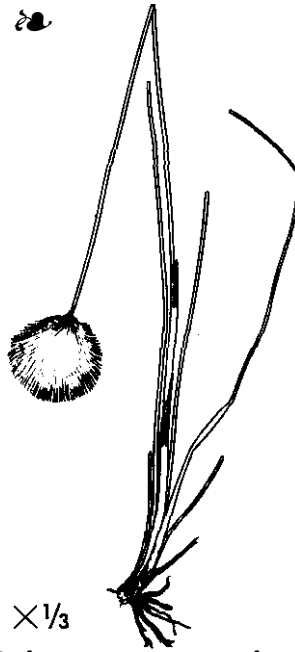
18 ☹️

19 



× 1/4
Epilobium angustifolium
Kimliiyaḅ E (UT 239)
Chikayaasiḅ W (UT 140)
Fireweed

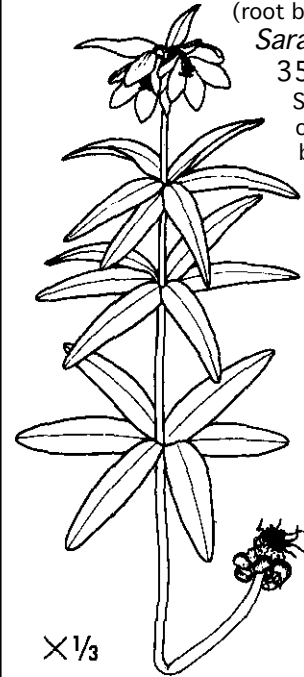
20 



× 1/3
Eriphorum russeolum
Tumḡasiḅ E (UT 406)
Lagim ichḅuusii W (UT 170)
(land goose's [Canada goose]
toilet paper)
Cotton flowers, cotton grass

Fritillaria camschatcensis

Alugam kangaa (UT 230)
(overground portion of)
Alugaḅ (UT 57)
(root bulb of)
Saranaḅ E (UT 353)[r]
Stinky flower,
chocolate lily,
black lily



× 1/3

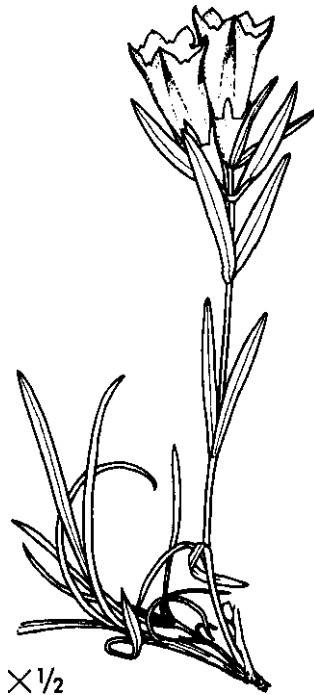
21 

22




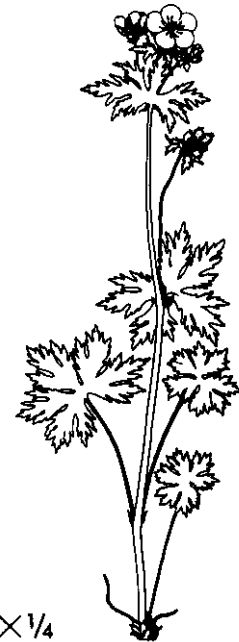
× 1/2
Galium aparine
Bedstraw

23




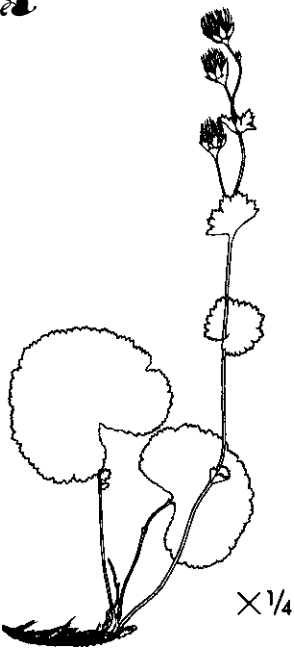
× 1/2
Gentiana algida
Gentian

24 




× 1/4
Geranium erianthum
Chunusiḅ E (UT 154)
Chuhnusiḅ E & W (UT 154)
Wild geranium, cranesbill

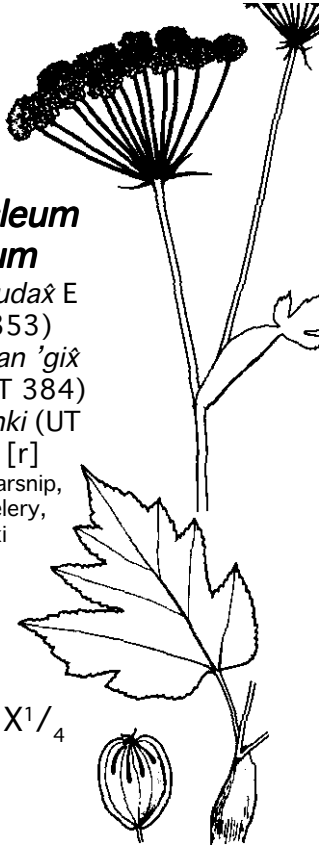
25 



Geum calthifolium
Amiduḡ E (UT 59)
Hamiduḡiḡ W (UT 59)
 Avens


X 1/4


26 



Heracleum lanatum
Saaḡudaḡ E (UT 353)
Taaḡan 'giḡ W (UT 384)
Putchki (UT 353) [r]
 Cow parsnip, wild celery, putchki


X 1/4

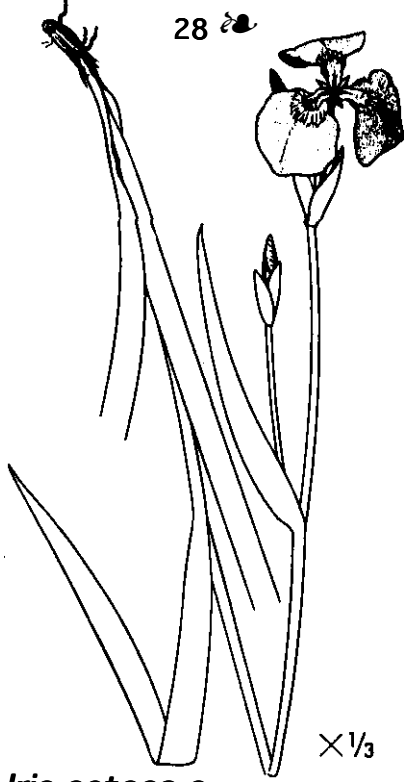
27 



Honckenya peploides
Isuḡim aningin E (UT 77)
 (hair seal's lupine root)
 Beach greens, scurvy grass, seabeach sandwort


X 1/2


28 



Iris setosa s.
Nuusnuchuudan E (UT 285)
 (small scissors)
Umsutuudaḡ W (UT 442)
 Iris


X 1/3

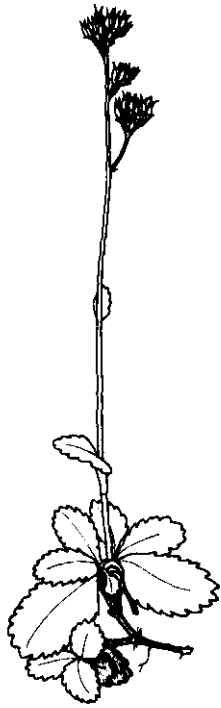
29 



Lathyrus maritimus
Chugum aahmaḡii W (UT 151)
 (sand flower)
 Purple beach pea, seaside pea


X 1/3

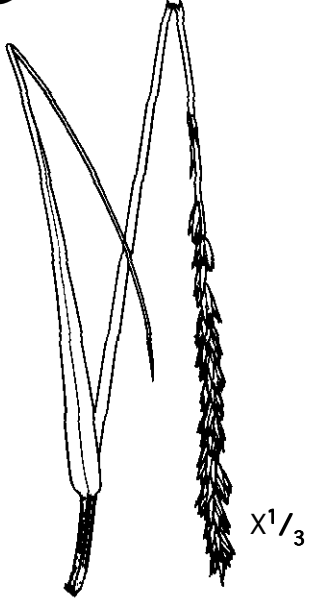
30 



Leptarrhena pyrolifolia
Aliḡsiisiḡ (UT 54)
 Leather-leaved saxifrage

X 1/2

31 




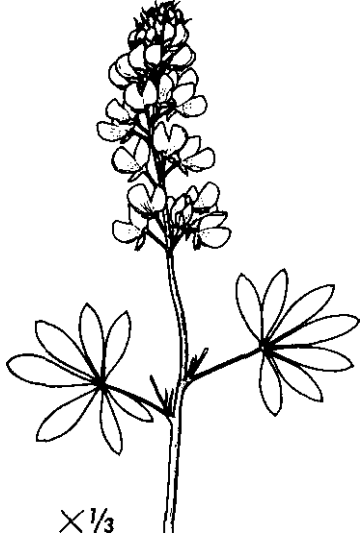
Leymus mollis, formerly known as *Elymus mollis*
Tīxyūx̄ E (UT 398)
Tīgyūx̄ W (UT 398)
 (basket grass)
 Wild rye, beach rye

32 



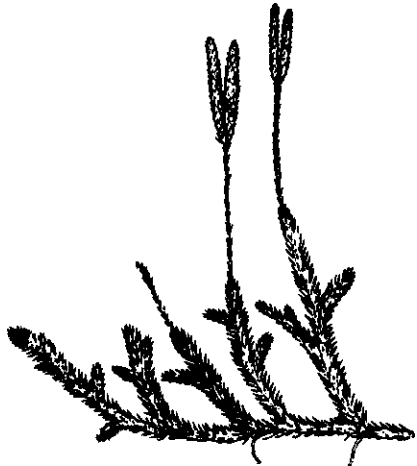
Ligusticum scoticum
Qanisan (UT 309, 737)
Pitruuskin (UT 287) [r]
 Beach lovage, wild parsley

33 



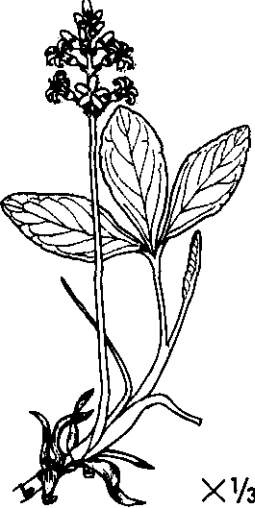
Lupinus nootkatensis
Hanīx̄ E & Attuan (UT 77)
 (lake)
Ahnīx̄ W (UT 77)
 Lupine

34



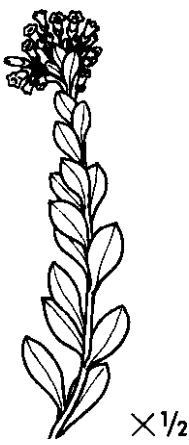
Lycopodium clavatum
Qugam chāx̄chuu Attuan (UT 331)
Qugam chach̄x̄uu W (UT 331)
 (demon's belt)
 (devil's apron)
 Common club moss

35



Menyanthes trifoliata
 Buckbean, bogbean

36

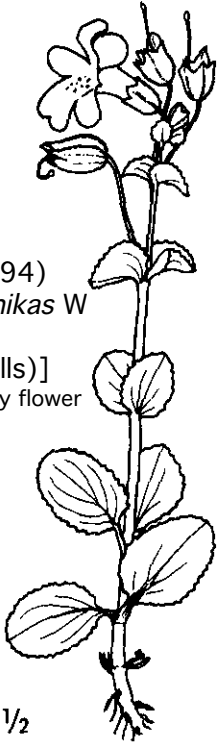


Mertensia maritima
 Oysterleaf

37 

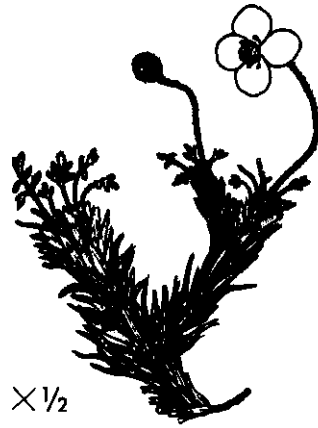
**Mimulus
guttatus**

Qaxatuŋ E
(UT 294)
Kulukuunchikas W
(UT 248)
[r (little bells)]
Yellow monkey flower



× 1/2

38

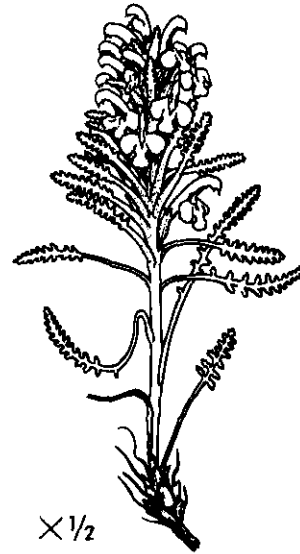


× 1/2

Papaver alaskanum

Alaska poppy

39



× 1/2

Pedicularis langsdorffii

Lousewort

40

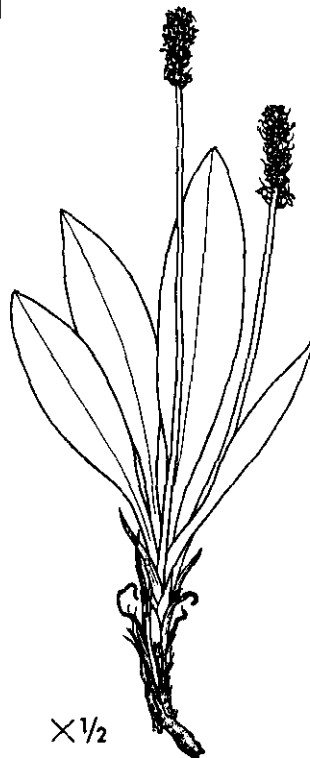


× 2/3

Phyllodoce aleutica

Aleutian heather

41



× 1/2

Plantago macrocarpa

Common plantain

42

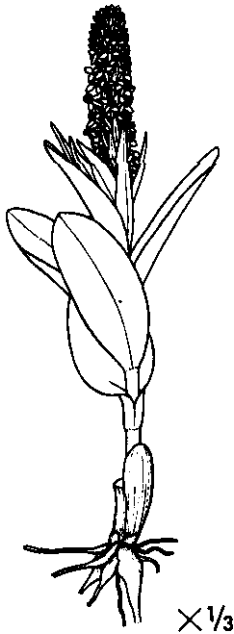


× 1/3

Platanthera dilatata

Bog candle, White orchid

43

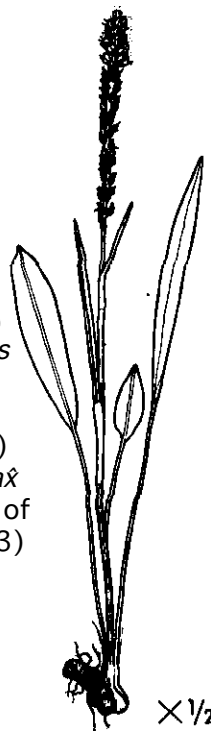


Platanthera convallariaefolia
Chagitxa W (UT 126)
 (white orchid)
 Cornflower, green bog orchid

44

Polygonum viviparum

Chiisuudan
 E (UT 146)
 (resembling
 fish eggs (tops))
Qulunguchiisis
 W (UT 335)
Makaarisa [r]
 (UT 272)
Quguchuuda (edible root of
 (E)) (UT 333)
 Alpine bistort,
 knotweed

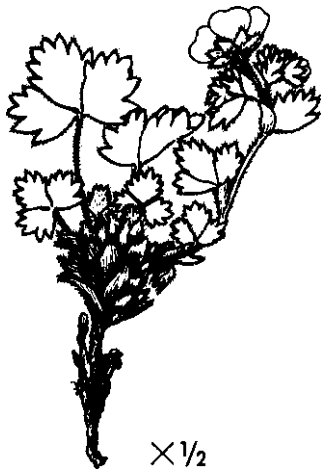


45



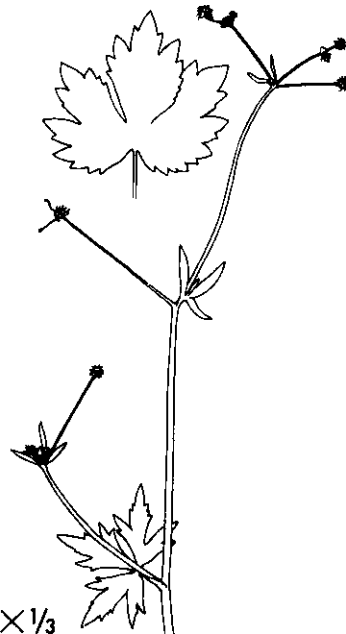
Polystichum aleuticum
 Aleutian shield fern

46



Potentilla
Sagaadada E (UT 346)
 Cinquefoil

47



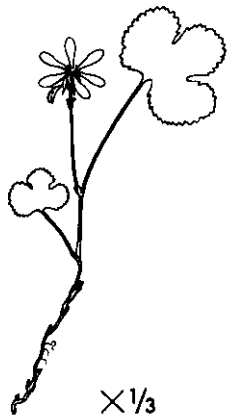
Ranunculus bongardi
*Chi*xtam chinguudgii E (UT 138)
*Chi*xtam aahmaagii W (UT 138)
 (rain flower in some places)
 Bongard buttercup

48



Rhododendron camtschaticum
 Kamchatka rhododendron,
 moss rose

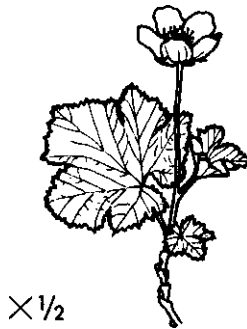
49



***Rubus arcticus* L.
ssp. stellatus (Sm.)**

Hama E (UT 61)
Haamachiiyan (E 1834)
Aamchiiyan (E 1909)
Aahmaadan (Golodoff:11/10/
2000)
Nagoonberry

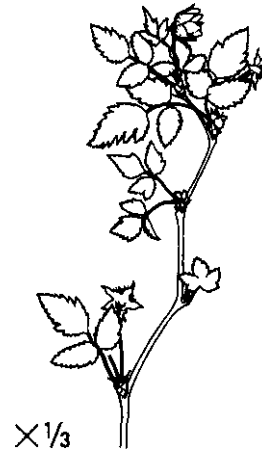
50



Rubus chamaemorus

Aqamda E (UT 95)
Quuniidas W (UT 337)
Cloudberry

51



Rubus spectabilis

Alagna E (UT 49)
Salmonberry

52



Rumex acetosella

Sheep sorrel

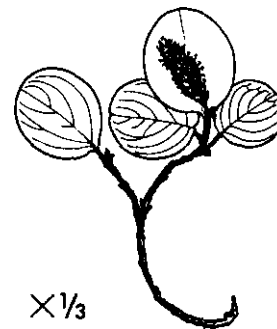
53



Rumex fenestratus

Aal(u)ngaaya E (UT 58)
Aluungi W (UT 58)
Rhubarb, sorrel, sour dock

54



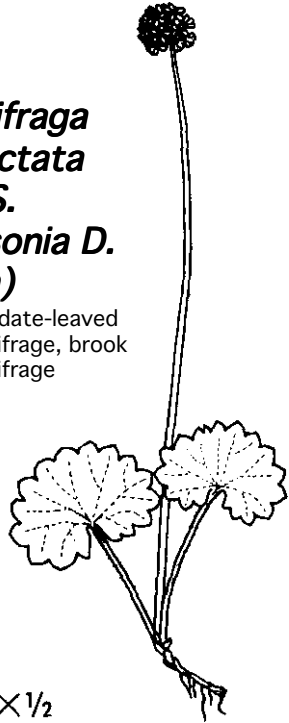
Salix arctica

Chuya E (UT 157)
Tagu W (UT 382)
Arctic willow


55

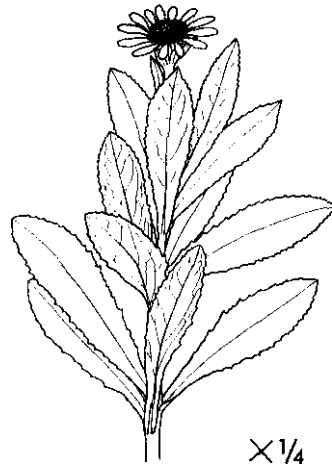
Saxifraga punctata
(= *S. nelsonia* D. Don)

Cordate-leaved saxifrage, brook saxifrage



X 1/2


56 

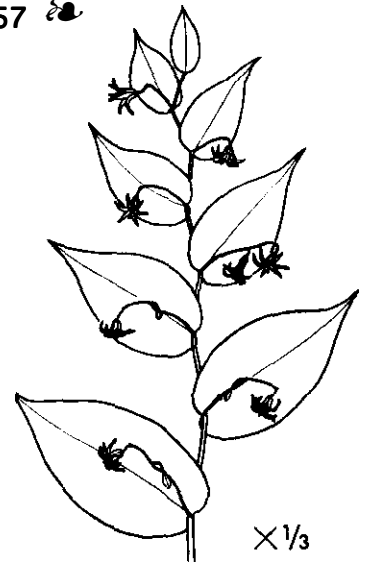


X 1/4

Senecio pseudo-arnica

Alaġum achidan alngaayuu E (UT 55)
Uxchuġaadaġ E (UT 417)
Uxchuudaġ W (UT 417)
Seabeach sunflower, ragwort


57 

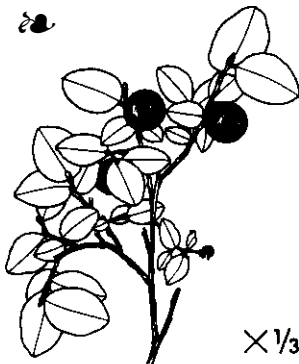


X 1/3

Streptopus amplexifolius

Taangadgusin E (UT 393)
Taangamchiizas W (UT 393)
(water container)
Watermelon berry, cucumber stalk, twisted stalk

58 



X 1/3



X 1/3

Vaccinium ovalifolium

Unignan E (UT 445)
also *Unigan* (Goldoff)
High bush blueberry

59



X 1/3

Vaccinium uliginosum

Uġiidgin E (UT 424)
Muġzaalġis W (UT 278) [r]
Alpine blueberry, lowbush blueberry

60



X 1/2

Vaccinium vitis-idaea

Kiikaġ E (UT 238)
Tuyangis W (UT 412)
Itim ulġuu (A also *Rubus stellatus* UT 218)
Mlusniikaġ (UT 278) [r]
Lingonberry, low-bush cranberry, cowberry

61



Cladina rangiferina

(formerly *Cladonia rangiferina*)
Huquqluŝ W (UT 449)
Itŝaygim kidngaa E (UT 237)
Kigyam aliŝa Attuan (UT 237)
 Reindeer moss

62



Fucus sp.

Kangadgiŝ (UT 231)
Kangadgim chuqii (UT 231)
 (stalk of bladderwrack)
 Bladderwrack, rockweed

63



Nereocystis luetkeana

Tmagiŝ (UT 399)
 bull kelp

64



Porphyra sp.

Nori, laver, red laver,
 teal nori

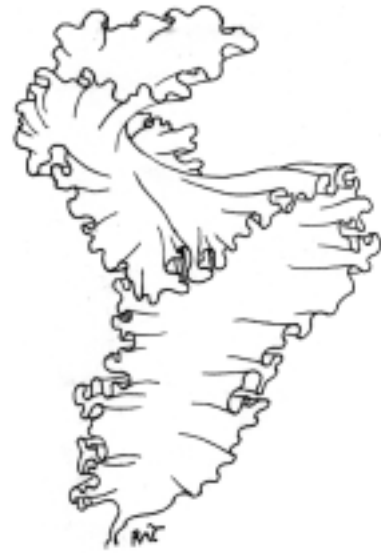
65



Alaria sp.

Qahnguŝ (UT 311)
 Ribbon kelp

66



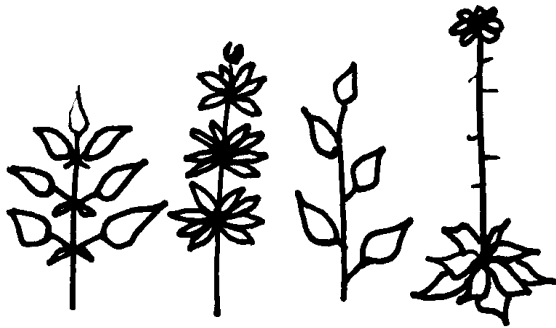
Ulva sp.

iiquŝ E (UT 210)
ikluŝ W (UT 189)
 Sea lettuce

Plant cards to cut apart and laminate

Leaf Arrangement:

1. Opposite: leaves in pairs at opposite sides of the stem.
2. Whorled: three or more leaves arranged wheel-like around the stem.
3. Alternate: leaves one above the other on opposite sides of the stem.
4. Basal: leaves at or near the bottom of the stem.



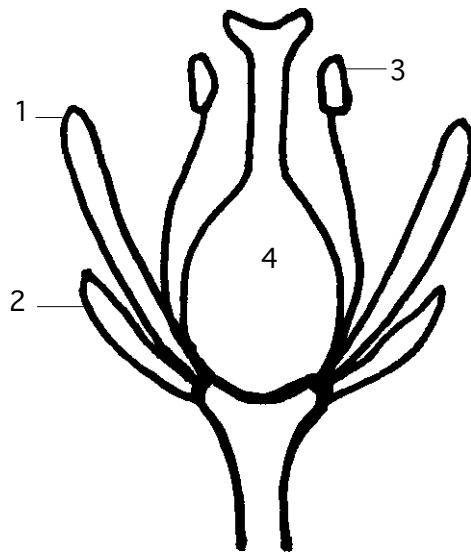
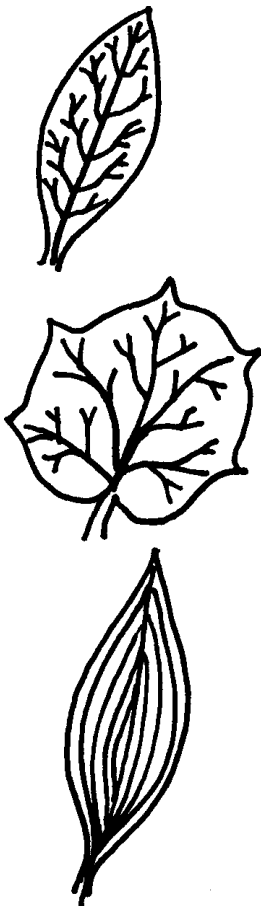
Leaf margins (edges)

1. Toothed: when the indentations on the margin look like a saw.
2. Lobed: when the indentations on the margin are deeply cut.
3. Smooth or entire: when the margin of the leaf is not cut or toothed.



Veins:

1. Pinnate: when the veins of about equal size lead off from the mid vein toward the margin.
2. Palmate: when the more prominent veins radiate from a point at or near the base of the leaf.
3. Parallel: when the veins of about equal size extend from the base to the tip.



Parts of a typical flower

1. Petals - delicate colored parts.
2. Sepals - protect the flower.
3. stamen - the male part of the flower that produces pollen.
4. pistil - the female part of the flower that produces seeds.

APPENDIX PLANT CARDS

SEED TEST CARD

Investigate one or more of your seeds using these tests:

Wind test: Hold the seed in the air and let it drop. If it drifts, it shows how a seed can travel by wind.

Water test: Drop seeds into a cup of water, and stir. The ones that float show how seeds can travel by water.

Hitchhiker test: Put a stuffed animal on top of each seed. Press down, then lift up the animal. The seeds that stick show how seeds can travel by sticking to an animal.

SEED TEST CARD

Investigate one or more of your seeds using these tests:

Wind test: Hold the seed in the air and let it drop. If it drifts, it shows how a seed can travel by wind.

Water test: Drop seeds into a cup of water, and stir. The ones that float show how seeds can travel by water.

Hitchhiker test: Put a stuffed animal on top of each seed. Press down, then lift up the animal. The seeds that stick show how seeds can travel by sticking to an animal.

SEED TEST CARD

Investigate one or more of your seeds using these tests:

Wind test: Hold the seed in the air and let it drop. If it drifts, it shows how a seed can travel by wind.

Water test: Drop seeds into a cup of water, and stir. The ones that float show how seeds can travel by water.

Hitchhiker test: Put a stuffed animal on top of each seed. Press down, then lift up the animal. The seeds that stick show how seeds can travel by sticking to an animal.

SEED TEST CARD

Investigate one or more of your seeds using these tests:

Wind test: Hold the seed in the air and let it drop. If it drifts, it shows how a seed can travel by wind.

Water test: Drop seeds into a cup of water, and stir. The ones that float show how seeds can travel by water.

Hitchhiker test: Put a stuffed animal on top of each seed. Press down, then lift up the animal. The seeds that stick show how seeds can travel by sticking to an animal.

EXPERIMENT FORM

SETTING UP YOUR EXPERIMENT

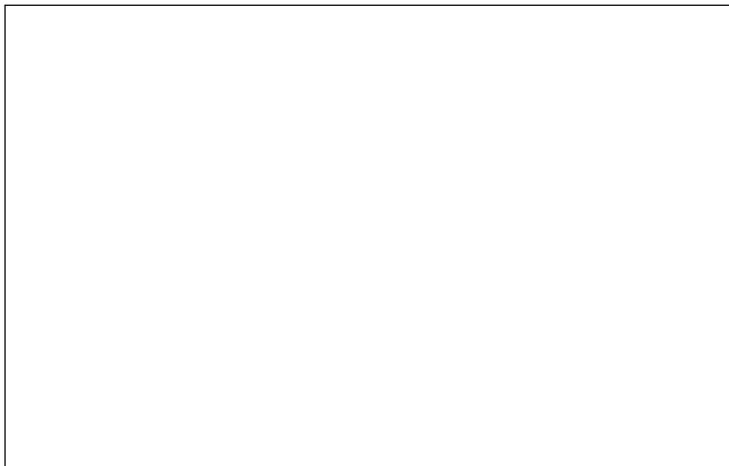
1. What do (did) you observe?
2. What are you asking about what you observe(d)?
3. Idea (hypothesis) you are testing: What is your idea about an answer for your question?

The Hypothesis is an educated guess based on background knowledge.

(will happen)

(must have a reason)

4. a. What variable will you change in your experiment?
b. What will remain constant in your experiment?
5. Make a sketch of the set-up for your experiment. Label all materials and state all conditions. List the materials you need.



Materials needed:

APPENDIX: EXPERIMENT FORM

a. What specific things will you observe?

b. What measurements will you make?

c. What plan do you have for recording your data? (Data may be reported using various methods such as pictures, words, charts and graphs)

7. Sketch a sample data table for your experiment.

For example:

8. Do the results of the experiment support your idea (hypothesis)? Did you answer the question? Conclusions:

My hypothesis was _____ because _____.
(correct or incorrect) (reason relating to hypothesis)

Was this a FAIR TEST? (did only one thing get tested at a time?) Why or why not?
(What, if anything, would you change to make your results more valid?)

Can you repeat this experiment at least 3X? Why or why not?

EXPERIMENT FORM

SETTING UP YOUR EXPERIMENT: *SAMPLE COMPLETED FORM BASED ON "DIRTY A SOCK."*

1. What do (did) you observe?

We observed dirt and mud being collected on the socks/boots

2. What are you asking about what you observe(d)?

Will the seeds we collected with our socks/boots grow when we plant them?

3. Idea (hypothesis) you are testing: What is your idea about an answer for your question?
The seeds we collected will grow if they have a dormant period (have been frozen and thawed).

The Hypothesis is an educated guess based on background knowledge.

I think the frozen seeds will grow because they will have a dormant/inactive period.

(will happen)

(must have a reason)

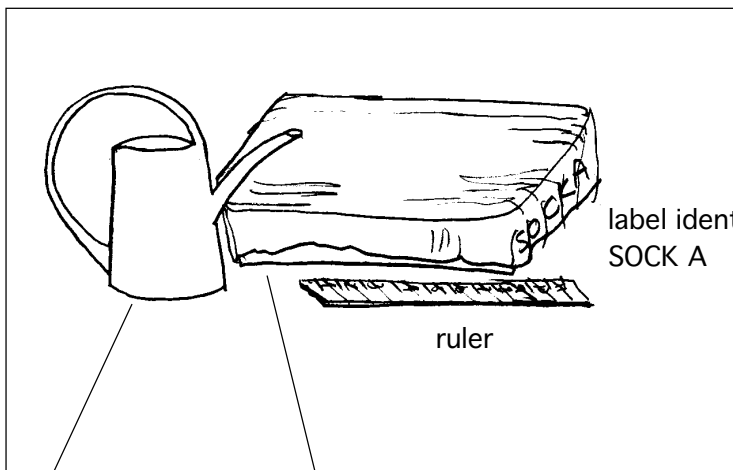
4. a. What variable will you change in your experiment?

Freezing and thawing: temperature

b. What will remain constant in your experiment?

Water and oxygen

5. Make a sketch of the set-up for your experiment. Label all materials and state all conditions. List the materials you need.



Water in watering can, used to keep soil moist for seed germination and growth. We measure it each time we put it in the watering can.

Planting container with soil and planted sock. The sock was used to collect wild seeds. The planting container is covered with clear plastic wrap to hold in moisture.

Materials needed:

wild seeds

planting container

water

freezer

ruler

soil

plastic food wrap

measuring cup

label identifying
SOCK A

ruler

An identical container has been set up with another sock. It is labeled SOCK B. SOCK B was put in a freezer on the day it was planted and removed periodically. On the 8th day after planting, it was left outside the freezer.

APPENDIX: EXPERIMENT FORM

6. During the experiment (Procedure):

a. What specific things will you observe?

Germination and growth of the collected seeds

b. What measurements will you make?

Numbers of plants

Size of plants

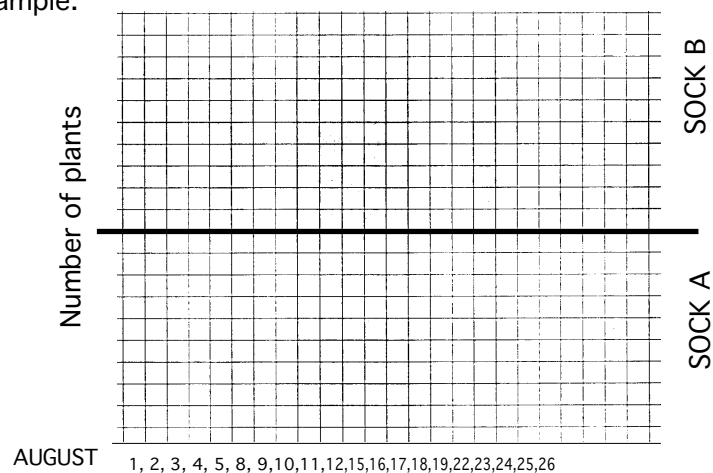
c. What plan do you have for recording your data? (Data may be reported using various methods such as pictures, words, charts and graphs)

Graph of number of plants recorded daily

Chart of plant height

7. Sketch a sample data table for your experiment.

For example:



8. Do the results of the experiment support your idea (hypothesis)? Did you answer the question? Conclusions: Too soon to know

My hypothesis was _____ because _____.
 (correct or incorrect) (reason relating to hypothesis)

9. Was this a FAIR TEST? (did only one thing get tested at a time?) Why or why not? (What, if anything, would you change to make your results more valid?)




10. Can you repeat this experiment at least 3X? Why or why not?

APPENDIX GAME

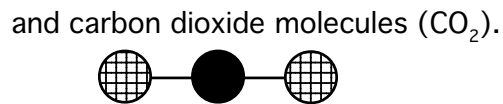
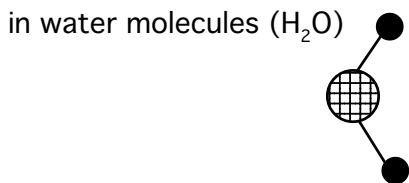
The Leaf Food Factory

You are the chemical messengers in a plant leaf.

Your job is to collect the atoms needed to make food for the plant. The food for the plant is a simple sugar. To make the simple sugar,

- you need 6 carbon atoms (**C**)  carbon atom **C**
- and 12 hydrogen atoms (**H**)  hydrogen atom **H**
- and 6 oxygen atoms (**O**).  Oxygen atom **O**

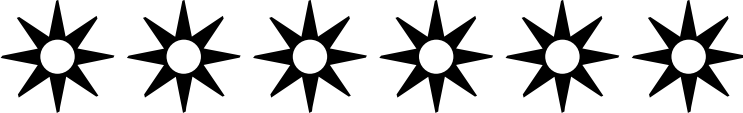
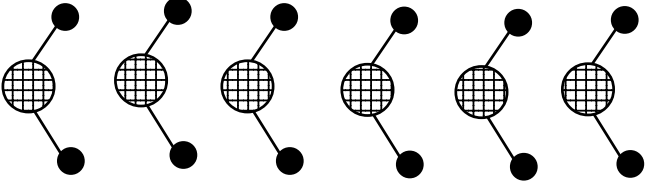
You collect these atoms of carbon, hydrogen and oxygen

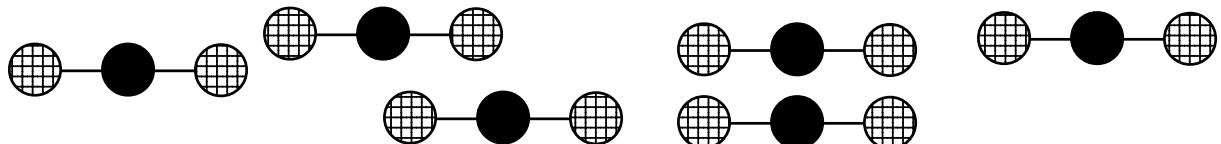


You also need 6 units of sunlight to complete the chemical change from water and carbon dioxide to sugar.



TOTAL NEEDED TO COMPLETE THE GAME:

- 6 units of sunlight** 
- AND**
- 6 molecules of water (H_2O)**
WHICH = 12 atoms of hydrogen
and 6 atoms of oxygen 
- AND**
- 6 molecules of carbon dioxide (CO_2)**
WHICH = 6 atoms of carbon and 12 atoms of oxygen.



APPENDIX GAME

THE WINNING COMBINATION: $C_6H_{12}O_6$

This is the chemical formula for the simple sugar molecule that is the basic food for the plant.

You cannot make a sugar molecule unless you also have one unit of sunlight for every water molecule and carbon dioxide molecule. That means you will need 6 water molecules and 6 carbon dioxide molecules and 6 sun units to make one sugar molecule. You must have sunlight to make the chlorophyll in the leaf excited about doing its photosynthesis. When you have all 6 units of sunlight, you can change the water and carbon dioxide molecules into the sugar you need for your food—and for the food for all the rest of the animal world.

Your job is critical to all animal life on the planet. You are the food producer. All the animals, including the humans, rely on you to survive. You must succeed.

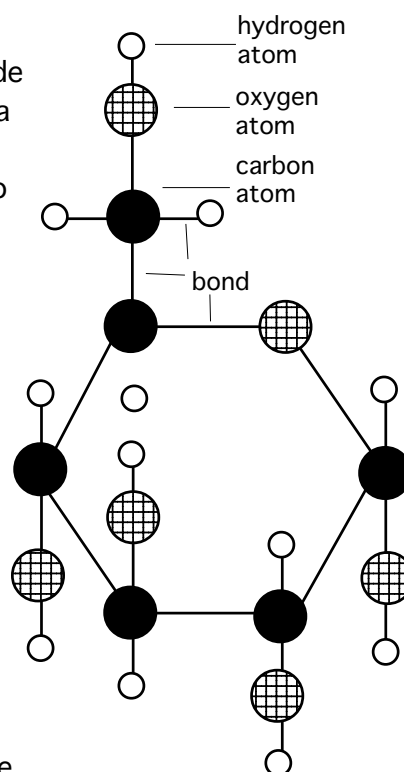
Perhaps you already know about **molecules** and **atoms**. Just in case you have forgotten, here is a brief reminder.

The atom is one of the basic units of matter. Everything around us is made up of atoms. An atom is very tiny—more than a million times smaller than the thickness of a human hair! Atoms are the building blocks of the simplest elements, such as **hydrogen**, **oxygen**, and **carbon**.

Molecules are more complex than atoms and are made of two or more linked atoms. Water, for example, is a molecule made of two atoms of hydrogen linked to one atom of oxygen. Oxygen is an atom and it is also a molecule. The oxygen in the air we breathe is actually two oxygen atoms linked together. That is why it has the **chemical formula** O_2 .

Scientists use chemical formulas to show atoms connected into molecules. For example, a water molecule is made from 2 hydrogen atoms and one oxygen atom. Its chemical formula is written H_2O . The chemical formula CO_2 represents carbon dioxide.

Atoms link together in molecules through strong attractive forces called **bonds**. For example, in this illustration, the lines stand for the bonds between the atoms. These atoms are combined to make a simple sugar called glucose. Count the atoms and see how this illustration compares to the chemical formula for the simple sugar in this game: $C_6H_{12}O_6$.



APPENDIX

RULES:

Each board can hold 4 players. Each player should provide a playing piece. Playing pieces can be coins, rings, nuts, small bottle caps, stones or other small objects. Put the playing pieces on the **START** space.

Arrange the atoms:

Each player begins with 3 molecules of water (H₂O) and 3 molecules of carbon dioxide (CO₂). How many atoms total is that?

6 H
9 O
3 C

Each player should organize his/her atoms into molecules of water (H₂O) and carbon dioxide (CO₂).

Put all the remaining H and 1/3 of the O in the water resources box.

Put all the remaining C and 2/3 of the O in the air resources box.

Put the units of sunlight in the light box.

Stack the challenge cards, question sides up, on the challenge space on the board.

Set the die by the board.

Roll a die to see who goes first. The highest number goes first. For each move, roll the die and move the number of spaces shown.

Each space on the board has directions. Some directions ask you to collect water molecules or carbon dioxide molecules, and some directions tell you to give up your water or carbon dioxide. Other directions tell you to select a challenge card or allow you to trade your molecules and units of sunlight.

CHALLENGE CARDS: When you land on a space that says “Time for a Challenge Card,” you must draw a card from the Challenge Card stack. Read the question aloud and then answer the question. After you have answered, turn the card over and read the correct answer. If you answered correctly, you may collect one unit of sunlight. If you answered incorrectly, you must sacrifice one unit of sunlight or one set of atoms that make a water molecule AND one set of atoms that make a carbon dioxide molecule. (You will return the unit of sunlight to the light box OR put 2 Hydrogen atoms and one oxygen atom—H₂O—in the water resources box AND you will put one carbon atom and 2 oxygen atoms—CO₂—in the air resources box.) Put the used Challenge Card under card stack so it can be used again.

When you land on a **BALANCE SPACE**, you may trade your resources. You may trade as much as you want any time you land on a BALANCE SPACE, but you are NOT REQUIRED to make a trade. If you do make a trade:

one unit of sunlight = one H₂O AND one CO₂

one unit of sunlight = two H₂O

one unit of sunlight = two CO₂

one CO₂ = one H₂O

The first player who finishes receives a primary food-maker reward, and then helps the other players complete their collection. All players continue until all players have completed their collection and made a simple sugar.

BALANCE
SPACE

CHLOROPHYLL
COMMAND
CENTER
Collect 2 units
of sunlight

Time for a
CHALLENGE
CARD

The water
level is good in
the xylem.
Collect 2
molecules of
water (H₂O)

AIR COMMAND
CENTER
Collect 2
molecules of
carbon dioxide
(CO₂).

CHLOROPHYLL
COMMAND
CENTER. Collect 2
units of sunlight

BALANCE
SPACE

BALANCE
SPACE

Night is
coming. Low
light levels. Go
back 2 spaces.

Go directly to the
CHLOROPHYLL
COMMAND
CENTER and
collect 2 units of
sunlight.

AIR COMMAND
CENTER
Collect 2
molecules of
carbon dioxide
(CO₂).

OOPS. Some insects
are eating on your leaf
and have ruined many
stomata. Return one
molecule of carbon
dioxide (CO₂) to the
Air Resources Box.

It has rained.
Hooray. Water
is flowing up the
xylem. Collect 2
molecules of
water (H₂O).

Time for a
CHALLENGE CARD.
If you answer
correctly, you win
double. If you
answer incorrectly,
you lose double.

Time for a
CHALLENGE
CARD

THE LEAF FOOD FACTORY GAME

There has been a volcanic eruption. Your leaf is covered in ash. Your stomata are closed tight. Return 2 molecules of CO_2 to the Air Resources Box.

A little creature took a bite out of your stem. You have lost some of the important xylem and phloem tubes. Go back 3 spaces.

BALANCE SPACE

Time for a CHALLENGE CARD. If you answer correctly, you win double. If you answer incorrectly, you lose double.

Each time you pass Start, collect one unit of sunlight

WATER COMMAND CENTER
Collect 2 molecules of water (H_2O).

You have learned that there is no water coming from the roots. Return one molecule of H_2O to the Water Resources Box.

BALANCE SPACE

The xylem are clogged by insects. No water is getting through. Return one molecule of H_2O to the Water Resources Box.

APPENDIX

O	O	O	O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O	O	O	O
O	O	O	O	O	O	O	O	O	O	H	H
H	H	H	H	H	H	H	H	H	H	H	H
H	H	H	H	H	H	H	H	H	H	H	H
H	H	H	H	H	H	H	H	H	H	H	H
H	H	H	H	H	H	H	H	H	H	H	H
H	H	H	H	H	H	H	C	C	C	C	C
C	C	C	C	C	C	C	C	C	C	C	C
C	C	C	C	C	C	C	C	C	C	C	C

APPENDIX GAME

<p>CHALLENGE CARD 1 QUESTION: What plant food ingredient comes into the leaf through the stomata?</p>	<p>CHALLENGE CARD 7 QUESTION: What animals depend on the food the plants produce?</p>
<p>CHALLENGE CARD 2 QUESTION: What is the name of the tubes that carry water from the roots to the leaf?</p>	<p>CHALLENGE CARD 8 QUESTION: What is the chemical formula for a simple sugar?</p>
<p>CHALLENGE CARD 3 QUESTION: What is the name of the tubes that carry food (simple sugars) from the leaves to the rest of the plant?</p>	<p>CHALLENGE CARD 9 QUESTION: What is the name for the mouth-like pores that open to let in carbon dioxide (CO_2) and let out oxygen (O) and water (H_2O)?</p>
<p>CHALLENGE CARD 4 QUESTION: In addition to giving strength to the leaf's structure, what do the veins do in the leaf? (2-part answer)</p>	<p>CHALLENGE CARD 10 QUESTION: What is the name of the food transportation tube of the plant's main plumbing system?</p>
<p>CHALLENGE CARD 5 QUESTION: What does chlorophyll do in the leaf?</p>	<p>CHALLENGE CARD 11 QUESTION: What is left over when water and carbon dioxide are changed through photosynthesis into a simple sugar?</p>
<p>CHALLENGE CARD 6 QUESTION: What happens to the food the leaf produces? Fill in the blank. The plant uses the food or _____ it for later use.</p>	<p>CHALLENGE CARD 12 QUESTION: What is the name for the chemical change of the sun's light energy into food in the plant?</p>

APPENDIX GAME

<p style="text-align: center;">7</p> <p>ANSWER: All animals depend on the food the plants produce.</p>	<p style="text-align: center;">1</p> <p>ANSWER: Carbon dioxide is the plant food ingredient that comes into the leaf through the stomata.</p>
<p style="text-align: center;">8</p> <p>ANSWER: The chemical formula for a simple sugar is $C_6H_{12}O_6$.</p>	<p style="text-align: center;">2</p> <p>ANSWER: The tubes that carry water from the roots to the leaf are named Xylem</p>
<p style="text-align: center;">9</p> <p>ANSWER: the name for the mouth-like pores that open to let in carbon dioxide (CO₂) and let out oxygen (O) and water (H₂O) is stomata.</p>	<p style="text-align: center;">3</p> <p>ANSWER: The tubes that carry food (simple sugars) from the leaves to the rest of the plant are named Phloem</p>
<p style="text-align: center;">10</p> <p>ANSWER: The name of the food transportation tube of the plant's main plumbing system is phloem</p>	<p style="text-align: center;">4</p> <p>ANSWER: The veins (a.) carry food and (b.) carry water.</p>
<p style="text-align: center;">11</p> <p>ANSWER: Oxygen is leftover when water and carbon dioxide are changed through photosynthesis into a simple sugar.</p>	<p style="text-align: center;">5</p> <p>ANSWER: Chlorophyll traps and packages the sun's energy.</p>
<p style="text-align: center;">12</p> <p>ANSWER: Photosynthesis is the name for the chemical change of the sun's light energy into food in the plant</p>	<p style="text-align: center;">6</p> <p>ANSWER: The plant uses the food or stores it for later use.</p>

APPENDIX GAME

<p>CHALLENGE CARD 13 QUESTION: What is the chemical formula for a water molecule?</p>	<p>CHALLENGE CARD 19 QUESTION: Name one of the two main substances that come out of the leaf through the stomata.</p>
<p>CHALLENGE CARD 14 QUESTION: What is the chemical formula for carbon dioxide?</p>	<p>CHALLENGE CARD 20 QUESTION: Animals cannot make their own food. True or false?</p>
<p>CHALLENGE CARD 15 QUESTION: What is the chemical formula for the oxygen in the air we breathe?</p>	<p>CHALLENGE CARD 21 QUESTION: The main food factories in plants are the flowers. True or false?</p>
<p>CHALLENGE CARD 16 QUESTION: Oxygen is the name for a molecule and an atom. True or false?</p>	<p>CHALLENGE CARD 22 QUESTION: The reverse of photosynthesis in a plant is respiration. True or false?</p>
<p>CHALLENGE CARD 17 QUESTION: Make up a question about photosynthesis to ask one other player. You can look at your background information on photosynthesis to help you. If s/he gives the correct answer, you both win. If s/he gives the incorrect answer, the other players win. No cheating!</p>	<p>CHALLENGE CARD 23 QUESTION: A leaf has only a few stomata. True or false?</p>
<p>CHALLENGE CARD 18 QUESTION: Make up a question about photosynthesis to ask one other player. You can look at your background information on photosynthesis to help you. If s/he gives the correct answer, you lose. If s/he gives the incorrect answer, you win. No cheating!</p>	<p>CHALLENGE CARD 24 Question: Plants cannot move at all! True or False?</p>

APPENDIX GAME

<p>19 ANSWER: One of the two main substances that comes out of the leaf through the stomata is oxygen. OR ANSWER: One of the two substances that comes out of the leaf through the stomata is water.</p>	<p>13 ANSWER: the chemical formula for a water molecule is H₂O.</p>
<p>20 ANSWER: It is true that animals cannot make their own food</p>	<p>14 ANSWER: The chemical formula for carbon dioxide is CO₂.</p>
<p>21 ANSWER: It is false that the main food factories in plants are the flowers. Leaves are the main food factories.</p>	<p>15 ANSWER: The chemical formula for the oxygen in the air we breathe is O₂.</p>
<p>22 ANSWER: It is true that the reverse of photosynthesis in a plant is respiration.</p>	<p>16 ANSWER: True: Oxygen is the name for a molecule and an atom.</p>
<p>23 ANSWER: It is false that a leaf has only a few stomata.</p>	<p>17 DID YOU GIVE THE CORRECT ANSWER?</p>
<p>24 ANSWER: It is false that a leaf cannot move at all. Leaves move to take advantage of the best light.</p>	<p>18 DID YOU GIVE THE CORRECT ANSWER?</p>

APPENDIX

one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT
one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT
one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT
one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT
one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT
one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT
one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT
one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT
one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT
one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT	one unit of SUNLIGHT



NOTES:

