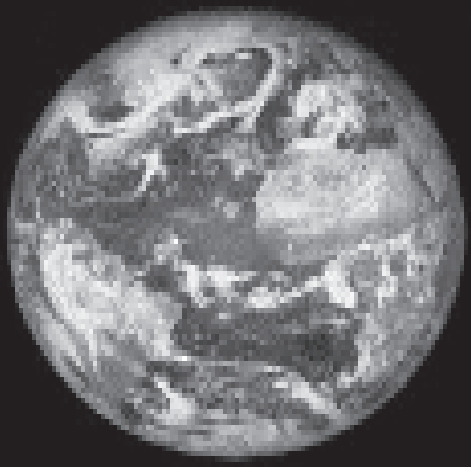
Name: _____

The Real Reasons for Seasons:
Sun-Earth Connections

Great Explorations
in Math and Science

Seasons Lab Book



1. "Name the Season" Game

Rules:

a. Pick one season to write about. On a piece of paper, write your name, but ***not*** the name of the season.

b. Write a paragraph describing some events, and include clues about what season it is. Without actually naming the season, make it possible for the reader to figure out what season it is.

c. At a "Ready-Set-Go" signal, leave your paragraph on your desk, and pick up a pencil and your Seasons Lab Book. Walk around and read as many of the paragraphs as possible, guessing what season each refers to.

d. For each paragraph, write below the name of the person who wrote it and which season you think is being described.

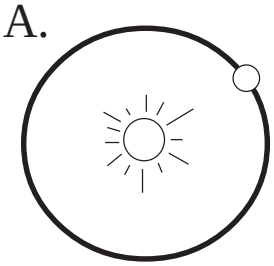
e. The person with the most correct guesses, wins the game.

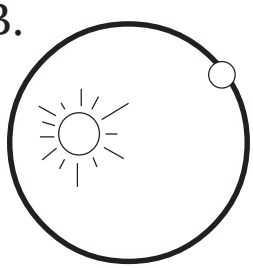
Student Name	Season

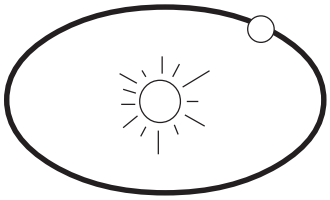
Student Name	Season

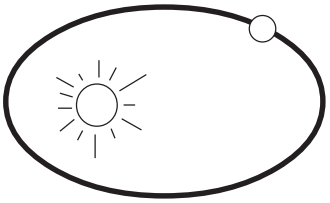
Sun-Earth Survey

1. Which of the four drawings do you think best shows the shape of Earth's orbit around the Sun? (The view is top down.) Circle the correct letter.

A. 

B. 

C. 

D. 

2. Which is the best drawing to show the sizes and distances between the Earth and the Sun? Circle the letter of the best drawing.

A. **Earth** **Moon** **Sun**

B. **Earth** **Moon** **Sun**

C. **Earth** **Moon** **Sun is about 11 page-widths away** →

3. Why do you think it is hotter in the United States in June than in December? Circle all that are correct.

A. Because the Sun itself gives off more heat and light energy in June and less in December.

B. Because the Earth is closer to the Sun in June, and farther away from the Sun in December.

C. Because the United States is closer to the Sun in June and farther from the Sun in December.

D. Because the United States is facing more toward the Sun in June and away from the Sun in December.

E. Because the Sun appears higher in the sky in June, so its rays are more concentrated on the ground.

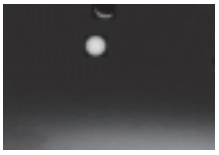
F. Because the Moon blocks out the Sun more in December.

G. Because in the United States, there are more hours of daylight in June than in December.

3. A Trip to the Sun

Step 1

View towards Sun:



Distance _____

Altitude _____

View toward Earth:

San Francisco, California

Step 2

View towards Sun:

Distance _____

Altitude _____

View toward Earth:

Sacr amento, California

Step 3

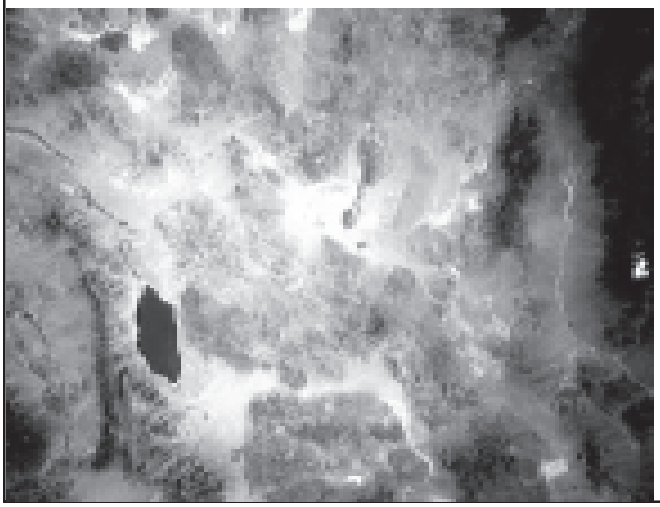
View towards Sun:

Distance _____

Altitude _____

View toward Earth:

Walker Lake, Nevada



Step 4

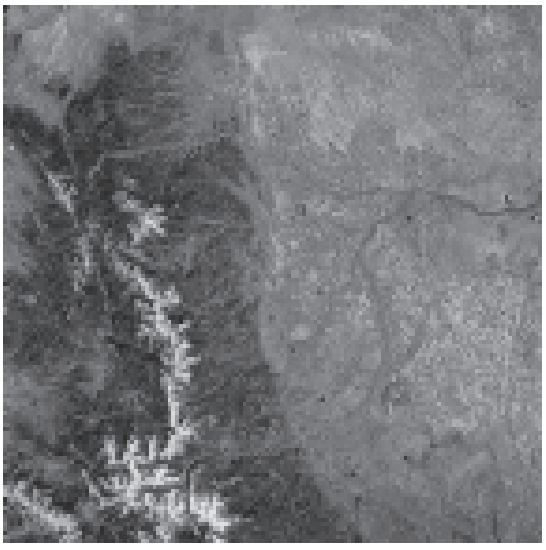
View towards Sun:

Distance _____

Altitude _____

Denver, Colorado

View toward Earth:



A Trip to the Sun (page 2)

Step 5

View towards Sun:

Distance _____

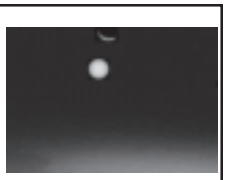
Altitude _____

View toward Earth:

St. Louis, Missouri

Step 6

View towards Sun:

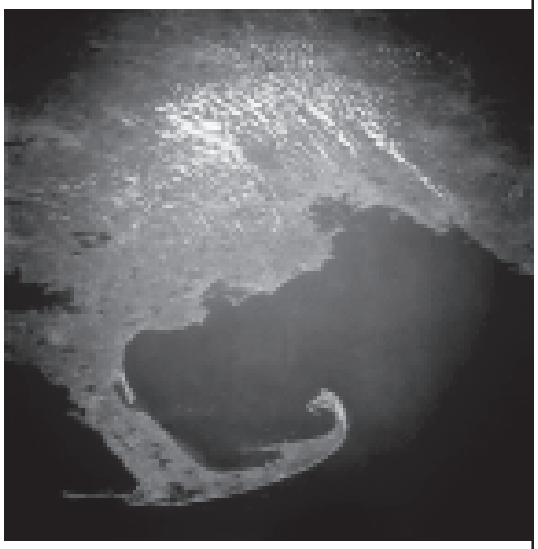


Distance _____

Altitude _____

Cape Cod, Massachusetts

View toward Earth:



Step 7

View towards Sun:

Distance _____

Altitude _____

View toward Earth:

Space Station Mir over the Atlantic Ocean

Step 8

View towards Sun:

Distance _____

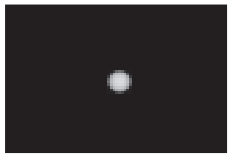
Altitude _____

View toward Earth:

A Trip to the Sun (page 3)

Step 9

View towards Sun:



Distance _____

Altitude _____

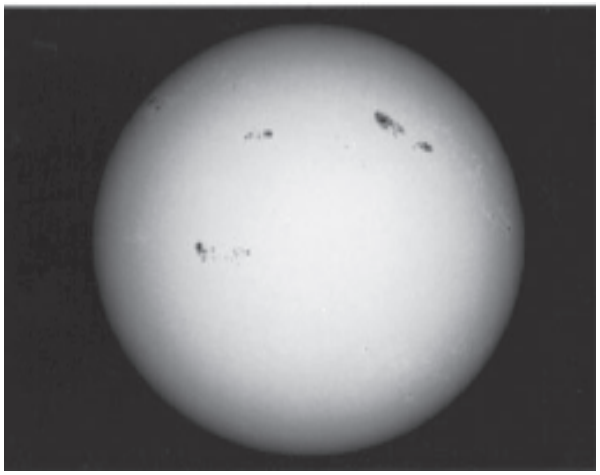
View toward Earth:

Step 10

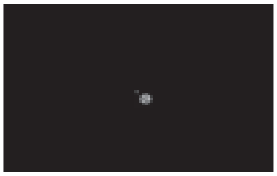
Distance _____

Altitude _____

View towards Sun:



View toward Earth:

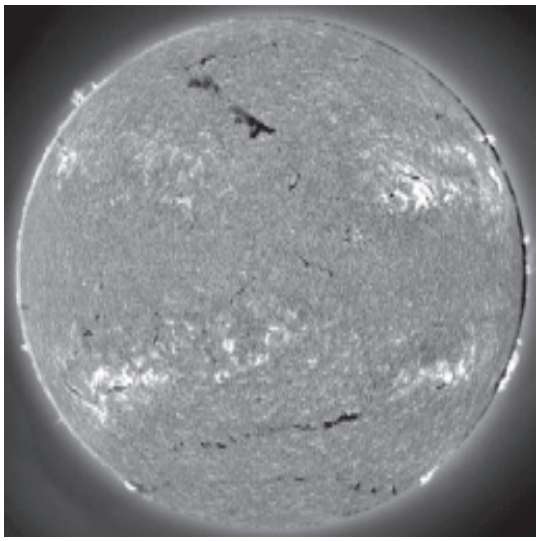


Step 11

Distance _____

Altitude _____

View towards Sun:



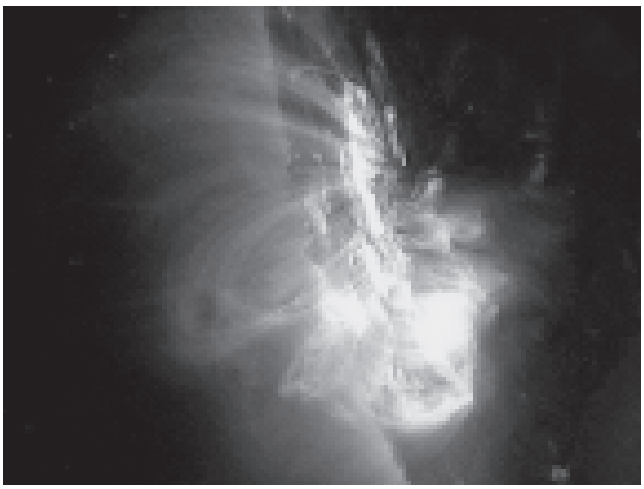
View toward Earth:

Step 12

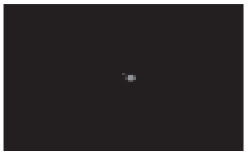
Distance _____

Altitude _____

View towards Sun:



View toward Earth:



3. Trip to the Sun

Explain on this page why, even though we traveled in a straight line east toward the Sun, our altitude was increasing in the first several steps. Draw a diagram to help show your reasoning.

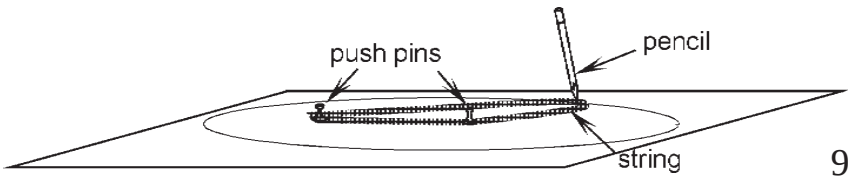
4. What Shape Is Earth's Orbit?

Draw the ***shape*** of... Earth's orbit: Separation of foci = 0.4 cm

Pluto's orbit: Separation of foci = 5 cm

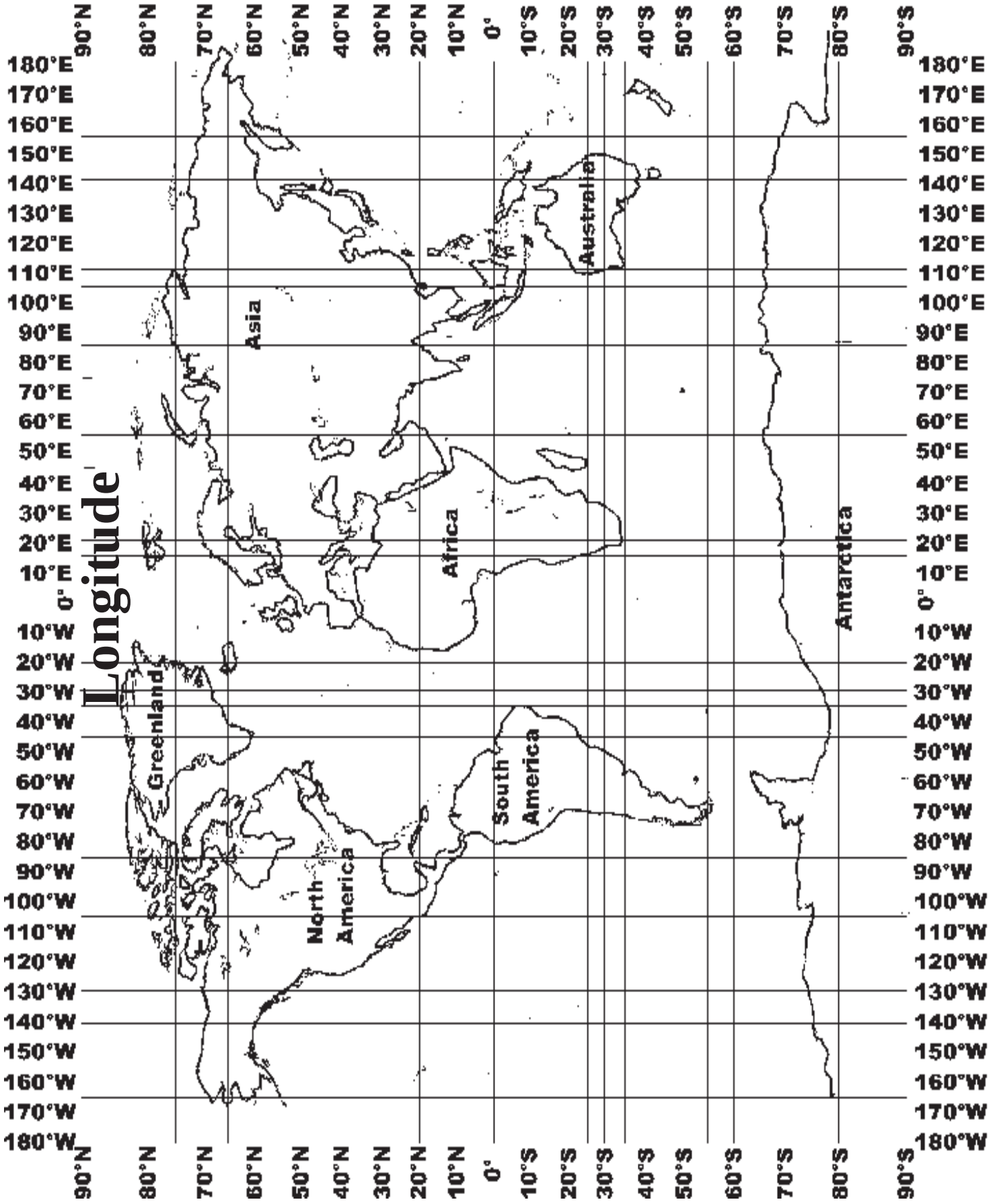
Which orbit seems most circular?

[Note: the ***size*** of these orbits would be much different in a proper scale drawing, but the ***shape*** of orbit is all we are looking at here.]



5. Temperatures Around the World Latitude and Longitude Data

Latitudes, Longitudes, and Elevations					
Escuela Antarctica, Esperanza; Provincial #38 Julio Argentina Roca Latitude: 63°S Longitude: 57°W Elevation: 10 m	Guangzhou, China Guangdong Guangya MS Latitude: 23°N Longitude: 113°E Elevation: 20 m				
Sandy Bay,Australia Fahan School Latitude: 43°S Longitude: 147°E Elevation: 20 m	Kyoto, Japan Koryu JrHS Latitude: 36°N Longitude: 135° E Elevation: 8 m				
Carltonville, S Africa; Tsitsiboga Primary School Lat:26°S Long:27°E Elevation : 1524 m	Minnesota USA Detroit Lakes Mid Sch Lat:47°N Long:96°W Elevation: 1431 m				
Quito, Ecuador; Colegio Albert Einstein Lat:0°N Long:78°W Elevation: 2890 m	Kodiak, Alaska, USA Kodiak HS Latitude: 58°N Longitude: 152°W Elevation : 35 m				
Chalatenango, El Salvador; Escuela Rural Mixta Latitude: 14°N Longitude: 89°W Elevation: 1700 m					


Longitude
Latitude
90°N
80°N
70°N
60°N
50°N
40°N
30°N
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
60°S
70°S
80°S
90°S
180°E
170°E
160°E
150°E
140°E
130°E
120°E
110°E
100°E
90°E
80°E
70°E
60°E
50°E
40°E
30°E
20°E
10°E
0°
10°W
20°W
30°W
40°W
50°W
60°W
70°W
80°W
90°W
100°W
110°W
120°W
130°W
140°W
150°W
160°W
170°W
180°W
Asia
Australia
Africa
Antarctica
Greenland
North America
South America

5. Temperatures Around the World

Average Temperatures: 1996-1998 Data from GLOBE Schools Around the World

Data is in Degrees Celsius (°C)

Below are Celsius to Fahrenheit Temperature Conversions

°C	°F
-40	-40.0
-18	-0.4
-16	3.2
-14	6.8
-12	10.4
-10	14.0
-8	17.6
-6	21.2
-4	24.8
-2	28.4
0	32.0
2	35.6
4	39.2
6	42.8
8	46.4
10	50.0
12	53.6
14	57.2
16	60.8
18	64.4
20	68.0
22	71.6
24	75.2
26	78.8
28	82.4
30	86.0
32	89.6
34	93.2
36	96.8
38	100.4
40	104.0
100	212.0

°F = (°C x 9/5) + 32

Escuela Antarctica, Esperanza; Provincial #38 Julio Argentina Roca
Latitude: 63°S
Longitude: 57°W
Elevation: 10 m

Month	Year	Avg Temp
Apr	1998	-3.8
May	1998	-3.9
Jun	1998	-4.2
Jul	1998	-12.5
Aug	1998	-11.5
Sep	1998	-9.7
Oct	1998	-6.3
Nov	1998	0.6
Dec	1998	1.2

Quito, Ecuador; Colegio Albert Einstein
Lat:0°N Long:78°W
Elevation: 2890 m

Month	Year	Avg Temp
Jan	1998	18.8
Feb	1998	18.4
Mar	1998	17.6
Apr	1998	16.0
May	1998	19.7
Jun	1998	17.1
{Aug	1997	17.6}
{Sep	1997	18.4}
{Oct	1997	18.0}
Nov	1997	18.3
Dec	1997	16.7

Kyoto, Japan Koryu JrHS
Latitude: 36°N
Longitude: 135° E
Elevation: 8 m

Month	Year	Avg Temp
Jan	1996	4.4
Feb	1996	2.9
Mar	1996	6.9
Apr	1996	9.5
May	1996	16.4
Jun	1996	21.2
Jul	1996	24.3
Aug	1996	25.5
Sep	1996	20.2
Oct	1996	15.7
Nov	1995	10.3
Dec	1995	5.8

Sandy Bay,Australia Fahan School
Latitude: 43°S
Longitude: 147°E
Elevation: 20 m

Month	Year	Avg Temp
{Jan	1998	18.0}
Feb	1998	17.5
Mar	1998	17.9
Apr	1998	14.7
May	1998	12.8
Jun	1998	10.1
Jul	1998	11.0
Aug	1998	10.6
Sep	1998	15.2
Oct	1998	13.7
Nov	1998	14.6

Chalatenango, El Salvador; Escuela Rural Mixta
Latitude: 14°N
Longitude: 89°W
Elevation: 1700 m

Month	Year	Avg Temp
Feb	1997	15.4
Mar	1997	15.5
Apr	1997	15.3
May	1997	16.0
Jun	1997	15.7
Jul	1997	15.7
Aug	1997	16.3
Sep	1997	16.5
Oct	1997	16.9
Dec	1996	15.1

Minnesota USA Detroit Lakes Middle School
Lat:47°N Long:96°W
Elevation: 1431 m

Month	Year	Avg Temp
Jan	1997	-14.1
Feb	1997	-9.2
Mar	1997	-2.1
Apr	1997	2.8
May	1997	10.6
Jun	1997	20.3
Jul	1997	19.3
Aug	1997	18.9
Sep	1997	17.3
Oct	1997	3.8
Nov	1997	-5.5
Dec	1997	-4.5

Carltonville, S Africa; Tsitsiboga Primary School
Lat:26°S Long:27°E
Elevation : 1524 m

Month	Year	Avg Temp
Feb	1998	20.8
Mar	1998	25.2
Apr	1998	23.5
May	1998	18.9
Jun	1998	11.8
Jul	1998	13.9
Sep	1998	14.8
Oct	1998	18.8
Nov	1998	19.1

Guangzhou, China Guangdong Guangya MS
Latitude: 23°N
Longitude: 113°E
Elevation: 20 m

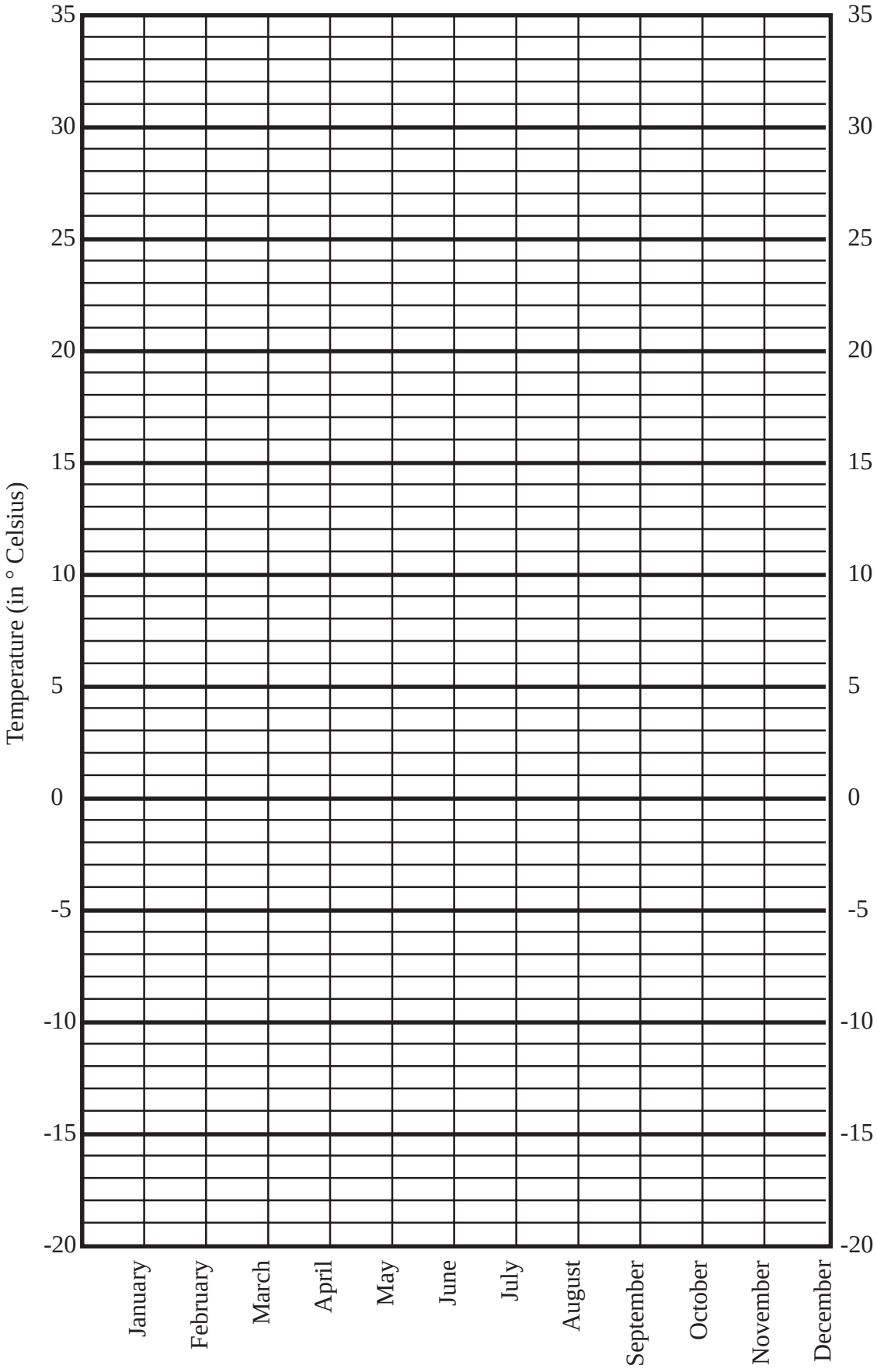
Month	Year	Avg Temp
Jan	1999	13.7
Feb	1998	18.4
Mar	1998	18.5
Apr	1998	23.6
May	1998	24.8
Jun	1998	27.2
Jul-Aug	{no data}	
Sep	1998	27.2
Oct	1998	23.1
Nov	1998	22.2
Dec	1998	18.0

Kodiak, Alaska, USA Kodiak High School
Latitude: 58°N
Longitude: 152°W
Elevation : 35 m

Month	Year	Avg Temp
Jan	1999	-0.9
May	1998	6.4
Jun	1998	10.8
Jul	1998	12.8
Aug	1998	12.9
Sep	1998	9.9
Oct	1998	5.3
Nov	1998	2.7
Dec	1998	-1.5

5. Temperatures Around the World

Label each plot line:
a. latitude and
b. state/country



6. Days and Nights Around the World: Seasonal Changes in Number of Hours of Daylight

All dates are the 21th day of the month

Latitude: 70° North

Date	Sunrise (AM)	Sunset (PM)	Day Length
Jan	NONE	NONE	0
Feb	8:14	4:34	8:20
Mar	6:04	6:32	12:28
Apr	3:35	8:46	17:11
May	NONE	NONE	24:00
Jun	NONE	NONE	24:00
Jul	NONE	NONE	24:00
Aug	3:36	8:46	17:10
Sep	5:46	6:17	12:31
Oct	7:49	3:58	8:09
Nov	NONE	NONE	0
Dec	NONE	NONE	0

Tromsö, NORWAY
Prudhoe Bay, ALASKA, USA
Clyde, Baffin Island, CANADA

Latitude: 57° North

Date	Sunrise (AM)	Sunset (PM)	Day Length
Jan	8:28	4:15	7:47
Feb	7:23	5:25	10:02
Mar	6:09	6:26	12:17
Apr	4:50	7:25	14:35
May	3:41	8:24	16:43
Jun	3:15	9:08	17:53
Jul	3:48	8:43	16:55
Aug	4:49	7:35	14:46
Sep	5:53	6:12	12:19
Oct	6:56	4:52	9:56
Nov	8:04	3:47	7:43
Dec	8:47	3:29	6:42

Kodiak, ALASKA, USA
Glasgow, SCOTLAND
Copenhagen, DENMARK
Moscow, RUSSIA

Latitude: 38° North

Date	Sunrise (AM)	Sunset (PM)	Day Length
Jan	7:22	5:21	9:59
Feb	6:52	5:55	11:03
Mar	6:12	6:23	12:11
Apr	5:26	6:51	13:25
May	4:55	7:18	14:23
Jun	4:47	7:36	14:49
Jul	5:04	7:28	14:24
Aug	5:30	6:55	13:25
Sep	5:57	6:08	12:11
Oct	6:24	5:24	11:00
Nov	6:57	4:54	9:57
Dec	7:22	4:54	9:32

USA: San Franci sco, CALIFORNIA
Charleston, W. VIRGINIA
Wichita, KANSAS
St. Louis, MISSOURI
Louisville, KENTUCKY
Pueblo, COLORADO
Richmond, VIRGINIA

Sendai, JAPAN
Tientsin, CHINA
Athens, GREECE
Cordoba, SPAIN
Seoul, S. KOREA
Izmir, TURKEY
Palermo, SICILY
Lisbon, PORTUGAL

Latitude: 26° North

Date	Sunrise (AM)	Sunset (PM)	Day Length
Jan	6:58	5:44	10:46
Feb	6:41	6:06	11:25
Mar	6:12	6:22	12:10
Apr	5:41	6:36	12:55
May	5:21	6:52	13:31
Jun	5:19	7:05	13:46
Jul	5:30	7:02	13:32
Aug	5:45	6:40	12:55
Sep	5:58	6:07	12:09
Oct	6:12	5:37	11:25
Nov	6:32	5:19	10:47
Dec	6:53	5:23	10:30

Monterey, MEXICO
Kunming CHINA
Karachi, PAKISTAN
Luxor, EGYPT
Taipei, TAIWAN
Patna, INDIA
Riyadh, SAUDI ARABIA
Wau El Kebir, LIBYA

Latitude: 0°

Date	Sunrise (AM)	Sunset (PM)	Day Length
Jan	6:18	6:25	12:07
Feb	6:20	6:27	12:07
Mar	6:14	6:20	12:06
Apr	6:05	6:12	12:07
May	6:03	6:10	12:07
Jun	6:08	6:15	12:07
Jul	6:13	6:20	12:07
Aug	6:09	6:16	12:07
Sep	6:00	6:06	12:06
Oct	5:51	5:58	12:07
Nov	5:52	5:59	12:07
Dec	6:04	6:12	12:08

Quito, ECUADOR; Nairobi, KENYA;
Singapore, MALAYA

Latitude: 26° South

Date	Sunrise (AM)	Sunset (PM)	Day Length
Jan	5:36	7:06	13:30
Feb	5:59	6:48	12:49
Mar	6:14	6:20	12:06
Apr	6:28	5:48	11:20
May	6:44	5:29	10:45
Jun	6:56	5:27	10:31
Jul	6:54	5:38	10:44
Aug	6:33	5:53	11:20
Sep	6:00	6:05	12:05
Oct	5:29	6:20	12:51
Nov	5:11	6:41	13:30
Dec	5:15	7:01	13:46

Pretoria, SOUTH AFRICA
Curitiba, BRAZIL
Brisbane, AUSTRALIA
Asuncion, PARAGUAY

Latitude: 38° South

Date	Sunrise (AM)	Sunset (PM)	Day Length
Jan	5:11	7:31	14:20
Feb	5:46	7:00	13:14
Mar	6:14	6:20	12:06
Apr	6:42	5:34	10:52
May	7:09	5:04	9:55
Jun	7:26	4:47	9:21
Jul	7:19	5:13	9:54
Aug	6:47	5:39	10:52
Sep	6:01	6:05	12:04
Oct	5:16	6:33	13:17
Nov	4:45	7:07	14:22
Dec	4:44	7:32	14:48

Melbourne, AUSTRALIA
Auckland, NEW ZEALAND
Bahia Blanca, ARGENTINA
Curacautin, CHILE

Latitude: 70° South

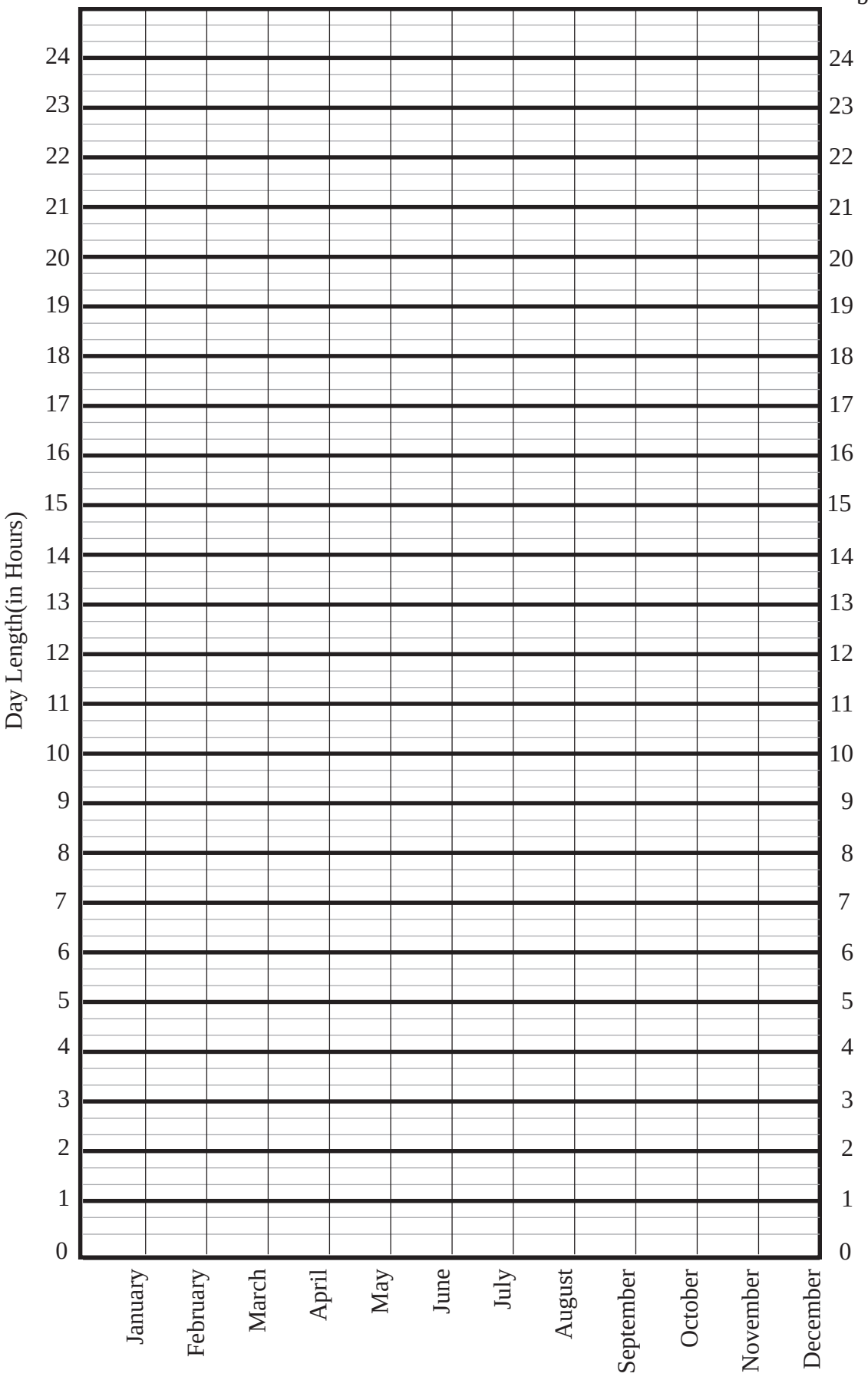
Date	Sunrise (AM)	Sunset (PM)	Day Length
Jan	NONE	NONE	24:00
Feb	4:09	8:35	16:26
Mar	6:10	6:21	12:11
Apr	8:19	3:57	7:38
May	NONE	NONE	0
Jun	NONE	NONE	0
Jul	NONE	NONE	0
Aug	8:24	4:03	7:39
Sep	6:00	6:07	12:07
Oct	3:37	8:15	16:38
Nov	NONE	NONE	24:00
Dec	NONE	NONE	24:00

ANTARCTICA

Data generated with Voyager
by Carina software,
Hayward, California

6. Days and Nights Around the World: Seasonal Changes in Number of Hours of Daylight

Label each plot line:
a. latitude and
b. state/country



The Real Reasons for Seasons: Sun-Earth Connections
A Great Exploration in Math and Science