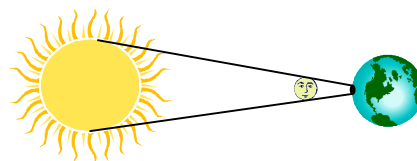# SOLAR ECLIPSE

Data Sheet 1
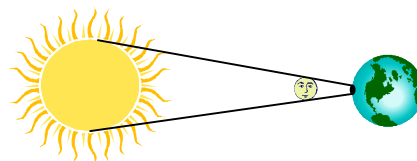
Total Solar Eclipses (1900 - 1949)

Key * denotes a total **annular** eclipse

Date Year	Month	Day	Maximum Duration (min:sec)	Maximum Path Width (miles)	Area
1900	Mar	28	02:10	58	Mexico, USA, Spain, Africa
1901	May	18	06:28	149	Indian Ocean, Sumatra, Borneo, New Guinea
1903	Sep	21	02:11	157	Indian Ocean, Antarctica
1904	Sep	9	06:19	146	Pacific Ocean
1905	Aug	30	03:46	123	Canada, Spain, Africa, Arabia
1907	Jan	14	02:24	119	Russia, China, Mongolia
1908	Jan	3	04:13	93	Pacific Ocean
1908	Dec	23	00:11	6	S. America, Atlantic Ocean, Indian Ocean
1909	Jun	17	00:23	32	*Greenland, Russia
1910	May	9	04:15		Antarctica
1911	Apr	28	04:57	120	Pacific Ocean
1912	Apr	17	00:01	1	*Atlantic Ocean, Europe, Russia
1912	Oct	10	01:55	54	Colombia, Brazil, Atlantic Ocean
1914	Aug	21	02:14	113	Greenland, Europe, Middle East
1916	Feb	3	02:36	69	Colombia, Venezuela, Atlantic Ocean
1918	Jun	8	02:22	70	Pacific Ocean, USA
1919	May	29	06:50	153	S. America, Atlantic Ocean, Africa
1921	Oct	1	01:52	189	Antarctica
1922	Sep	21	05:58	142	Indian Ocean, Australia
1923	Sep	10	03:36	106	Pacific Ocean, California, Mexico
1925	Jan	24	02:32	130	Great Lakes, USA, Atlantic Ocean
1926	Jan	14	04:10	92	Africa, Indian Ocean, Borneo
1927	Jun	29	00:50	48	England, Scandinavia, Arctic Ocean, Siberia
1928	May	19			(Umbra hardly touched Antarctica)
1929	May	9	05:06	122	Indian Ocean, Malaya, Philippines
1930	Apr	28	00:01	1	*Pacific Ocean, USA, Canada
1930	Oct	21	01:55	54	Pacific Ocean
1932	Aug	31	01:44	104	Arctic Ocean, Canada, New England
1934	Feb	14	02:52	79	Borneo, Pacific Ocean
1936	Jun	19	02:31	83	Greece, Turkey, Soviet Union, Japan
1937	Jun	8	07:04	156	Pacific Ocean, Peru
1938	May	29	04:04		Atlantic Ocean
1939	Oct	12	01:32	276	Antarctica
1940	Oct	1	05:35	137	Colombia, Brazil, Atlantic Ocean, S. Africa
1941	Sep	21	03:21	91	Soviet Union, China, Pacific Ocean
1943	Feb	4	02:39	146	Japan, Pacific Ocean, Alaska
1944	Jan	25	04:08	90	Peru, Brazil, W. Africa
1945	Jul	9	01:15	57	USA, Canada, Greenland, Scandinavia, Soviet Union
1947	May	20	05:13	124	S. America, Atlantic Ocean, Africa
1948	Nov	1	01:55	53	Africa, Indian Ocean

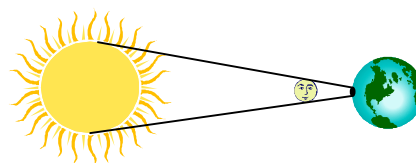Photo-copiable

SOLAR ECLIPSE

Data Sheet 2

Total Solar Eclipses (1950 - 1999)

Key * denotes a total **annular** eclipse

Date Year	Month	Day	Maximum Duration (min:sec)	Maximum Path Width (miles)	Area
1950	Sep	12	01:13	90	Arctic Ocean, Siberia, Pacific Ocean
1952	Feb	25	03:09	89	Africa, Middle East, Soviet Union
1954	Jun	30	02:35	96	USA, Canada, Iceland, Europe, Middle East
1955	Jun	20	07:07	159	Indian Ocean, Southeast Asia, Philippines, Pacific Ocean
1956	Jun	8	04:44	269	Pacific Ocean
1957	Oct	23			(Umbra hardly touched Antarctica)
1958	Oct	12	05:10	131	Pacific Ocean, Chile, Argentina
1959	Oct	2	03:01	76	New England, Atlantic Ocean, Africa
1961	Feb	15	02:45	164	Europe, Soviet Union
1962	Feb	5	04:08	92	Borneo, New Guinea, Pacific Ocean
1963	Jul	20	01:39	63	Pacific Ocean, Alaska, Canada, Maine
1965	May	30	05:15	124	New Zealand, Pacific Ocean
1966	Nov	12	01:57	53	Pacific Ocean, S. America, Atlantic Ocean
1967	Nov	2			(Umbra hardly touched Antarctica)
1968	Sep	22	00:39	68	Soviet Union, China
1970	Mar	7	03:27	99	Pacific Ocean, Mexico, USA, Canada
1972	Jul	10	02:35	111	Siberia, Alaska, Canada
1973	Jun	30	07:03	160	Atlantic Ocean, Africa, Indian Ocean
1974	Jun	20	05:08	216	Indian Ocean, Australia
1976	Oct	23	04:46	125	Africa, Indian Ocean, Australia
1977	Oct	12	02:37	63	Pacific Ocean, Colombia, Venezuela
1979	Feb	26	02:49	195	USA, Canada, Greenland
1980	Feb	16	04:08	93	Africa, Indian Ocean, India, Burma, China
1981	Jul	31	02:02	68	Soviet Union, Pacific Ocean
1983	Jun	11	05:10	125	Indian Ocean, Indonesia, New Guinea
1984	Nov	22	01:59	53	New Guinea, Pacific Ocean
1985	Nov	12	01:58	430	Antarctica
1986	Oct	3	00:01	1	*Atlantic Ocean
1987	Mar	29	00:07	3	*Atlantic Ocean, Africa
1988	Mar	18	03:46	109	Sumatra, Borneo, Philippines, Pacific Ocean
1990	Jul	22	02:32	130	Finland, Soviet Union, Aleutian Islands
1991	Jul	11	06:53	160	Hawaii, Mexico, Central America, Colombia, Brazil
1992	Jun	30	05:20	182	Atlantic Ocean
1994	Nov	3	04:23	117	Peru, Bolivia, Paraguay, Brazil
1995	Oct	24	02:09	48	Iran, India, Southeast Asia
1997	Mar	9	02:50	221	Mongolia, Siberia
1998	Feb	26	04:08	94	Galapagos Islands, S America, Caribbean
1999	Aug	11	02:22	69	Europe, Middle East, India

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SOLAR ECLIPSE

Data Sheet 3

Predicted for the Future

Total Solar Eclipses (2000 - 2035)

Key * denotes a total **annular** eclipse

| Date Year	Month	Day	Maximum Duration (min:sec)	Maximum Path Width (miles)	Area
2001	Jun	21	04:56	124	Atlantic Ocean, Africa
2002	Dec	4	02:03	54	Africa, Indian Ocean, Australia
2003	Nov	23	01:57	308	Antarctica
2005	Apr	8	04:31	100	*Pacific Ocean
2006	Mar	29	04:06	114	Africa, Turkey, Soviet Union
2008	Aug	1	02:27	147	Greenland, Soviet Union, China
2009	Jul	22	06:38	160	India, China, Pacific Ocean
2010	Jul	11	05:20	160	Pacific Ocean, S. America
2012	Nov	13	04:02	111	Australia, Pacific Ocean
2013	Nov	3	01:39	35	*Atlantic Ocean, Africa
2015	Mar	20	02:46	287	Atlantic Ocean, Norwegian Sea, Svalbard
2016	Mar	9	04:09	96	Indonesia, Pacific Ocean
2017	Aug	17	02:40	71	USA
2019	Jul	2	04:32	124	Pacific Ocean, Chile, Argentina
2020	Dec	14	02:09	56	Chile, Argentina
2021	Dec	4	01:54	260	Antarctica
2023	Apr	20	01:16	30	*Indonesia
2024	Apr	8	04:28	122	Mexico, USA, Canada
2026	Aug	12	02:18	182	Greenland, Iceland, Spain
2027	Aug	2	06:22	160	Gibraltar, Africa, Saudi Arabia
2028	Jul	22	05:09	143	Indian Ocean, Australia, New Zealand
2030	Nov	25	03:43	105	S. Africa, Indian Ocean, Australia
2031	Nov	14	01:08	24	*Pacific Ocean
2033	Mar	30	02:37	483	Alaska, Arctic Ocean
2034	Mar	20	04:09	99	Africa, Middle East
2035	Sep	2	02:54	72	China, Korea, Japan, Pacific Ocean

SOLAR ECLIPSE

Data Sheet 4

11th August 1999

Did you see the eclipse? The map shows approximately how much of the sun was eclipsed by the moon in regions of the U.K.

70%

75%

80%

85%

90%

95%

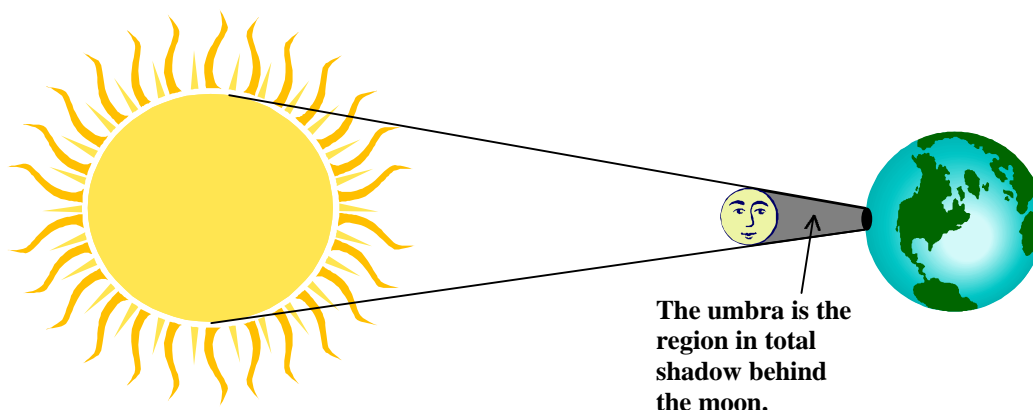**Total Eclipse
in this region**

100%
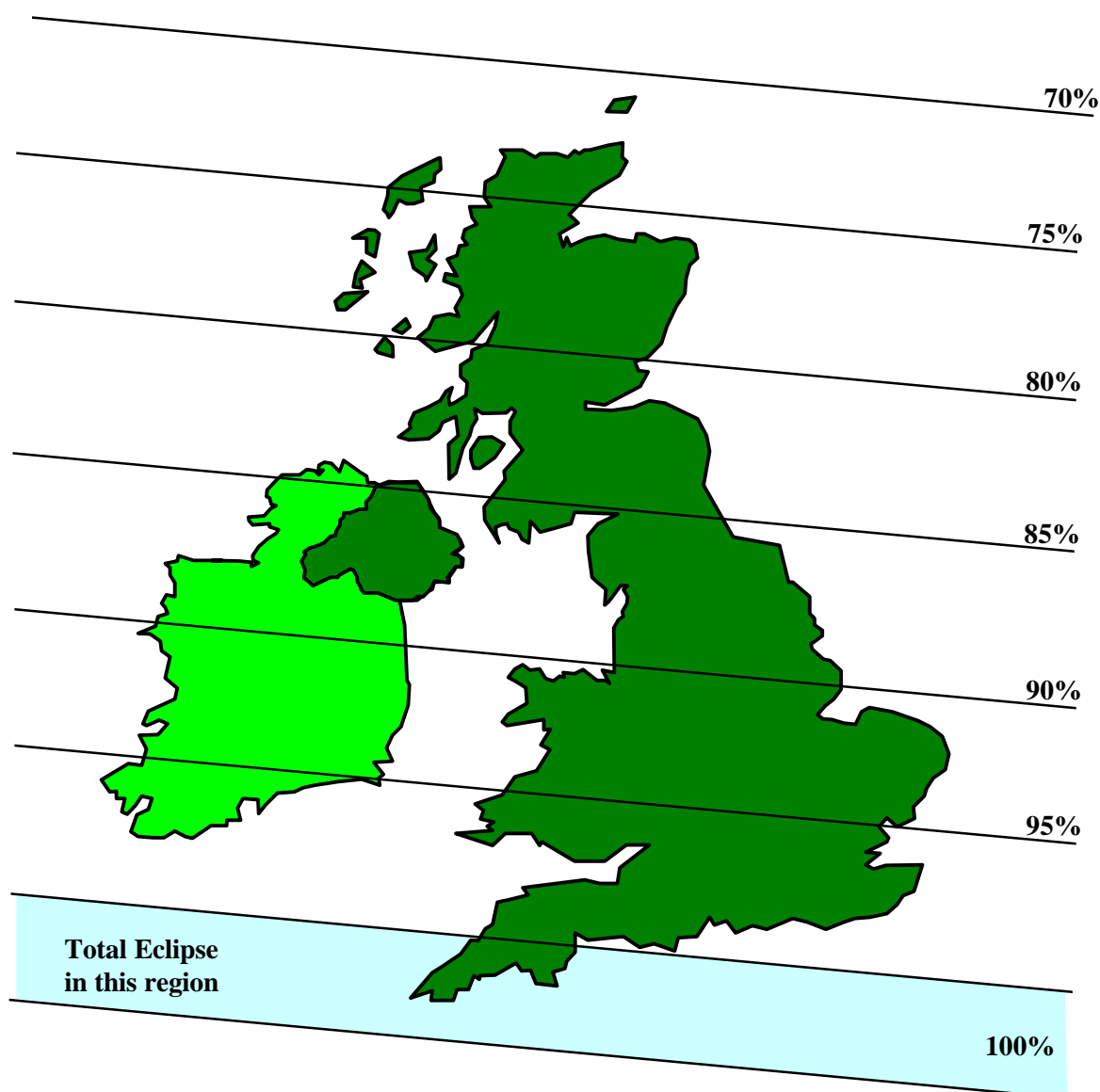
The eclipse occurred in Europe and Asia, with a total eclipse in the following countries: England, France, Germany, Switzerland, Austria, Hungary, Romania, Turkey, Iraq, Iran, Pakistan and India.

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SOLAR ECLIPSE

Data Sheet 5

What happens during a solar eclipse

The umbra is the region in total shadow behind the moon.

The shadow of the moon falls on the surface of the earth as shown in the sketch. This shadow moves at a speed of more than 1000 mph from west to east across the surface of the earth.

Types of Solar Eclipse

Total
The sun is about 400 times as big as the moon, but because it is about 400 times as far away, they appear to be roughly the same size. In a total eclipse the moon appears to move across the sun until it completely covers it. This happens at places crossed by the shadow where the umbra meets the earth. The whole process can take a few hours, but the period of totality lasts only a few minutes. In a wide area around the shadow the sun is only partly eclipsed by the sun.

Partial
The orbit of the moon is at an angle to the orbit of the sun. This means that sometimes the umbra passes the earth without touching it, but is near enough to give a partial eclipse in some places. These eclipses are not included on the data sheets.

Annular
The shape of the moon's orbit means that the distance between the moon and earth varies. If the umbra comes to a point before it reaches the earth, the eclipse is annular. This means that the moon is too small to completely eclipse the sun. When this happens the part of the sun surrounding the earth looks like a very bright doughnut.

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Teacher Notes

Unit   Intermediate Level, Handling and interpreting data

Skills used in this activity:
Analysis of statistical data which may involve one or more of the following:
- drawing statistical diagrams
- calculating mean, mode and median
- calculating measures of spread

Preparation
For the class you need:
- a copy of those data sheets that you wish to use for each student
  (select from pages 1 - 5)
- graph paper and other equipment necessary for the drawing of statistical diagrams

Notes on the Activity
Data Sheets 1 and 2 give information about total eclipses which have occurred in the 20th century, Data Sheet 3 gives information about total eclipses which are predicted for the first 35 years of the 21st century, Data Sheet 4 gives more detailed information about the last total eclipse to occur in the UK and Data Sheet 5 gives general information about types of eclipse. You may decide to use all or just one or two of these data sheets.

The data sheets have been supplied without any accompanying questions because it is intended that they are used to generate class discussion about what can be found out from them or what hypotheses can be tested.

Some possibilities for questions are listed below, but there are many others.
- Are total eclipses becoming more frequent?
- What is the 'average' duration of a total eclipse?
- Was the 1999 total eclipse 'typical'?
- If a histogram is drawn of the maximum path widths, is it symmetrical?
- Do those eclipses which last for the longest times also tend to have the widest path widths?

After the initial discussion students could work individually or in groups to calculate averages or draw statistical diagrams.
At the end of the class they could communicate their results to the rest of the class.

(N.B. The fact that the laws of physics give relationships and predictions has been ignored here but should be discussed with students at some point.)

Alternative
The data on the first three data sheets is also supplied on the Excel spreadsheet Solar Eclipse.xls. It can therefore be used for practice in using a spreadsheet to calculate averages or draw statistical diagrams.