

PLANET EARTH & EARTH'S SHAPE

A. Model - a representation of an object or an idea

1. There are 5 different types of models used in Earth Science:

- a) Physical model - a globe, model car/plane, Barbie
- b) Mechanical model - it has moving parts - a planetarium
- c) Mental model - a picture in your mind
- d) Mathematical model - a formula
- e) Graphic model - a graph/grid

B. Earth Dimensions & Measurements - Topics 1&2 pp. 17-18 TQ's 1,2 p. 20

Circumference - the distance around a spherical object as measured at the surface

1. Equatorial circumference = 40076 Km.
2. Polar circumference = 40008 Km.
3. Clearly, the Earth is not a perfect sphere
 - a) its true shape is an oblate spheroid - a sphere with a slight polar flattening and a bulge at the equator - caused by rotation
4. The Earth's % of error = $17/100$ of 1% put another way:
The Earth is 99 and $83/100$ % perfectly round

C. There are 4 lines of evidence that rule out flat & perfectly round as choices:

1. Simple observations

- a) sailing ships disappear bottom up over the horizon
sailing ships appear mast first over the horizon
- b) during a lunar eclipse, a curved shadow from the Earth
is cast upon the surface of the Moon

2. Changing altitude of Polaris

Altitude = the angle between a celestial object and the horizon

Polaris = the North Star - in the constellation of the Little Dipper/Ursa Minor

Celestial Object = any object outside of the Earth's atmosphere

- a) as ships sailed north or south, the altitude changed in
a regular fashion - inconsistent with a flat surface

3. Varying Gravity Measurements

- a) you weigh the most at the poles - closest to Earth's center

- b) you weigh the least at the equator - furthest from the Earth's center - there shouldn't be a closest or furthest

4. Photographs from Outer Space p.18

D. Locating Positions on the Earth - Topics 2&3 pp. 111&112 TQ's 2&3 p. 114

1. We use a co-ordinate system - any system used to locate the position of a point
 - a) graphs or grids as examples
2. Latitude and Longitude are the co-ordinate systems used on the surface of the earth
3. Latitude - the angular distance North or South of the Equator
 - a) minimum value of 0° at the Equator
 - b) maximum value of 90° at the Poles
 - c) to determine your latitude you measure the altitude of Polaris (in the Northern Hemisphere)
4. Longitude - the angular distance East or West of the Prime Meridian
 - Prime Meridian - an imaginary line running pole to pole that passes through Greenwich, England and crosses the Equator at a right angle
 - a) minimum value of 0° on the Prime Meridian
 - b) maximum value of 180° on the International Date Line
 - c) longitude is based on the fact that: the Earth rotates at 15° per hour from west to east
 - d) to determine your longitude you use a chronometer - a device that tells time on the Prime Meridian and your local solar time
 - 1) for every hour in time difference there are 15° of difference in longitude
 - 2) if your local solar time is earlier than time on the Prime Meridian, you're in the Western Hemisphere
 - 3) if your local solar time is later than time on the Prime Meridian, you're in the Eastern Hemisphere
5. Facts about latitude and longitude
 - a) both are based on celestial measurements - latitude is based on Polaris, longitude on time which is a function of the Sun's position in the sky
 - b) degrees of latitude and longitude are divided into 60 equal parts called minutes
 - c) an imaginary line connecting points of equal latitude is called a parallel - all are different lengths and none touch

- d) an imaginary line connecting points of equal longitude is called a meridian - all are the same length and all intersect at the poles

E. Major sub-divisions of the Earth

1. Lithosphere - the continuous layer of rock that forms the solid outer shell of the Earth
 - a) it includes the crust and the uppermost mantle known as the asthenosphere
 - b) it's up to 100 Km. thick in spots
 - c) it's usually covered by a layer of loose soil and rocks
2. Hydrosphere - the thin layer of water that rests on the lithosphere
 - a) it covers about 71% of the Earth's surface
 - b) it varies in thickness up to about 10 Km.
 - c) drawn to scale, it's almost invisible on the surface of Earth
3. Atmosphere - the thin shell of gases that surrounds the Earth
 - a) it's sub-divided into various "spheres" - see ESRT
 - b) the lowermost sphere - the troposphere - is the most important - 0 to 12 Km. above the surface
 - 1) it contains all the gases needed to support life - 78% nitrogen, 21% oxygen, 1% all others
 - 2) it contains most of the mass of the atmosphere
 - 3) it's where weather occurs
 - 4) it contains virtually all of the water vapor of the
4. Biosphere - the community of plants and animals on the Earth
 - a) it aids in weathering of the surface
 - b) it contributes to the formation of soils

F. Fields - any portion of the environment that has a measurable value at every point

1. There are two types of fields, scalar fields and vector fields
2. Scalar field - a field which requires only a magnitude (strength or number) to express itself
 - a) temperature b) relative humidity c) air pressure
 - d) population e) elevation
3. Vector field - a field which requires both a magnitude and a direction to express itself
NOTE : direction includes points of the compass as well as up and down
 - a) wind b) gravity c) magnetism d) latitude e) longitude
 - f) velocity g) ocean currents

4. Facts about fields

- a. all fields change with the passage of time
- b. fields are commonly expressed by the use of isolines - a line connecting points of equal value
- c. common isolines include:
 - 1) parallels - latitude
 - 2) meridians - longitude
 - 3) isotherms - temperature
 - 4) isobars - air pressure
 - 5) contour lines - elevation

G. Topographic/Contour Maps - a map used to show elevations, landforms, and cultural features of the Earth's surface

1. satellites do modern map data gathering -Topics 14,15,16 pp. 121-123
2. Things found on a topographic map:
3. Latitude - in degrees and minutes on the right hand side of the map
 - a) a minute is $1/60^{\text{th}}$ of 1 degree
 - b) if the numbers increase towards the top of the map, it's from the northern hemisphere
4. Longitude - in degrees and minutes running along the top and bottom of the map
 - a) if the numbers increase towards the left hand side of the map, it's from the western hemisphere
5. Scales - used to determine distances on the map - Topic 5 pp. 112-113 TQ 5ab p. 114
 - a) a bar scale is usually used - on the bottom of the map
 - b) mathematical scale - a ratio of map distance to real world distance - 1:63360 for example
6. Magnetic Declination - the difference between true north (geographic north) and magnetic north - Topic 10 p. 118 p. 118 7.11
 - a) expressed in degrees
 - b) used to calibrate a compass
7. Contour Lines - isolines that connect points of equal elevation
Topic 6 p. 115 TQ 6abc p. 117
 - a) every 5^{th} one is darkened and has its value printed on it
 - b) every point on the line has the same elevation as every other point

- c) the ocean has an elevation of 0 - where the ocean meets the beach is the equivalent of a 0 foot contour line
8. Contour Interval - the vertical difference between adjacent contour lines - it tells you what to count by
- a) it's always a power of 5
 - b) it's usually printed on the bottom of the map
 - c) it can be determined by dividing the number of "gaps" into the vertical difference between listed contour lines
9. Gradient (slope) - change in field value (elevation) divided by change in distance - ESRT - Topic 12 p. 119 TQ 12 p. 120
- a) as the distance between contour lines increases, gradient decreases
 - b) the closer the lines, the steeper the slope
10. Stream Gradient - a measure of how far a stream drops vertically over a specific horizontal distance
- a) use the formula in ESRT
11. Rule of Contour "V's" - Topic 11 pp. 118-119 TQ 11a-f p. 120
- a) whenever a contour line crosses a stream or river, it takes on a V-shape and the V always points uphill/upstream
 - b) it's used to tell which way a stream is flowing
12. Compass Direction
- a) North at the top, South at the bottom, East to the right, West to the left
13. Hatchured Contour Line - a Depression Contour - a special contour line used to show a closed depression - Topic 7 p. 116 TQ 7
- a) quarries, swamps, volcanic cones, craters, and sinkholes are examples of closed depressions p. 128 & 162
 - b) if you are moving uphill and encounter a hatchured contour line, you repeat the value of the last regular contour line you crossed
 - c) if you are moving downhill and encounter a hatchured contour line, you continue to drop by the contour interval of the map
14. Symbols/Key - self explanatory
15. Colors
- a) Green = vegetation b) Blue = water c) White = Bedrock
 - d) Red = roadways e) Brown = contour lines f) Black = labels and print

16. Profile - a cross-sectional view of the surface - a side view - Topic 13 p.120 TQ 13a p. 120

17. Elevation - the vertical difference above or below sea level - Topic 8 p. 116 TQ 8ab p. 117

- a) it's usually expressed as a range - higher than the lower line, and lower than the higher line
- b) the range must be within one contour interval
- c) exact elevation is possible if:
 - 1) the spot sits right on a contour line
 - 2) the spot happens to be a bench mark p. 116 7.9