Topographic Maps

I. *Introduction*

A. Topographic maps are essential tools in geologic and engineering studies because they show the configuration of Earth's surface in remarkable detail and permit one to measure horizontal distances and _____elevations. This is accomplished by means of carefully surveyed _____ connecting points of_____to represent elevations of hills and valleys. They are also used by the military, hikers, hunters, campers, and anyone who for whom knowledge of the three-dimensional nature of the land surface is useful.

B. Topographic Maps are also called _____.

II. *Representing Elevation*

A. Contour Lines
1. Connect points of_____ with respect to _____.
2. Represent_____ distance (altitude can also be used).
3. Contour lines are plotted in _____.
4. Bathymetric contours
   a. Show the shape and slope of the_____ surface
   b. Shown in_____, depending on their location.
5. Index Contours
   a. _____brown lines with elevations printed on them.
   b. Usually every _____ line.
   c. Not used if the map area has low _____.
      (1) Relief is the difference between the _____ and _____ elevation.
      (2) A region with low relief will be relatively _____.
      (3) In areas with low relief, few contour lines will be required and all will be labeled.
6. The Contour Interval
   a. The difference in elevation between two_____ contour lines.
   b. Specified on maps as either _____or _____.
   c. Maps use the smallest contour interval that will allow easy readability and provide as much detail as possible.
      (1) _____ intervals are used if there is a high relief.
      (2) _____ intervals are used for low relief.
7. Rules for Contour Lines
   a. Every point on a contour line is of the exact _____ elevation.
   b. Contour lines always close to form an irregular _____.
      (1) Sometimes part of a contour line _____ the mapped area.
      (2) This is why the entire circle formed can't be seen.

c. Contour lines _____ cross one another.
   (1) A map location can't have _____ elevations.
   (2) A rare exception is where an _____ is present. In this case the hidden contour lines are dashed.
   (3) If the cliff is vertical the contour lines will merge to form a _____ contour line.

d. Gradient (Slope)
   (1) Gradient is a measure of the _____ of a slope.
   (2) Gradient is determined by finding the _____ over a _____ distance. Expressed as:
      (a) Feet per mile
      (b) Meters per kilometer (for metric maps)
   (3) Can be inferred by the _____ of the contour lines. (Figure 1)
      (a) A steeper gradient will be shown by _____ contour lines.
      (b) The more gentle the gradient, the _____ the contour lines will be spaced.

e. Stream Valleys
   (1) Contour lines form a _____ when crossing a stream. (Figure 2)
   (2) The apex of the V always points _____ towards the _____ elevation.

f. A concentric series of circular close contour lines represents a _____. (Figure 3)

g. Depressions:
   (1) Depression contour lines have _____ marks on the downhill side.
   (2) They represent _____ depressions.
   (3) Contour lines _____ on opposite sides of the depression.
      (a) This means that the _____ contour line inside the depression has the _____ elevation as the last contour line outside. (Figure 4)
      (b) If the depression is on a slope, the contour lines will repeat on _____ _____ side. (Figure 5)

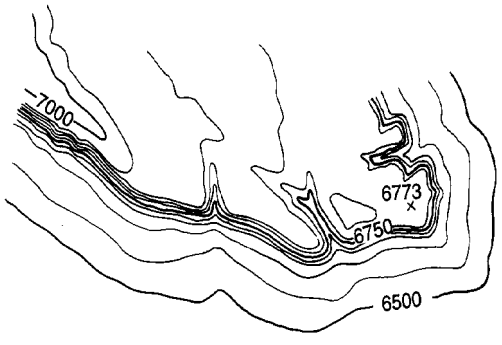

Figure 1

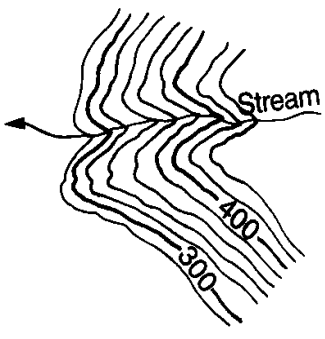

Figure 2

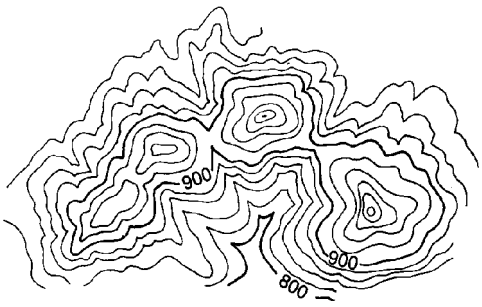

Figure 3

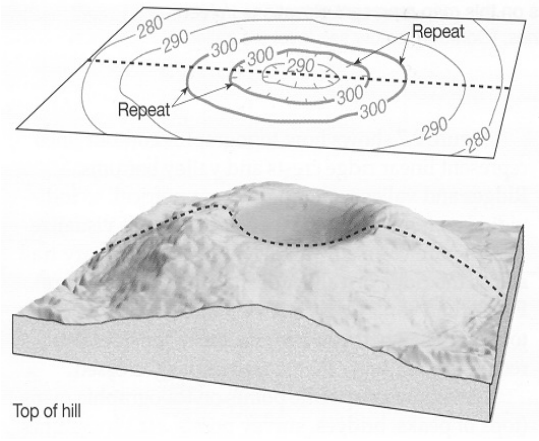

Figure 4

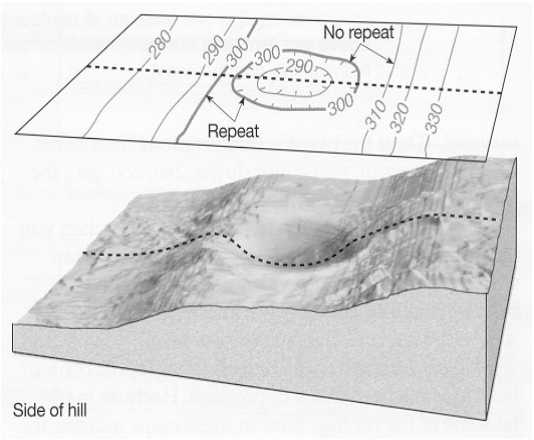

Figure 5

B. Vertical Control Points
   1. These are symbols on a map that indicate the _____ at that location.
   2. Some types of vertical control points:
      a. Bench Marks
         (1) A _____ set into the ground.
         (2) It's _____ position has been surveyed as accurately as possible.
         (3) Abbreviated "**BM**."
         (4) Shown as a _____ with the elevation if latitude and longitude coordinates are certain.
         (5) If **VABM** next to a triangle symbol it indicates the elevation was determined by a surveying technique that used a vertical angle (hense, the letters VA).
         (6) If shown as by an ^{BM}**X** symbol with the elevation.
            (a) The horizontal position has been surveyed as accurately as possible, but exact coordinates haven't been determined.
            (b) Instead of a brass plate, the marker is a concrete tablet with the numbers etched onto the top (like a gravestone).
      b. Recoverable Mark
         (1) Naturally occurring _____ whose horizontal position has been surveyed as accurately as possible.
         (2) Shown by an **X** symbol with the elevation.
         (3) Referred to as a _____.

III. *Latitude and Longitude on Topographic Maps*

A. Quadrangles
   1. Topographic maps are a _____ whose borders are lines of _____ and _____.
   2. Because most maps cover _____ of Earth's surface whole degrees aren't used.
      a. Maps are published in sizes using _____ and _____ of latitude and longitude.

b. Two common sizes
(1) 7 ½ minute quadrangle
(a) Covers _____ (7' 30") of latitude and longitude.
(b) Most common map published by the United States Geologic Survey (USGS.)
(2) 15 minute quadrangle
(a) Covers _____ (15' 00") of latitude and longitude.
(b) Covers _____ times the area of a 7 ½ minute quadrangle.
(c) This size is no longer published by the USGS

3. The Direction to North
a. North is always at the _____ of the quadrangle grid
b. Longitude lines (meridians)form the _____ and _____ borders of the map.
c. They aren't parallel because meridians _____ toward the north.
d. Grid North (___)
(1) At the top of the quadrangle grid.
(2) Based on a grid constructed on the map.
(3) About the same as true north (_____) on the actual Earth.

B. Magnetic North is not the same as True North
1. Magnetic North (____)
a. The direction in which Earth's magnetic lines of force _____.
b. This is _____ in the same location as true north and moves 10 to 40 km per year.
c. It's currently about 1,000 km from the true North Pole, in Hudson Bay, Northern Canada (at 82.7° N, 114.4° W in 2005).
2. Magnetic Declination
a. The_____ between _____ (MN) and _____ (shown by a star).
b. Because magnetic north is continually changing, this is good only for the year of the map.
c.

IV. *Map Scale*
A. What is meant by scale?
1. Maps are _____.
2. Scale is the _____ by which the real distance has been reduced.
3. All scales are shown on the bottom of the map.

B. Ratio Scale
1. Expresses how much a certain distance on the map equals on the *real* Earth.
2. Units are in inches (centimeters if the contour lines are in meters).
3. Samples
a. 1:24,000
(1) One inch on the map represents _____ in real distance on Earth's surface.
(2) Used on 7 ½ minute quadrangle maps
b. 1:62,000

(1) Once inch on the map represents _____ in real distance on Earth's surface.
(2) Used on 15 minute quadrangle maps.

c. 1:100,000
(1) One centimeter on the map represents _____ (1 km) in real distance on Earth's surface.
(2) Used on metric maps.

C. Fractional Scale
1. Indicates that map has been reduced to the_____.
2. Ratio Scale can easily be expressed as_____.
a. 1:24,000 equals a fractional scale of 1/24,000.
b. 1:62,000 equals a fractional scale of 1/62,000.
c. 1:100,000 equals a fractional scale of 1/100,000.

D. Bar Scale
1. Printed in the lower margin.
2. Four types:
a. Miles
b. Feet
c. Kilometers (subdivided into meters)

V. *Map Symbols and the Use of Color*

A. Features and Symbols
1. Shown as points, lines, or areas, depending on their size and extent.
2. Individual houses may be shown as small black squares. For larger buildings, the actual shapes are mapped.
3. In densely built-up areas, most individual buildings are omitted and an area tint is shown. On some maps, post offices, churches, city halls, and other landmark buildings are shown within the tinted area.
4. Various point symbols are used to depict features such as buildings, campgrounds, springs, water tanks, mines, survey control points, and wells. Names of places and features are shown in a color corresponding to the type of feature. Many features are identified by labels, such as "Substation" or "Golf Course.

B. _____:
1. The used colors usually indicate similar classes of information.
2. Colors used:
a. _____: Contour lines
b. _____**:** Vegetation (e.g., woods, orchards, and vineyards)
c. _____: Water features such as lakes, swamps, rivers, and drainage
d. _____**:** Classifies cultural features ("man-made"), such as populated areas, main roads, and boundaries
e. _____**:** Cultural features (e.g., buildings, roads, railroads, mines, towers, etc.)

f. _____: At one time, purple was used as a revision color to show all feature changes. Currently, purple is not used in the USGS revision program, but purple features are still present on many existing maps.

VI. *Public Land Survey System (PLS)*

➢ Refer to separate handout

VII. *Universal Transverse Mercator System (UTM)*

➢ Refer to separate handout