GE 3040
Midterm #1
2/28/2006

Name_____

1. Fill in the blank.

a. Magnetic effects of external origin cause the geomagnetic field to vary on a daily basis to produce _____ of Earth's magnetic field.

b. In these materials the spin magnetic moments of the unpaired electrons between neighboring atoms are magnetically coupled but anti-parallel and equal: _____

c. Places on the Earth's surface where the inclination of the magnetic field is ± 90^o are termed _____.

d. The process of making a series of alternate readings at two stations to determine the difference in gravity between an IGSN station and the local base is called _____.

e. The temperature at which ferromagnetic materials loose their spontaneous magnetization is called the _____.

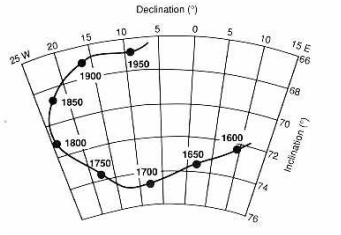
f. The phenomena of ground state splitting of electron energy levels in the presence of a magnetic field is called the _____.

g. This equipotential surface describes how sea level gravity varies on a hypothetical earth that has the same mass and shape as the real Earth _____.

h. A deviation from the uniform in geophysics is called a(n) _____.

i. 1 m/sec^2 = ___ cm/sec^2 = ___ mgal = ___ gu

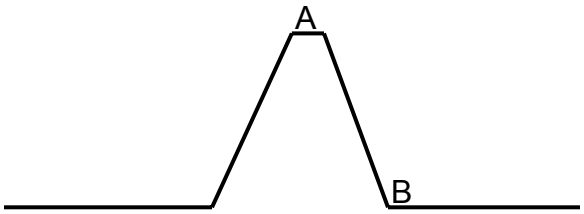
j. The phenomenon shown in the figure below is called _____.



2. To a first order approximation, Earth's magnetic field is said to be a dipole field. Why?

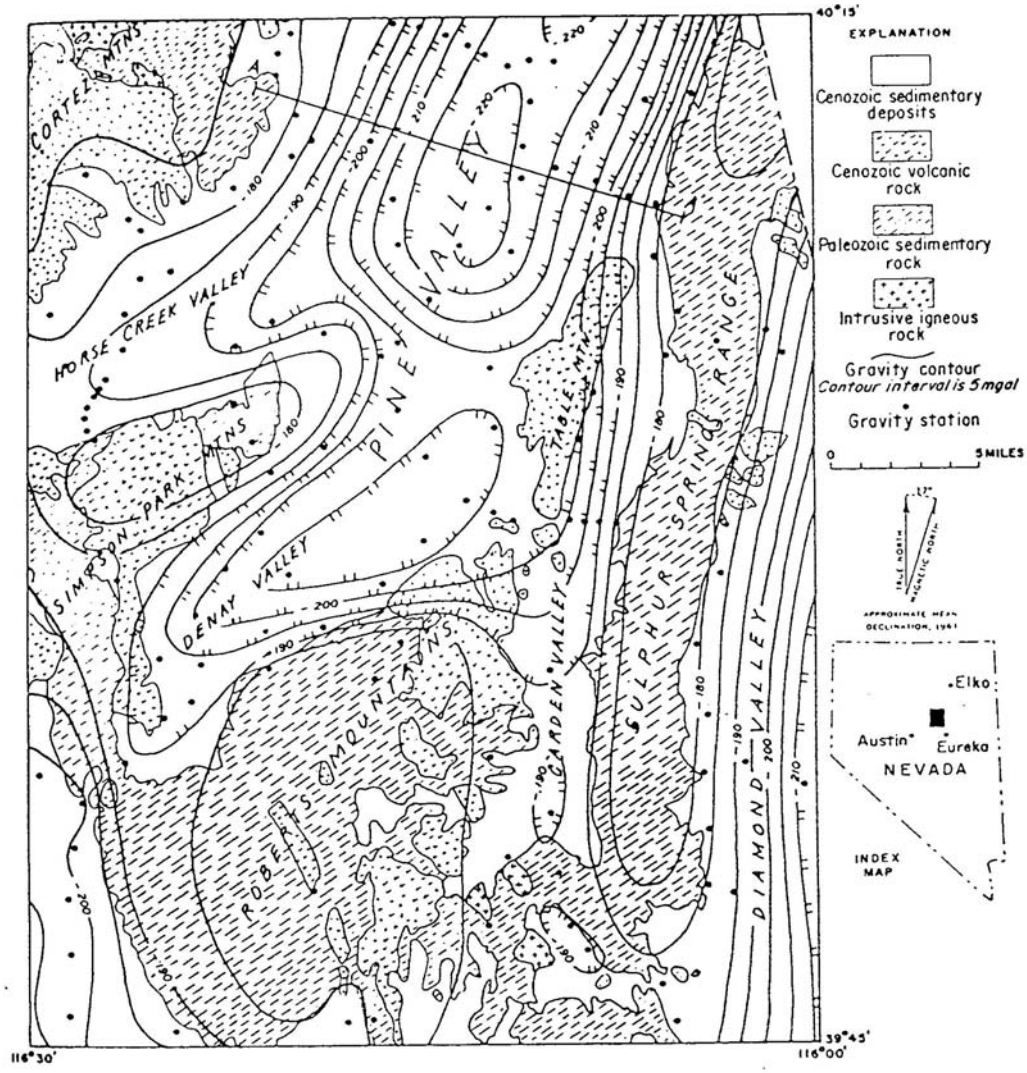
3. The Earth's gravitational field is 0.05186 m/sec^2 greater at the poles than at the equator. What the factors contribute to this variation? Would the frequency of a simple pendulum be greater at the poles or at the equator? Why?

4. Explain why the terrain correction is positive for both stations A and B in the diagram below.



5. What are the 3 vectors and 2 angles that uniquely describe Earth's magnetic field at a given point on its surface? Draw a diagram illustrating the relationship between these vectors and angles for an arbitrary location in the Northern Hemisphere. For the three vectors, name the magnetometers used to measure these components.

6. The Bouguer anomaly map shown below displays rather large negative values (between -175 and -225 mgal) that result because of a relatively thick crust in this part of North America. However, local variations do exist. Using the data from this map, what is the thickness of sediments in Pine Valley? The density of the sediment that fills the valley is approximately 2200 kg/m^3 while rocks of the Sulphur Springs and Cortez Mountains average 2670 kg/m^3. Is your answer a maximum or minimum thickness?



7. Compare and contrast stable and unstable gravimeters. Start by drawing schematically each gravimeter.

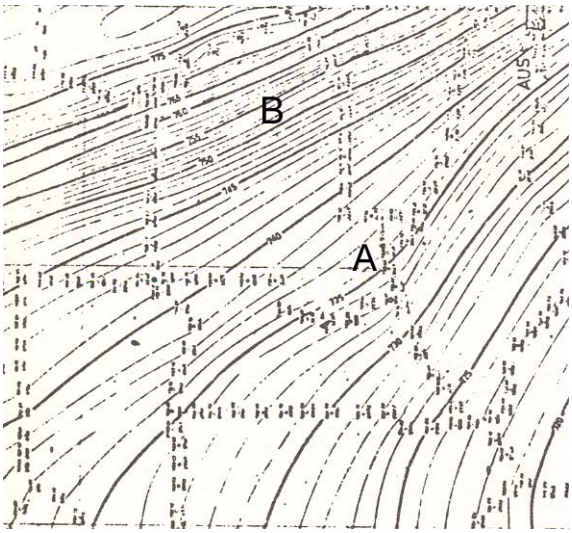
9. Two gravity features A and B are readily apparent on the Bouguer gravity map shown below. The survey was undertaken to evaluate the potential for hydrocarbon potential of a sedimentary basin along the west coast of Australia.

   a. Draw in the regional gravity field associated with anomaly A and the 0 mgal residual contour line of anomaly A.?

   b. Does the gravity anomaly in the center result from a positive or negative contrast?

   c. What is the possible cause of anomaly B?

   d. If the half width of anomaly A is _____ km, what is it's depth?



10. For the various physical properties listed below give the geophysical technique or techniques that exploits that physical property:

    a. susceptibility _____

    b. dielectric constant _____

    c. elastic moduli _____

    d. density _____

    e. electrical conductivity _____

11. Given:
    - g_{obs} at base is 9,805,003.2 gu
    - Δg at station relative to base is 53.8 g.u.
    - g_{th} at the latitude of the station is 9,805,021.0 gu
    - elevation of the station above sea level is 305 meters
    - density of the Earth above sea level is 2000 kg/m^3 (2.0 Mg/m^3), and
    - terrain effect is 10 g.u.

    Calculate the complete Bouguer anomaly for this station if the reference level is the geoidal surface.

    If the reference or datum level for the gravity reductions is 605 instead of sea level, what would the simple Bouguer and Free Air anomalies be?

12. A gravimeter reads 1234.8 dial units (du) at the base station before the start of a gravity survey (8:00 am). Two and one-half hours later (10:30 am) the base is re-occupied and the null-reading is 1259.8. The survey ends two hours later (12:30 pm) with the gravimeter recording a base reading of 1242.8.

    a. What is the drift correction with respect to the 8:00 am base (in dial units) for station reading taken at 9:00 am? (Be sure to include the correct sign of the correction.)

    b. If the gravimeter scale constant is 3.75 g.u./du, what is the difference in observed gravity between the 8:00 am and 9:00 am stations?

    c. What is the drift correction for a station reading taken at 12:00 noon with respect to the 8:00 am reading? (Be sure to include the correct sign of the correction.)