ES302 Quiz 2 (20 pts) Name KEY

Open Book – Use notes / textbook to solve the following problems. Work independently and complete your own work. No team conferences.

1. Refer to the attached topographic map from Galice, Oregon. Complete the following tasks:

   A. Calculate the fractional scale of the map. Show all your math work. Scale: 1:63,360

   $1\,in = 1\,mi = 5280\,ft\left(\frac{12\,in}{ft}\right) = 63{,}360\,in$

   1:63,360

   B. Given the above scale, you measure 5.6 inches between two locations, what is the straight line distance in kilometers? Show all your math work.

   Answer 9.02 Km

   $5.6\,in\,(63{,}360)\left(\frac{1\,ft}{12\,in}\right)\left(\frac{1\,mi}{3.28\,ft}\right)\left(\frac{1\,Km}{1000\,m}\right) = 9.02\,Km$

   C. Determine the following orientations:

   Quadrant Bearing from Pt C to Pt B 34° = N. 34° E.

   See MAP

   Azimuth Bearing from Pt A to Pt C 166° SE

   D. Using a ruler, precisely measure the map dimensions of the "test box" in the SE corner of the map in decimal inches, to the nearest two decimal places. Show all of your math work and scaling calculations for determining the line lengths.

   Line A-B Length 1.15 inch See MAP

   Line B-C Length 1.68 inch

   $AREA = \overline{AB} \times \overline{BC} = (1.85\,Km)(2.70\,Km) = 4.99\,Km^2$

   E. Given your fractional scale calculated in A above, determine the ground-equivalent area of the "test box" in square kilometers. Show all of your math work and unit algebra.

   $LENGTH\ AB = 1.15\,in\,(63{,}360)\left(\frac{1\,ft}{12\,in}\right)\left(\frac{1\,mi}{3.28\,ft}\right)\left(\frac{1\,Km}{1000\,m}\right) = 1.85\,Km$

   $LENGTH\ B\text{-}C = 1.68\,in\,(63{,}360)\left(\frac{1\,ft}{12\,in}\right)\left(\frac{1\,mi}{3.28\,ft}\right)\left(\frac{1\,Km}{1000\,m}\right) = 2.70\,Km$

2. Stokes Law states that the velocity at which a spherical particle suspended in a fluid settles to the bottom is given by the equation:

$$V = \frac{2(d_p - d_f)gr^2}{9u}$$

where V = velocity, d_p = density of particle, d_f = density of fluid, g = acceleration due to gravity (9.8 m/sec^2), and r is particle radius and u = viscosity

If the measured velocity = 0.24 m/sec, d_p = 3.2 kg/m^3, d_f = 1.1 kg/m^3, and r = 3.2 mm, determine u in dimensional units of kg/m-sec. Show all of your unit algebra and algebraic manipulation.

$$(9u)\,V = \frac{2(d_p - d_f)gr^2}{9u}(9u) \qquad \frac{u9V}{9V} = \frac{2(d_p - d_f)gr^2}{9V}$$

$$\boxed{u = \frac{2(d_p - d_f)gr^2}{9V}}$$

$$u = \frac{2(d_p - d_f)gr^2}{9V} = \frac{2\left(3.2\frac{kg}{m^3} - 1.1\frac{kg}{m^3}\right)\left(9.8\frac{m}{sec^2}\right)\left[3.2\,mm\left(\frac{1\,m}{1000\,mm}\right)\right]^2}{9(0.24\,m/sec)}$$

$$u = \frac{2(2.1\,kg/m^3)(9.8\,m/sec^2)(1.024\times10^{-5}\,m^2)}{2.16\,m/sec}$$

$$\boxed{u = 1.95\times10^{-4}\,kg}$$

ASCE check on p. 2

$1t = 1000kg$ $\quad r = (3,959mi)\left(\frac{5280ft}{mi}\right)\left(\frac{1m}{3.28ft}\right) = 6,373,024m$

3. The average density of planet Earth is 5.5 g/cm^3. Given that the average radius of the Earth is 3,959 mi, estimate the total mass of the planet in both kilograms and metric tons. **Show all of your math work and unit algebra.**

$(5.94\times10^{24}kg)\frac{1t}{1000kg} = 5.94\times10^{21}t$ $\quad D = 5.5\frac{g}{cm^3}\left(\frac{1kg}{1000g}\right)\left(\frac{100cm}{1m}\right)^3 = 5,500\frac{kg}{m^3}$

$Vol_{EARTH} \approx Vol_{sphere} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(6,373,024m)^3 = 1.08\times10^{21}m^3$

$D = \frac{MASS}{VOL} \Rightarrow MASS = D\cdot VOL = \left(5,500\frac{kg}{m^3}\right)(1.08\times10^{21}m^3) = 5.94\times10^{24}kg = 5.94\times10^{21}t$

4. Convert the following Longitudes and Latitudes to decimal degrees (show all of your math work)

Long 124° 23' 44"W = $-124.3955°$ W $\quad$ Lat. 42° 55' 32"S = $-42.9256°$ S.

Using available resources, describe your location geographically: SOUTHERN PACIFIC, AT SEA BETWEEN SAM & AUSTRALIA

LONG 124° 23min 44sec

$44sec\left(\frac{1min}{60sec}\right) = 0.73min$

$23min + 0.73min = 23.73min$

$23.73min\left(\frac{1°}{60min}\right) = 0.3955°$

1 degree = 60 min $\quad$ 1 min = 60 sec

LAT. 42° 55min 32sec

$32sec\left(\frac{1min}{60sec}\right) = 0.53min$

$55min + 0.53min = 55.53min\left(\frac{1°}{60min}\right) = 0.9256°$

5. Convert the following Longitudes and Latitudes to degrees-minutes-seconds (show all of your work)

Long. 102.3456° E = $+102°\ 20'\ 44"$ E $\quad$ Lat. 10.7934° N = $+10°\ 47'\ 36"$ N.

Using available web map resources, describe your location geographically: GULF OF THAILAND SE ASIA

LONG

$0.3456°\left(\frac{60min}{deg}\right) = 20.736min$

$0.736min\left(\frac{60sec}{min}\right) = 44.16sec$

LAT.

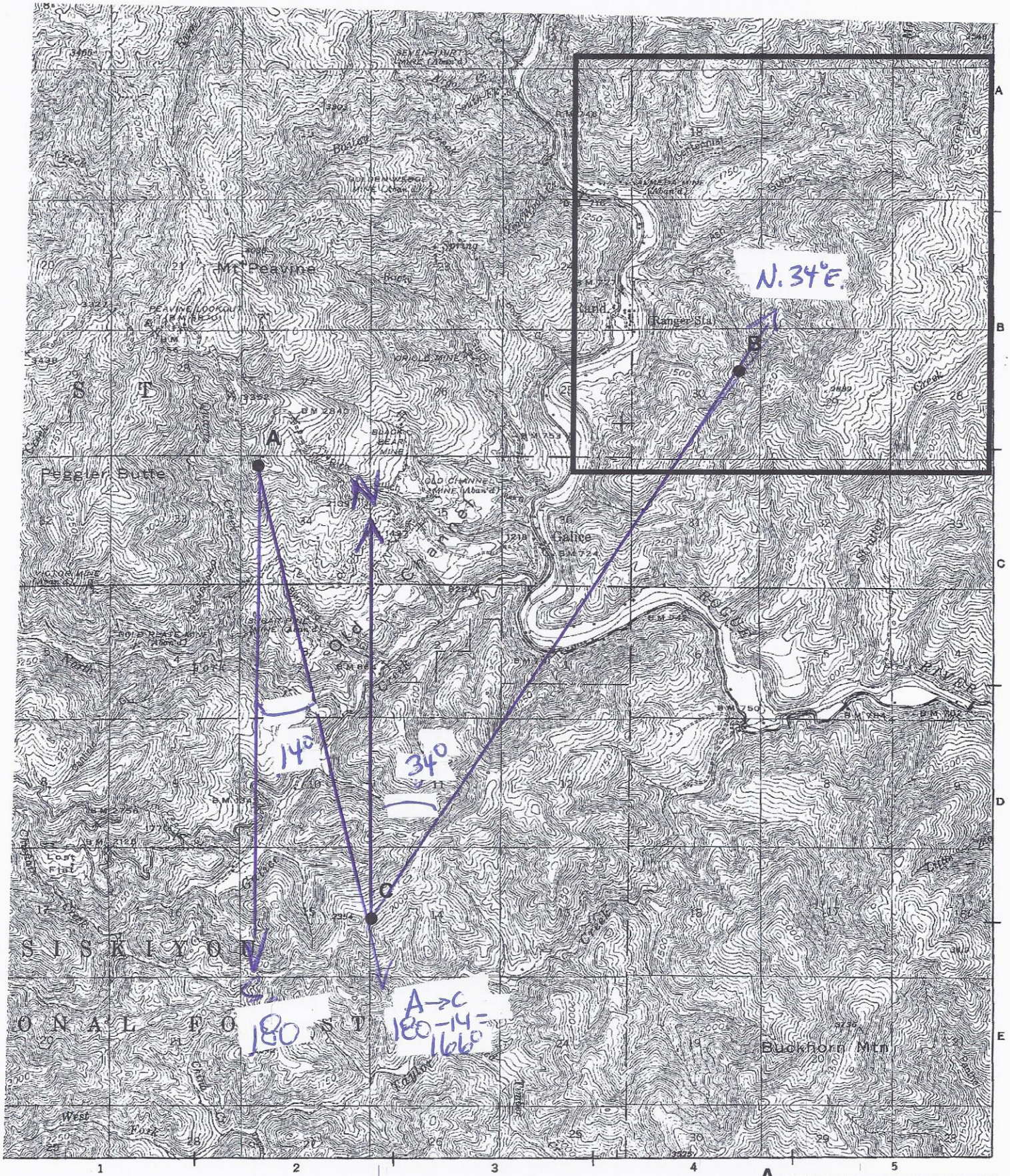
$0.7934°\left(\frac{60min}{deg}\right) = 47.604'$

$(0.604min)\left(\frac{60sec}{min}\right) = 36.24"$

QUESTION 2 RECHECK

$V = \frac{(2)(2.1\frac{kg}{m^3})(9.8\frac{m}{sec^2})(1.024\times10^{-5}m)^2}{9(1.95\times10^{-4}\frac{kg}{m\text{-}sec})} = \frac{4.21\times10^{-4}}{1.755\times10^{-3}}\frac{m}{sec} = 0.24\frac{m}{sec}$

$0.24\frac{m}{sec} = 0.24\frac{m}{sec}$



GALICE, OREGON An important feature of this map is the old high level channel of the Rogue River with placer deposits. Other features include the Rogue River canyon, a dissected upland, entrenched meanders, terraces, and a V-shaped valley.