

GEL4250 Groundwater (Hydrogeology)

Basic Math Skills Exam Requirements & Review Sheet

Please review in detail the following basic mathematical operations. You will be tested on these generalities during the first week of class using a 25point exam. If you receive less than 70% on the test you may FAIL the class, because you are expected to know the basics below. I will NOT have time to tutor or re-teach you! YOU WILL NEED A SCIENTIFIC CALCULATOR FOR THE COURSE. Be familiar with the operation of your calculator!!!

LOGARITHMS (From Fetter)

Common logarithms use base 10 and are designated by log. Natural logarithms use the base 2.718... and are designated by ln. The number 2.718... is also designated by the letter "e". The log of 25.7 is 1.409933. This means $25.7 = 10^{1.409933}$! Practice using your calculator and find the see if you can find it using the "log" key. Now find the antilog. Enter 10, press the "y^x" key, enter 1.409933 and then press "=". 25.7 is the inverse log of 1.409933. The ln of 25.7 is 3.246491. This means $25.7 = e^{3.246491} = 2.718^{3.246491}$! Play with your calculator and the "ln" button. Now try to find the inverse and you will end up with 25.7 again. BE FAMILIAR WITH YOUR INVERSE KEYS ON YOUR CALCULATOR.

Logarithmic relationships: $\log ab = \log a + \log b$ $\log a/b = \log a - \log b$ $\log a^n = n \log a$

The natural and common logarithm of 1.0000 = 0. Logarithm of any number > 1.0000 is positive. Logarithm of any number < 1.0000 is negative. The log of 10 is 1, the log of 100 is 2, the log of 1000 is 3, etc.

EQUATIONS FOR AREA

Area of a circle with radius r
Area of a triangle with a base b and altitude h
Area of a rectangle with sides a and b
Area of a parallelogram with sides a and b and an included angle z
Area of a trapezoid whose parallel sides are a and b and with an altitude h

$$A = \pi r^2 \quad (\pi = 3.1416)$$
$$A = 1/2 bh$$
$$A = ab$$
$$A = ab \sin z.$$
$$A = 1/2(a + b)h.$$

EQUATIONS FOR CIRCUMFERENCE

Circumference of a circle with a diameter d $C = \pi d.$
Circumference of a triangle of sides a, b and c $C = a + b + c.$
Circumference of a rectangle with sides a and b $C = 2 a + 2b.$

EQUATIONS FOR VOLUME

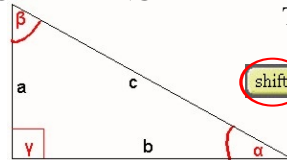
Volume of a regular prism $V = \text{area of base} \times \text{altitude}.$
Volume of a pyramid $V = 1/3 \text{ area of base} \times \text{altitude}.$
Volume of a cylinder with radius r and height h $V = \pi r^2 h$
Volume of a cone with radius r and height h $V = 1/3 \pi r^2 h$

EQUATION OF A STRAIGHT LINE IN RECTILINEAR COORDINATES

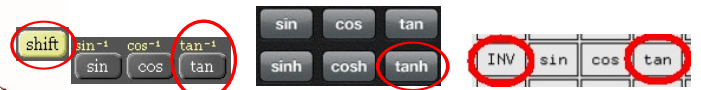
$y = m x + b$ where m is the slope of the line, b is the intercept of the y axis.

TRIGONOMETRIC FUNCTIONS OF A RIGHT TRIANGLE

Sine $\alpha = \sin \alpha = a/c$
Cosine $\alpha = \cos \alpha = b/c$
Tangent $\alpha = \tan \alpha = a/b$
Cotangent $\alpha = \cot \alpha = b/a$
Secant $\alpha = \sec \alpha = c/b$
Cosecant $\alpha = \csc \alpha = c/a$



Taking the Inverse of tan....



FOCUS ON THE TANGENT FUNCTIONS, especially figuring slope angles if height and length are given!!!

SOLVING FOR OTHER VARIABLES IN EQUATIONS!

Example: If $F = m \times a$, what is a? Answer: $a = F/m$

PERCENT CALCULATION

Example: You analyze 125g of rock and measure 1.8g potassium in the sample. What is the percentage of potassium?
Answer: $1.8g/125g \times 100 = 1.4\%$

SIGNIFICANT DIGITS

The significant digits are all the digits you measured + the one you estimated.

Counting Significant Digits - Four basic rules:

Zeros in the beginning of a number never count. Zeros at the end of a number count only if there is a written decimal point.
The digits 1 - 9 always count. Zeros between the digits 1 - 9 always count.

Calculating with significant digits: RULE: Answer can only be as precise as the least precise number used!

Addition / Subtraction: Example: $1.45 + 1.4318 = 2.88!$

Multiplication / Division: Example: $3.0 \times 1.26 = 3.9!$

THE METRIC SYSTEM

Know the metric system backwards and forwards, especially units for MASS, LENGTH, VOLUME.



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Basic Chemistry Skills Exam Requirements & Review Sheet

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Periodic Table
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1 1/A	1 H 1.008																	2 He 4.003	18/VIIIA				
2	3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18					
3	11 Na 22.99	12 Mg 24.30							← VIII →									13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.05	18 Ar 39.95
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80					
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 98.91	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3					
6	55 Cs 132.9	56 Ba 137.3	La-Lu	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po 210.0	85 At 210.0	86 Rn 222.0					
7	87 Fr 223.0	88 Ra 226.0	Ac-Lr	104 Db	105 Jl	106 Rf	107 Bh	108 Hn	109 Mt	110 Uun	111 Uuu												

← s → ← d → ← p →

Lanthanides	57 La 138.9	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm 146.9	62 Sm 150.4	63 Eu 152.0	64 Gd 157.2	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
Actinides	89 Ac 227.0	90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.0	94 Pu 239.1	95 Am 241.1	96 Cm 244.1	97 Bk 249.1	98 Cf 252.1	99 Es 252.1	100 Fm 257.1	101 Md 258.1	102 No 259.1	103 Lr 262.1

← f →

Be familiar with the use and application of the Periodic Table. More specifically with:

Element Names and Associated Symbols

Example: Au = Gold, Hg = Mercury, Fe = Iron

Atomic Mass Calculation of Compounds

Example: What is the atomic weight of Quartz? $\text{SiO}_2 = 28.09 + 2 \times 16.00 = 60.09 \text{g/mol}$

Simple Mol Calculations

Example: How many moles of Quartz are in 100.0g? $100.0 \text{g} \div 60.09 \text{g/mol} = 1.664 \text{mol}$

Common Valences of Elemental Ions

Example: O = -2, Ca = +2, Cl = -1, Fe = +2 or +3

Ionic Compounds & Associated Formulas

Example: Reaction of Calcium & Chlorine makes...? CaCl_2

Also be familiar with:

- difference between covalent, ionic, metallic and hydrogen bonding
- difference between cations and anions
- meaning of chemical formulas and subscripts
- understand pH and the difference between oxidizing and reducing environments
- working knowledge of solutions, solubility, mixtures, homogenous and heterogenous systems, and precipitation is a must.