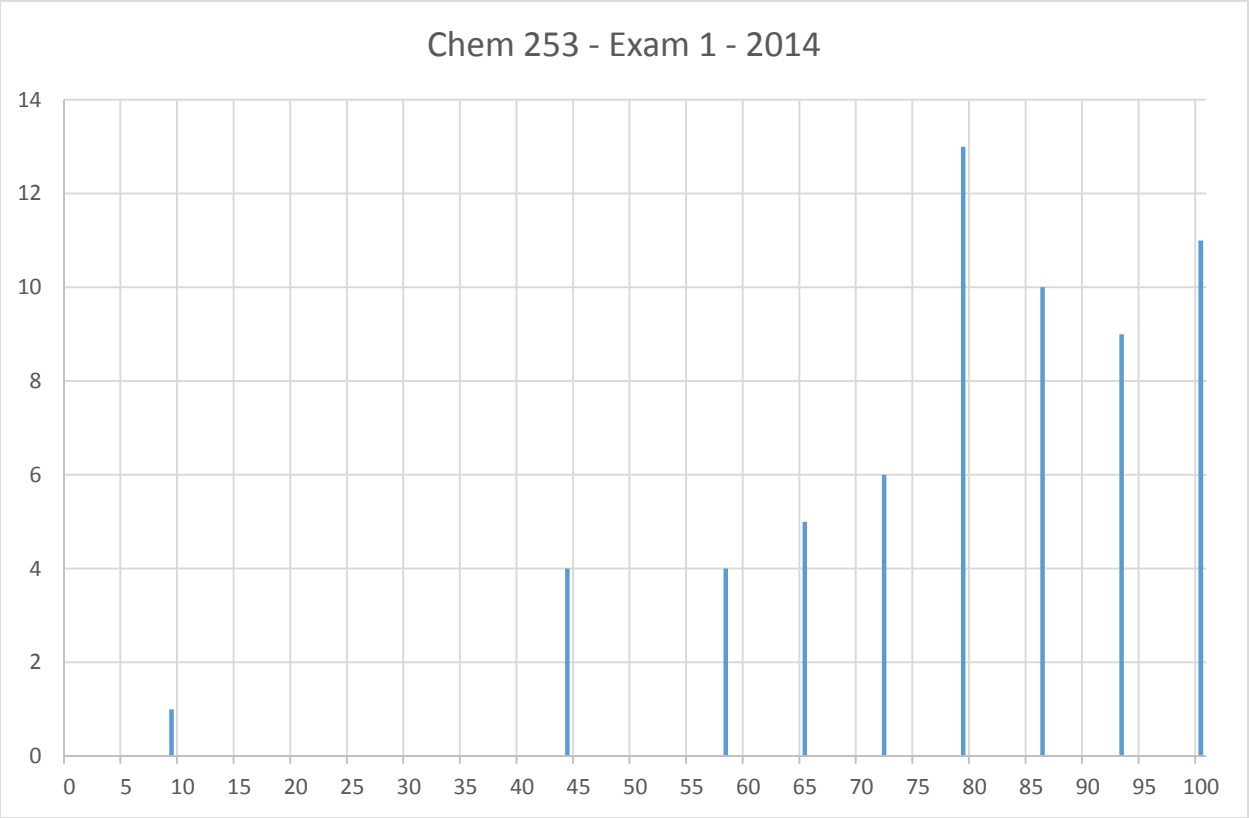
Chem 253 – Exam 1 –September 17, 2014




Average = 79, Median = 79, Std Dev = 17.9

1] If $K_a$ for HA is $5.0 \times 10^{-6}$, what is $K_b$ for $A^-$? [1]

2] What is the solubility of $PbCl_2$? ($K_{sp} = 1.7 \times 10^{-5}$) [2]

3] What is solubility of AgCl in 0.10 M NaCl? ($K_{sp} = 1.8 \times 10^{-10}$) [3]

4] What is the pH of 0.10 M phenylacetic acid? ($K_a = 4.90 \times 10^{-5}$) [4]

5] Calculate $K_{sp}$ of a salt MX that has a measure solubility of $1.0 \times 10^{-7}$ M. [5]

6] Calculate $[H^+]$ of a solution that at pH 7.889. [6]

7] You need to deliver 5.00 mL of pH buffer to a microbiological experiment. Which device would allow you to do this with most accuracy? [7]

a) 5-mL graduated cylinder
b) 10-mL class A buret
c) 5-mL class A buret
d) 5-mL class A pipet
e) 5-mL class A volumetric flask

8] Calculate pH of a solution that has $[H^+] = 7.889 \times 10^{-3}$ M. [8]

9] A concentrated nitric acid has a density of 1.42 g/mL is 70.0% by mass. What is its concentration in molarity? (MW = 63.01 g/mol) [9]

10] Given that the signal (y) follows as y = mx + b, where x is concentration how is the detection limit defined? Let s represent the standard deviation in the signal measure for b. [10]

11] What is the relative population of above the value of 75.0 for a Gaussian distribution whose mean is 45.0 with a standard deviation of 15.0? [11]

12] What are the 90% confidence limits for 5 samples whose mean was measure as 102 mg/dL with a standard deviation of 11 mg/dL? [12]

13] Which of the following data points may be discarded with 90% confidence? [13]

1.053, 1.060, 1.059, 1.070, 1.058 ppm

14] The molality of a solution of a salt solution MX is 1.50. What is it's concentration in mass/mass % if the MW of the salt is 100.0? [14]

Answers

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[1] $K_aK_b = K_w$ $K_b = K_w/K_a = 10^{-14}/5.0e\text{-}6 = 2.0e\text{-}9$ ans. c

[2]

| | | | | |
|---|---|---|---|---|
| $PbCl_2 = Pb^{2+}$ | $+ 2Cl^-$ | $K_{sp} = [x][2x]^2 = 4x^3 = 1.7e\text{-}5$ | $x = 1.6e\text{-}2$ M |
| x | +2x | | ans. e |

[3]

| | | | |
|---|---|---|---|
| $AgCl =$ | $Ag^+$ | + | $Cl^-$ |
| -- | 0 | | 0.10 M |
| | +x | | +x |
| | x | | 0.10 + x |

$(0.10 + x)x = 1.8 \times 10^{-10}$ $0.10x \approx 1.8 \times 10^{-10}$ $x = 1.8 \times 10^{-9}$ M ans. b

[4]

| | | | |
|---|---|---|---|
| HA = | H+ | + | A- |
| 0.10 | 0 | | 0 |
| -x | +x | | +x |
| 0.10-x | x | | x |

$x^2/(0.10\text{-}x) = 4.9 \times 10^{-5}$ pH = 5.37 ans. e

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[5] MX = $M^{n+}$ + $X^{n-}$

x x $x^2 = K_{sp} = 1.0e\text{-}7^2 = 1.0e\text{-}14$ ans. b

[6] pH = -log[$H^+$] [$H^+$] = 1.29e-8 M 3 s.f. ans. d

[7] 5-mL class A pipet ans. d also ans. c was given full credit

[8] pH = - log (7.889e-3) = 2.1030 M 4 s.f. ans. e

[9] 70.0 g $HNO_3$/100 g solution * 1.42 g soln/0.001 L * mol/63.01 g = 15.8 M ans. c

[10] LOD = 3s/m ans. a

[11] $z = \frac{x - \mu}{s}$ = 75 – 45 / 15 = 2 or just recognize that you are at 2s at 75.

from z-table area = 0.4773 area above 75 = 0.50000 – 0.4773 = 0.0227 or 2.27%
ans. d

[12] d.f. = 4, use t-table @ 90% c.l. t = 2.132

$$\mu = \bar{x} \pm \frac{t\sigma}{\sqrt{n}} = 102 \pm \frac{2.132(11)}{\sqrt{5}} = 102 \pm 10 \text{ mg/dL}$$ ans. d

[13] 1.053, 1.060, 1.059, 1.070, 1.058

Q = 1.070 – 1.060 / 1.070 – 1.053 = 0.588
Q table = 0.64
The data should be retained

ans. a

[14] Calculate the mass of 1.50 mol of MX. 1.50 mol * 100.0 g/mol = 150 g of MX
now calculate m/m %

150 g /(1000 g + 150 g) * 100 = 13.0% ans. c