

Instructor:
Course:
Date:

Frank Secretain
Math 150
June 12, 2026

Assessment:
Time allowed:
Devices allowed:
Notes from instructor:

Test 2
110 minutes
Pencil, pen, eraser, calculator
Be neat. Show your work where needed. Box final answers.

Marks allocated: 10 questions worth 25 marks
Percentage of final grade: 25% of final grade

group

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

period

1

2

3

4

5

6

7

1.00794

H

Hydrogen

6.941

Li

Lithium

23.802891

Na

Sodium

39.0983

K

Potassium

85.4678

Rb

Rubidium

132.90545

Cs

Cesium

223

Fr

Francium

4.002602

He

Helium

7.0001619

Be

Beryllium

9.012182

Mg

Magnesium

24.304094

Ca

Calcium

85.4678

Sr

Strontium

132.90545

Ba

Barium

223

Ra

Radium

10.811

B

Boron

12.0107

C

Carbon

26.981538

Al

Aluminum

26.981538

Si

Silicon

68.076

Ge

Germanium

121.757

Sn

Sn

208.9804

Pb

Lead

209

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138.90547	57	La Lanthanum	140.116	58	Ce Cerium	140.90768	59	Pr Praseodymium	144.242	60	Nd Neodymium	144.9127	61	Pm Promethium	150.36	62	Sm Samarium	151.964	63	Eu Europium	157.25	64	Gd Gadolinium	158.92535	65	Tb Terbium	162.50085	66	Dy Dysprosium	164.93033	67	Ho Holmium	167.259	68	Er Erbium	168.93432	69	Tm Thulium	173.054	70	Yb Ytterbium
227.02877	89	Ac Actinium	232.03806	90	Th Thorium	231.03688	91	Pa Protactinium	238.02891	92	U Uranium	237.04817	93	Np Neptunium	244.0642	94	Pu Plutonium	243.06138	95	Am Americium	247.07125	96	Cm Curium	251.07958	97	Bk Berkelium	252.0833	98	Cf Californium	257.1037	99	Fm Fermium	258.10528	100	Md Mendelevium	259.10828	101	No Nobelium	262.10536	102	Lr Lawrencium

electron configuration blocks

The diagram shows four colored blocks representing electron configuration blocks: a small yellow block labeled 's', a large blue block labeled 'd', a large red block labeled 'p', and a small yellow block labeled 'f'.

notes

- as of yet, elements 113-118 have no official name designated by the IUPAC.
- 1 kJ/mol $\approx$ 96.485 eV.
- all elements are implied to have an oxidation state of zero.

Formula Sheet

Order of Operations

$$ac + bc = c(a + b)$$

exponents

$$a^n a^m = a^{n+m}$$

$$(a^n)^m = a^{nm}$$

$$(ab)^n = a^n b^n$$

$$a^0 = 1$$

$$a^{-n} = \frac{1}{a^n}$$

radicals

$$a^{\frac{n}{m}} = \sqrt[m]{a^n}$$

Unit Conversions

angles

$$2\pi = 6.28 \text{ rad} = 360^\circ$$

mass

$$1 \text{ kg} = 2.2 \text{ lbs.}$$

lengths

$$1 \text{ mile} = 1.6 \text{ km}$$

$$1 \text{ inch} = 2.54 \text{ cm}$$

$$1 \text{ m} = 3.3 \text{ ft}$$

volumes

$$1 \text{ gallon} = 3.78 \text{ Litres}$$

Concentrations (assume density of solvent water = 1 g/mL)

$$C = M/V = M/M = V/V$$

percentage (%)

$$x\%(w/v) = \frac{x[g]}{100[mL]}$$

$$x\%(v/v) = \frac{x[mL]}{100[mL]}$$

$$x\%(w/w) = \frac{x[g]}{100[g]}$$

parts

$$pph = x\%(w/v)$$

$$ppt = \frac{x[g]}{1[L]}$$

$$ppm = \frac{x[mg]}{1[L]}$$

$$ppb = \frac{x[\mu g]}{1[L]}$$

molarity

$$M = \text{molarity} \frac{[moles]}{[L]}$$

$$FW = \text{formula weight} \frac{[g]}{[mole]}$$

Dilutions

$$C_1 V_1 = C_2 V_2$$

$$\text{dilution} = \frac{\text{solute volume}}{\text{total/final volume}}$$

$$\text{dilution factor (DF)} = \frac{1}{\text{dilution}}$$

Prepare 320 mL of a 2.2% (w/v) KCl solution.

Prepare a 3:1 alcohol:water solution using 130 mL of alcohol.

Prepare 250 mL of a 350 ppm nitrate solution.

Prepare a 1.9 M sucrose solution using 320 g/mol as the formula weight, and a total volume of 100 mL.

Prepare a 0.2% (w/w) hydrogen peroxide solution using 1.7 g of H_2O_2 . What is the total mass of the solution?

Determine the formula weight of NaHCO_3 (baking soda).

Prepare a 1:4 oil:vinegar solution using 50 mL of oil.

Prepare 1.2 L of a 1.6% (w/v) calcium chloride solution.

Prepare a 1.2 M H_2SO_4 solution using 98.1 g/mol as the formula weight, and a total volume of 1.0 L.

Prepare a 3.5 pph potassium chloride solution using 0.2 kg of solute.

Prepare 320 mL of a 2.2% (w/v) KCl solution.

$$C = 2.2\% \left(\frac{w}{v} \right) = \frac{2.2 \text{ g}}{100 \text{ mL}}$$

$$C = \frac{m}{V}$$

$$320 \text{ mL} \left(\frac{2.2 \text{ g}}{100 \text{ mL}} \right) = \left(\frac{m}{\cancel{320 \text{ mL}}} \right) \cancel{320 \text{ mL}}$$

$$m = \frac{(\cancel{320 \text{ mL}})(2.2 \text{ g})}{\cancel{100 \text{ mL}}} = 7.04 \text{ g}$$

$$m = 7.0 \text{ g}$$

Prepare a 3:1 alcohol:water solution using 130 mL of alcohol.

$$\text{total parts} = 3 + 1 = 4$$

alcohol:

$$C = \frac{V}{V_{\text{total}}}$$

$$\frac{3 \text{ parts}}{4 \text{ parts}} = \frac{130 \text{ mL}}{V_{\text{total}}}$$

$$V_{\text{total}} = \frac{(130 \text{ mL})(4 \text{ parts})}{3 \text{ parts}} = 173.3 \text{ mL}$$

water:

$$C = \frac{V}{V_{\text{total}}}$$

$$\frac{1 \text{ parts}}{4 \text{ parts}} = \frac{V}{173.3 \text{ mL}}$$

$$V_{\text{water}} = \frac{(1 \text{ part})(173.3 \text{ mL})}{4 \text{ parts}} = 43.3 \text{ mL}$$

Prepare 250 mL of a 350 ppm nitrate solution.

$$C = 350 \text{ ppm} = \frac{350 \text{ mg}}{1 \text{ L}}$$

$$C = \frac{m}{V}$$

$$\frac{350 \text{ mg}}{1 \text{ L}} = \frac{m}{250 \text{ mL}}$$

$$m = \frac{(350 \text{ mg})(250 \cancel{\text{mL}})}{1 \cancel{\text{L}}} \left(\frac{1 \cancel{\text{L}}}{1000 \cancel{\text{mL}}} \right) = 87.5 \text{ mg}$$

$$m = 87.5 \text{ mg}$$

Prepare a 1.9 M sucrose solution using 320 g/mol as the formula weight, and a total volume of 100 mL.

$$C = 1.9 \text{ M} = 1.9 \frac{\cancel{\text{mol}}}{\text{L}} \left(\frac{320 \text{ g}}{\cancel{\text{mol}}} \right) = 608 \frac{\text{g}}{\text{L}}$$

$$C = \frac{m}{V}$$

$$\frac{608 \text{ g}}{1 \text{ L}} = \frac{m}{100 \text{ mL}}$$

$$m = \frac{(608 \text{ g})(100 \cancel{\text{mL}})}{1 \cancel{\text{L}}} \left(\frac{1 \cancel{\text{L}}}{1000 \cancel{\text{mL}}} \right) = 60.8 \text{ g}$$

$$\boxed{m = 60.8 \text{ g}}$$

Prepare a 0.2% (w/w) hydrogen peroxide solution using 1.7 g of H_2O_2 . What is the total mass of the solution?

$$C = 0.2\% \left(\frac{w}{w} \right) = \frac{0.2 \text{ g}}{100 \text{ g}}$$

$$C = \frac{m}{m}$$

$$\frac{0.2 \text{ g}}{100 \text{ g}} = \frac{1.7 \text{ g}}{m_{\text{total}}}$$

$$m_{\text{total}} = \frac{(1.7 \cancel{\text{g}})(100 \text{ g})}{0.2 \cancel{\text{g}}} = 850 \text{ g}$$

$$m_{\text{total}} = 850 \text{ g}$$

Determine the formula weight of NaHCO_3 (baking soda).

Formula weight:

$$\text{Na} : 22.98976 = 22.98976$$

$$\text{H} : 1.00794 = 1.00794$$

$$\text{C} : 12.0107 = 12.0107$$

$$\text{O}_3 : 3(15.9994) = 47.9982$$

$$84.0066$$

$$\boxed{\text{FW}_{\text{NaHCO}_3} = 84.0 \text{ g/mol}}$$

Prepare a 1:4 oil:vinegar solution using 50 mL of oil.

$$\text{total parts} = 1 + 4 = 5 \text{ parts}$$

concentration (oil):

$$C = \frac{V}{V_{\text{total}}}$$

$$\frac{1 \text{ part}}{5 \text{ parts}} = \frac{50 \text{ mL}}{V_{\text{total}}}$$

$$V_{\text{total}} = \frac{(50 \text{ mL})(5 \text{ parts})}{1 \text{ part}} = 250 \text{ mL}$$

concentration (vinegar):

$$C = \frac{V}{V_{\text{total}}}$$

$$\frac{4 \text{ parts}}{5 \text{ parts}} = \frac{V}{250 \text{ mL}}$$

$$V = \frac{(4 \text{ parts})(250 \text{ mL})}{5 \text{ parts}} = 200 \text{ mL}$$

Prepare 1.2 L of a 1.6% (w/v) calcium chloride solution.

$$C = 1.6\% \left(\frac{w}{v} \right) = \frac{1.6 \text{ g}}{100 \text{ mL}}$$

$$C = \frac{m}{V}$$

$$\frac{1.6 \text{ g}}{100 \text{ mL}} = \frac{m}{1.2 \text{ L}}$$

$$m = \frac{(1.6 \text{ g})(1.2 \cancel{\text{L}})}{100 \cancel{\text{mL}}} \left(\frac{1000 \cancel{\text{mL}}}{1 \cancel{\text{L}}} \right) = 19.2 \text{ g}$$

$$\boxed{m = 19.2 \text{ g}}$$

Prepare a 1.2 M H_2SO_4 solution using 98.1 g/mol as the formula weight, and a total volume of 1.0 L.

$$C = 1.2 \text{ M} = \frac{1.2 \cancel{\text{ mol}}}{1 \text{ L}} \left(\frac{98.1 \text{ g}}{\cancel{\text{ mol}}} \right) = 117.72 \frac{\text{g}}{\text{L}}$$

$$C = \frac{m}{V}$$

$$\frac{117.72 \text{ g}}{1 \text{ L}} = \frac{m}{1 \text{ L}}$$

$$m = \frac{(117.72 \text{ g})(1 \cancel{\text{ L}})}{1 \cancel{\text{ L}}} = 117.72 \text{ g}$$

$$\boxed{m = 118 \text{ g}}$$

Prepare a 3.5 pph potassium chloride solution using 0.2 kg of solute.

$$C = 3.5 \text{ pph} = 3.5\% (\text{w/v}) = \frac{3.5 \text{ g}}{100 \text{ mL}}$$

$$C = \frac{m}{V}$$

$$\frac{3.5 \text{ g}}{100 \text{ mL}} = \frac{0.2 \text{ kg}}{V}$$

$$V = \frac{(0.2 \text{ kg})(100 \text{ mL})}{3.5 \text{ g}} \left(\frac{1000 \text{ g}}{1 \text{ kg}} \right) = 5714.29 \text{ mL} \left(\frac{1 \text{ L}}{1000 \text{ mL}} \right) \\ = 5.714 \text{ L}$$

$$V = 5.71 \text{ L}$$