Bench Starter Kit

Six cheat sheets for the calculations every lab runs. By Suryaprakash Tripathy, NexagenLabs.

01 Molarity and mass

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mass (g) = molarity (mol/L) × volume (L) × MW (g/mol)
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COMPOUND	MW (G/MOL)	1 M, 100 ML
NaCl	58.44	5.844 g
KCl	74.55	7.455 g
Tris base	121.14	12.11 g
$MgCl_2$ anhydrous / $\cdot 6H_2O$	95.21 / 203.30	9.52 g / 20.33 g
$Na_2EDTA \cdot 2H_2O$	372.24	37.22 g (0.5 M: 18.61 g)

Always use the MW printed on your bottle, hydrate included. Dissolve in less than the final volume, adjust pH, then make up to volume. Purity under ~98%: divide mass by the purity fraction.

02 C1V1 dilutions

$$C_1 \times V_1 = C_2 \times V_2 \rightarrow V_1 = C_2V_2 / C_1$$

UNIT	EQUALS
1 M	1000 mM = 10^6 µM
1 mM	1000 µM = 10^6 nM
1 mg/mL	1 µg/µL = 1 g/L

10X to 1X, 1 L: 100 mL stock + 900 mL water.
V_1 under ~1 µL? Make a 1:10 or 1:100 intermediate first.
Mixing two sources? $C_1V_1 + C_2V_2 = C_3V_3$.

03 Serial dilutions and CFU

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factor = (sample + diluent) / sample
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100 µL into 900 µL = 1:10. Six steps = 10^6. For 2-fold plates: 100 µL diluent per well, carry 100 µL across, discard the last 100 µL.

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CFU/mL = colonies ÷ (mL plated × dilution)
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54 colonies, 0.1 mL of 10^{-6} → 5.4 × 10^8 CFU/mL. Count plates with 30-300 colonies. Change tips every step; 2% error per step ≈ 13% after six.

04 Buffers

BUFFER	PKA 25 °C	RANGE
Acetate	4.76	3.8-5.8
MES	6.1	5.5-6.7
Phosphate	7.2	6.2-8.2
HEPES	7.5	6.8-8.2
Tris	8.1	7.0-9.0
Glycine	9.6	8.8-10.6

1X PBS, 1 L	WEIGH
NaCl	8.0 g
KCl	0.2 g
Na_2HPO_4 (anhyd. / $7H_2O$ / $12H_2O$)	1.44 / 2.72 / 3.63 g
KH_2PO_4	0.24 g

pH 7.4. Dissolve in ~800 mL, check pH, make up to 1 L.

Tris shifts about -0.028 pH units per °C. pH 8.0 at 25 °C reads ~8.6 at 4 °C and ~7.7 at 37 °C. Set pH at the temperature of use. Calibrate the meter daily with two bracketing standards.

05 Percent solutions

TYPE	MEANS
% w/v	g per 100 mL solution
% v/v	mL per 100 mL solution
% w/w	g per 100 g solution

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M = (% w/v × 10) / MW
M = (% w/w × density × 10) / MW
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0.9% NaCl = 0.154 M. 37% HCl (1.19 g/mL) ≈ 12.1 M. 70% ethanol from 95%: 73.7 mL made up to 100 mL. Weigh glycerol (≈1.26 g/mL). Acid into water, never water into acid.

06 Nucleic acids

1 A260 UNIT	≈
dsDNA	50 ng/µL
ssDNA	33 ng/µL
RNA	40 ng/µL

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nM = ng/µL × 10⁶ / (bp × 650)
copies/µL = ng/µL × 6.022×10²³ / (bp × 650 × 10⁹)
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A260/280 ≈ 1.8 DNA, 2.0 RNA. A260/230 2.0-2.2. 500 bp at 50 ng/µL ≈ 154 nM. Ligation 1:3 vector:insert by moles.