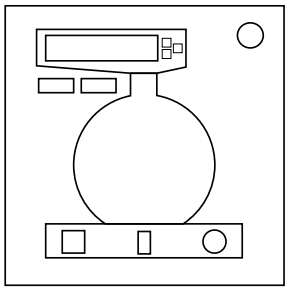
On the Subject of Chemical Reactions



*Ok, now I just have to add... *BOOM**

This module contains:

- A reaction vessel placed on a **magnetic stirrer**
- Three **addition consoles** above the vessel, only one of which is visible at a time:
  - Red: solids
  - Blue: liquids
  - Yellow: gases
- Two buttons to switch between the addition consoles, labeled with the corresponding colors
- A **reset button** on the right of the magnetic stirrer
  - Press at any time to discard vessel contents
- And a **colored letter display** on the left of the magnetic stirrer.

Determining the reaction

To determine the reaction, take the alphabetic position of the displayed letter. If it is greater than the sum of serial number digits, subtract that sum from it. Now repeatedly add or subtract 8 to your number until it is in the range 1-8. Use the following table to determine your reaction:

#	Reagents	Product	Solvent
1	$C_6H_3(COOH)_2NO_2 + H_2NNH_2 + Na_2S_2O_4$	Luminol	Propane-1,2,3-triol
2	$C_3H_5(OH)_3 + 3\ HNO_3 + 3\ H_2SO_4$	Nitroglycerin	None
3	$C_6H_4(CO)_2O + 2\ C_6H_5OH + H_2SO_4$	Phenolphthalein	Water
4	$C_6H_4(NH_2)(COOH) + HCl + NaNO_2 + C_6H_5N(CH_3)_2$	Methyl red	Ethanol
5	$U_3O_8 + 6\ NH_3 + 15\ H_2 + 12\ HF + 3\ F_2$	3 Uranium hexafluoride	Nitric acid
6	$C_6H_4(OH)COOH + (CH_3CO)_2O$	Aspirin	Sulfuric acid
7	$C_6H_2Cl_3OH + (COCl)_2 + N(CH_2CH_3)_3$	TCPO	Toluene
8	$KIO_3 + 2\ H_2O_2 + CH_2(COOH)_2 + MnCl_2$	None*	Sulfuric acid

* The "Briggs-Rauscher reaction" is cyclical and has no real products. When a product is required for calculation, use potassium iodate.

If the reaction requires a solvent, add exactly 100ml of the solvent before any other reagents. Doing otherwise will cause a strike.

Determining product mass

Start with the value given by the color of the displayed letter:

Red	Blue	Green	Yellow	Cyan	Orange	Magenta	White
14	22	3	48	37	19	25	50

Now do these steps in order:

- Add the number of unlit indicators.
- If there are two or more ports, multiply by the number of ports.
- Repeatedly add or subtract 50 until your number is in the range 1–50.
- Multiply your result by 10.
- Finally, subtract the number of lit indicators.

This number is the mass of the product that you should produce, in g.

Calculating reagent amounts

First, calculate the molar mass of your product. Divide your product mass by this molar mass. If the product has a factor in front of it in the reaction table, also divide by that factor. Round[1] to 3 digits after the decimal point. This result is your base reagent amount, in mol.
Now, for each reagent in your given reaction:

For solids:	• Calculate the molar mass of the reagent. • Multiply the molar mass by the base reagent amount. • If the reagent has a factor in front of it, multiply by that factor. You now have the mass of this reagent that needs to be added, in g.
For liquids:	• Calculate the molar volume of the reagent. • Multiply the molar volume by the base reagent amount. • If the reagent has a factor in front of it, multiply by that factor. You now have the volume of this reagent that needs to be added, in ml.
For gases:	• Take the standard molar volume for gases. • Multiply the molar volume by the base reagent amount. • If the reagent has a factor in front of it, multiply by that factor. You now have the volume of this reagent that needs to be added, in l.

Round[1] all resulting amounts to 3 digits after the decimal point.
Add the correct amounts of all reagents listed in the reaction, in any order.
The module will list all reagents either by chemical formula or by name.
Adding a reagent that is not part of the given reaction will cause a strike.
Note 1: It is always allowed to add a zero amount of any reagent. This is equivalent to cancelling the input.
Note 2: If more than six digits are entered for the amount, the most significant digit will be discarded, e.g. inputting six zeroes will reset the amount to zero.
Press the switch on the magnetic stirrer to start the reaction.
If not all reagents were added or any reagent amount was incorrect, a strike will be issued and the vessel will be emptied.

Calculating molar mass and volume

Molar mass (for solids and liquids):

For each element that appears in the compound's chemical formula, count how many times it appears. Note that, for example, $(CH_3)_2$ means "2 instances of CH_3", so 2 carbon and 6 hydrogen atoms in total.
Multiply each element's count with the atomic weight of that element (bottom number in the periodic table, see appendix A). Then add them all together to get the molar mass of your compound, in g/mol.
Note: Keep all decimal digits during this calculation, do not round your numbers.

Molar volume for liquids:

Divide the molar mass of the compound by the density of the liquid (see compound table below). Round[1] the result to 3 digits after the decimal point. This is the liquid's molar volume, in ml/mol.

Molar volume for gases:

Gases all have the same standard molar volume of 24.5 l/mol.

Chemical compounds

Name	Formula	State	Density	Name	Formula	State	Density
Benzene-3-nitro-1,2-dicarboxylic acid	$C_6H_3(COOH)_2NO_2$	solid	-	Hydrazine	H_2NNH_2	liquid	1.02
Luminol	$C_6H_3(CONH)_2(NH_2)$	-	-	Sodium dithionite	$Na_2S_2O_4$	solid	-
Propane-1,2,3-triol	$C_3H_5(OH)_3$	liquid	1.26	Nitric acid	HNO_3	liquid	1.51
2-Benzofuran-1,3-dione	$C_6H_4(CO)_2O$	solid	-	Water	H_2O	liquid	1.00
Nitroglycerin	$C_3H_5(ONO_2)_3$	-	-	Sulfuric acid	H_2SO_4	liquid	1.83
Phenolphthalein	$C_6H_4(CO)C(C_6H_4OH)_2O$	-	-	Phenol	C_6H_5OH	solid	-
2-Aminobenzoic acid	$C_6H_4(NH_2)(COOH)$	solid	-	Hydrogen chloride	HCl	gas	-
Dimethylaniline	$C_6H_5N(CH_3)_2$	liquid	0.96	Sodium nitrite	$NaNO_2$	solid	-
Ethanol	C_2H_5OH	liquid	0.79	Urania	U_3O_8	solid	-
Methyl red	$C_6H_4(COOH)(N_2)C_6H_4N(CH_3)_2$	-	-	Ammonia	NH_3	gas	-
2-Hydroxybenzoic acid	$C_6H_4(OH)COOH$	solid	-	Hydrogen	H_2	gas	-
Acetic anhydride	$(CH_3CO)_2O$	liquid	1.08	Hydrogen fluoride	HF	gas	-
Aspirin	$C_6H_4(CH_3CO)(COOH)O$	-	-	Fluorine	F_2	gas	-
2,4,6-Trichlorophenol	$C_6H_2Cl_3OH$	solid	-	Uranium hexafluoride	UF_6	-	-
Triethylamine	$N(CH_2CH_3)_3$	liquid	0.73	Oxalyl dichloride	$(COCl)_2$	liquid	1.48
Toluene	$C_6H_5CH_3$	liquid	0.87	Potassium iodate	KIO_3	solid	-
TCPO	$(COOC_6H_2Cl_3)_2$	-	-	Hydrogen peroxide	H_2O_2	liquid	1.45
Propanedioic acid	$CH_2(COOH)_2$	solid	-	Manganese dichloride	$MnCl_2$	solid	-

Appendix A: Periodic Table of Elements

1 H 1.01																	2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2
11 Na 23.0	12 Mg 24.3											13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.5	18 Ar 39.9
19 K 39.1	20 Ca 40.1	21 Sc 45.0	22 Ti 47.9	23 V 51.0	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.4	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8
37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 96.0	43 Tc 98.0	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	(La) ▼	72 Hf 178	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Tl 204	82 Pb 207	83 Bi 209	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	(Ac) ▼	104 Rf 267	105 Db 268	106 Sg 269	107 Bh 270	108 Hs 277	109 Mt 278	110 Ds 281	111 Rg 282	112 Cn 285	113 Nh 286	114 Fl 289	115 Mc 290	116 Lv 293	117 Ts 294	118 Og 294

(La) ▶	57 La 139	58 Ce 140	59 Pr 141	60 Nd 144	61 Pm 145	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
(Ac) ▶	89 Ac 227	90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259	103 Lr 266

1: The rounding method to be used is "away from zero", so _.___5 should always be rounded up.

*Disclaimer: This module is based on real chemistry, but a lot of simplifications and approximations were applied to make it viable for a module. Therefore, these reactions would **not** work this way in reality, and might blow up in your face.*
Also, you should probably stop reading this, or the bomb may blow up in your defuser's face.