In-Class Exercise: English Unit System Derived.

STUDENT NAME:

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Given is the modern (not yet completed) metric system where the Ampere (which was not realizable anyway) is replaced by the standard for Volt (via the Josephson junction) and the Ohm (via the Hall effect, Von Klitzing constant). Also the kg is here a derived unit through the Watt Balance which equalizes the Mechanical and Electrical power.

Your assignment is to do the the same thing, **but you can only use English units**. Draw it all in there with pencil, rip out the page and hand it in (don't forget your name).

Speed of light

$c_0 = 299\ 792\ 458\ \left[ms^{-1}\right]$

meter

LENGTH

kg
Mass

kg=Ns²/m

Resonance Cesium atom

$\Delta\nu\left(^{133}C_s\right) = 9\ 191\ 631\ 770\ \left[s^{-1}\right]$

second

TIME

| Coulomb Electric Charge | C=A*s | Farad Capacitance | F=(C/V) | Newton Force |

N=J/m

$K_J = \dfrac{2e}{h}$

Josephson junction

$K_J = \dfrac{2e}{h} = 4.835979 * 10^{14}\ \left[\dfrac{Hz}{V}\right]$

Volt

VOLT

| Ampere Electric Current | A=V/Ω) | Joule Energy (Work) | J=W*s=Nm |

$R_K = \dfrac{h}{e^2}$

Quantum Hall Effect

$R_K = \dfrac{h}{e^2} = 25,812.807\Omega$

Ohm

RESISTANCE

Watt Power

W=V*A=J/s

Boltzmann constant

$k = 1.3\ 806\ 505\ \left[JK^{-1}\right]$

Kelvin

THERMODYNAMIC TEMPERATURE

Millikan charge of single electron experiment

$e = 1.60217653 * 10^{-19}\ \left[Coulomb\right]$

$$\dfrac{K_J * R_K}{2} = \dfrac{e}{h} * \dfrac{h}{e^2} = \dfrac{1}{e} = C$$

Spectral luminance

$K\left(\lambda_{555}\right) = 683\ \left[lumens W^{-1}\right]$

Candela

LUMINOUS INTENSITY

Avogadro constant

$N_A = 6.0221415 * 10^{23}\ \left[mol^{-1}\right]$

mol

AMOUNT OF SUBSTANCE
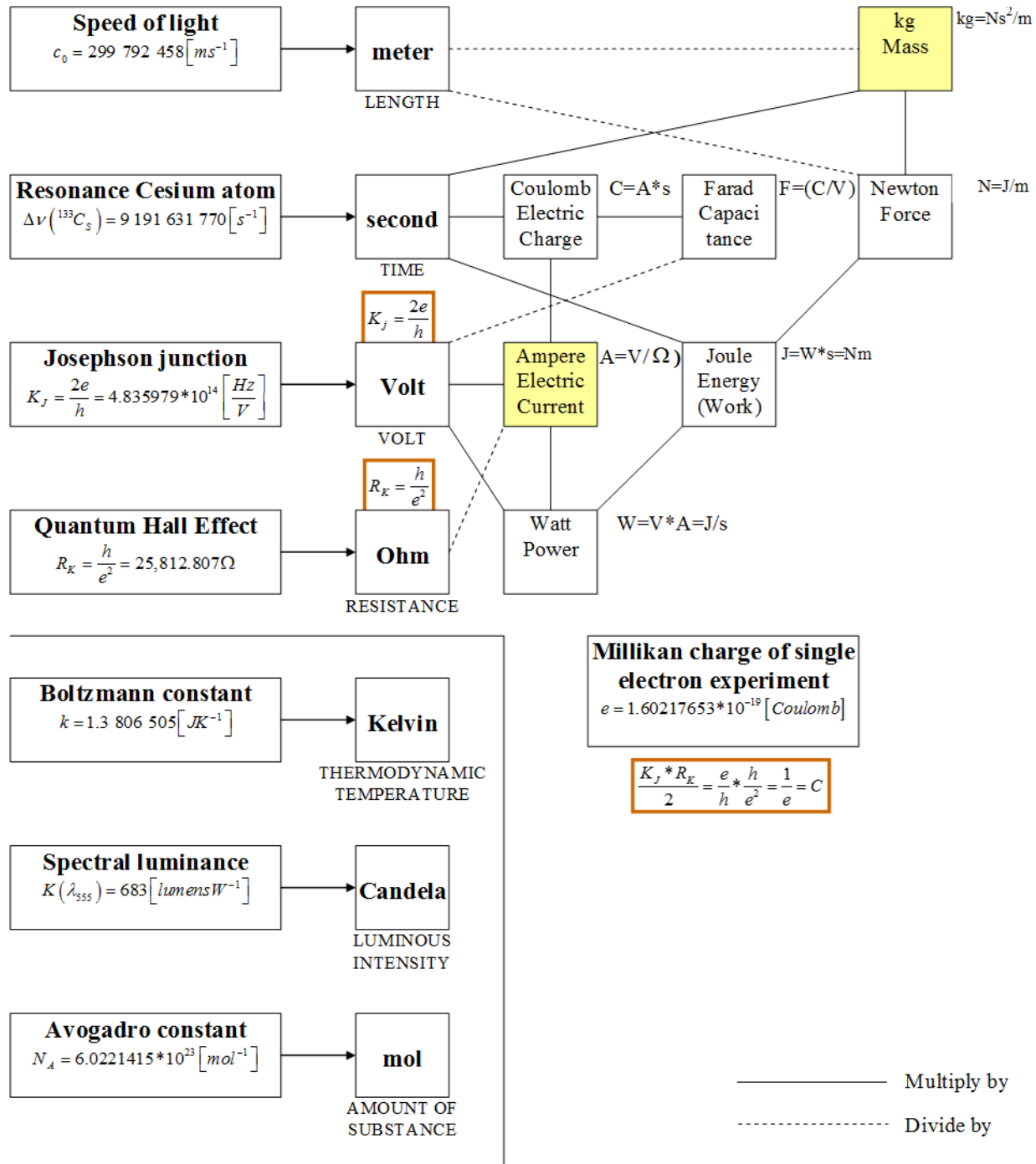
——————— Multiply by

----------------- Divide by

Figure 1: Modern SI unit relationships where the kg is a derived unit and the Ampere is replaced by the ratio between Volt and Ohm. Note that solid lines indicate multiplication and dashed lines division.
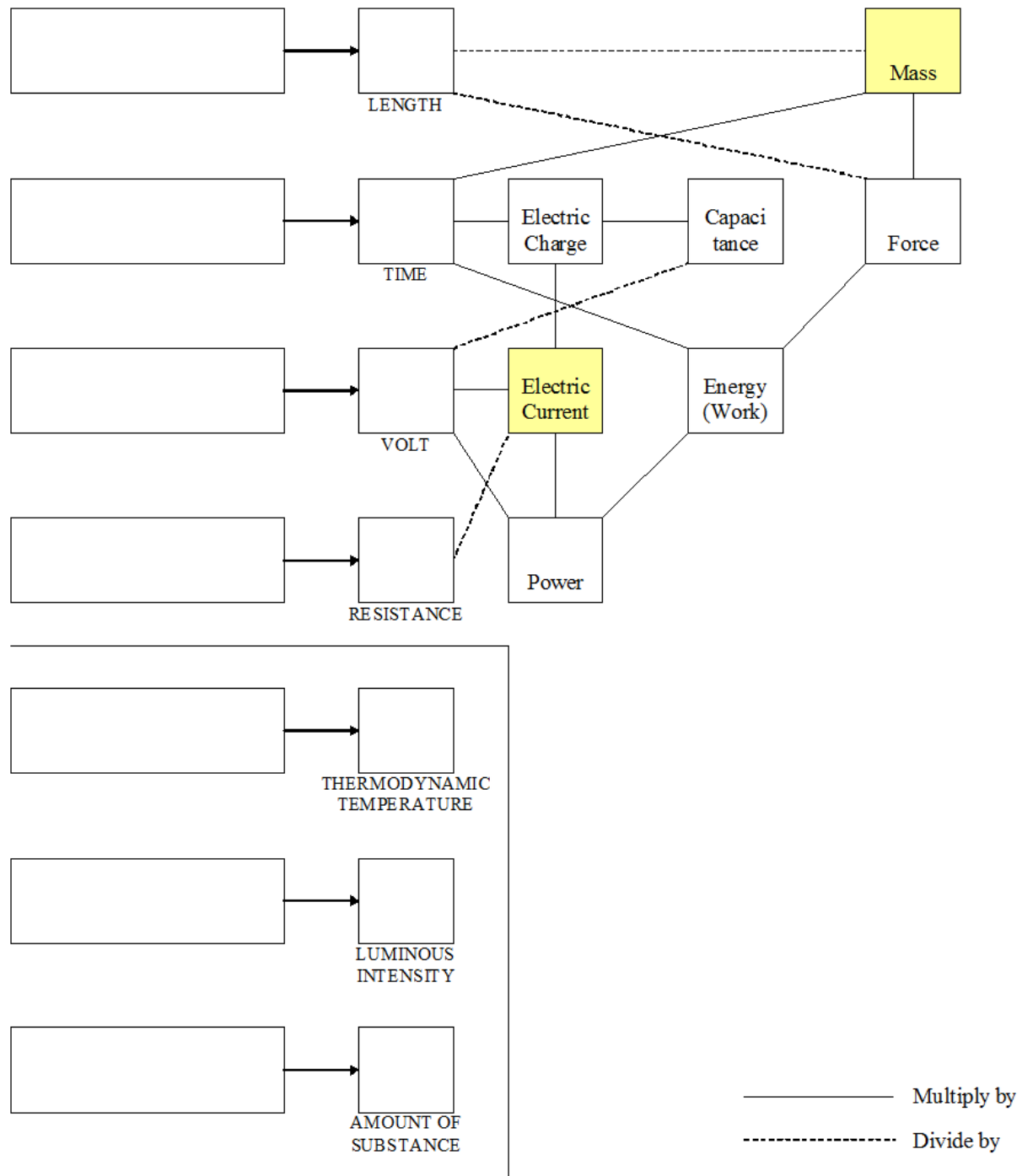
Figure 2: Here is the basic idea of the modern metric system unit definition, you need to do the same for the English Unit system.