alpha
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1) $F_G = F_C$

$\frac{GMm}{r^2} = \frac{mv^2}{r}$

$v^2 = \frac{GM}{r}$

2) $F_G = \frac{GMm}{r^2}$ and $g = \frac{F}{m}$

so $g = \frac{GMm}{r^2} \div m$

$g = \frac{GM}{r^2}$

3) In a box with distance l between opposite faces, for a molecule: $\Delta p = -mc - mc = -2mc$

Time between 2 collisions $= \frac{2l}{c}$

$F = \frac{\Delta p}{t} = -2mc \div \frac{2l}{c} = \frac{mc^2}{l}$

Pressure $= \frac{F}{A} = \frac{mc^2}{l} \div l^2 = \frac{mc^2}{l^3}$

$\langle c^2 \rangle = c_x^2 + c_y^2 + c_z^2$ and $c_x^2 = c_y = c_z$

so $\langle c_x^2 \rangle = \frac{1}{3}\langle c^2 \rangle$

so for all molecules, $p = \frac{1Nm\langle c^2 \rangle}{3V}$, $pV = \frac{1}{3}Nm\langle c^2 \rangle$

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4) $pV = NkT$

$pV = \frac{1}{3} Nm\langle c^2 \rangle$

$\frac{1}{3} Nm\langle c^2 \rangle = NkT$

$m\langle c^2 \rangle = 3kT$

$E_K = \frac{1}{2} m\langle c^2 \rangle = \frac{3}{2} kT$

5) For two capacitors in series

$Q_T = Q_1 = Q_2$

$V = V_1 + V_2$

$V = \frac{Q}{C_T}$

$\frac{Q}{C_T} = \frac{Q}{C_1} + \frac{Q}{C_2}$

taking Q common

$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2}$

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6) For two capacitors in parallel

$Q = Q_1 + Q_2$

$V = V_1 = V_2$

$Q = C_T V$

$C_T V = C_1 V + C_2 V$

$C_T = C_1 + C_2$

7) For Hall voltage

$E = \frac{V_H}{d}$ where d = width of conductor

At V_H, $F_E = F_B$

$qE = Bqv$

$\frac{V_H}{d} = Bv$

$v = \frac{I}{nAq}$ so $\frac{V_H}{d} = \frac{BI}{nAq}$

$A = dt$ so $\frac{V_H}{d} = \frac{BI}{ndtq}$

$V_H = \frac{BI}{ntq}$