Physics 212	**Final Exam**		9 December 98
2:00–3:50 PM	Closed Book		No Notes
$p = p_0 + \rho gh$	$1\,\text{atm} = 1.01 \times 10^5 \text{Pa}$	$A_1 v_1 = A_2 v_2$	$p + \frac{1}{2}\rho v^2 + \rho g y = \text{C}$
$x = A\cos(\omega t + \phi)$	$a(x) = -\omega^2 x$	$k = \frac{2\pi}{\lambda}$	$\omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{g}{L}} = \sqrt{\frac{mgh}{I}}$
$y(x,t) = A\sin(kx \mp \omega t)$	$c = \frac{\omega}{k} = \lambda f$	$c = \sqrt{\frac{\tau}{\mu}} = \sqrt{\frac{B}{\rho}}$	$PE = \frac{1}{2}kx^2$
$I = \frac{P}{A}$	$\beta = (10\text{dB})\log\frac{I}{I_0}$	$F_{\text{beat}} = F_1 - F_2$	$f' = f\frac{v \pm v_d}{v \mp v_s}$
$\Delta L = L\alpha\Delta T$	$\Delta V = V\beta\Delta T$	$1\text{ cal} = 4.186\text{ J}$	$Q = C\Delta T = cm\Delta t$
$Q = Lm$	$W = \int dW = \int pdV$	$Q = \Delta U + W$	$T_K = T_C + 273^o$
—	—	$\sin A \pm \sin B =$	$2\sin\frac{1}{2}(A \pm B)\cos\frac{1}{2}(A \mp B)$
$N_A = 6.02 \times 10^{23} mol^{-1}$	$pV = nRT = NkT$	$R = 8.31 J/mol \cdot K$	$T = T_C + 273^o$
$1cal = 4.186J$	$Q = cm\Delta T = Cn\Delta T$	$W = \int_i^f pdV$	$Q = W + \Delta U$
$\overline{KE_{trans}} = \frac{3}{2}kT$	$\frac{1}{2}kT/^o freedom$	$F_c = \frac{q_1 q_2}{(4\pi\epsilon_0)r^2}$	$V = \frac{q}{(4\pi\epsilon_0)r}$
$E = F_c/q$	$E_d = 2k\frac{p}{z^3}$	$\vec{\tau} = \vec{p} \times \vec{E}$	$\kappa\epsilon_0 \oint \vec{E} \cdot d\vec{A} = q$
$k = 1.38 \times 10^{-23} J/K$	$\frac{1}{4\pi\epsilon_0} = \frac{8.99\times10^9 N\cdot m^2}{C^2}$	$e = 1.60 \times 10^{-19} C$	$W_{ext} = q\Delta V$
$V = \frac{q}{4\pi\epsilon_0 r}$	$x = x_0 + v_0 t + \frac{1}{2}at^2$	$PE = \frac{q_1 q_2}{4\pi\epsilon_0 r}$	$m_e = 9.11 \times 10^{-31} kg$
$Q = CV$	$C = \frac{\epsilon_0 A}{d}$	$C_P = C_1 + C_2$	$\frac{1}{C_S} = \frac{1}{C_1} + \frac{1}{C_2}$
$U = \frac{Q^2}{2C} = \frac{1}{2}CV^2$	$I = \frac{dq}{dt} = JA$	$\vec{J} = ne\vec{v}_d$	$V = IR$
$\vec{E} = \rho\vec{J}$	$R = \frac{\rho L}{A}$	$\mathcal{E} = \frac{dW}{dq}$	$\sum \mathcal{E}_i = 0$
$\sum_{in} I = \sum_{out} I$	$R_S = R_1 + R_2$	$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$	$Q = Q_0 e^{-t/RC}$

♠ There are ?? questions. For full credit [n points] show physics-based reasoning, work, and units.
♠ Use no auxiliary aids. Calculators *without* stored equations are OK.
♠ Place all books, notes, packs, etc up front.
♠ All answer sheets must be handed in (do not separate them).
♠ The back of pages will *not* be graded *unless* you so indicate on the front.

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