PHYS 1220 Study Guide for Final Exam

Exam information:

Bring Accuscan #20140 Bubble sheets (the green ones) to the exam. Also acceptable (but older) are the #100643 or #6703 bubble sheets.
#2 pencils are required. Calculators are allowed. However, equation/formula sheets are not allowed.

Exam Logistics:

Section 1 (8:00 to 9:40 am section): December 12th, 2016. Exam time: 8:00 to 10:00 am in STEM195, with optional starting time at 7:30 am.
Section 2 (10:00 to 11:40 am section): December 12th, 2016. Exam time: 10:15 am to 12:15 pm in STEM195, with optional ending time at 12:45 pm.

If a conflict exists, the make-up time for both sections is Friday, December 16th in STEM 195 from 10:15 am to 12:15 pm, with optional ending time at 12:45 pm. Please let me know via email if you will be attending the make-up session on Friday. You should remember that grades are typically lower when students take finals in the last part of finals week due to student fatigue.

Exam composition:

Roughly two thirds of the thirty-question exam will cover chapters 28, 29, and 17-19, while roughly one third of the exam will be over previous material (chapters 21 through 27).

Specifically:
0-2 questions on propagation of error, correct plotting techniques, graph interpretation
2-4 questions on Coulomb's law, Gauss's electric field law, relationship between $\vec{F}$, $\vec{E}$, U, and V, electrical work, electrical dipoles.
1-2 questions on resistivity, resistance, and electrical power.
1-2 questions on capacitors and dielectrics, particularly moving dielectrics in or out of a capacitor.
2-3 questions on circuits: multiple emf sources in a circuit, charging/discharging of capacitors, determination of current or voltage in a circuit with resistors and capacitors, networks of capacitors or resistors.
2-3 questions on magnetic fields: motion of a charged particle in a magnetic field,

nature of magnetic fields, Gauss's magnetic field law, Hall effect.
1 question on obtaining a magnetic field from a moving charge
1 question on obtaining a magnetic field from current
1 question on magnetic force between conductors with flowing currents
2 questions on Ampere's law
1 question on the three major types of magnetism (paramagnetism, diamagnetism, and ferromagnetism) that occur in materials
2 questions on Faraday's law
0-1 questions on Lenz's law
1 question on the displacement current and Maxwell's equations
0-1 questions on the Kelvin temperature scale
1 question on thermal expansion (linear or volumetric)
0-1 questions on thermal stress
1 question on phase transitions
1-3 questions on heat transfer via conduction or radiation
1 question about the ideal gas equation
1-2 questions about $p - V$ diagrams
0-2 questions about molecular kinetic energy and the Maxwell-Boltzmann distribution

Equations and constants that will provided on the exam:

$e = 1.60 * 10^{-19}$ C
$m_e = 9.11 * 10^{-31}$ kg
$\epsilon_0 = 8.85 * 10^{-12}$ $\mathrm{C^2/N\text{-}m^2}$
$\mu_0 = 4\pi * 10^{-7}$ Wb/A-m
$k_\mathrm{B} = 1.381 * 10^{-23}$ J/K
$\sigma = 5.67 * 10^{-8}$ $\mathrm{W/m^2\text{-}K^4}$
$R = 8.314$ J/mol-K
$N_\mathrm{A} = 6.022 * 10^{23}$ molecules/mol
$c = 3 * 10^8$ m/s

$\oiint \vec{E} \cdot d\vec{a} = \frac{1}{\epsilon_0} Q_\mathrm{enclosed}$
$\oiint \vec{B} \cdot d\vec{a} = 0$
$\oint \vec{E} \cdot d\vec{l} = -\frac{d\Phi_B}{dt}$
$\oint \vec{B} \cdot d\vec{l} = \mu_0 \left(i_C + \epsilon_0 \frac{d\Phi_E}{dt}\right)_\mathrm{enclosed}$
$\vec{F} = q\left(\vec{E} + \vec{v} \times \vec{B}\right)$
$\vec{F} = \frac{1}{4\pi\epsilon}\frac{q_1 q_2}{r^2}\hat{r}$
$V_a - V_b = \int_b^a \vec{E} \cdot d\vec{l}$
$C = \epsilon \frac{A}{d}$ (parallel-plate capacitor with dielectric separation)
$Q = CV$
$U = \frac{Q^2}{2C} = \frac{1}{2}CV^2 = \frac{1}{2}QV$
$\vec{J} = nq\vec{v}_d$
$V = IR$
$\vec{E} = \rho\vec{J}$
$R = \frac{\rho L}{A}$
$P = I^2 R$
$\vec{F} = q\left(\vec{E} + \vec{v} \times \vec{B}\right)$
$\Phi_\mathrm{B} = \iint \vec{B} \cdot d\vec{A}$
$\oiint \vec{B} \cdot d\vec{A} = 0$
$\vec{F} = I\left(\vec{\ell} \times \vec{B}\right)$
$\vec{p} = q\vec{d}$ (electric dipole) and $\vec{m} = I\vec{A}$ (magnetic dipole)
$\vec{\tau}_E = \vec{p} \times \vec{E}$ (electric dipole) and $\vec{\tau}_B = \vec{m} \times \vec{B}$ (magnetic dipole)
$U_E = -\vec{p} \cdot \vec{E}$ (electric dipole) and $U_B = -\vec{m} \cdot \vec{B}$ (magnetic dipole)
$R = \frac{mv}{|q|B}$ (cyclotron resonance)
$\vec{B} = \frac{\mu_0}{4\pi}\int \frac{I d\vec{l} \times \hat{r}}{r^2}$

$\frac{F}{L} = \frac{\mu_0 I I'}{2\pi r}$

$Q = mc\Delta T$ and $Q = \pm mL$

$\frac{F}{A} = -Y\alpha\Delta T$

$\frac{dQ}{dt} = kA\frac{T_H - T_C}{L}$

$\frac{dQ}{dt} = A\epsilon\sigma T^4$

$pV = nRT$

$KE_{3D} = \frac{3}{2}nRT = \frac{3}{2}Nk_BT$

$\Delta U = Q - W$

$W = \int_{V_1}^{V_2} pdV$