

You are allowed a pencil and a non-graphing calculator.

No scratch paper is allowed.

Make your calculations on the exam itself. When you are confident you have found the correct answer, fill in the appropriate bubble on the scantron sheet.

Note: a version of the exam without formulas is available for 5% extra credit. In that case, only the "**Constants, Conversions**" portion would be included on the exam.

$F_{12} = k_e \frac{ q_1  q_2 }{r^2}$ $E = k_e \frac{ q }{r^2}$ $\vec{E} \equiv \frac{\vec{F}}{q_0}$ $V = k_e \frac{q}{r}$ $PE = k_e \frac{q_1 q_2}{r}$ $\Delta V \equiv V_B - V_A = \frac{\Delta PE}{q}$ $\Delta V = -Ed$ $C \equiv \frac{Q}{\Delta V}$ $C = \frac{\epsilon_0 A}{d}$ $\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots$ $C_{eq} = C_1 + C_2 + C_3 + \dots$ $\frac{1}{2} Q \Delta V = \frac{1}{2} C (\Delta V)^2 = \frac{Q^2}{2C}$	$I \equiv \frac{\Delta Q}{\Delta t} = nqv_d A$ $\Delta V = IR$ $P = I \Delta V = I^2 R = \frac{(\Delta V)^2}{R}$ $\Delta V = \mathcal{E} - Ir$ $R_{eq} = R_1 + R_2 + R_3 + \dots$ $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$ $q = Q(1 - e^{-t/RC})$ $q = Qe^{-t/RC}$ <p><b>Mechanics</b></p> $v = v_o + at$ $x = x_o + \frac{1}{2}(v_o + v)t$ $x = x_o + v_o t + \frac{1}{2}at^2$ $v^2 = v_o^2 + 2a(x - x_o)$ $KE = \frac{1}{2}mv^2$ <p><b>Constants, Conversions</b></p> $k_e = \frac{8.99 \times 10^9 \text{ Nm}^2}{\text{C}^2}$ $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 / \text{N} \cdot \text{m}^2$ $1 \text{ eV} = 1.60 \times 10^{-19} \text{ C} \cdot \text{V} = 1.60 \times 10^{-19} \text{ J}$ $1 \text{ kWh} = 3.60 \times 10^6 \text{ J}$
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