

Name:

Student ID Number:

Physics 12: Final Exam

June 8, 2009

Version A

- Be sure to write your name at the top of the front page and the short answer page
- Multiple Choice problems are worth 1.65 points each for a total of 49.5 points
- True/False problems are worth 1.65 points each for a total of 16.5 points
- Short Answer Problems total 34 points
- Show your reasoning, write formulas where appropriate (short answer)
- You may use 10 m/s^2 in lieu of 9.8 m/s^2 in all calculations
- **If you miss one part of the short answer, but need the number for the next part, make up a number and proceed**

Formula List:

- $P.E. = mgh$
- $K.E. = \frac{1}{2}mv^2$
- $\Delta E = \Delta Q = c_p m \Delta T$
- $P = \Delta E / \Delta t$
- $P/A = \frac{1}{2}\rho v^3 \approx 0.61v^3$ in W/m^2
- $P/A = \sigma T^4$ in W/m^2 ; $\sigma = 5.67 \times 10^8 \text{ W/m}^2/\text{K}^4$; T in Kelvin
- $E = mc^2$; $c = 3.0 \times 10^8 \text{ m/s}$

Factors of Ten

quadrillion: 10^{15} ; Q
trillion/tera: 10^{12} ; T
billion/giga: 10^9 ; G
million/mega: 10^6 ; M
thousand/kilo: 10^3 ; k

Complex Units:

- Newtons: $\text{N} = \text{kg}\cdot\text{m/s}^2$
- Joules: $\text{J} = \text{N}\cdot\text{m} = \text{kg}\cdot\text{m}^2/\text{s}^2$
- Watts: $\text{W} = \text{J/s} = \text{kg}\cdot\text{m}^2/\text{s}^3$; 1 horsepower = 746 W
- $1 \text{ Wh} = 1 \text{ watt-hour} = (1 \text{ W}) \times (1 \text{ hr}) = (1 \text{ J/s}) \times (3600 \text{ s}) = 3600 \text{ J}$
- $1 \text{ kWh} = 1000 \text{ Wh} = (1000 \text{ W}) \times (1 \text{ hr}) = (1000 \text{ W}) \times (10 \text{ h})$ (etc.) = $(1000 \text{ J/s}) \times (3600 \text{ s}) = 3,600,000 \text{ J}$

Numerical and Conversion factors:

- 1 calorie = 4.184 J; 1 Calorie = 4,184 J; 1 Btu = 1055 J; 1 kWh = 3.6 MJ; 1 QBtu $\approx 10^{18}$ J
- density of water is $1 \text{ g/cm}^3 = 1 \text{ g/ml} = 1 \text{ kg/l} = 1000 \text{ kg/m}^3$; heat capacity is $4184 \text{ J/kg/}^\circ\text{C}$
- density of air is 1.3 kg/m^3 ; heat capacity is $\sim 1000 \text{ J/kg/}^\circ\text{C}$