Name: **Student ID Number:**

Physics 12: Final Exam

June 12, 2013

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 1.7 points each for a total of 51 points
- True/False problems are worth 1.7 points each for a total of 17 points
- Short Answer Problems total 32 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:

- $P.E. = mgh$
- $K.E. = \frac{1}{2}mv^2$
- $\Delta E = \Delta Q = c_p m \Delta T$
- $P = \Delta E / \Delta t$
- $P/A = \frac{1}{2}\rho v^3 \approx 0.61 v^3$ in W/m^2
- $P/A = \sigma T^4$ in W/m^2; $\sigma = 5.67 \times 10^8$ W/m^2/K^4; T in Kelvin
- $E = mc^2$; $c = 3.0 \times 10^8$ 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: N = kg·m/s^2
- Joules: J = N·m = kg·m^2/s^2
- Watts: W = J/s = kg·m^2/s^3; 1 horsepower = 746 W
- 1 Wh = 1 watt-hour = (1 W)×(1 hr) = (1 J/s)×(3600 s) = 3600 J
- 1 kWh = 1000 Wh = (1000 W)×(1 hr) = (100 W)×(10 h) (etc.) = (1000 J/s)×(3600 s) = 3,600,000 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 g/cm^3= 1 g/ml = 1 kg/l = 1000 kg/m^3; heat capacity is 4184 J/kg/°C
- density of air is 1.3 kg/m^3; heat capacity of air is ∼1000 J/kg/°C
- useful proton #'s: Th (thorium: 90); Pr (protactinium: 91); U (uranium: 92); Np (neptunium: 93); Pl (plutonium: 94)