**PHYSICS-2**

Elementary Physics of Energy

**Practice Midterm**

To be reviewed in class on 26 APRIL 2011

100 Total Points

1. A coal burning power plant burns coal at $706^0C$ and exhausts heat into a river with average temperature $19^0C$. What is the *minimum possible* rate of thermal pollution (i.e. heat exhausted into the river) if the station generates 125 MW of electricity? [25]

2. A jeweller needs to melt a .5kg block of silver at $20^0C$, in order to pour into her molds. How much heat is needed to achieve this in kJ? [25]

3. Solar energy is incident on a parking lot with intensity 1000 W/m$^2$, and 75 % of it is absorbed. After 8 hours of exposure, how much energy per squared meter has been absorbed? Express your answer in Btu/m$^2$ and in calorie/m$^2$.

   If 50 % of the solar energy (again with intensity 1000 W/m$^2$) incident on a 3 m $\times$ 3 m surface for 30 minutes is used to heat up 10 kg of water, how much is the increase in the water temperature? [25]

4. An ideal heat pump takes in work at the rate of 3000 Btu/second and delivers heat at the rate of 5000 Btu/second. What is the power that it absorbs from the environment? What is its coefficient of performance? If the pump is non ideal, would its coefficient of performance decrease or increase? [25]

**DATA**

- Heat capacity of water $=4.2kJ/(kg^0C)$. Density of water $=1gm/cc$.
- Heat capacity of silver $=.235kJ/(kg^0C)$.
- Melting temp of silver $=960.8^0C$.
- Latent heat of fusion for silver = $88.3kJ/kg$.
- 1 BTu = 1055 J. 1 calorie = 4.2 J.