PHYSICS-2

Elementary Physics of Energy

Quiz 1

Date: May 2, 2012 in class, Time 30 minutes. [100] points total.
None of the problems requires any elaborate calculation.

Your name:

1. *In the following processes, identify if these as adiabatic or isothermal:*

   a) Pumping air into a bicycle tire in your garage. [5]

   Adiabatic: Usually the tire heats up under this operation.

   b) Melting of an ice block. [5]

   Isothermal: As the block melts, it remains at $T = 0^0$C.

   c) Pulling an elastic band. [5]

   Adiabatic: Recall the band cools or warms up in this process cyclically.

2. *Carbon (A=12,Z=6,N=6), Sodium (A=23,Z=11,N=12) and Oxygen (A=16,Z=8,N=8) form soda ash, a compound denoted by Na_2CO_3. What is the weight (in grams) of a mole of soda ash? [15]*

   Soda ash molecule has 106 nucleons (protons or neutrons) by adding $A = 2 \times 23 + 12 + 3 \times 16$. Therefore a mole of soda ash will weigh 106 gms.

3. *In the gas law $PV = Nk_BT$. The appropriate units for the LHS (and the RHS) are a) Joules b)Newton c) Watts [15]*

   Joules since PV has dimensions of work done.

4. *Is heat absorbed or released in the following?*

   a) Melting of ice: [10]

Absorbed (we need to break the ice crystalline bonds and this requires energy or heat).

b) Evaporation of alcohol: [10]

Absorbed (recall the cool feeling when an alcohol swab is applied prior to any injection!).

c) Condensation of steam: [10]

Released (recall steam engines where cooling steam drives the piston).

d) Adiabatic compression of freon gas: [10] Released.

5. *In a Carnot refrigerator Q_H, Q_C, W are the usual symbols for heat exchanged at the hot and cold reservoirs and W the work done. What is its efficiency? [15]*

   The Carnot efficiency is given by the ratio Q_C/W.