FE-Style Questions **(In order to be counted as correct you need to show your work, and/or thought process. Circle all correct answers)**3-1 Which are examples of closed systems?  
 a) water boiling in a tea kettle  
 b) fuel/air mixture in an internal combustion engine during the combustion event  
 c) a communications satellite in high earth orbit  
 d) a mountain biker and her bike climbing Moscow Mountain

3-2 Which of the following are true about gc?  
 a) gc does not have dimensions in the SI System  
 b) gc is 32.174 lbm-ft/lbf-s2 on earth  
 c) gc varies depending on what celestial body on which you are located  
 d) gc is a correction factor that insures Newton’s 2nd Law an exact equality

3-3 Which of the following are true of intensive properties?  
 a) these are always indicated by capital letter  
 b) these depend on the amount of substance present  
 c) these often have the word ‘specific’ in the name of the property  
 d) two of these can specify a thermodynamic state of a simple homogeneous substance

3-4 What conditions need to exist to apply the ideal gas law?  
 a) particles should be in a gaseous state   
 b) inter-molecular forces between particles should be negligible  
 c) temperature should be fairly low   
 d) pressure should be relatively low

## Practice Problems are on the next page

## Practice Problems

1. For liking the US Coal Miners page on facebook, you were informed that you won a prize of 1.00 lbmole of coal – you only pay for shipping costs. This coal has an average molecular composition of C100H85S2.1N1.5O9.5. Determine the mass [lbm] of coal that you just won.
2. An airliner is cruising at 30,000 ft and 500 mph. If the mass of the full plane (with people/cargo, etc.) is 10,000 lbm. Calculate the potential and kinetic energies [ft\*lbf] of the plane. Assume that gravity is the same value as sea level.
3. While bowling, you and some engineering friends get in to an argument about the relative magnitude of translational vs. rotational kinetic energy of a bowling ball. Based on some rough approximations, you determine that the ball is 12 lbm, has a diameter of 8.5 in, a linear velocity of ~17 ft/sec, and a rotational velocity of 1.0 rev/sec. Calculate translational and rotational energies [ft\*lbf] of the bowling ball.
4. An ideal gas is being put through a cycle that consists of the following steps. Draw the diagram of this cycle on a PV diagram. If you’re not sure what you should be doing, do an Internet search for something like “PV cycle diagram”.
   1. Isothermal compression (p1, V1) to (p2, V2)
   2. Isochoric compression (p2, V2) to (p3, V3)
   3. Isobaric expansion (p3, V3) to (p4, V4)
   4. Isothermal expansion (p4, V4) to (p5, V5)
   5. Isochoric decompression (p5, V5) to (p6, V6)

## Answers to FE Questions

1. b and c
2. a, b, and d
3. c and d
4. a, b, and d

## Answers to Practice Problems

1. ~1527 lbm of coal
2. KE Plane ~ 1.13 \* 105 kJ, or 8.36 \* 107 ft\*lbf  
   PE Plane ~ 4.07 \* 105 kJ, or 3 \* 108 ft\*lbf
3. KE\_total ~ 54.26 ft\*lbf
4. It’s a closed cycle, which means it starts and ends at the same point. Pay attention to the ‘iso’ terms to know what is constant.