1. (4 pts) If the escape velocity on planet X is 1000 m/s, what is the mass of the planet? 
\[ V_{esc} = \sqrt{\frac{2Gm_e}{r_e}} \]
\[ \frac{V_{esc}}{2} \cdot \frac{r_e}{G} = \frac{(1000 \text{m/s})^2 \cdot 5.2 \cdot 10^3}{2 \cdot 6.67 \times 10^{-11} \text{N} \cdot \text{m}^2/\text{kg}^2} \]
\[ = 3.4 \times 10^{19} \text{kg} \]

2. (4 pts) Bowling balls 1 and 2 are identical. Ball 1 is submerged 5.5 inches in water, while ball 2 is submerged 10 inches in water. Which one of the following statements is true?
A. \( F_{flex} = F_{flex} \)
B. \( F_{flex} > F_{flex} \)
C. \( F_{flex} < F_{flex} \)

3. (4 pts) To make an omelet, Dr. Bennett puts oil in a hot frying pan. What will happen to the viscosity of the oil as the oil is heated?
A. Increase
B. Decrease
C. Stay the same

4. (4 pts) An object will float if:
A. \( RD > 1 \)
B. \( RD < 1 \)
C. \( RD = 1 \)

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**EF 152 Exam #1, Spring, 2011**

**Name:**

**Section:**

**Guidelines:**
- Assume 3 significant figures for all given numbers unless otherwise stated
- Show all of your work — no work, no credit
- Write your final answer in the box provided
- Include units for all answers

**Table of Conversions:**

| 1 ft² | 7.48 gal |
| 1 m²  | 1000 L   |
5. (14 pts) A force is applied to the end of a 3-m long uniform board weighing 150N in order to keep it in equilibrium. The mass of the sign is 30kg. Determine the total magnitude of the reaction force at the wall. A separate, complete FBD is required for full credit.

-2 units
-2 sig digits
-2
\[ H \]

-3 units
-3
\[ Z \]

\[ W \]

\[ L \]

\[ F \]

\[ M \]

\[ A \]

\[ B \]

\[ C \]

\[ D \]

\[ E \]

\[ F \]

\[ G \]

\[ H \]

\[ I \]

\[ J \]

\[ K \]

\[ L \]

\[ M \]

\[ N \]

\[ O \]

\[ P \]

\[ Q \]

\[ R \]

\[ S \]

\[ T \]

\[ U \]

\[ V \]

\[ W \]

\[ X \]

\[ Y \]

\[ Z \]

\[ A \]

\[ B \]

\[ C \]

\[ D \]

\[ E \]

\[ F \]

\[ G \]

\[ H \]

\[ I \]

\[ J \]

\[ K \]

\[ L \]

\[ M \]

\[ N \]

\[ O \]

\[ P \]

\[ Q \]

\[ R \]

\[ S \]

\[ T \]

\[ U \]

\[ V \]

\[ W \]

\[ X \]

\[ Y \]

\[ Z \]

\[ A \]

\[ B \]

\[ C \]

\[ D \]

\[ E \]

\[ F \]

\[ G \]

\[ H \]

\[ I \]

\[ J \]

\[ K \]

\[ L \]

\[ M \]

\[ N \]

\[ O \]

\[ P \]

\[ Q \]

\[ R \]

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\[ V \]

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\[ X \]

\[ Y \]

\[ Z \]

\[ A \]

\[ B \]

\[ C \]

\[ D \]

\[ E \]

\[ F \]

\[ G \]

\[ H \]

\[ I \]

\[ J \]

\[ K \]

\[ L \]

\[ M \]

\[ N \]

\[ O \]

\[ P \]

\[ Q \]

\[ R \]

\[ S \]

\[ T \]

\[ U \]

\[ V \]

\[ W \]

\[ X \]

\[ Y \]

\[ Z \]
9. (14 pts) When a 5 kg toy car is submerged in water and held up by a scale, the scale reads 30N. What is the mass density of the car?

\[ \rho = 2575 \text{ kg/m}^3 \]

\[ \begin{align*}
    \rho & = \frac{m}{V} \\
    m & = 5 \text{ kg} \\
    V & = \frac{\rho g h}{4} \\
    \end{align*} \]

\[ \begin{align*}
    L & = 1000 \text{ m}^3 \cdot 9.81 \text{ m/s}^2 \cdot V \\
    30 \text{ N} + 1000 \text{ kg/m}^3 \cdot 9.81 \text{ m/s}^2 \cdot V - 5 \text{ kg} \cdot 9.81 \text{ m/s}^2 = 0 \Rightarrow V = 0.000194 \text{ m}^3 \\
    \rho_{\text{car}} & = \frac{m_{\text{car}}}{V_{\text{car}}} \approx 0.000194 \text{ m}^3 = 2575 \text{ kg/m}^3
\]

10. (14 pts) A Pitot Tube is modified to create a Z-shaped tube as shown. This is placed in a flowing stream of water. The water exits the tube with a speed of 4 ft/s. What is the speed of the water in the stream?

\[ V = 7.33 \text{ ft/s} \]

\[ \begin{align*}
    \rho + \rho g h + \frac{1}{2} \rho V_i^2 = \rho g h + \frac{1}{2} \rho V_o^2 + \frac{2}{\rho} (\rho g h + \frac{1}{2} \rho V_i^2 - \rho g h) \\
    \rho g h + \frac{1}{2} \rho V_i^2 = \rho g h + \frac{1}{2} \rho V_o^2 + \frac{2}{\rho} (\rho g h + \frac{1}{2} \rho V_i^2 - \rho g h) \\
    32.2 \text{ ft/s}^2 \cdot \frac{5 \text{ in}}{1 \text{ ft}} + \frac{1}{2} \cdot V_1^2 = 32.2 \text{ ft/s}^2 \cdot \left(7 \text{ in} + 5 \text{ in}\right) \cdot \frac{1 \text{ ft}}{12 \text{ in}} + \frac{1}{2} \cdot (4 \text{ ft/s})^2 \\
    V_1^2 = 72 \text{ ft/s}^2 \\
    V_1 = 8.73 \text{ ft/s} \\
    \end{align*} \]

\[ \rho = 4 \text{ ft/s}^2 \]

\[ V = 7.33 \text{ ft/s} \cdot \frac{12 \text{ in}}{1 \text{ ft}} = 87.36 \text{ in/s} \\
\]

\[ \text{wrong height} -2 \]

\[ V \text{ instead of } \rho = 8.73 \text{ ft/s} \\
\]

\[ \text{5.17 ft/s} - 4 \]

\[ \text{gravity} -6 \]

\[ -1 \]