SCHOOL NAME ____ TEAM # ____

Hovercraft Exam Answer Sheet

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34. ____
35. ____
36. ____

Answer Key
Testname: HOVERCRAFT ISLIP

1) B
2) A
3) A
4) E
5) B
6) E
7) B
8) B
9) B
10) E
11) E
12) D
13) B
14) C
15) D
16) E
17) A
18) A
19) B
20) E
21) D
22) A
23) 0.280 m/s
24) 6.6 lb at 68° clockwise from rope A
25) 68 m
26) 17 lb
27) recirculation system
28) B, D, A, C
29) SRN4

30. To find the specific gravity of the fluid, take the ratio of the density of the fluid to that of water, noting that the same volume is used for both liquids.

$$SJ_{\text{fluid}} = \frac{\rho_{\text{fluid}}}{\rho_{\text{water}}} = \frac{(m/V)_{\text{fluid}}}{(m/V)_{\text{water}}} = \frac{m_{\text{fluid}}}{m_{\text{water}}} = \frac{88.78\text{ g} - 35.00\text{ g}}{98.44\text{ g} - 35.00\text{ g}} = \boxed{0.8477}$$

31. The height is the height from the spigot to the top of the water tank.

$$P_G = \rho g h = (1.00\times10^3\text{ kg/m}^3)(9.80\text{ m/s}^2)[5.0\text{ m} + (110\text{ m})\sin 58° - 3.2\text{ m}] = \boxed{9.3\times10^5\text{ N/m}^2}$$

32. The buoyant force of the balloon must equal the weight of the balloon plus the weight of the helium in the balloon plus the weight of the load. For calculating the weight of the helium, we assume it is at 0°C and 1 atm pressure. The buoyant force is the weight of the air displaced by the volume of the balloon.

$$F_{\text{buoyant}} = \rho_{\text{air}} V_{\text{balloon}} g = m_{\text{He}} g + m_{\text{balloon}} g + m_{\text{cargo}} g \quad \rightarrow$$

$$m_{\text{cargo}} = \rho_{\text{air}} V_{\text{balloon}} - m_{\text{He}} - m_{\text{balloon}} = \rho_{\text{air}} V_{\text{balloon}} - \rho_{\text{He}} V_{\text{balloon}} - m_{\text{balloon}} = (\rho_{\text{air}} - \rho_{\text{He}}) V_{\text{balloon}} - m_{\text{balloon}}$$

$$= (1.29\text{ kg/m}^3 - 0.179\text{ kg/m}^3)\tfrac{4}{3}\pi(7.35\text{ m})^3 - 930\text{ kg} = \boxed{920\text{ kg}} = \sout{9.0\times10^3\text{ N}} \approx 9.2\times10^2\text{ kg}$$

33. The volume flow rate of water from the hose, multiplied times the time of filling, must equal the volume of the pool.

$$(Av)_{\text{hose}} = \frac{V_{\text{pool}}}{t} \quad \rightarrow \quad t = \frac{V_{\text{pool}}}{A_{\text{hose}} v_{\text{hose}}} = \frac{\pi(3.05\text{ m})^2(1.2\text{ m})}{\pi\left[\frac{1}{2}\left(\frac{5}{8}\right)''\left(\frac{1\text{ m}}{39.37''}\right)\right]^2(0.40\text{ m/s})} = 4.429\times10^5\text{ s}$$

$$4.429\times10^5\text{ s}\left(\frac{1\text{ day}}{60\times60\times24\text{ s}}\right) = \boxed{5.1\text{ days}}$$

34. P = F / A

A = (2.5 m)(1.2 m) = 3.0 m^2

P = (10,000 N) / (3.0 m^2) = 3333.3 Pa = 3000 Pa (SF)

35. $F_{thrust} - F_f = ma$

a = 0.2 (9.8 m/s^2) = 1.96 m/s^2

mass = 5000 N / 9.8 m/s^2 = 510.2 kg

$F_f = F_{thrust} - ma$ = 2500 N – (510.2 kg)(1.96 m/s^2) = 1500 N

$\mu = F_f / F_{normal}$ = 1500 N / 5000 N = 0.3

36. $KE = \frac{1}{2} mv^2$ where v is the velocity the bullet has when it exits the gun barrel, called v_f

$v_i = 0$ (before bullet fired)

$x_f = \frac{1}{2}(v_f)t$, so $v_f = 2x_f / t = 2(0.85 \text{ m}) / 0.002 \text{ s} = 850 \text{ m/s}$

$KE = \frac{1}{2} (0.002 \text{ kg})(850 \text{ m/s})^2 = 722.5 \text{ J} = 700 \text{ J (SF)}$