The University of Jordan	**2nd Semester 2014/2015**
Faculty of Science	**Date: 22/4/2015**
Department of Physics	**Physics 105 - Second Exam**
Name (In Arabic):	**Instructor:**
Student Number:	**Section:**

Constants: $g = 9.8\ m/s^2$, $1\ atm = 1.013\times10^5\ Pa$, $\rho_{water} = 1.0\times 10^3\ kg/m^3$

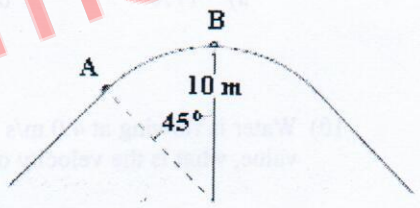
1) A 5.0-kg object is pulled along a horizontal surface at a constant speed by a 15-N force acting 20° above the horizontal. How much work is done by this force as the object moves 6.0 m?

a) 85 J b) 82 J c) 74 J d) 78 J e) 43 J

2) When a ball rises vertically to a height h and returns to its original point of projection, the work done by the gravitational force is

a) +mgh b) −mgh c) 0 d) −2mgh e) +2mgh

3) A skier weighing 0.70 kN goes over a frictionless circular hill as shown. If the skier's speed at point A is 9.2 m/s, what is his speed at the top of the hill (point B)?



a) 3.1 m/s b) 5.2 m/s c) 6.5 m/s d) 4.1 m/s e) 6.2 m/s

4) An all-terrain vehicle of 2000 kg mass moves up a 15.0° slope a distance of 48 m at a constant velocity in 8 sec. The rate of change of gravitational potential energy with time is

a) 30.4 kW b) 5.25 kW c) 24.8 kW d) 118 kW e) 439 kW

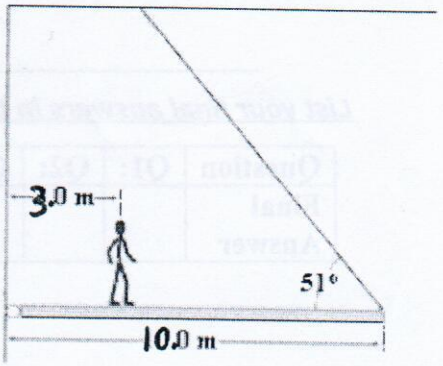
5) Find the pressure in atmospheres in the water at the base of a dam if the water in the reservoir is 200 meters deep.

a) 194 b) 24.7 c) 29.4 d) 20.4 e) 75

6) A balloon is filled with 200 m^3 of helium. How large a mass can the balloon lift while moving upward at constant speed? The density of helium 0.179 kg/m^3 and of air is 1.29 kg/m^3. Consider the mass of the skin of the balloon to be negligible. (ignore the buoyant force on the load)

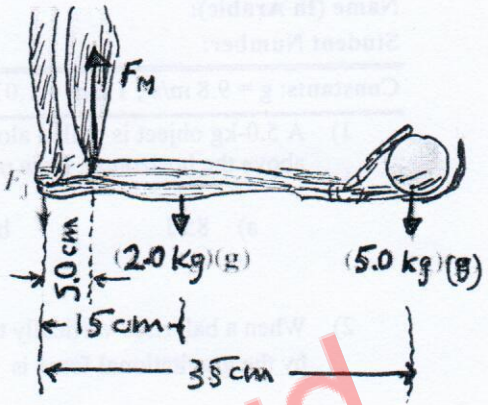
a) 115 kg b) 315 kg c) 222 kg d) 415 kg e) 37 kg

7) The figure shows a uniform, horizontal beam (length = 10 m, mass = 25 kg) that is pivoted at the wall, with its far end supported by a cable that makes an angle of 51° with the horizontal. If a person (mass = 60 kg) stands 3.0 m from the pivot, what is the tension in the cable?



a) 0.83 kN b) 0.30 kN c) 0.42 kN
d) 3.0 kN e) 0.38 kN

8) How much force (F_M) must the biceps muscle exert when a 5.0-kg mass is held in the hand with the arm horizontal as in the figure. Assume that the mass of forearm and hand together is 2.0 kg and their CG is as shown.



a) 800 N b) 400 N c) 100 N
d) 200 N e) 50 N

9) What fraction of an iceberg is submerged if $\rho_{ice} = 917$ kg/m^3 and $\rho_{sea} = 1.03 \times 10^3$ kg/m^3?

a) 77% b) 89% c) 91% d) 93% e) 95%

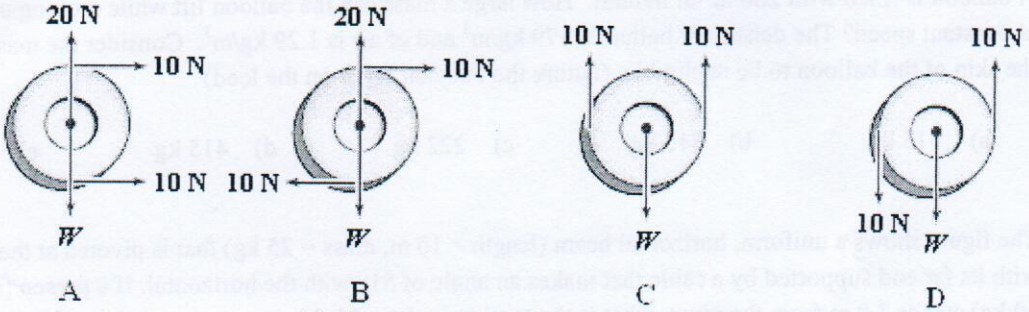
10) Water is flowing at 4.0 m/s in a circular pipe. If the diameter of the pipe decreases to 1/2 its former value, what is the velocity of the water downstream?

a) 1.0 m/s b) 2.0 m/s c) 4.0 m/s d) 8.0 m/s e) 16 m/s

11) Water pressurized to 3.5×10^5 Pa is flowing at 5.0 m/s in a horizontal pipe which contracts to 1/3 its former area. What are the pressure and velocity of the water after the contraction?

a) 4.5×10^5 Pa, 1.5 m/s b) 3.0×10^5 Pa, 10 m/s c) 3.0×10^5 Pa, 15 m/s
d) 2.5×10^5 Pa, 15 m/s e) 5.5×10^5 Pa, 1.5 m/s

12) The diagrams below show forces applied to a wheel that weighs 20 N. The symbol *W* stands for the weight. In which diagram(s) is (are) the wheel in static equilibrium? (the wheel is **NOT** pivoted)

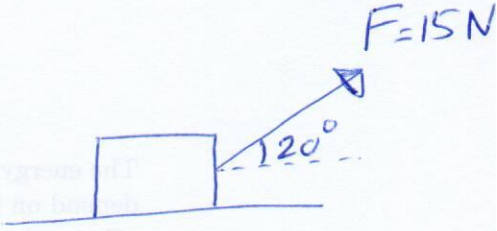


a) A b) B c) C d) D e) B and C

List your final answers in this table. Only the answer in this table will be graded..

Question	Q1:	Q2:	Q3:	Q4:	Q5:	Q6:	Q7:	Q8:	Q9:	Q10:	Q11:	Q12:
Final Answer												

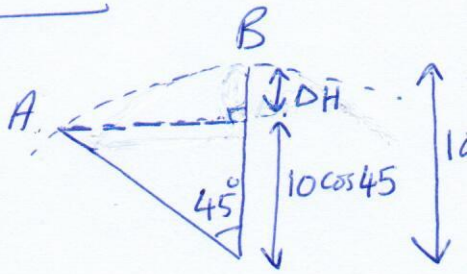
Physics for Medical and Dentistry students
Second Exam / 22/4/2015
Solutions



Q1] $W_F = (F\cos 20)(6)$

$\simeq 85$ J.

Q2] Vertical displacement $= 0 \Rightarrow W_g = 0$.



Q3] No friction $\Rightarrow \Delta K + \Delta U = 0$

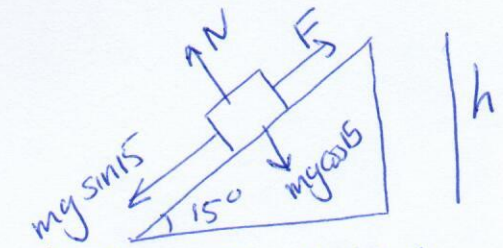
$\frac{1}{2}m(v_B^2 - v_A^2) + mg\Delta H = 0$

$\Delta H = 10 - 10\cos 45 = 2.93$ m

$\frac{1}{2}v_B^2 = \frac{1}{2}(9.2)^2 - g\Delta H$

$v_B = [(9.2)^2 - 2g\Delta H]^{1/2} \simeq 5.2$ m/s

Q4] $P = Fv$



constant velocity $\Rightarrow F = mg\sin 15$

$P = (mg\sin 15)\underbrace{\left(\frac{48}{8}\right)}_{v} = (2000\times 9.8\sin 15)(6) = 30.4$ kW

Note as speed is constant all the work is converted into potential energy.

Alternatively $\Delta U = mgh = 2000\times 9.8\times(48\sin 15)$

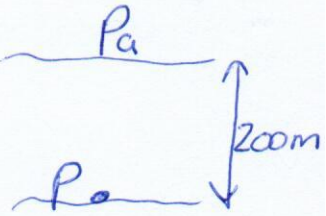
$P = \frac{\Delta U}{\Delta t} = \frac{\Delta U}{8} = 30.4$ kW.

5] $P = P_a + \rho g h$

$= 1\ atm + \frac{1000 \times 9.8 \times 200}{1.013 \times 10^5}\ atm$

$= 1\ atm + 19.35$

$= 20.4\ atm$



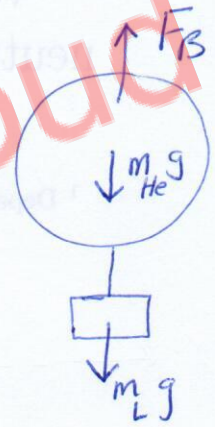
6] constant speed $\Rightarrow$ Dynamic equilibrium

$\Rightarrow \sum \vec{F} = 0$

$+\uparrow \quad F_B - m_{He} g - m_L g = 0$

$\rho_{air} V g - \rho_{He} V g = m_L g$

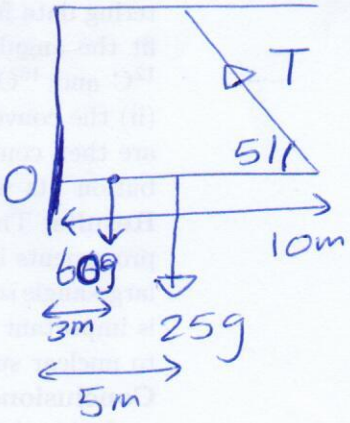
$(\rho_{air} - \rho_{He}) V = m_L = 222\ kg$



7] $+\circlearrowleft_O \quad (T \sin 51)(10) - 60g(3) - 25g(5) = 0$

$T = \frac{180g + 125g}{10 \sin 51}$

$\simeq 0.38\ kN$

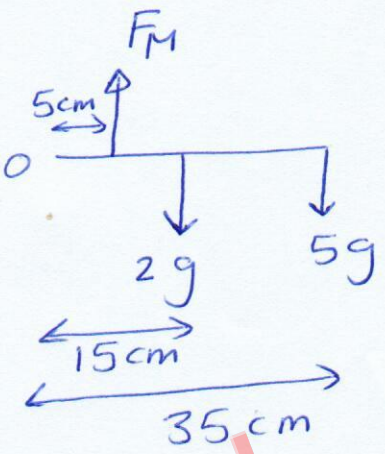


8] $+\circlearrowleft$ $\sum \tau_O = 0$

$F_M(0.05) - 2g(0.15) - 5g(0.35) = 0$

$F_M = \dfrac{0.3g + 1.75g}{0.05}$

$F_M \sim 400\ N.$

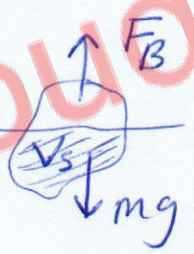


9] $F_B = mg$ static equilibrium

$\rho_w V_s g = \rho V g$

$\dfrac{V_s}{V} = \dfrac{\rho}{\rho_w} = \dfrac{.917}{1030} \sim 0.89$

$\Rightarrow$ % submerged volume = 89%.

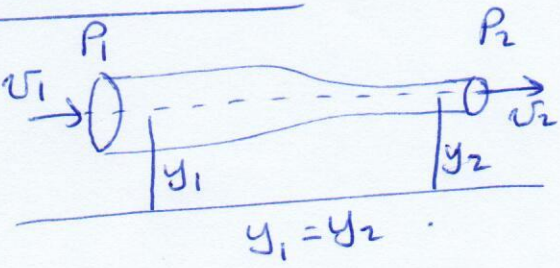


10] $A_1 v_1 = A_2 v_2$

$\pi\left(\frac{D_1}{2}\right)^2 (4) = \pi\left(\frac{D_2}{2}\right)^2 v_2$

$v_2 = \left(\frac{D_1}{D_2}\right)^2 (4) = \left(\frac{D_1}{\frac{D_1}{2}}\right)^2 (4) = 4 \times 4 = 16\ m/s$

11] $P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$



$A_1 v_1 = A_2 v_2$

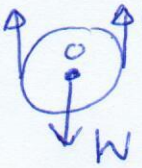
$A_1(5) = \frac{A_1}{3} v_2 \Rightarrow v_2 = 15\ m/s.$

$y_1 = y_2$.

$\Rightarrow P_1 + \frac{1}{2}\rho(v_1^2 - v_2^2) = P_2 \Rightarrow P_2 = 2.5 \times 10^5\ Pa.$

Q12] static equilibrium $\Rightarrow \sum \vec{F} = 0,\ \sum \vec{\tau} = 0$

only diagram that satisfies both conditions is



$+\circlearrowleft$ $\sum \vec{\tau} = 0$

$\sum \vec{F} = 0$