THE UNIVERSITY OF JORDAN **PHYSICS DEPARTMENT**

PHYSICS 105 (2nd EXAM) **SEMESTER (Nov. 29th ,2016)**

Student's Name (Arabic):..... Registration #.....

Lecturer's Name:..... Section # .....

$g = 9.8\ m/s^2$, $\rho_{water} = 1000\ kg/m^3$, $P_0 = 1.013 \times 10^5\ Pa$, $\rho_{blood} = 1050\ kg/m^3$

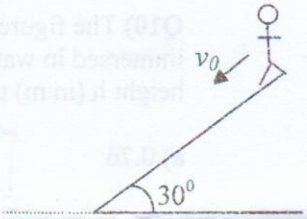
Q1) A boy lifts a 4 kg mass vertically upwards a distance of 2m at constant speed. The work (in J) done by the boy is

a) 78.4 b) 19.6 c) 39.2 d) -19.2 e) -78.4

Q2) A stone is thrown vertically upwards. Ignoring air resistance, which of the following statements is correct?

a) The sum of the kinetic and potential energies is zero.
b) As the stone rises the potential energy decreases.
c) As the stone descends the kinetic energy decreases.
d) The total mechanical energy is conserved.
e) The change in the potential energy equals the change in the kinetic energy.

Q3) A skier slides down a 30^0 inclined path as shown in the figure. He starts with an initial velocity of 6 m/s and slides down the hill a distance of 20 m. If the coefficient of kinetic friction between the ice and his skies is 0.15, determine his speed (in m/s) at the bottom of the hill.



a) 15.7 b) 17.2 c) 16.8 d) 13.5 e) 8.2

Q4) The average power output of a 60 – kg running athlete is 400 W. The work (in k J) that he does in 5 minutes is:

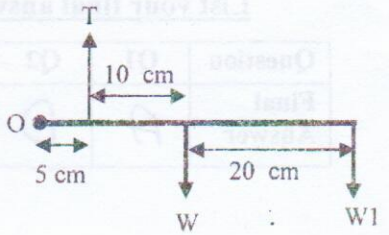
a) 60.0 b) 120 c) 0 d) 1.5 e) 90

Q5) The figure shows a see – saw of length L = 6 m pivoted in the middle at point O. A 20 – kg boy sits at point A and a 30 kg boy sits at point B. How far from point O (in m) should a 15 kg child sit so that the see –saw is in static equilibrium?

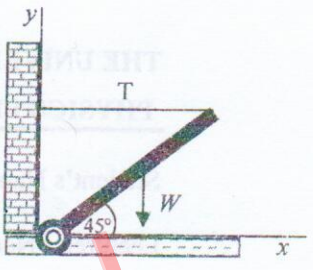
a) 2 to the right of O b) 2 to the left of O c) 1.3 to the left of O
d) 1.3 to the right of O e) at point O

Q6) The figure shows the forearm modeled as a beam kept horizontally in static equilibrium by the tension T exerted by the biceps muscle. The arm rotates about point O at the **elbow joint**. The weight of the forearm is W = 12 N. If the forearm carries a weight W1 = 15 N, calculate the tension T (in N) in the biceps muscle to keep the forearm in static equilibrium in a horizontal position.

a) 34 b) 106 c) 20
d) 12 e) 141



Q7) In the figure, the weight of the uniform beam $W = 500$ N, and its length $l = 8$ m. A massless cable holds the beam in static equilibrium at an angle of 45° with the x-axis. The **horizontal** component of the hinge force (in N) acting at the joint (point O) is:



a) 250 b) 352 c) 250

d) 500 e) 707

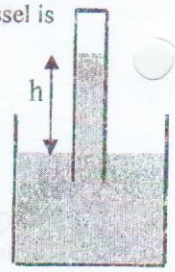
Q8) A 60 – kg man just floats in water with all of his body below the water surface. What is his volume (in m^3) ?

a) 1.2 b) 0.08 c) 0.06 d) 0.6 e) 1.0

Q9) A blood vessel of radius r splits into three vessels, each of radius $r/4$. If the velocity in the larger vessel is v, then the velocity in each of the smaller vessels is

a) $3v/16$ b) $v/3$ c) $9v/4$ d) $16v/3$ e) v

Q10) The figure shows a long **evacuated** tube with its open lower end immersed in water. The water tank is open to the atmosphere. The maximum height h (in m) the water can rise in the evacuated tube is:



a) 0.76 b) 10.3 c) 9.1 d) 3 e) 6.6

Q11) A 6.0 cm radius horizontal pipe gradually narrows down to 5.0 cm. If $P_1 = 30$ kPa and $V_2 = 6$ m/s, then the value of the pressure P_2 (in kPa) is:

a) 39.3 b) 63.5 c) 20.7

d) 209.6 e) 24.2

Q12) An object of density ρ is placed in a fluid of density ρ_F. Assume the only forces acting on the object are its weight and the buoyant force. Which of the following statements is correct?

a) The buoyant force depends on the density of the object.
b) The buoyant force is due to the increase in the fluid pressure with depth below the fluid surface.
c) If $\rho_F > \rho$, the object sinks.
d) If $\rho_F < \rho$, the object floats.
e) None of the above is correct.

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	A	D	D	B	B	E	C	C	D	B	C	B

A

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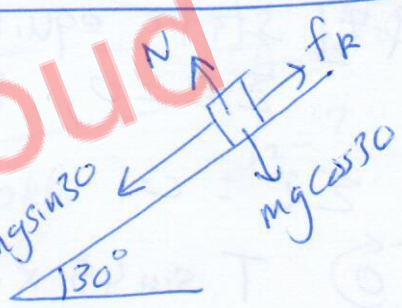
Q1] $W_{ext} = \Delta U \Rightarrow W_{by} = \Delta U = mgh = 4 \times 9.8 \times 2$
$= 78.4\ J$ (a)

Q2] The total mechanical energy is conserved. (d)

Q3] # mg is a conservative force
N is a non-conservative force but does NO work.
f_k is a non-conservative force and does negative work.



distance moved down the incline

$\Delta K + \Delta U = W_{nc}$

$\frac{1}{2}m(v_f^2 - v_i^2) - mgd\sin 30 = (f_k)(d)\cos 180°$

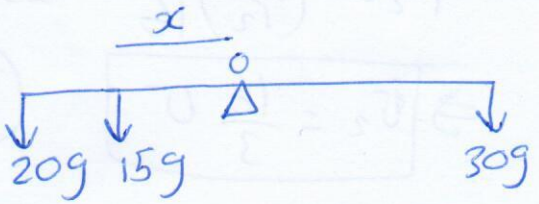
$\frac{1}{2}m(v_f^2 - v_i^2) - mgd \times \frac{1}{2} = -\mu_k(mg\cos 30)(d)$

$v_f^2 = v_i^2 + gd - \mu_k gd\sqrt{3} \Rightarrow v \simeq 13.5$ m/s (d)

Remember $\cos 30 = \frac{\sqrt{3}}{2}$

Q4] $\bar{P} = \frac{W}{t} \Rightarrow W = \bar{P}t = 400 \times 5 \times 60 = 120{,}000$
$= 120\ kJ$ [b]

Q5] 15 kg child should sit on the same side as the lighter boy i.e on the left hand side of 'O'

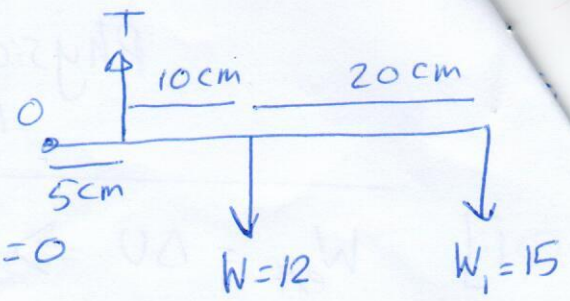


$+\circlearrowleft$ (O) $20g(3) + 15gx - 30g(3) = 0$

$\Rightarrow x = 2$ m (to the left of O) (b)

Q6] static equilibrium

$\Rightarrow \Sigma \tau = 0$



$+\circlearrowleft$ (O) $\quad T(0.05) - 12(0.15) - 15(0.35) = 0$

$\Rightarrow T = 141\ N$. (e)

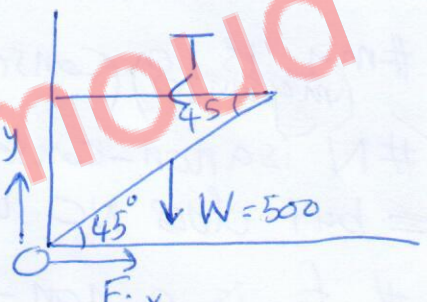
Q7] static equilibrium $\Rightarrow$

$\Sigma \tau = 0, \quad \Sigma \vec{F} = 0$

$\Sigma \tau = 0$

$+\circlearrowleft$ (O) $\quad T \sin 45 \times 8 - W \sin 45 \times 4 = 0$

$\therefore T = \frac{4W}{8} = \frac{W}{2} = 250\ N.$



$\Sigma F_x = 0$

$\rightarrow +$ $\quad F_{jx} - T = 0 \Rightarrow F_{jx} = 250\ N.$ (c)

Q8] $F_B = mg$

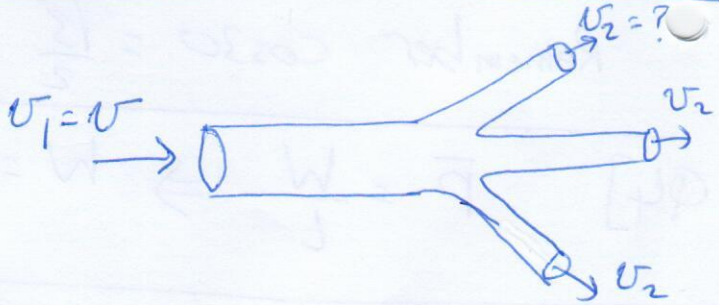
$\rho_F V g = mg \Rightarrow V = \frac{m}{\rho_F} = \frac{80}{1000} = 0.08\ m^3$

Q9] $A_1 v_1 = 3 A_2 v_2$

$\pi r_1^2 v = 3 \pi r_2^2 v_2$

$r^2 v = 3 \frac{r^2}{16} v_2$

$\Rightarrow \boxed{v_2 = \frac{16}{3} v}$ (d)



Q10] $P_{water} = P_0$ ← atmospheric pressure

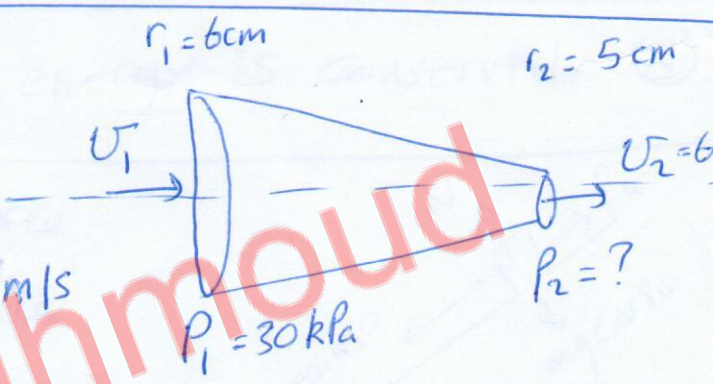
$\rho_w g h = 1.013 \times 10^5 \Rightarrow h = \dfrac{1.013 \times 10^5}{(9.8) \times 10^3} = 10.3$ m

B

Q11] $A_1 v_1 = A_2 v_2$

$\pi (0.06)^2 v_1 = \pi (0.05)^2 v_2$

$v_1 = \left(\dfrac{0.05}{0.06}\right)^2 (6) \approx 4.167$ m/s



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

[remember $mgh_1 = mgh_2$ since pipe is horizontal]

$P_2 = P_1 + \frac{1}{2}\rho(v_1^2 - v_2^2) = 30 \times 10^3 + \frac{1}{2} \times 1000 (v_1^2 - v_2^2)$

$= 20.7$ kPa (C)

Q12] (b)