Physics Department	Physics 0342105	2017/2018
The University of Jordan	Practical Final Exam	Fall Semester

Information:
R = 8.314 J/mole.K; k_B=1.38×10^{-23} J/K; g = 9.8 m/s^2. ρ_{water} = 1000.0 kg/m^3 and P_{atm} = 1.013 × 10^5 Pa. 1u = 1.66 x 10^{-27} kg. N_A = 6.02 x 10^{23} molecules/mole. Note: Some Results Are Rounded.

1) A patient is administered (^{131}I). How long will it take for the observed radioactivity in her body to decrease to one-fourth its original magnitude? Given that (^{131}I) has half-life ($T_{1/2}$) of 8.1 days

A) 8.1 days B) 360 days C) 376.2 days D) 16.2 days E) 7.75 days

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3) A submarine deep below the surface of the sea is at a gauge pressure of 40 atm. The air inside the submarine is at normal atmospheric pressure. The *net* force (in N) on a flat hull plate 2m by 6m is:

A) 4.86 x 10^2 B) 4.86 C) 4.86 x 10^7 D) 4.92 E) 4.92 x 10^7

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4) The linear expansion coefficient for *Al* is $\alpha = 2.2\times10^{-5}$ K^{-1}. What is the increase in volume of a block of 1 m^3 of *Al* if the temperature of the block is raised by 10 ºC?

A) 220 cm^3 B) 440 cm^3 C) 22 cm^3 D) 660 cm^3 E) 66 cm^3

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5) What volume fraction of a cube of density (ρ = 0.50 g/cm^3) would sink under the surface of a liquid of density (ρ_o = 1.0 g/cm^3)?

A) 0.80 B) 0.67 C) 0.33 D) 0.50 E) 0.20

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6) A 63-kg researcher absorbs 2.6 × 10^8 neutrons in a work day. The energy of each neutron is 6.5 MeV. The quality factor (QF) for fast neutrons is 10. The biologically equivalent dosage of the radiation, in mrem (mrem = 10^{-3} rem), is closest to (Note: 1 rad = 0.01 J/kg and 1ev = 1.6 x 10^{-19} J)

A) 43 B) 1.3 C) 2.7 D) 13 E) 4.3

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7) A man pulls a box weighting 40 N a distance of 10 m across the floor at constant speed. How much work (in J) does he do if the coefficient of kinetic friction is 0.20?

A) 80 B) -40 C) 0.0 D) 40 E) -80

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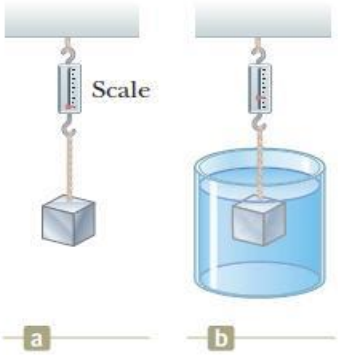
8) The gravitational force exerted on a solid object, in air, is 4.0 N (Figure a). When the object is suspended from a spring scale and submerged in water, the scale reads 2.0 N (Figure b). Find the density of the object (in kg/m^3). Assume density of water ρ = 1000.0 kg/m^3.

A) 4000 B) 2000 C) 5000
D) 1000 E) 1500



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9) When a man stands, his brain is 0.5 m above his heart. If he bends so that his brain is 0.4 m below his heart, by how much does the blood pressure in his brain change? (Assume density of blood is 1059.5 kg/m^3.)

A) 13.3 kP B) 4.0 kP C) 13.1 kP D) 9.3 kP E) 16.6 kP

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10) If both gases H_2 and CO_2 are at the same temperature. Then the ratio of the *rms* velocities of H_2 and CO_2, [V_{rms} (H_2)/ V_{rms} (CO_2)] is: (Given that the molecular mass of H_2 = 2.016 u and for CO_2 = 44.009 u)

A) 21.8 B) 0.21 C) 4.0 D) 0.05 E) 4.67

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11) Water flows (streamline, nonviscous) from point *a* to point *b* in the horizontal section shown in the figure. Which of the following statements is correct regarding the velocity *v*, pressure *P*, and flow rate *Q* at the two ends of the section?

A) $v_a < v_b$. B) $P_a > P_b$ C) $P_a < P_b$.
D) $P_a = P_b$. E) $Q_a > Q_b$ (Q is the flow rate).

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12) ^{60}Co beta decays with half life of 5.27 years (1.66 x10^8 sec) into ^{60}Ni, which then promptly emits gamma rays. These gamma rays are widely used in treating cancer. What is the mass (in gram) of a 1000-Ci cobalt source? (Given that one mole of ^{60}Co has a mass of 60 g)

A) 0.118 B) 0.441 C) 0.882
D) 0.245 E) 0.0147

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13) If an object was thrown vertically from the ground level with initial speed 25 m/s and return to the same ground level after 5.1 seconds. What is the average velocity (in m/s) of the object when reaching the ground?

A) 12 B) 24 C) 6 D) 0 E) -12

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14) The maximum permissible workday dose for occupational exposure to radiation is 26 mrem. A 63 kg laboratory technician absorbs 2.1 mJ of 0.7 MeV gamma rays in a work day. The quality factor (QF) for gamma rays is 1.0. The ratio of the equivalent dosage received by the technician to the maximum permissible equivalent dosage is closest to: (mrem = 10^{-3} rem, 1rad = 0.01 J/kg and 1ev = 1.6 x 10^{-19} J)

A) 0.18 B) 0.14 C) 0.17 D) 0.13 E) 0.15

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15) A radioactive source emits 2.4 MeV neutrons at the rate of 9200 neutrons per second. The number of atoms in the source is 4.0 x 10^9. The activity of the source, in nCi, is closest to: Hint (nCi = 10^{-9} Ci) and (1Ci = 3.70 x 10^{10} decays/sec.)

A) 2500 B) 92 C) 920 D) 25 E) 250

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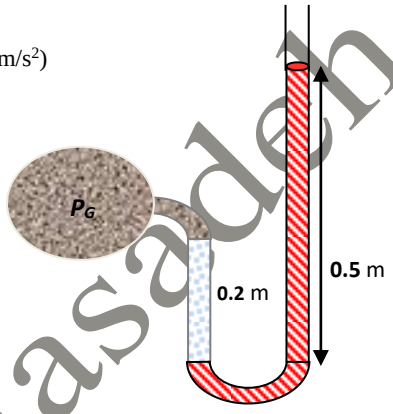
16) The level of the fluid with density ρ_s = 1000 kg/m^3 in the left arm of the manometer is 0.2 m above the manometer fluid of density ρ_f = 800 kg/m^3 in the right arm. Which of the following relations is true? (Use ; g = 10 m/s^2)

A. $P_G = P_{atm}$.
B. P_G is 2000 Pa higher than P_{atm}.
C. P_G is 2000 Pa lower than P_{atm}.
D. P_G is 4000 Pa higher than P_{atm}.
E. P_G is 6000 Pa higher than P_{atm}



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17) The radioactive nuclide ^{60}Co is widely used in medical applications. It undergoes beta decay, and the energy of the decay process is 2.82 MeV per decay event. The half-life of this nucleus is 272 days. Suppose that a patient is given a dose of 6.9 microCurie of ^{60}Co. If all of this material decayed while in the patient's body, what would be the total energy (in J) deposited there? Hint: (1Ci = 3.70 x 10^{10} decays/sec.) and 1ev = 1.6 x 10^{-19} J.

A) 3.9 B) 11.0 C) 14.0 D) 8.63 × 101^{12} E) 4.15 × 10^6

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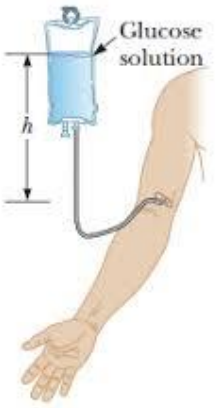
18) A collapsible plastic bag contains glucose. If the average gauge pressure in the vein is 1.33 x 10^3 Pa, what must be the minimum height h (in m) of the bag in order to infuse glucose into the vein? Assume density of the solution is equal 1.02 ρ_{water}.

A) 0.133 B) 0.113 C) 0.150 D) 0.752 E) 0.333



19. Oxygenation of the deep waters in a sea occurs in early winter due to:

a. Diffusion of air molecules through water.
b. Water mixing resulting from the decrease in density of water at lower as the temp decreases.
c. Water mixing resulting from the increase in density of water at lower as the temp decreases.
d. The lower density of ice relative to water.
e. Water mixing resulting from turbulence and the see waves in early winter.

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20. One mole of an ideal gas has a temperature of 25°C. If the volume is held constant and the pressure is doubled, the final temperature (in °C) will be

a. 174 b. 323 c. 50 d. 596 e. 25

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21. If water is to be pumped into a water tank at the top of a 10 m high building, what should the water pressure at the base of the building be if the speed of water is constant through the water pipe? (1.013 bar = 1 atm, g = 9.8 m/s^2)

a. 1.0 bars b. 2.0 bars c. 0.5 bars d. 3.0 bars e. 0.3 bars

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22. The temperature of an object is 80 °F. What is its absolute temperature on the Kelvin scale?

a. 300 K. b. 335 K. c. 359 K. d. 475 K. e. 400 K.

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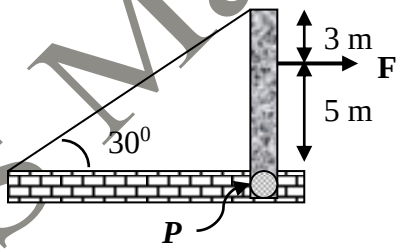
23. A uniform 100 N beam is held in a vertical position by a pin (***P***) at its lower end and a cable at its upper end. A horizontal force of magnitude **F** = 75 N acts as shown in the figure. What is the tension in the cable?

a. 47 N b. 69 N
c. 61 N d. 94 N
e. 54 N



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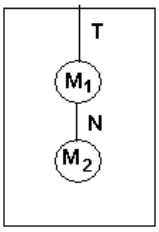
24. If two objects M_1, M_2 ($M_1 = M_2$) are connected by a light inextensible cord which is attached to the ceiling of an elevator that is accelerating upward at 2 m/s², the ratio T/N

a. 5/3 b. 2 c. 1 d. 3/2 e. ½



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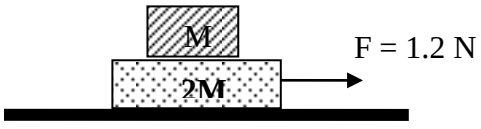
25. The frictional force between mass 2M and the surface is zero, and the frictional force between masses M and 2M causes both masses to move together when the F = 1.2 N is applied to 2M. If M = 1 kg, what is the frictional force exerted by the large block on the small block?

a. 0.4 N to the lef b. 0.8 N to the right
c. 0.4 N to the right d. 0.8 to the left
e. 1.2 to the right



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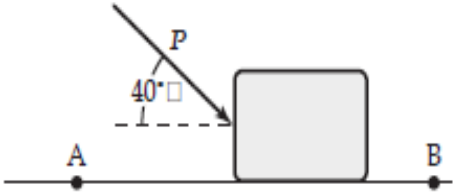
26. A block slides on a rough horizontal surface from point A to point B. A force (P = 2.0 N) acts on the block between A and B, as shown. Points A and B are 1.5 m apart. If the kinetic energies of the block at A and B are 5.0 J and 4.0 J, respectively, how much work is done on the block by the force of friction as the block moves from A to B?

a. –3.3 J b. +1.3 J c. +3.3 J
d. –1.3 J e. +4.6 J



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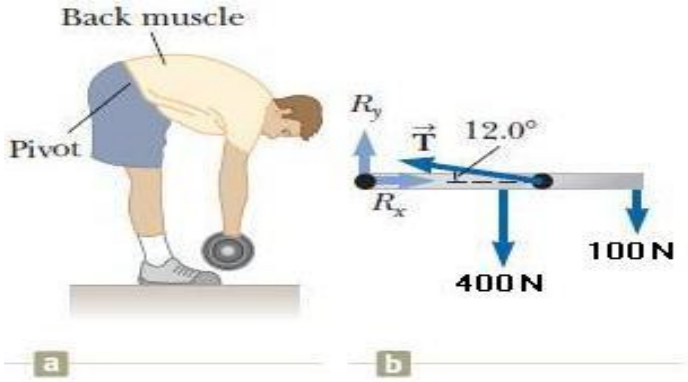
27) Consider the model shown in Figure (b) for a person bending forward to lift a 100-N object. The spine and upper body are represented as a uniform horizontal rod of weight 400 N and length L, pivoted at the base of the spine. The erector spinal muscle, attached at a point 2L/3 a way from the pivot, maintains the position of the back. The angle between the spine and this muscle is 12 degrees. The tension T (in N) in the back muscle is:

A) 460 B) 2117 C) 0
D) 722 E) 2164



28) The horizontal component of the force R ($\equiv R_x$) exerted by the pivot (sacrum) along the spine (in N)?

A) 2117 B) 450 C) 0
D) 2164 E) 1667

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