Dr. Mohammad Hussein PHY 105 Recitation Session - FINAL Exam

1. *

Take ρ as the density of water. A rubber ball floats in three fluids X, Y and Z of densities: 0.9ρ, ρ and 1.1ρ, respectively. One of the following statements is true:

The three fluids exert the same buoyant force on the ball.

The buoyant force of fluid X is greater than the buoyant forces of the other two fluids.

The buoyant force of fluid Z is greater than the buoyant forces of the other two fluids.

The volume of the fluid displaced by the ball is the same for the three fluids.

The buoyant force of fluid Z is smaller than the buoyant forces of the other two fluids.

2. **

In your physiology textbook, you read that the blood is pumped by heart through a series of contractions known as heartbeats. The pressure created by the heart's contraction varies from point to point in the heart. Assume that 70 cm^3 of blood is pumped during one heartbeat under a blood pressure of 150 mm-Hg. If the heart performs 80 of such heartbeats per minute, then the power (in W) delivered by the heart is: (Recall that 76 cm-Hg = 1 atm = 101.3 kPa)

1.87 0.47 3.33 0.89 2.67

3. **

A radiation oncologist treats cancer with two species of radioactive nuclei, X and Y. The initial number of nuclei for each species (at t = 0) is N_0. At t = 100 s, the oncologist observes that $N_X = 100\ N_Y$. If $\tau_X = 2\ \tau_Y$, the value of τ_Y (in s) is: (Recall that 1 Ci = 3.7 x 10^{10} Bq)

10.86 61.77 0.50 4.07 36.36

4. **

A radiation oncologist treats cancer with two species of radioactive nuclei, X and Y. The initial number of nuclei for each species (at t = 0) is N_0. At t = 100 s, the oncologist observes that $N_X = 100\ N_Y$. If $\tau_X = 2\ \tau_Y$, the value of τ_X (in s) is: (Recall that 1 Ci = 3.7 x 10^{10} Bq)

21.72 0.50 34.34 5.07 59.41

5. **

A cup filled with milk to a depth of 9.8 cm is held in an elevator that is accelerating upward. With constant acceleration, the elevator is speeding up from 0 m/s to 2.4 m/s during 2.9 s. The change in the pressure (in Pa) exerted by the milk on the bottom of the cup during the period of acceleration is: (Recall that the density of milk is 1027 kg/m^3)

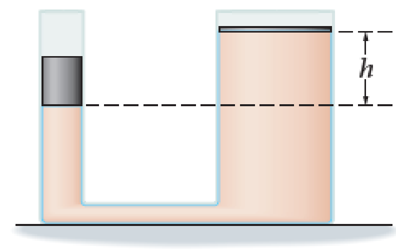
+83.3 -100.6 zero +78.1 -63.1

6. **

A cup filled with milk to a depth of 9.8 cm is held in an elevator that is accelerating downward. With constant acceleration, the elevator is speeding up from 0 m/s to 2.4 m/s during 2.9 s. The change in the pressure (in Pa) exerted by the milk on the bottom of the cup during the period of acceleration is: (Recall that the density of milk is 1027 kg/m^3)

-83.8 zero +100.6 -78.1 +63.1

7. **

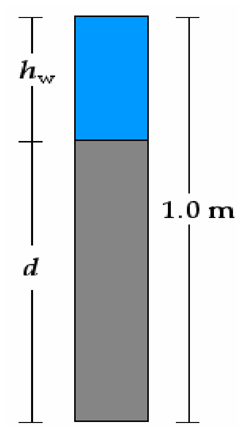


The schematic diagram for a hydraulic lift shows two pistons in a container filled with a fluid of density 750 kg/m^3. The larger piston on the right has a diameter of 13 cm and a mass of 3.6 kg, while the piston on the left has a diameter of 5.1 cm and a mass of 2.3 kg. The height difference h (in m) between the two pistons is:

1.1 0.28 0.93 1.74 0.02

8. **

The figure belongs to problems 8 & 9



The figure shows a 1.0 m tall vessel that is open to the atmosphere at the top. It is filled with mercury (of density of 13.6 10^3 kg/m^3) up to a depth d, and the rest of it is filled with water (of density of 10^3 kg/m^3).
If the pressure at the bottom of the vessel is two atmospheres, what is the depth d (in cm)? (Recall that 1 atm = 101.3 kPa)

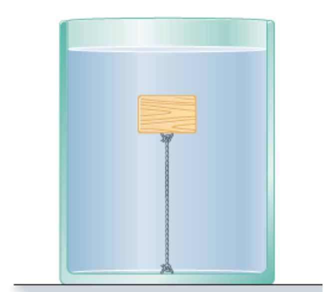
74 76 78 80 72

9. **

The figure shows a 1.0 m tall vessel that is open to the atmosphere at the top. It is filled with mercury (of density of 13.6 10^3 kg/m^3) up to a depth d, and the rest of it is filled with water (of density of 10^3 kg/m^3).
If the pressure at the bottom of the vessel is two atmospheres, what is h_w (in cm)?

26 24 22 20 28

10. **

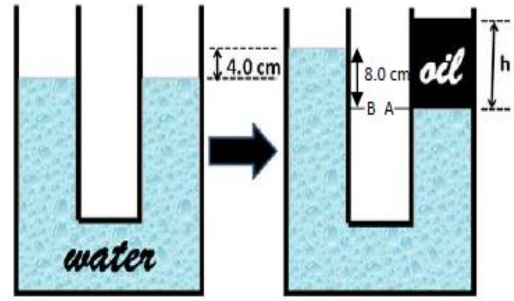


The figure shows a wooden block attached with a rope to the bottom of a water-filled vessel. Knowing that the volume of the block is 8 x 10^{-6} m^3, what is the tension (in N) in the rope? (Recall that the density of wood is 706 kg/m^3 and that of water is 10^3 kg/m^3).

0.023 0.079 0.056 0.135 0.033

11. **

To the left, an open U-shaped tube contains water (of density of 1 g/cm^3) in equilibrium. To the right, the same tube contains water and oil (of density of 0.8 g/cm^3) in equilibrium. The length (in cm) of the oil column (h) is: (Recall that 1 atm = 101.3 kPa)



10 16 17 12 9

12. **

A 4-kg steel ball (of density of 7.8 x 10^3 kg/m^3) suspended from a rope is partially immersed in water (of density of 10^3 kg/m^3). If one third of the ball's volume is below the surface of the water, the tension (in N) in the rope is: (Recall that 1 atm = 101.3 kPa)

37.5 39.2 40.9 35.8 42.6

13. *

Assume that blood flows into the aorta at 1.0 m/s for 0.5 s, from which it flows then through an artery at 0.6 m/s for another 0.5 s. The average speed (in m/s) of the blood through the total time elapsed is:

0.8 1.0 0.6 zero 1.6

14. *

Assume that blood flows into the aorta at 1.0 m/s over a distance of 0.5 m, from which it flows then through an artery at 0.6 m/s for another 0.5 m. The average speed (in m/s) of the blood over the total specified distance is:

0.75 0.83 1.0 0.6 zero

15. *

A car travels in a straight line towards north at 23.6 m/s. If the car's acceleration is 1.15 m/s^2 towards south, it's velocity (in m/s) after 7.1 s is:

15.4 north 31.8 north 15.4 south 31.8 south 23.6 north

16. *

Arabian horse, with an initial velocity of +9.2 m/s, runs in a straight line in the positive direction while slowing down uniformly at a rate of 1.81 m/s^2 in the negative direction. After a while, the velocity of the horse becomes +5.5 m/s.
The time (in s) elapsed for the specified change in velocity is:

2.04 8.12 3.04 1.67 7.35

17. *

An object travels in a straight line in the positive direction while speeding up uniformly at a rate of +6.24 m/s^2 in the positive direction for 0.45 s. At the end of this time, the object's velocity is +9.31 m/s. What was the object's initial velocity (in m/s)?

+6.5 +12.12 -2.81 +2.81 -6.5

~~18.~~ EXCLUDED

A PHY 105 student on the Moon released an apple from a height of 1.25 m above the surface of the Moon. The speed (in m/s) of the apple just before it hits the Moon's surface is:
(Recall that the acceleration of gravity on the Moon is one-sixth that on the Earth)

2.02 4.95 zero 4.08 24.50

19. *

A person whose mass is 75.0 kg is exposed to a whole absorbed dose of 30.0 rad.
How many joules of energy are deposited in the person's body? (Recall that 1 Ci = 3.7 x 10^{10} Bq)

22.5 0.30 2250 30 750

20. *

A substance has absorbed 20 joules of energy. If its absorbed dose is 0.4 Gy, then its mass (in kg) is approximately: (Recall that 1 Ci = 3.7 x 10^{10} Bq)

50 0.02 2250 20 8

21. *

A 60.0-kg radiation worker absorbs 24 joules of energy. His absorbed dose (in rad) is:
(Recall that 1 Ci = 3.7 x 10^{10} Bq)

40 0.4 2.5 2500 250

22. *

The absorbed dose of a radiation worker is 20 rad due to alpha radiation.
His equivalent dose (in Sv) is: (For alpha radiation RBE = 20, and recall that 1 Ci = 3.7 x 10^{10} Bq)

4 0.4 400 20 0.2

23. *

The effective dose of a radiation worker due to alpha radiation is 30 rem.
His absorbed dose (in Gy) is: (For alpha radiation RBE = 20, and recall that 1 Ci = 3.7 x 10^{10} Bq)

0.015 1.5 300 30 15

24. **

The radioactive source ^{99}Tc is used in medicine to treat and diagnose patients. The half-life of this source is 6.05 h. A drug contains 1.6 micrograms of this radioactive source was prepared for a patient. The activity (in Ci) of this source is approximately:
(Recall that 1 Ci = 3.7×10^{10} Bq and $N_A = 6.022 \times 10^{23}$)

8.4 0.14 0.02 3.08×10^{11} 3.08

25. **

The radioactive source ^{99}Tc is used in medicine to treat and diagnose patients. The half-life of this source is 6.05 h. The activity of a drug that was prepared for a patient is 3.1 Ci.
The mass (in micrograms) of the radioactive ^{99}Tc source contained in the drug is approximately:
(Recall that 1 Ci = 3.7×10^{10} Bq and $N_A = 6.022 \times 10^{23}$)

0.59 0.09 9.10 0.25 2.15

26. **

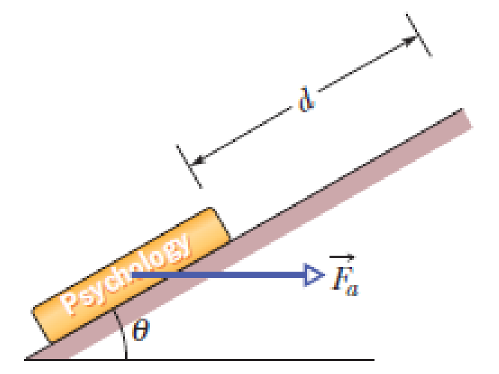
A ^{60}Co source with an activity of 26.0 µCi is embedded in a tumor that has a mass of 0.5 kg. The ^{60}Co emits gamma radiation each with energy of 1.25 MeV. Only half of the emitted gammas are absorbed by the tumor. Assuming the RBE for gamma radiation to be 1.0, what is the equivalent dose that is delivered to the tumor per second? (Recall that 1 Ci = 3.7×10^{10} Bq)

1.92×10^{-5} rem 2.05×10^{-5} rem 5.20×10^{-16} rem 26.00×10^{-5} Sv 1.25×10^{-5} Sv

27. **

The figure shows a 3-kg psychology book, initially with zero kinetic energy, being displaced up a frictionless ramp ($\theta = 30^O$) by an applied force F_a (20 N).
At the end of the displacement (d = 0.5 m),
the speed (in m/s) of the book is:

0.94 1.31 zero 0.67 6.08



28. **

With a 128 J of kinetic energy, a 4 kg ball starts sliding up a rough ramp with inclination of 30^o. How far (in m) will it slide up the ramp knowing that the coefficient of kinetic friction between the ball and the ramp is 0.3?

4.3 17.2 13.6 3.7 3.2

29. **

Starting from rest, a car accelerates in a straight line, achieving speed v. The work needed to accomplish this acceleration is W. The work required to accelerate the same car from v/2 to v is:

¾ W　　　3/2 W　　　¼ W　　　⅜ W　　　½ W

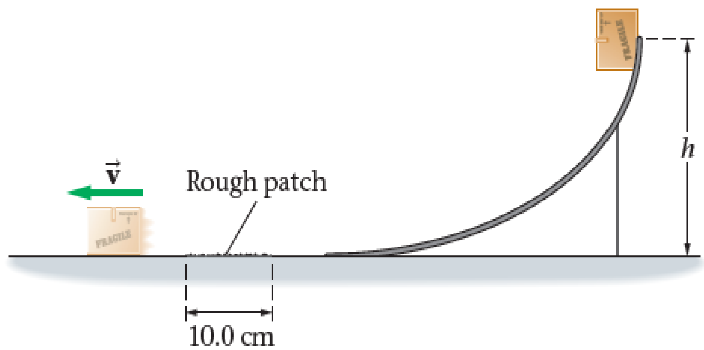
30. **

Starting from rest, a car accelerates in a straight line, achieving speed v in T seconds. Assume that the power delivered by the car's engine remains constant, how much time does it take for the car to accelerate from v to 2v?

3T　　　$\sqrt{2}$T　　　4T　　　2$\sqrt{2}$T　　　2T

31. **

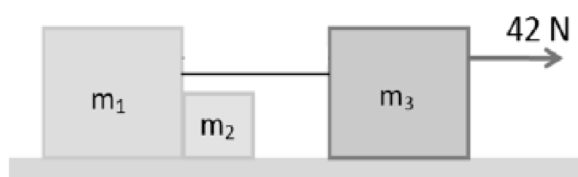
From rest, a 2.3 kg block slides down a frictionless hill and then across a rough patch that has a coefficient of kinetic friction of 0.64. As shown, the velocity of the block after crossing the rough patch is 3.5 m/s directed to the left. What is the vertical height of the hill, *h*, (in m)?



0.69　　　0.56　　　1.06　　　0.62　　　0.96

32. **

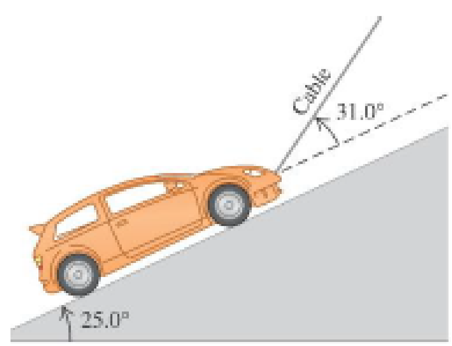
As shown, a 42 N force pulls block m_3, which is connected to block m_1, over a frictionless surface. Take m_1 = 1 kg, m_2 = 2 kg, and m_3 = 3 kg. What is the force (in N) exerted by m_1 on m_2?



14　　　42　　　21　　　28　　　0

33. **

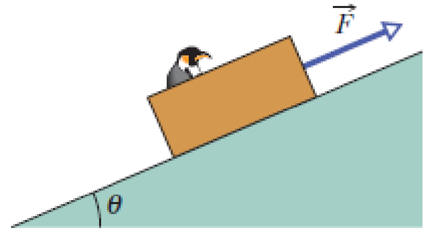
We wish to put a car in equilibrium by pulling it with a cable as shown in the figure. The 1130-kg car is held in place when the cable makes an angle 31.0° with the frictionless incline. The incline itself makes an angle of 25.0° with the horizontal. The normal force (in N) exerted on the car by the incline is:



7.2×10^3　　　1.1×10^4　　　4.8×10^2　　　1.0×10^3　　　2.4×10^3

34. **

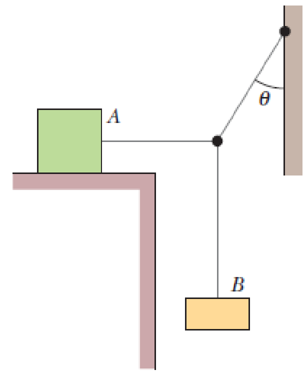
As shown, a penguin inside a box (total loaded mass 4 kg), initially with zero kinetic energy, is displaced up a frictionless inclined plane by a 50 N force. The magnitude of the normal force on the loaded box from the incline is 13.41 N. When the loaded box is displaced 3 m up the incline, it's speed (in m/s) is:



4.44 3.29 70.0 11.41 7.41

35. **

An assembly of two connected blocks (A = 7 kg and B = 3 kg) is shown in the figure. The assembly is in equilibrium. However, block A would slip over the rough table if block B becomes any heavier than 3 kg. When θ is 30°, what is the coefficient of static friction between block A and the table?

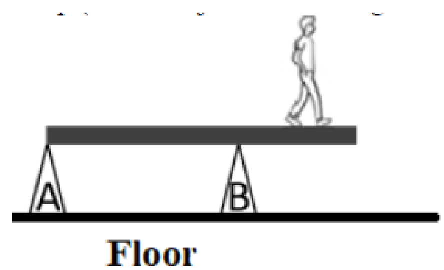


0.25 0.21 0.37 0.11 0.08

36. **

The board shown is at a complete static equilibrium as it rests on the two pivots A and B, which are 4 m apart. A 60-kg PHY 105 student walks slowly towards the right end of the board until he feels that the board is about to tip and lose contact with pivot A. At the tipping moment, determine how far (in m) the student is from pivot A. Assume that the length of the board is 6 m and its mass is 90 kg.

The figure belongs to problems 36 & 37



5.5 4.5 4.8 5.0 6.0

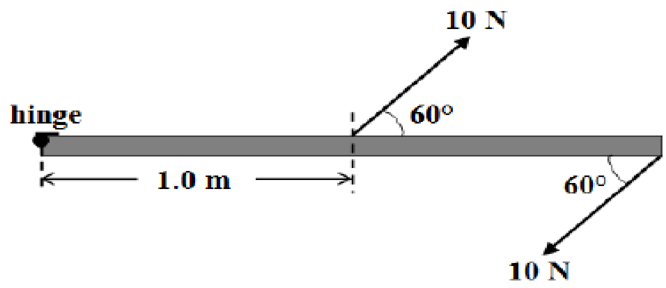
37. **

The board shown is at a complete static equilibrium as it rests on the two pivots A and B, which are 4 m apart. A 60-kg PHY 105 student walks slowly towards the right end of the board until he feels that the board is about to tip and lose contact with pivot A. At the tipping moment, determine how far (in m) the student is from pivot B. Assume that the length of the board is 6 m and its mass is 90 kg.

1.5 0.5 0.8 1.0 2.0

38. **

A 2 m steel rod is hinged as shown. The net torque (in N.m) exerted by the two forces on the rod about a vertical axis passing through the hinge is:

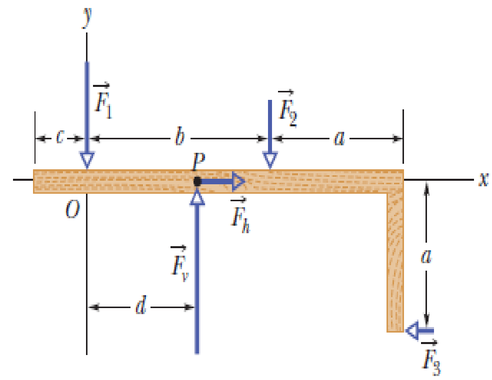


8.7, clockwise   8.7, counterclockwise

26, counterclockwise   26, clockwise   zero

39. **

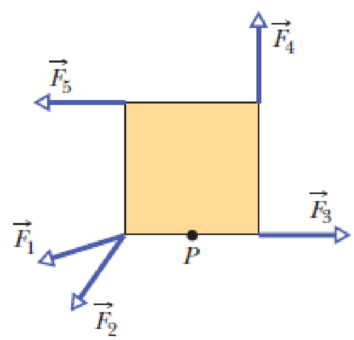
The figure shows three forces $\mathbf{F}_1$, $\mathbf{F}_2$ and $\mathbf{F}_3$ acting on an unstable L-shaped tube. Once a fourth force is applied at point P, the tube has reached the static equilibrium. The fourth force has two components; $\mathbf{F}_v$ and $\mathbf{F}_h$. Take a = 2 m, b = 3 m, c = 1 m, F_1 = 20 N, F_2 = 10 N and F_3 = 5 N.
The distance d (in m) is:



1.33   1.0   0.67   2.67   2.0

40. **

A square of side L is free to rotate about the point P - at the middle of the lower side - as shown in the figure. All five forces acting on the square have the same magnitude. Rank the five torques, τ, produced by those forces, from the greatest to the smallest.



$\tau_5, \tau_4, \tau_2, \tau_1, \tau_3$ $\tau_5, \tau_4 = \tau_2, \tau_1, \tau_3$ $\tau_3 = \tau_4 = \tau_5, \tau_1, \tau_2$

$\tau_4, \tau_5, \tau_2, \tau_1, \tau_3$ $\tau_5, \tau_2, \tau_4, \tau_1, \tau_3$

41. *

A sample consists of N_0 Radon isotopes (^{222}R) at time t = 0. The number of isotopes that remain after half of a half-life equal to: (Recall that 1 Ci = 3.7 x 10^{10} Bq)

$\frac{1}{\sqrt{2}} N_0$ ¼ N_0 ¾ N_0 ⅛ N_0 $\frac{1}{\sqrt{8}} N_0$

42. *

^{15}O is commonly used as a tracer in medical tests. Its half-life is 122 s. How much time does it take for the number of ^{15}O nuclei in a given sample to decrease by a factor of 10^{-4}?
(Recall that 1 Ci = 3.7 x 10^{10} Bq)

27 minutes   1340 seconds   2.4 days   65 minutes   91 minutes

43. **

A pure gold isotope (^{198}Au) with a half-life of 2.70 days is used in cancer treatment.
The mass (in milligram) of this isotope that is required to give an activity of 225 Ci is:
(Recall that 1 Ci = 3.7×10^{10} Bq and $N_A = 6.022 \times 10^{23}$)

0.92 1.07 0.06 0.76 4.03

44. **

The initial activity of isotope M is twice that of isotope N. After two half-lives of isotope M have elapsed, the two isotopes have the same activity.
The ratio of the half-life of N to the half-life of M is: (Recall that 1 Ci = 3.7×10^{10} Bq)

2 4 1 ½ ¼

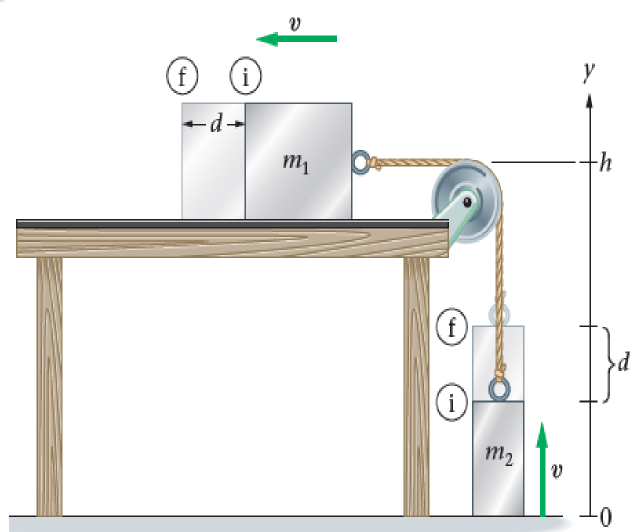
45. **

In a nuclear laboratory hosted by “JU”, a PHY 105 student is investigating two radioactive sources, J and U. The initial activity of J is 16 Ci and that of U is 4 Ci, but after 8 days the two have the same activity of 0.25 Ci. The ratio of the half-life of U to the half-life of J is:
(Recall that 1 Ci = 3.7×10^{10} Bq)

1.54 0.66 1.08 2.00 0.25

46. ***

The two blocks shown (m_1 and m_2) are given an initial velocity, v, in the counterclockwise sense. After traveling the distance d, the two blocks came to a complete stop. Assume that the whole system is frictionless.
The work exerted by the string on m_2 is:



$\frac{1}{2} m_1 v^2$

$\frac{1}{2} (m_1 + m_2) v^2$

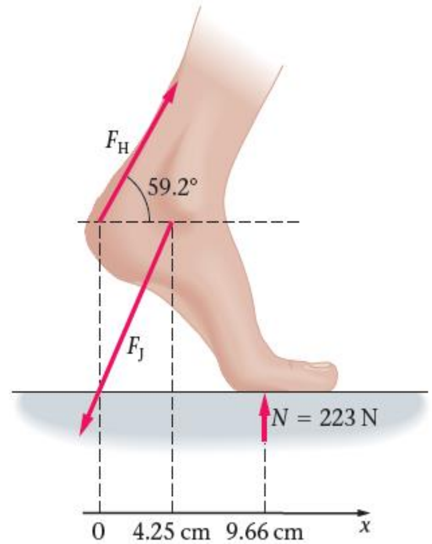
$m_2 g d + \frac{1}{2} m_2 v^2$

$\frac{1}{2} m_2 v^2 - m_2 g d$

$\frac{1}{2} m_2 v^2$

47. ***

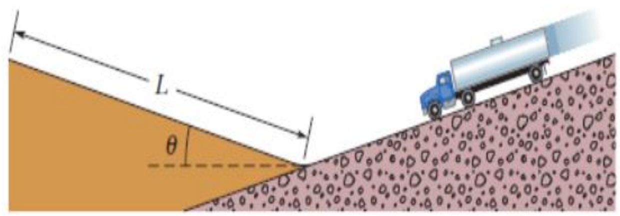
Three forces act on the foot as shown. F_H is the force exerted by the Achilles tendon on the heel. F_J is the force exerted by the ankle joint on the foot. N is the force exerted by the ground on the toes. The foot is in a complete static equilibrium at the moment of consideration. The magnitude of F_J (in terms of the magnitude of the force N) is:



2.39 * N   0.76 * N   1.07 * N   3.11 * N   2.80 * N

48. *

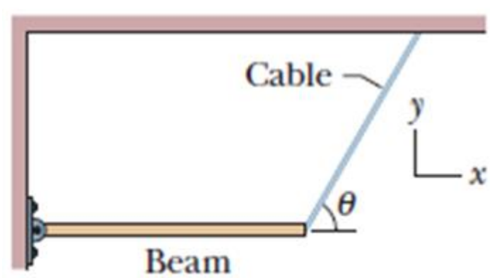
The speed of the truck just before it goes up a frictionless hill (θ = 15°) is 130 km/h. The truck's mass is 1.2×10^4 kg. The minimum length along the hill, L (in m), needed so that the truck will momentarily stop is:



256.8   1800.8   66.5   13.3   1048.7

49 & 50. **

The figure belongs to problems 49 & 50



The 53-kg uniform beam shown is 5.0 m long and is supported in a horizontal position by a hinge and a cable. The beam is in a complete static equilibrium when the angle θ is 60°.

49. As a result, the x-component force (in N) exerted by the hinge on the beam is:

-260   +520   -150   +150   +260

50. As a result, the y-component force (in N) exerted by the hinge on the beam is:

-150   +520   +150   +260   -260

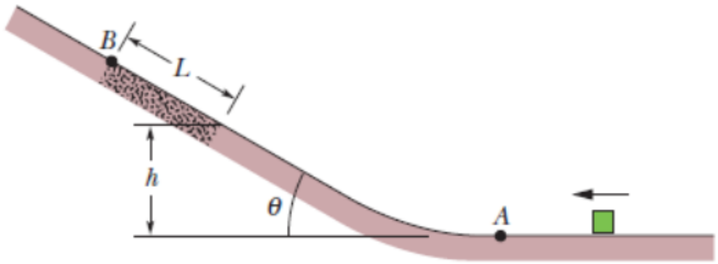
51. *

A 0.15 kg ball is thrown vertically upward from the top of a 10-m high building with an initial speed of 12 m/s. At its highest point, the net force (in N) on the ball is:
(Take $g = 10\ m/s^2$)

9.8, vertically up   9.8, vertically down   zero   1.5, vertically down   1.5, vertically up

52. ***

As shown, a block passes through point A with a speed of 8.0 m/s heading uphill of angle θ = 30° towards point B. The track AB is frictionless except the rough portion L = 0.75 m, which begins at height h = 2.0 m. In this rough portion, the coefficient of kinetic friction is 0.40.



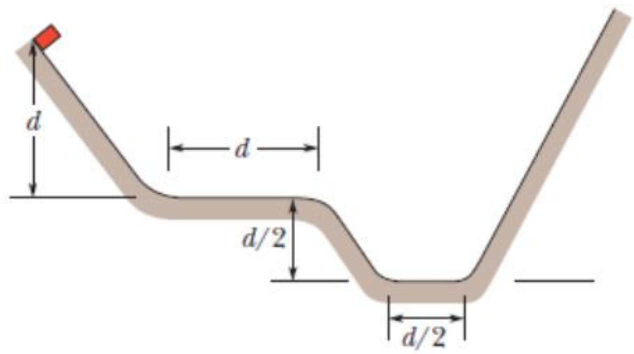
If the block can reach point B (where the friction ends), what is its speed (in m/s) there?

3.52 zero 0.37 4.98

The kinetic energy of the block will turn entirely into potential energy and thermal energy before reaching point B.

53. ***

As shown, a 2-kg block slides from rest down a frictionless hill at height d = 40 cm. It then moves along a horizontal rough level of length d, where the coefficient of kinetic friction is 0.50. If the block is still moving, it then slides down a second frictionless hill at height d/2 and onto a second horizontal rough level, which has length d/2 and where the coefficient of kinetic friction is again 0.50. If the block is still moving, it then slides up a frictionless incline until it momentarily stops. If the block can reach the incline, what is its maximum height (in cm) on the incline measured from the second horizontal level?

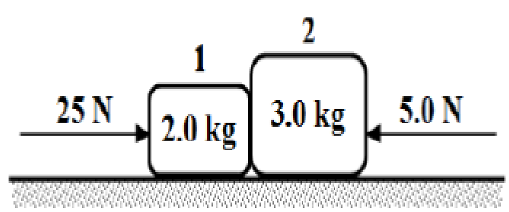


50 30 10 20

The kinetic energy of the block will be dissipated entirely into thermal energy along the second horizontal rough level before start sliding up the incline.

54. **

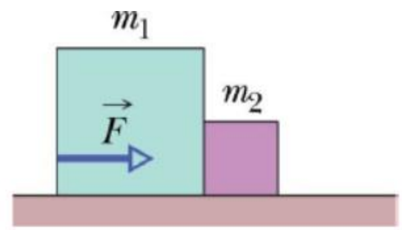
Two blocks of masses 2.0 kg and 3.0 kg move on a horizontal frictionless surface and are subject to two horizontal forces of magnitudes 25 N and 5.0 N, as shown. What is the magnitude of the force (in N) exerted by block 2 on block 1?



37 11 29 21 17

55. **

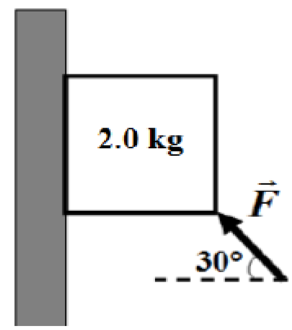
Two blocks, with m_1 = 2.5 kg and m_2 = 1.5 kg, are in contact on a horizontal frictionless table. A horizontal force F is applied to the larger block, as shown. If the magnitude of the force between the two blocks is 1.2 N, what is the magnitude of the applied force F (in N)?



2.0　　3.2　　2.4　　1.2　　5.6

56. **

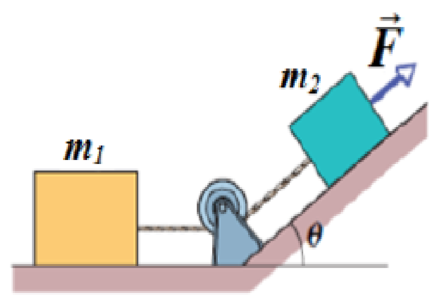
The 2.0 kg box shown in the figure slides down a smooth vertical wall while you push it with a force ***F*** at a 30° angle from the horizontal. What magnitude of the force *F* (in N) should you apply to let the box slide down at a constant speed?



33　　44　　23　　39　　12

57. **

As shown in the figure, a force ***F*** of magnitude 12 N is pulling a box of mass m_2 = 1.0 kg up an inclined plane (θ = 37°). The box is connected by a cord to another box of mass m_1= 3.0 kg on the floor. The floor, plane, and pulley are frictionless, and the masses of the pulley and cord are negligible. What is the tension (in N) in the cord?



5.5　　2.2　　4.6　　1.3　　6.4

58. *

The density of salt water is 1.02 greater than the density of fresh water. A box floats in static equilibrium in both fluids. Which of the following statements is correct?

The volume of the displaced water is the same in both cases.
Buoyant force excreted by salt water is greater than that by fresh water.
Buoyant force is the same in both.
Buoyant force excreted by fresh water is greater than that by salt water.
None of the statements is correct.

59. *

A radioactive sample with decay rate *R* and decay energy *Q* has a power output of

Q/R　　QR　　Q^2R　　R　　QR^2

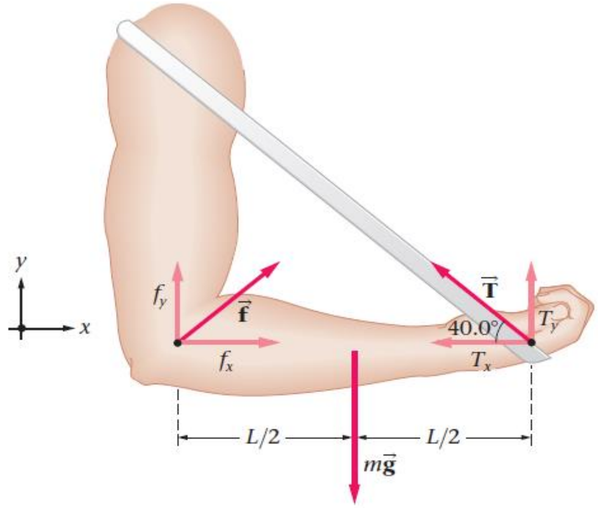
60. *

A certain nucleus containing 8 protons and 7 neutrons has a radius *R*.
Which of the following values would be closest to the expected value of the radius of a nucleus having 51 protons and 69 neutrons?

1.85*R* 2.00*R* 2.14*R* 6.38*R* 8.00*R*

61. **

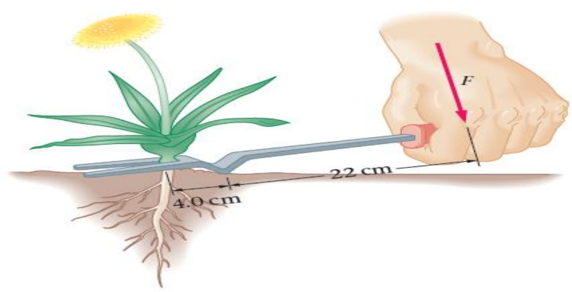
A freshman dental student has a broken forearm (hmm… most likely caused by a combination of tensile and shearing stresses from his/her upcoming PHY_105 final exam!). A cord -stretching from the shoulder to the hand- does hold the forearm **level**. The cord makes an angle of 40.0° with the horizontal. Considering the forearm and hand to be uniform, with a total mass of 1.30 kg and a length of 0.300 m, find: (a) the tension in the cord, **T**.
(b) the horizontal and vertical components of the force, **f**, exerted by the humerus (the bone of the upper arm) on the radius and ulna (the bones of the forearm).



T = 9.92 N, f_x = 7.60 N, and f_y = 6.38 N

62. *

The gardening tool shown is used to pull weeds. If a 1.23 N.m torque is required to pull a given weed, what force did the weed exert on the tool?
F_{weed} = 31 N.



63. *

The speed of light changes when it goes from ethyl alcohol (*n* = 1.36) to carbon tetrachloride (*n* = 1.46). The ratio of the speed in carbon tetrachloride to the speed in ethyl alcohol is:

1.99 1.07 0.932 0.511 0.760

64. *

A layer of water (*n* = 1.333) floats on carbon tetrachloride (*n* = 1.461) contained in an aquarium. To the nearest degree, what is the critical angle at the interface between the two liquids?

88° 78° 66° 58° 43°

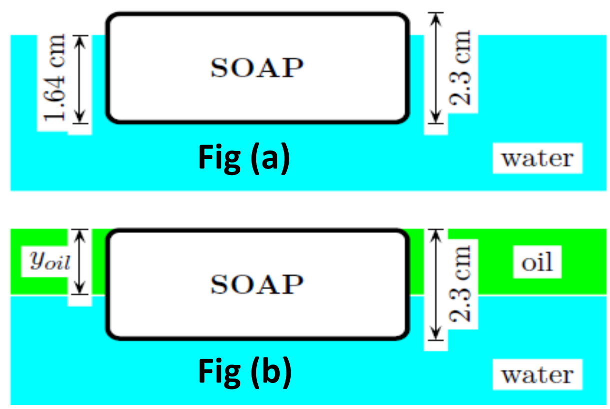
65. **

Aluminum Rod#1 has a length L and a diameter d. Aluminum Rod#2 has a length 2L and a diameter 2d. If Rod#1 is under tension T and Rod#2 is under tension 2T, how do the changes in length of the two rods compare?

They are the same.
Rod#1 has double the change in length that Rod#2 has.
Rod#2 has double the change in length that Rod#1 has.
Rod#1 has quadruple the change in length that Rod#2 has.
Rod#2 has quadruple the change in length that Rod#1 has.

66. ***

A 2.3 cm thick bar of soap is floating on a water surface so that 1.64 cm of the bar is underwater, as shown in Fig (a). An oil with specific gravity 0.6 is poured into the water as shown in Fig (b). What is the depth of the oil layer (y_{oil}) (in cm) when the top of the soap is just level with the upper surface of the oil?



1.65 1.10 0.66 1.15 0.34

67. **

A 3-cm high object is in front of a thin lens. The object distance is 4 cm and the image distance is –8 cm. The image height (in cm) is:

0.5 1 1.5 6 24

68. **

Let *p* denote the object-lens distance and *i* the image-lens distance.
The image produced by a lens of focal length *f* has a height that can be obtained from the object height by multiplying it by:

p/*i* *i*/*p* *f*/*p* *f*/*i* *i*/*f*

69. **

A camera with a lens of focal length 6.0 cm takes a picture of a 1.4-m boy standing 11 m away. The height of the image (in cm) is about:

0.39 0.77 1.5 3.0 6.0

70. **

An erect object is 2*f* in front of a convex lens of focal length *f*. The image is:

real, inverted, magnified
real, erect, same size
real, inverted, same size
virtual, inverted, reduced
real, inverted, reduced