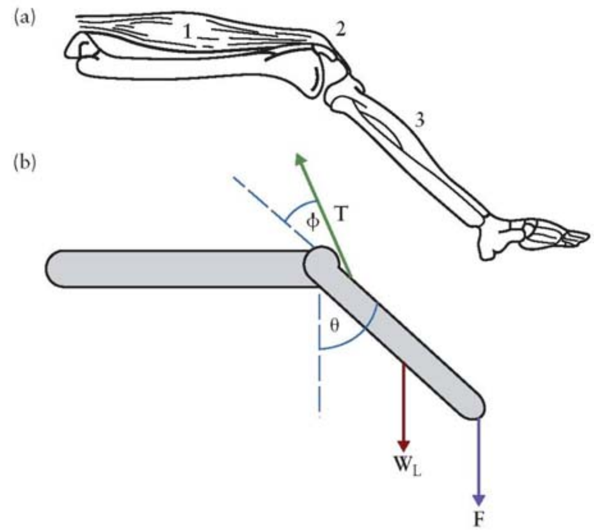
Unit Test I – 2014/2015

(UT-01-1415-01) omitted

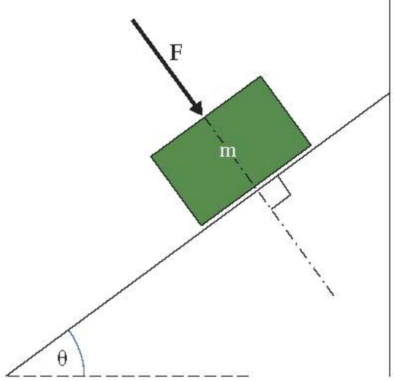
(UT-01-1415-02) What do all forces have in common which we call tensions?

a. They act along a vertical axis
b. They are the smallest force in the respective problem
c. They are always smaller in magnitude than the weight of the object of interest
d. A problem can only be solved if the magnitude of all tension forces are given in the question text
e. None of the above



(UT-01-1415-03) The attached figure (at the right) shows three forces, **T**, $\mathbf{W_L}$ and **F**. These forces act on the lower leg of a person (muscle and bone sketch shown in part (a) of the figure). If the lower leg is held at rest, do the three forces shown constitute all the forces needed to draw the free–body diagram?

a. Yes
b. No, one of the forces **T**, $\mathbf{W_L}$ and **F** does not act on the lower leg
c. No, there is at least one more force missing
d. This depends on the specific question asked in the pertinent problem text



(UT-01-1415-04) The attached figure (at the left) shows an object of mass m on a frictionless inclined plane. The object is pushed with an external force **F** into the inclined plane. How large has the magnitude of **F** at least to be to prevent the object from sliding down the inclined plane?

a. Even a tiny magnitude of force **F** will do
b. Greater than the magnitude of the weight of the object
c. Greater than the magnitude of the normal force acting on the object
d. Greater than the sum of the magnitude of the weight and the magnitude of the normal force acting on the object
e. Significantly greater than any other force acting on the object, because then we can neglect these other forces
f. The object will slide down the inclined plane no matter how large the magnitude of force **F**

(UT-01-1415-05) In the attached figure (at the right) note that the bottle does not fall down onto the table. In which direction does the transparent plastic support exert a force on the bottle? Note that we associate only one force with the interaction between the support and the bottle. (Note: the term "vertical" in answers C and D refers to the direction opposite to the direction of gravity)

a. Toward the upper left
b. Toward the lower right
c. Vertically up
d. Vertically down
e. In another direction than the ones listed in choices (A) through (D)

(UT-01-1415-06) The attached figure (at the right) shows a bat in level flight hunting an insect (the picture is taken from a position below and to the side of the action). Does a force act on the bat in the direction vertically upward (the term vertical is used in reference to the direction perpendicular to the surface of the Earth, not in reference to the direction up or down on the photograph)?

a. Yes
b. No
c. I can answer this question only once I know the magnitude of other forces acting on the bat

(UT-01-1415-07) For an exam, I want to modify Example 4.21 so that it is an application of Newton's first law. What change in the example text will allow me to do this? Hint: You can only answer this question when reviewing the Example and its Solution in the textbook. (It is the one with two objects on two inclined planes connected with a massless string over a frictionless rotating pulley)

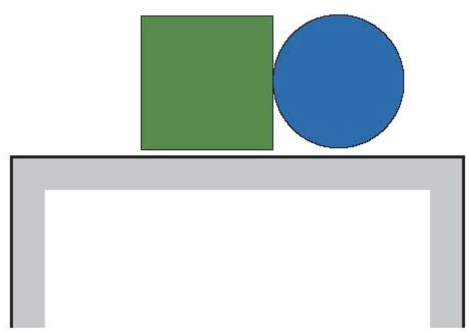
a. Increase mass m_1
b. Decrease mass m_2
c. Increase angle θ_1
d. Increase angle θ_2
e. None of the above will allow me to achieve mechanical equilibrium

(UT-01-1415-08) In problem P-4.14 we discuss that the two objects accelerate. Which change would possibly lead to the two objects moving with constant speed? Hint: you can answer this question without reviewing the Problem text or the Solution to the problem in your homework, just inspect Fig. 4.58. We do not include an additional force to the ones shown. Focus on the object on the incline; the other object follows suit in a odd fashion (due to the frictionless surface, a tension on the lower object will accelerate it initially, then the string loosens and it will move at constant speed without the tension acting on it any further).

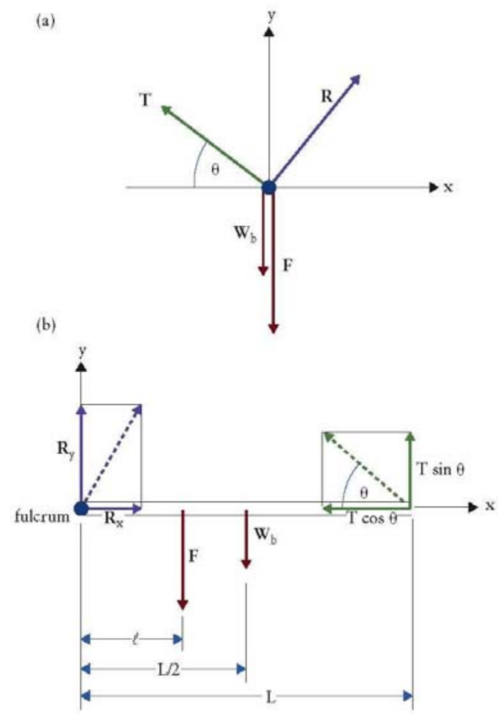
a. There is no change possible to achieve the desired change of the motion of the objects
b. Increase the magnitude of force $\mathbf{F}_{ext}$
c. Decrease the mass m_1
d. Decrease the mass m_2
e. Lower the angle θ
f. Pull with a force of same magnitude as $\mathbf{F}_{ext}$ but at an angle steeper than angle θ.
g. None of the changes suggested in (B) through (F) will do, but it is possible to achieve mechanical equilibrium with other changes to these parameters

(UT-01-1415-09) In the attached figure (at the right), under which circumstances will the force exerted by the green object on the blue object be in magnitude the same as the force exerted by the blue object on the green one?

a. Under no circumstances
b. When the two object have the same mass
c. When an external force acting on the blue object is equal in magnitude to an external force acting on the green object
d. Always

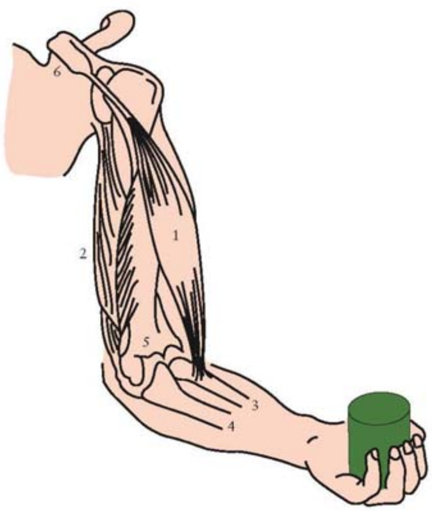


(UT-01-1415-10) The attached figure (at the right) shows a free–body diagram. Without knowing anything else about the problem, but assuming that it is a mechanical problem like the ones in the mechanics chapters of the textbook, what is the greatest possible number of distinguishable objects that are in contact with the object of interest?



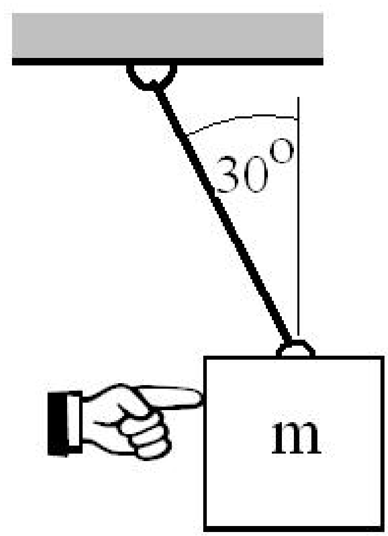
a. None (0)
b. One (1)
c. Two (2)
d. Three (3)
e. Four (4)
f. This cannot be answered from the shown free–body diagram

(UT-01-1415-11) Look at the attached figure (at the left). In a problem about the lower arm and hand (object of interest), which of the following forces will appear in the free–body diagram?



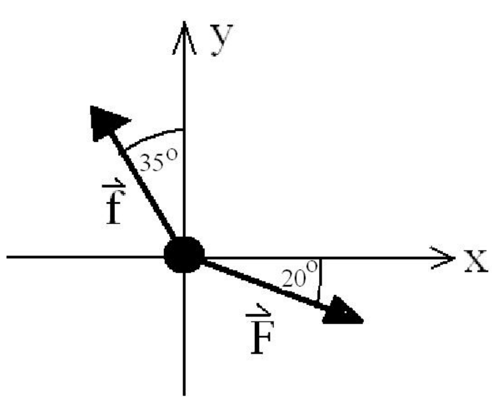
a. The weight of the upper arm
b. The weight of the cylindrical object in the person's hand
c. The weight of the lower arm and hand
d. A force due to the weight of the upper arm
e. A force due to the weight of the lower arm and hand
f. None of the choices (A) through (F) is correct
g. More than one of the choices (A) through (F) is correct

(UT-01-1415-12) The attached figure (at the right) shows a person pushing with an external force an object of mass m = 4.0 kg horizontally to the right. Calculate the magnitude of the external force when the string that holds the object attached to the ceiling forms an angle of 30^0 with the vertical and the object is held in that position at rest.



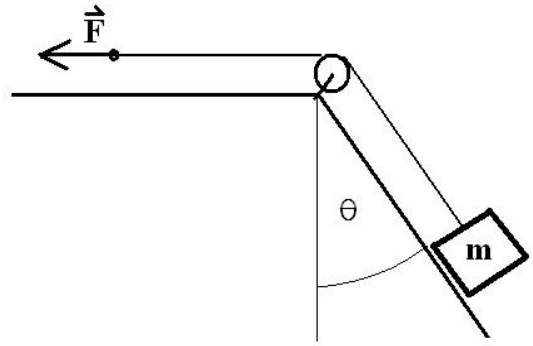
a. $0 \text{ N} \leq F_{ext} < 20 \text{ N}$
b. $20 \text{ N} \leq F_{ext} < 50 \text{ N}$
c. $50 \text{ N} \leq F_{ext} < 80 \text{ N}$
d. $80 \text{ N} \leq F_{ext} < 120 \text{ N}$
e. $120 \text{ N} \leq F_{ext}$

(UT-01-1415-13) The attached figure (at the left) shows an object in a horizontal xy–plane. Three forces act on the object, of which two are shown. These are **f** with magnitude f = 2.0 N, and **F** with magnitude F = 3.0 N. If the third force (balancing force **B**) establishes mechanical equilibrium for the object, what is its x–component?



a. $-5.0 \text{ N} \leq B_x < -1.0 \text{ N}$
b. $-1.0 \text{ N} \leq B_x < 0 \text{ N}$
c. $0 \text{ N} \leq B_x < +1.0 \text{ N}$
d. $+1.0 \text{ N} \leq B_x < +5.0 \text{ N}$
e. $5.0 \text{ N} \leq B_x$

(UT-01-1415-14) The attached figure (at the right) shows an object of mass m on an incline. The angle between the incline and the vertical is $\theta = 30^0$. A string is attached to the object. It runs parallel to the incline in the upward direction, around a pulley and then horizontally to the left. At the end of the string a force **F** of magnitude F = 10 N is applied horizontally toward the left. Calculate the mass m if the object accelerates with magnitude $a = 1.0\ m/s^2$ up along the incline.



$0\ g \le m < 800\ g$
$800\ g \le m < 1.9\ kg$
$1.9\ kg \le m < 3.5\ kg$
$3.5\ kg \le m < 5.0\ kg$
$5.0\ kg \le m$

(UT-01-1415-15) The attached figure (below, to the right) shows an object of mass m = 5.0 kg (red) on a sleigh of mass 2.0 kg (yellow). The object is attached to the sleigh with a hook. The sleigh is attached to a string that runs horizontally to the left, around a pulley, and then horizontally to the right. At its end a force F = 10 N is applied horizontally to the right. Calculate the magnitude of the acceleration, a, of the object on the sleigh.

$0\ m/s^2 \le a < 1.0\ m/s^2$
$1.0\ m/s^2 \le a < 2.0\ m/s^2$
$2.0\ m/s^2 \le a < 3.0\ m/s^2$
$3.0\ m/s^2 \le a < 4.0\ m/s^2$
$4.0\ m/s^2 \le a < 5.0\ m/s^2$
$5.0\ m/s^2 \le a$