Free Body Diagrams Worksheet

10 Practice Questions

Organic Chemistry Tutor

1. Draw a free body diagram for each of the following situations: (a) A box is at rest on a table. (b) A block attached to a rope hangs from a ceiling. (c) A block is pulled upward at constant velocity. (d) A block is pulled upward with a constant acceleration. (e) A block descends lower with a downward acceleration using a rope.

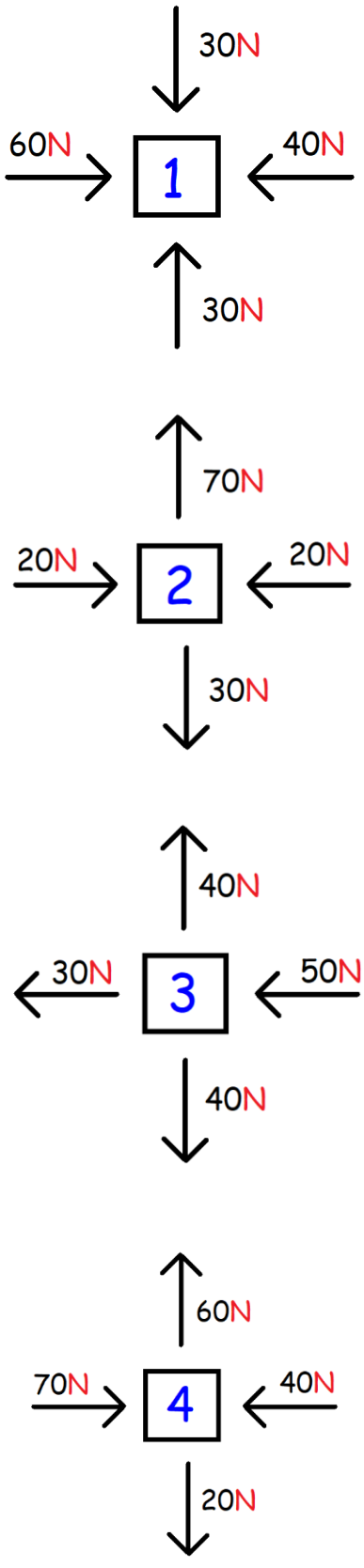
2. Draw a free body diagram for each of the following situations: (a) A block slides across a frictionless horizontal surface at constant speed. (b) An applied force is used to push a box to the right at constant speed. (c) An applied force is used to accelerate a box across a horizontal surface with friction present. (d) A rope is used to pull a block to the right across a horizontal surface with friction present at constant velocity. (e) A rope, directed at 30^{o} above the horizontal, is used to pull a block to the right across a horizontal surface with friction at constant acceleration.

3. Draw a free body diagram for each of the following situations: (a) A block slides down a frictionless incline. (b) A block remains at rest on an incline. (c) A block slides down an incline with friction present at constant acceleration. (d) A rope is used to pull a block up on an incline against friction at constant velocity.

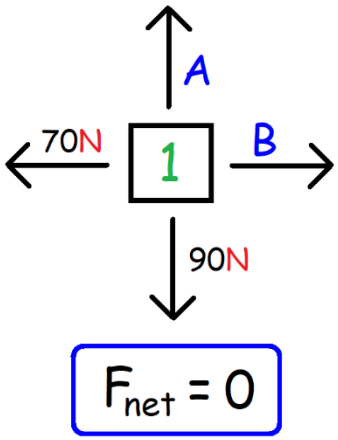
4. Draw a free body diagram for each of the following situations: (a) A projectile is moving horizontally in the air. (b) A rock is thrown horizontally off a cliff against air resistance. (c) A basketball is in free fall at terminal velocity. (d) A car is coasting to the right. (e) A man tries to push a box to the right, but it doesn't move. (f) A rocket accelerates upward toward outer space. (g) A hot air balloon remains afloat in the air. (h) A skier is accelerating down a slope against friction and air resistance.

5. Draw a free body diagram for each of the following situations: (a) A rope is used to pull two blocks (connected by another rope) to the right across a smooth surface. (b) A rope is used to pull three blocks (connected by two other ropes) to the right across a rough surface. (c) Two hanging masses attached to a rope across a frictionless pulley remains at rest. (d) A hanging mass attached to a frictionless pulley that is attached to a block on an incline begins to accelerate downward pulling the block up the incline against friction.

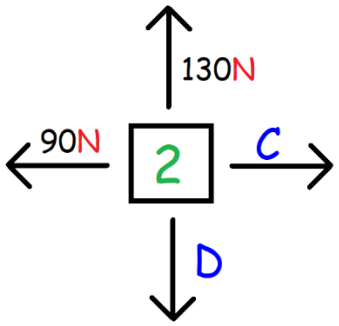
6. Determine the magnitude and direction of the net force on each box:



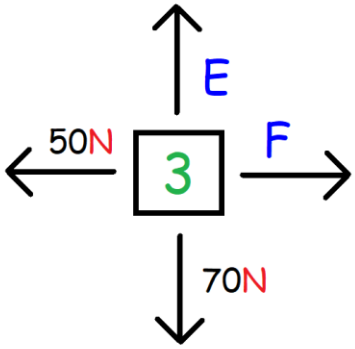
7. Calculate the magnitudes of the missing forces.



$F_{net} = 0$



$F_{net} = -30N$ West



$\sum F_x = +60N$

$\sum F_y = -30N$

8. A horizontal force of 150 N is applied on a 20 kg box which causes it to move to the right. (a) What is the acceleration if there is no friction? (b) What is the acceleration if the coefficient of kinetic friction is 0.25? (c) Using the acceleration in part b, what is the final speed of the box after 8 seconds?

9. A rope lifts a 5 kg box with a tension force of 80 N. What is the acceleration of the box?

10. A 10 kg box rest on a 30^{o} incline and begins to slide down. (a) What is the acceleration if no friction is present? (b) What is the acceleration if the coefficient of kinetic friction is 0.20? (c) What is the final speed of the box when it reaches the bottom of an incline that is 200 m? (Use the answer in part b)

Answers:

1-3. See the free video: https://www.youtube.com/watch?v=52R61aSWHg0

4-5. See the full-length video: https://www.youtube.com/watch?v=d1uEEjfs2iY&t=0s
Patreon: https://www.patreon.com/MathScienceTutor

6a. 20 N East
6b. 40 N North
6c. 80 N West
6d. 50 N @ 53.1° counter-clockwise from the +x-axis

7a. 90 N North
7b. 70 N East
7c. 60 N East
7d. 130 N South
7e. 40 N North
7f. 110 N East

8a. 7.5 m/s^2
8b. 5.1 m/s^2
8c. 40.4 m/s

9. 6.2 m/s^2

10a. 4.9 m/s^2
10b. 3.2 m/s^2
10c. 36 m/s