11. Electromagnetic forces are primarily responsible for all of the following, **except**

a) decay of leaves in compost pile.
b) melting of Plutonium 239.
c) color of Uranium 235.
d) photographing a broken bone with X-ray photons
*e) none of the above

12. Identify states of motion given below, where balanced forces act on the object?

a) When a ball thrown straight upward, reaches the highest point.
b) At the point closest to the catcher, when a pitched baseball is hit.
c) At the lowest point reached by a person bouncing on a trampoline.
d) A car travelling with a constant speed around a circle.
*e) none of the above.

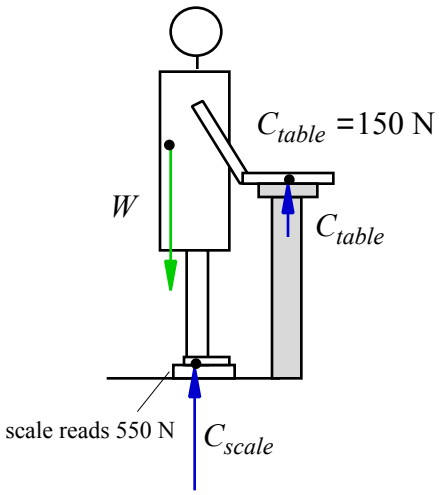
13. Find below the true statement about *mass* or *weight.*

a) A Helium filled balloon has a negative weight.
b) Weight of an object is the same on every planet.
c) The mass of an object in orbit around the earth is zero.
*d) An object orbiting the earth has a weight (gravitational force acting on it).
e) Two objects, each with a 100 kg mass, have a total weight of 200 kilograms.

14. A person stands on an accurate scale that reads 700 N. While still on the scale, the person pushes down on a nearby table with a force of 150 N. What does the scale now read?

a) 850 N
b) 700 N
c) 450 N
*d) 550 N
e) zero

Forces acting **ON** this person when pushing down.



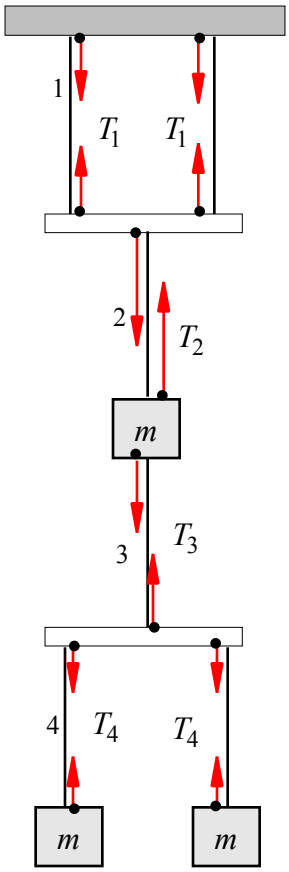
$$C_{scale} + C_{table} = W = 700 \text{ N}$$
$$C_{scale} = W - C_{table}$$
$$= 700 \text{ N} - 150 \text{ N}$$
$$= 550 \text{ N}$$

15. On a planet where g = 20 N/kg , the weight of an object is 1000 N. On the Earth, what is the **weight** of the object?

a) 20000 N
b) 50 N
c) 1000 N
d) 10 N
*e) 500 N

$$m = \frac{W_p}{g_p} = \frac{1000 \text{ N}}{20 \text{ N/ kg}} = 50 \text{ kg}$$
$$W = mg = (50 \text{ kg})(10 \text{ N/ kg}) = \underline{500 \text{ N}}$$

Three masses, each with a mass m, are hung from a ceiling by (massless) wires and bars, as shown in the figure below. To answer the questions, you are advised to draw the tension forces (T_1 to T_4) acting in each of the six wires, and using the balance condition on each mass and bar, determine the tension in each wire.



16. What is the magnitude of the tension force in wire #4?

a) 0.5 *mg* *b) 1.0 *mg* c) 1.5 *mg* d) 2.0 *mg* e) 3.0 *mg*

17. What is the magnitude of the tension force in wire #3?

a) 0.5 *mg* b) 1.0 *mg* c) 1.5 *mg* *d) 2.0 *mg* e) 3.0 *mg*

18. What is the magnitude of the tension force in wire #2?

a) 0.5 *mg* b) 1.0 *mg* c) 1.5 *mg* d) 2.0 *mg* *e) 3.0 *mg*

19. What is the magnitude of the tension force in wire #1?

a) 0.5 *mg* b) 1.0 *mg* *c) 1.5 *mg* d) 2.0 *mg* e) 3.0 *mg*

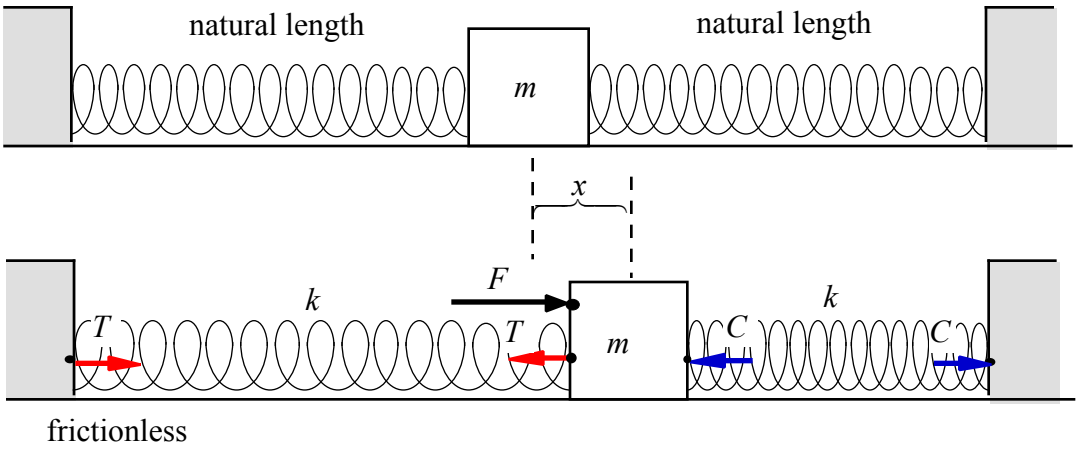


Figure for problem 41

Two natural length springs, each with spring constant k, are attached to a mass and to walls on either side. Applied slowly, a force, F, stretches the spring on the left, and compresses the spring on the right, leaving the mass stationary at a new position, a distance, x, from its original position.

Before answering the following questions, you are advised to draw the tension or compression forces that act at the ends of the springs, and consider the balancing of forces acting on the mass.

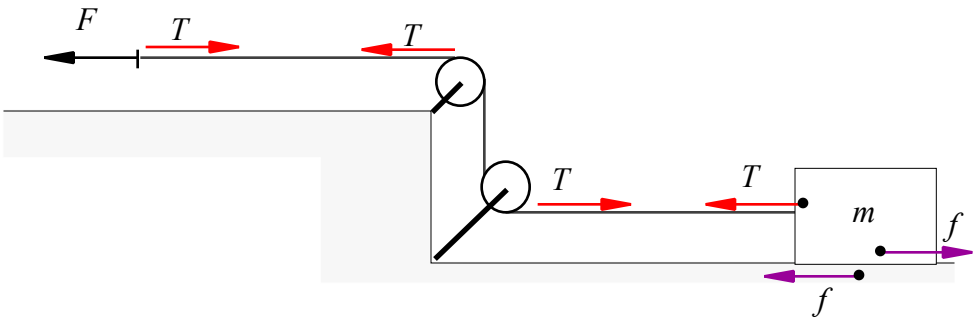
20. What force, F, will move the mass over the distance, x ?

$$\boxed{\begin{aligned} C &= kx; \quad T = kx \\ F &= C + T = 2kx \end{aligned}}$$

a) $F = \dfrac{kx}{2}$ *b) $F = 2kx$ c) $F = kx$ d) $F = \sqrt{2}kx$ e) $F = \dfrac{kx}{\sqrt{2}}$

21. Based on the analysis used to obtain the correct answer to problem 20, which statement below is true.

a) the springs should be considered as being attached in series.
*b) the springs should be considered as being attached in parallel.
($k' = 2k$, parallel springs)
c) the springs cannot be considered as being attached in series or in parallel.
d) the springs can be considered at being attached in series or in parallel.
e) the springs can be considered as being attached in series and in parallel.



A string shown above, pulled on its handle by a force vector, $\mathbf{F} = -F$ (magnitude, F, direction to the left, –), runs over two pulleys (massless and frictionless) and is attached to a mass, m. The mass is observed to be **moving** on the ground **with a constant speed** to the left.

To answer the following questions, you are advised to draw the force vectors acting on the object at the end of each section of string.

22. The ground acts with what frictional force vector, **f**, on the sliding mass?

a) $\mathbf{f} = -mg$ b) $\mathbf{f} = +2mg$ *c) $\mathbf{f} = +F$ d) $\mathbf{f} = +F - mg$ e) $\mathbf{f} = -F$

23. The mass applies what frictional force vector, $\mathbf{f}'$, on the ground?

a) $\mathbf{f}' = +mg$ b) $\mathbf{f}' = -2mg$ c) $\mathbf{f}' = +F$ d) $\mathbf{f}' = -F + mg$ *e) $\mathbf{f}' = -F$

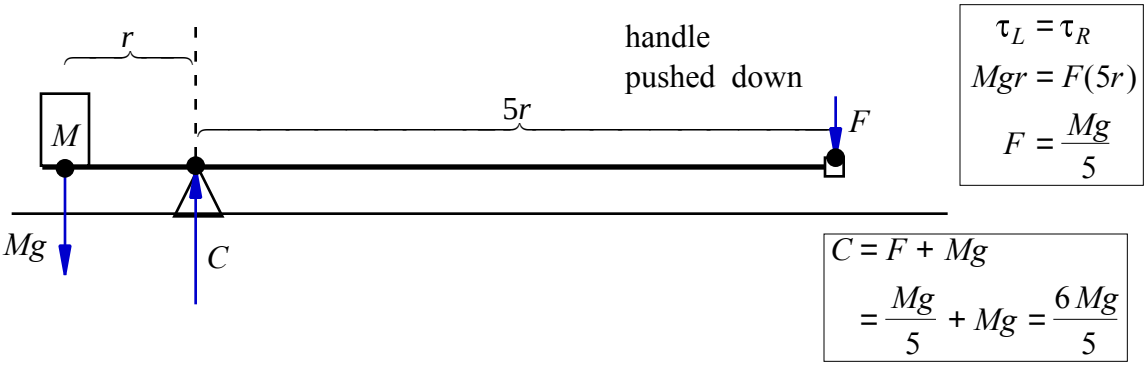


Figure for problem 24

24. A mass, M, rests on a massless board a distance, r, to the left of a pivot. To balance the board, what force magnitude must be applied to a handle a distance, $5r$, to the right of the pivot?

a) $6Mgr$ b) $\frac{6Mg}{5}$ c) $5Mg$ d) $\frac{M}{5}$ *e) $\frac{Mg}{5}$

25. On the same balanced board, what force magnitude does the pivot apply to the board?

a) $6Mgr$ *b) $\frac{6Mg}{5}$ c) $5Mg$ d) $\frac{M}{5}$ e) $\frac{Mg}{5}$