ISP209 Spring 2001 Homework 2 Answers Name: _____
Due: Thurs., Jan. 25, 2:40 pm, in Rm 118PA.. ID:_____

Vectors: magnitude cannot be negative; sign (+/–) is the direction.

1. Which force, electromagnetic(E), gravitational(G), weak nuclear(WN) or strong nuclear(SN), is primarily responsible for the following:

charging a battery. __E__	hitting a baseball. ___E__
shaking of a earthquake. ___E__	skating on a frozen lake. __E__ and __G__
twinkling of star. ___E__	coloring of paints. __E___
cauterizing an injury. ___E__	decay of dead plants. __E___
dying of cloth. __E___	singing a song. __E___
tanning of leather. ___E__	beating of the heart. __E___

2. There are no forces acting a spring. What word describes its length? natural length.

3. With an open hand, you try to apply a force to only one end of an ideal spring (other end free). As it leaves your hand, is the spring moving? YES, Compressed? NO.

4. Choose a magnitude and direction for two force vectors, $\mathbf{F}_1 =$ ±10 lb, and $\mathbf{F}_2 =$ –10 lb, so that they can stretch a stationary spring. (same magnitude, opposite directions)

5. What is the angle between the vectors $\mathbf{F}_1 = -F$ and $\mathbf{F}_2 = +F$? 180°.

6. Is there a value for C making vectors, $\mathbf{C} = -C$ and $\mathbf{T} = +T$, equal, Yes or No? NO
State your reasons for this answer! Vectors in opposite directions cannot be equal.
The magnitude of a vector MUST BE POSITIVE.

7. A physics quantity can be either a vector or a scalar. Is the sum of 5 vectors a *scalar* or a *vector*? vector

8. a) Given that $\mathbf{F} = -F$, and $\mathbf{T} = +T$, where $F = 2T$, What is $\mathbf{S} = \mathbf{F}+\mathbf{T} =$ $-T$

$$\mathbf{S} = \mathbf{F} + \mathbf{T} = (-F) + (T) = (-2T) + (T) = -T$$

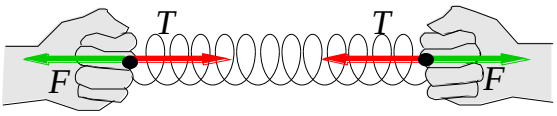
b) A vector sum, $\mathbf{F} + \mathbf{T} = 0$, and $\mathbf{F} = -F$. Which is correct? $\mathbf{T} = +F$ or $\mathbf{T} = -F$.

9. What is the spring-like kid's toy that is definitely not an ideal spring? slinky..

10. What name is given to the force a material generates when stretched? Tension

11. What name is given to the force a material generates when squeezed? Compression

12. Draw below two hands holding a stretched spring, showing the spring and the force vectors *acting on* it, and tension force vectors of the spring acting on the hands.



13. Acting on an object, can two force vectors cancel (have no effect at all)? NO, balanced forces acting on an object generate tension or compression forces in the object.

Show work for all questions. Attach extra sheets if necessary.

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14. Two forces satisfy three conditions if they are going to balance. How many objects can they act on? only ONE. Are the two magnitudes equal or different? magnitudes are equal. Are the two directions the same or opposite? Directions are opposite.

15. Copy a statement of Newton's third law of motion from the text. Between two objects, an *action* force is paired with a *reaction* force of equal magnitude and opposite direction.

16. Normally, how many objects must be involved to find an action - reaction pair of forces? Two. Where on the objects does one find action - reaction force pairs? At the point where the two objects touch, and at all points within the object.

17. Fixed to the ceiling, is a frictionless pulley wheel with a rope hanging over the wheel. The rope tension forces pulling on either side of the wheel must have equal magnitudes. True or False? True .

18. Can two force vectors "balance" and be "equal" at the same time. NO! Balanced forces have opposite directions, while equal forces have the same direction.

19. A spring is stretched by an amount x , by a force applied to both ends of a spring. What is the stretch of the spring if the force on it is doubled? $2x$ Does the force have to be doubled on both sides of the spring for this to happen? YES!

20. The compression force vectors are generated by the top and bottom of the frame as drawn, and have magnitude, C .

21. To balance, the tension T and the compression C are related by : (left side)

$\mathbf{C} = -C$, $\mathbf{T} = +T$, $2\mathbf{C} + 3\mathbf{T} = 0$ (balance),
$2(-C)+3(T) = 0$, therefore, $C = \frac{3T}{2}$

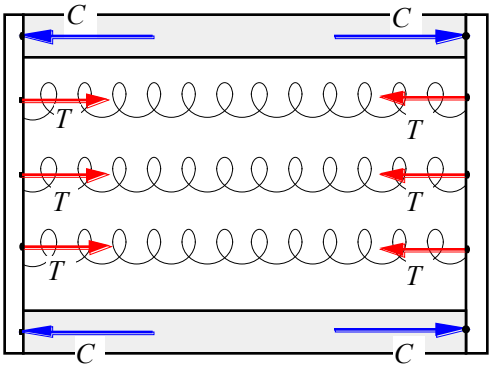

Figure for problems 20 and 21.

22. The tension force vectors, magnitude T, generated by each spring are drawn.

23. The relationship between the value of C, and the value of T, that will balance is:

(left side) $\mathbf{C} = -C$, $\mathbf{T} = +T$, $\mathbf{C} + 4\mathbf{T} = 0$
$(-C) + (4T) = 0$, therefore, $T = \frac{C}{4}$

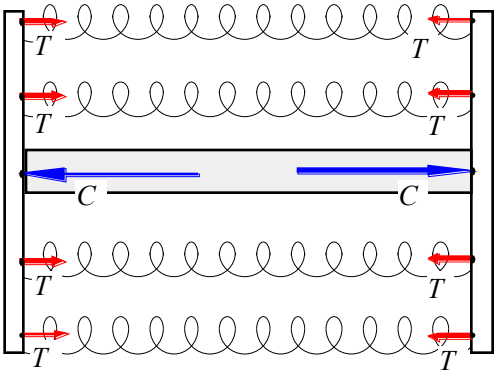

Figure for problems 22 and 23.

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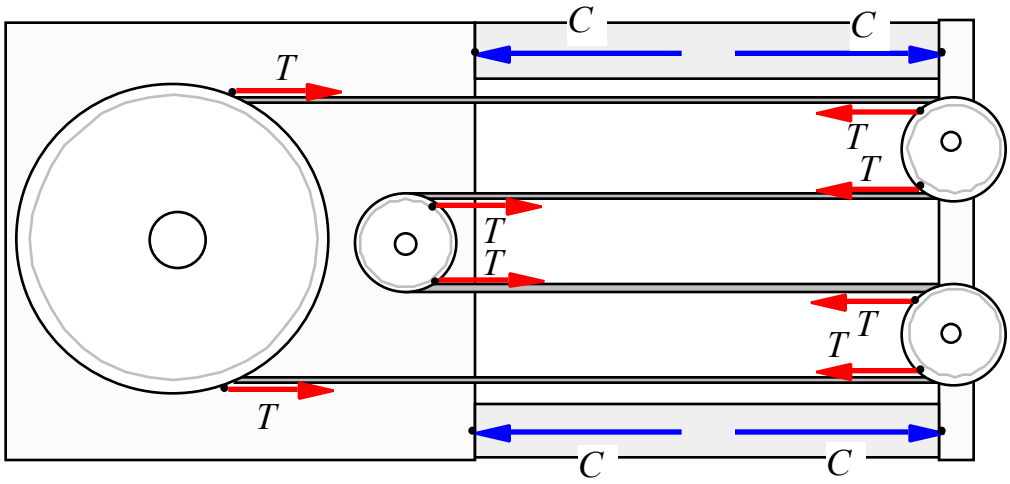

Figure for Problem 24 and 25

24. Three small pulleys and one large pulley are mounted on a frame. A belt with tension, T, runs over the pulleys causing compression forces, C , in the top and bottom of the frame as shown in the figure. With a reasonable length and standard labels, draw on the figure all tension vectors acting in each of the 4 sections of the belt.

25 The relationship between the tension T and compression C is $\underline{C = 2T}$, and the vectors are drawn to agree with this.

To balance either side: $2C = 4T$, therefore $C = 2T$

Show work for all questions. Attach extra sheets if necessary.