ZTF Test Review

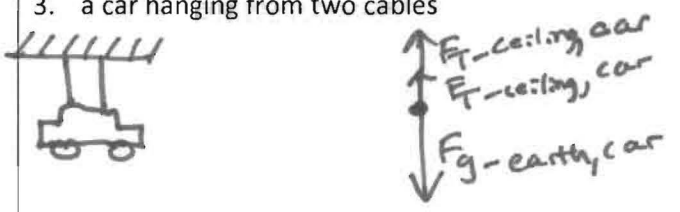
Name KEY Pd _____

Draw and label a force diagram of the following:

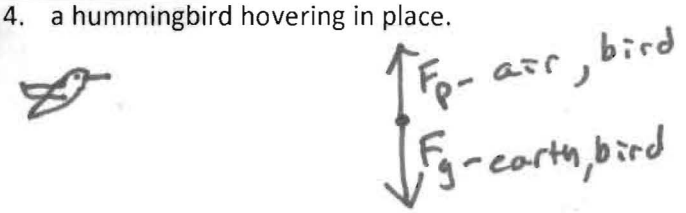
1. a box lying flat on the floor.

2. a hockey puck moving at constant velocity across frictionless ice

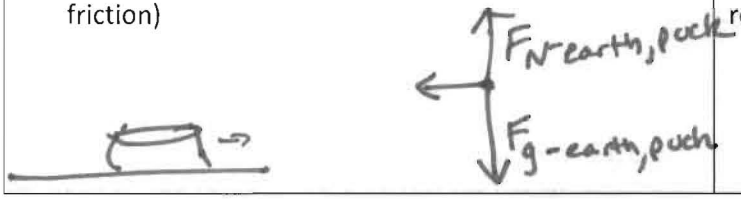
3. a car hanging from two cables



4. a hummingbird hovering in place.



5. a hockey puck sliding across the floor (yes there is friction)



6. a football in the air during a kickoff (ignore friction/air resistance)

7. A frictionless bowling ball is rolled down a frictionless bowling lane. Describe the motion of the ball as it travels down the lane. Also describe the forces as it travels down the lane.

The ball will roll with a constant velocity. There will be a F_g down and a F_N up. $F_g + F_N$ will balance.

8. Write all 3 of Newton's laws and give an example of each.

1. Balanced forces cause constant velocity. Unbalanced forces cause changing velocity. Ex: Freefall is unbalanced - has acceleration.
2. $F=ma$
3. Forces come in pairs; for every force there is an equal & opposite force.

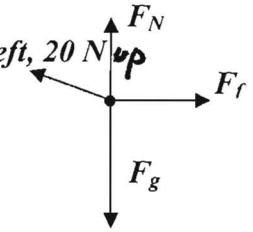
9. A Chevy Silverado pickup truck pulls a trailer with 900N of force which causes it to accelerate. How does the force of the truck on the trailer compare to the force of the trailer on the car?

equal but opposite

10. The same truck comes across a car stuck in a mud pit. The truck slowly pushes the car out of the mud using 800N of force. How does the force of the truck on the car compare to the car on the truck?

equal but opposite

11. To the right is a force diagram for an 20kg object sliding (via a rope) with constant velocity on a surface. What must be the coefficient of friction? $F_f = F_T = 40N$ $F_N = F_g - 20N$



$F_g = 9.8 \cdot 20kg = 196N$

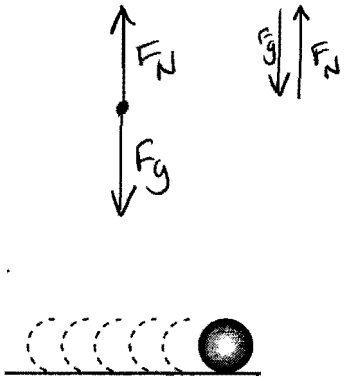
$F_N = 196N - 20N = 176N$

$$\mu = \frac{F_f}{F_N} = \frac{40N}{176N} = \boxed{0.23}$$

Draw a **force diagram** and **vector addition diagram** for each of the situations below. Label all forces and quantities.

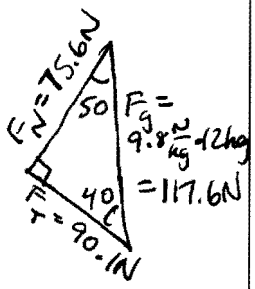
12. 4 kg bowling ball rolls at constant speed without friction

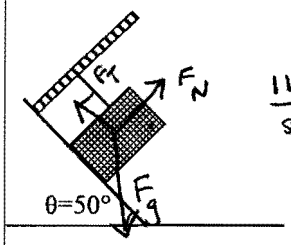
$\Delta v = 0 \rightarrow a = 0 \rightarrow \Sigma F = 0$



13. The 12 kg box is motionless.

$\Delta v = 0 \rightarrow a = 0 \rightarrow \Sigma F = 0$



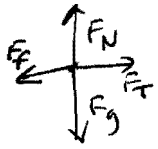


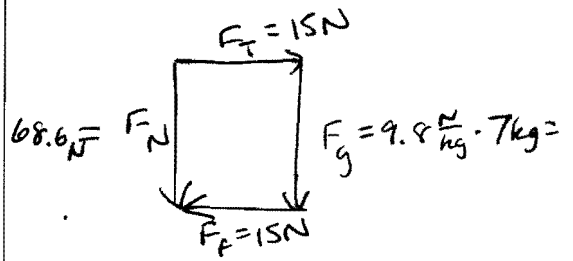
$\frac{117.6N}{\sin 90} = \frac{F_N}{\sin 40}$ $F_N = 75.6N$

$\frac{117.6N}{\sin 90} = \frac{F_T}{\sin 50}$ $F_T = 90.1N$

14. The 7 kg box is pulled by a 15 N force parallel to the surface at a constant speed.

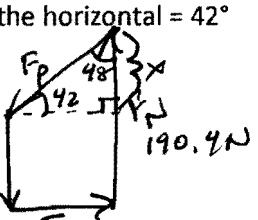
$\Delta v = 0 \rightarrow a = 0 \rightarrow \Sigma F = 0$





15. A 15kg object is pushed by a 65N force applied downward at an angle. The box doesn't budge.
The angle between the push and the horizontal = 42°

$\Delta v = 0 \rightarrow a = 0 \rightarrow \Sigma F = 0$



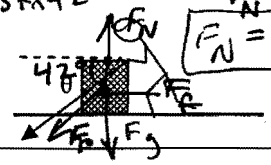
$15kg \cdot 9.8\frac{N}{kg} = 147 = F_g$

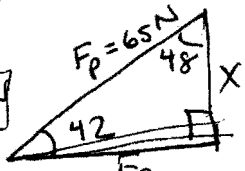
$\frac{F_p}{\sin 48} = \frac{65N}{\sin 90}$ $F_p = 48.3N$

$\frac{X}{\sin 42} = \frac{65N}{\sin 90}$ $X = 43.4N$

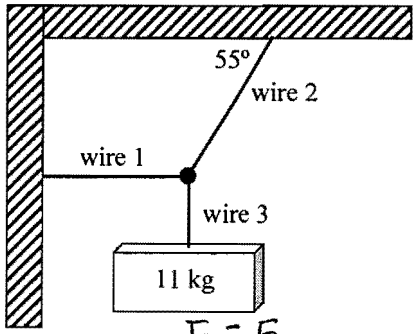
$F_N = F_g + X$

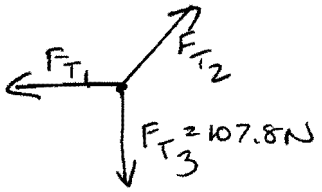
$F_N = 190.4N$





16. What tension is necessary in each wire in order to support the object as pictured below? Draw a force diagram and a vector addition diagram.

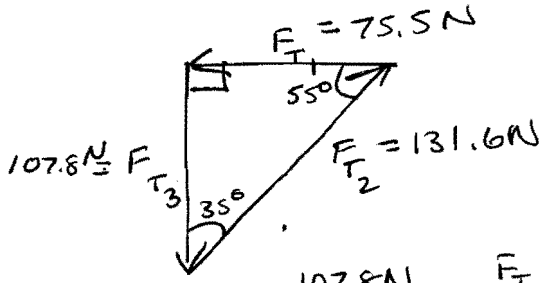




$F_g = F_{T_3}$

$= 11kg \cdot 9.8\frac{N}{kg}$

$= 107.8N$



$\frac{107.8N}{\sin 55} = \frac{F_{T_2}}{\sin 90}$

$F_{T_2} = 131.6N$

$\frac{107.8N}{\sin 55} = \frac{F_{T_1}}{\sin 35}$

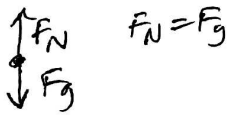
$F_{T_1} = 75.5N$

KEY

$F_f = \mu \cdot F_N$	$F_g = g \cdot m$	$\frac{a}{\sin A} = \frac{b}{\sin B}$

17. Define the following forces (explain how strong it is, what it acts upon, and where it is found):
    a) Strong: strongest of all forces, Holds nucleus together.
    b) Electromagnetic: Attraction between opposite charges. Holds molecules together. 2nd strongest.
    c) Weak: only in radioactive decay - found in nucleus, 3rd strongest.
    d) Gravity: Attracts matter (mass) to other matter. Can act across large distances. Is weakest force.
18. Explain how objects fall differently on the moon compared to the earth. What is the same about how they fall?
    Objects fall at the same rate on the moon because there is no air resistance. They have a lower rate of acceleration than earth, but otherwise gravity acts the same.
19. Why don't things fall off the moon?
    Even though there is less gravity, there is still gravity.

20. A box of cereal with a mass of 0.8 kg is placed on a kitchen counter. What force must the counter exert in order to support the box?



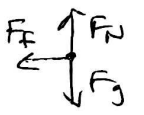
$F_N = F_g$

$F_g = 9.8\ N/kg \cdot 0.8\ kg = 7.84N$

21. A jug of water with a mass of 2.0 kg is slid across a kitchen counter. If the coefficient of friction between the jug and the counter is 0.10, then what force of friction must be acting on the carton?

$F_f = \mu F_N$

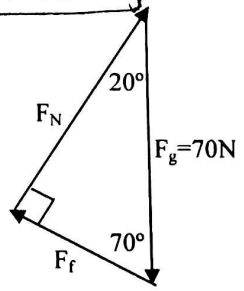
$F_N = F_g$



$F_g = 9.8\ N/kg \cdot 2.0\ kg = 19.6N$

$F_f = 0.10 \cdot 19.6N = 1.96N$

22. Calculate the normal force (F_N), force friction (F_f), and coefficient of friction (μ) for the following vector addition diagram:



$\frac{70N}{\sin 90} = \frac{F_f}{\sin 20}$

$F_f = 70N \sin 20 = 23.9N$

$\frac{70N}{\sin 90} = \frac{F_N}{\sin 70}$

$F_N = 70N \sin 70 = 65.8N$