UCONN Physics / 70

Copy # _____

Unit 3 & 4: (Chapters 3 & 4) Pre-test

Directions: Use provided formula and conversion sheets provided. Do NOT write on this Pre-test if you wish to do your best on the actual test. I will not collect this pre-test, but writing on it will put you at a disadvantage for studying. Each question is worth 2 pts. You will have one class period to complete the actual test, therefore time yourself appropriately and don't spend too much time on any one question.

1) The resultant of two vectors is the smallest when the angle between them is
A) 0°.
B) 45°.
C) 90°.
D) 180°.

2) A ball is thrown with a velocity of 20 m/s at an angle of 60° above the horizontal. What is the horizontal component of its instantaneous velocity at the exact top of its trajectory?
A) 10 m/s
B) 17 m/s
C) 20 m/s
D) zero

3) An Olympic athlete throws a javelin at four different angles above the horizontal, each with the same speed: 30°, 40°, 60°, and 80°. Which two throws cause the javelin to land the same distance away?
A) 30° and 80°
B) 40° and 60°
C) 40° and 80°
D) 30° and 60°

4) A plane flying horizontally at a speed of 50.0 m/s and at an elevation of 160 m drops a package. Two seconds later it drops a second package. How far apart will the two packages land on the ground?
A) 100 m
B) 162 m
C) 177 m
D) 283 m

5) Your motorboat can move at 30 km/h in still water. How much time will it take you to move 12 km downstream, in a river flowing at 6.0 km/h?
A) 20 min
B) 22 min
C) 24 min
D) 30 min

6) If you walk 6.0 km in a straight line in a direction north of east and you end up 2.0 km north and several kilometers east. How many degrees north of east have you walked?
A) 19°
B) 45°
C) 60°
D) 71°

7) Two vectors $\vec{A}$ and $\vec{B}$ have components (0, 1) and (-1, 3), respectively. What are the components of the sum of these two vectors?
A) (1, 4)
B) (-1, 4)
C) (1, 2)
D) (-1, 2)

8) Vector $\vec{A}$ = (1, 3). Vector $\vec{B}$ = (3, 0). Vector $\vec{C} = \vec{A} + \vec{B}$. What is the magnitude of $\vec{C}$?
A) 3
B) 4
C) 5
D) 7

9) If vector $\vec{A}$ = (-3.0, -4.0) and vector $\vec{B}$ = (+3.0, -8.0), what is the magnitude of vector $\vec{C} = \vec{A} - \vec{B}$?
A) 13
B) 16
C) 144
D) 7.2

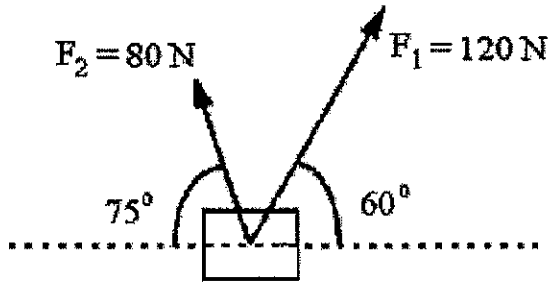


FIGURE 3-1

10) Two forces are acting on an object as shown in Fig. 3-1. What is the magnitude of the resultant force?
A) 47.5 N
B) 185 N
C) 198 N
D) 200 N

11) A ball thrown horizontally from a point 24 m above the ground, strikes the ground after traveling horizontally a distance of 18 m. With what speed was it thrown?
A) 6.1 m/s
B) 7.4 m/s
C) 8.1 m/s
D) 8.9 m/s

12) A projectile is launched with an initial velocity of 60.0 m/s at an angle of 30.0° above the horizontal. How far does it travel?
A) 152 m
B) 160 m
C) 184 m
D) 318 m

13) A fighter plane moving 200 m/s horizontally fires a projectile with speed 50.0 m/s in a forward direction 30.0° below the horizontal. What is the speed of the projectile with respect to a stationary observer on the ground?
A) 245 m/s
B) 250 m/s
C) 268 m/s
D) 293 m/s

14) A swimmer heading directly across a river 200 m wide reaches the opposite bank in 6 min 40 s. She is swept downstream 480 m. What is the speed of the current?
A) 0.50 m/s
B) 1.2 m/s
C) 1.4 m/s
D) 1.8 m/s

15) Which of Newton's laws best explains why motorists should buckle-up?
A) the first law
B) the second law
C) the third law
D) the law of gravitation

16) In the absence of an external force, a moving object will
A) stop immediately.
B) slow down and eventually come to a stop.
C) go faster and faster.
D) move with constant velocity.

17) A constant net force acts on an object. Describe the motion of the object.
A) constant acceleration
B) constant speed
C) constant velocity
D) increasing acceleration

18) Two cars collide head-on. At every moment during the collision, the magnitude of the force the first car exerts on the second is exactly equal to the magnitude of the force the second car exerts on the first. This is an example of
A) Newton's first law.
B) Newton's second law.
C) Newton's third law.
D) Newton's law of gravitation.

19) A 20-N weight and a 5.0-N weight are dropped simultaneously from the same height. Ignore air resistance. Compare their accelerations.
A) The 20 N weight accelerates faster because it is heavier.
B) The 20 N weight accelerates faster because it has more inertia.
C) The 5.0 N weight accelerates faster because it has a smaller mass.
D) They both accelerate at the same rate because they have the same weight to mass ratio.

20) An object of mass "m" is hanging by a string from the ceiling of an elevator. The elevator is moving up at constant speed. What is the tension in the string?
A) less than mg
B) exactly mg
C) greater than mg
D) cannot be determined without knowing the speed

21) An object of mass m is hanging by a string from the ceiling of an elevator. The elevator is moving upward, but slowing down. What is the tension in the string?
A) less than mg
B) exactly mg
C) greater than mg
D) zero

22) The force that keeps you from sliding on an icy sidewalk is
A) weight.
B) kinetic friction.
C) static friction.
D) normal force.

23) It's more difficult to start moving a heavy carton from rest than it is to keep pushing it with constant velocity, because
A) the normal force is greater when the carton is at rest.
B) $\mu_s < \mu_k$
C) initially, the normal force is not perpendicular to the applied force.
D) $\mu_k < \mu_s$.

24) A packing crate slides down an inclined ramp at constant velocity. Thus we can deduce that
A) a frictional force is acting on it.
B) a net downward force is acting on it.
C) it may be accelerating.
D) it is not acted on by appreciable gravitational force.

25) A block of mass M slides down a frictionless plane inclined at an angle θ with the horizontal. The normal reaction force exerted by the plane on the block is directed
A) parallel to the plane in the same direction as the movement of the block.
B) parallel to the plane in the opposite direction as the movement of the block
C) perpendicular to the plane.
D) toward the center of the Earth.

26) Starting from rest, a 4.0-kg body reaches a speed of 8.0 m/s in 2.0 s. What is the net force acting on the body?
A) 4.0 N
B) 8.0 N
C) 16 N
D) 32 N

27) What is the mass of an object that weighs 250 N on the surface of the Earth where the acceleration due to gravity is 9.80 m/s^2?
A) 250 kg
B) 24.5 kg
C) 25.5 kg
D) 2,450 kg

28) A person on a scale rides in an elevator. If the mass of the person is 60.0 kg and the elevator accelerates downward with an acceleration of 4.90 m/s^2, what is the reading on the scale?
A) 147 N
B) 294 N
C) 588 N
D) 882 N

29) A student pulls a box of books on a smooth horizontal floor with a force of 100 N in a direction of 37° above the horizontal. If the mass of the box and the books is 40.0 kg, what is the acceleration of the box?

A) 1.5 m/s^2

B) 1.9 m/s^2

C) 2.0 m/s^2

D) 3.3 m/s^2

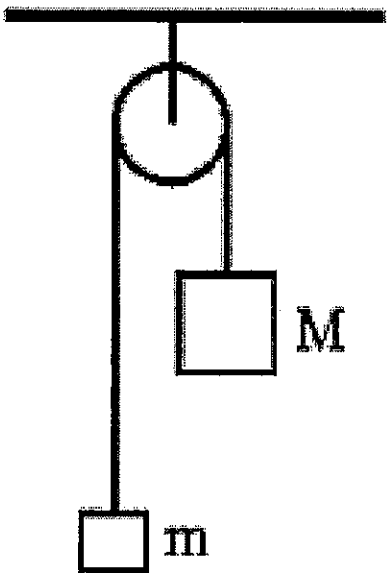


FIGURE 4-1

30) In the Atwood machine shown in Fig. 4-1, if M = 0.60 kg and m = 0.40 kg, what is the magnitude of the acceleration of the system? (Ignore friction and the mass of the pulley.)

A) 5.3 m/s^2

B) 3.9 m/s^2

C) 2.0 m/s^2

D) 0.98 m/s^2

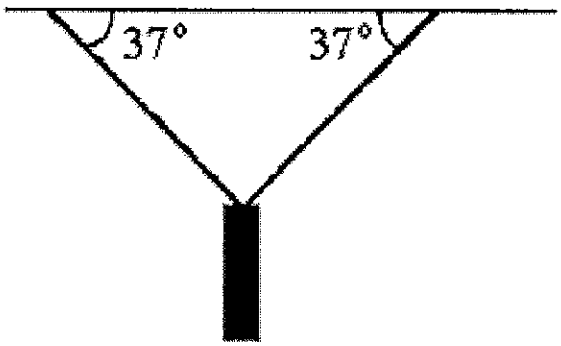


FIGURE 4-2

31) In Fig. 4-2, if the tensions in the ropes are 50 N, what is the mass of the traffic light?

A) 3.1 kg

B) 4.1 kg

C) 6.1 kg

D) 8.1 kg

32) The coefficient of static and kinetic frictions between a 3.0-kg box and a desk are 0.40 and 0.30, respectively. What is the net force on the box when a 15 N horizontal force is applied to the box?
A) 6.2 N
B) 12 N
C) 8.8 N
D) zero

33) A horizontal force of 5.0 N accelerates a 4.0-kg mass, from rest, at a rate of 0.50 m/s^2 in the positive direction. What friction force acts on the mass?
A) 2.0 N
B) 3.0 N
C) 4.0 N
D) 5.0 N

34) A 10-kg mass slides down a flat hill that makes an angle of 10° with the horizontal. If friction is negligible, what is the resultant force on the sled?
A) 1.7 N
B) 17 N
C) 97 N
D) 98 N

35) A wooden block slides directly down an inclined plane, at a constant velocity of 6.0 m/s. What is the coefficient of kinetic friction, if the plane makes an angle of 25° with the horizontal?
A) 0.47
B) 0.42
C) 0.37
D) 0.91

CHAPTER / UNIT # 3 1/4 ANSWER SHEET NAME: KEY

COPY # N/A PERIOD: _____

FORM N/A / DATE: _____

DIRECTIONS: Use the back side for any Bonus problems and be sure to identify the bonus area. The "Work Area" is to be used like scrap paper. If you need additional paper, raise your hand and I will provide you additional paper. Any extra scrap paper needs to be stapled to this answer sheet. GOOD LUCK!!

D	1.	C	26.
A	2.	C	27.
D	3.	B	28.
A	4.	C	29.
A	5.	C	30.
A	6.	C	31.
B	7.	A	32.
C	8.	B	33.
D	9.	B	34.
B	10.	A	35.
C	11.		36.
D	12.		37.
A	13.		38.
B	14.		39.
A	15.		40.
D	16.		41.
A	17.		42.
C	18.		43.
D	19.		44.
B	20.		45.
A	21.		46.
C	22.		47.
D	23.		48.
A	24.		49.
C	25		50.

WORK AREA

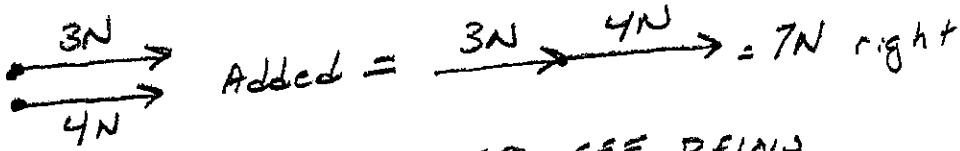
BONUS WORK ON BACK

UNIT 3 & 4
PRE-TEST
GUIDE

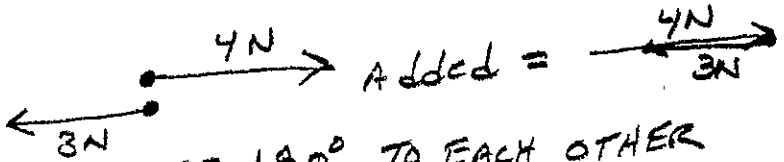
UCONN
PHYSICS
1201Q

* USE THIS AS A GUIDE TO HELP YOU ANSWER EACH QUESTION. EACH QUESTION IS DESIGNED TO ADDRESS A COMPONENT FOUND IN EACH CHAPTER OR UNIT COVERED.

(1) RESULTANT IS ALWAYS LARGEST WHEN ANGLE BETWEEN VECTORS ARE 0°. SEE BELOW,

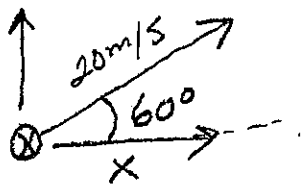


LEAST WHEN OPPOSING EACH OTHER. SEE BELOW



or 180° TO EACH OTHER

(2)

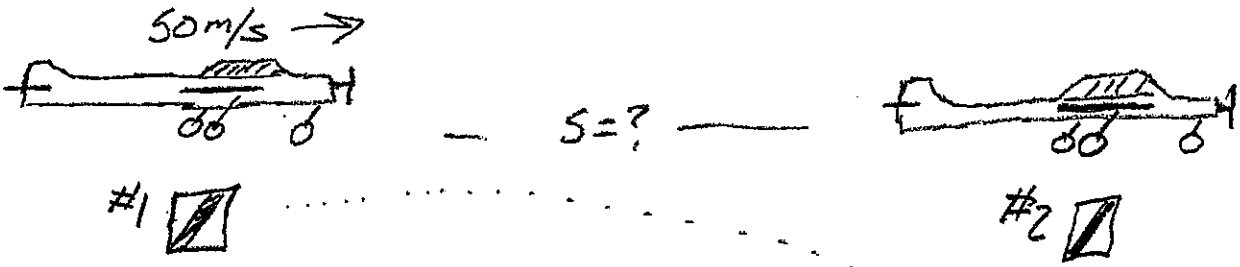


Horizontal component is the same at any point due to gravity being perpendicular

$$\cos 60° = \frac{x}{20\,m/s} \qquad x = 10.0\ m/s$$

(3) THROWING @ 45° yields best Horizontal Distance. THROW Equal Angles From 45° will Land in the SAME LOCATION.

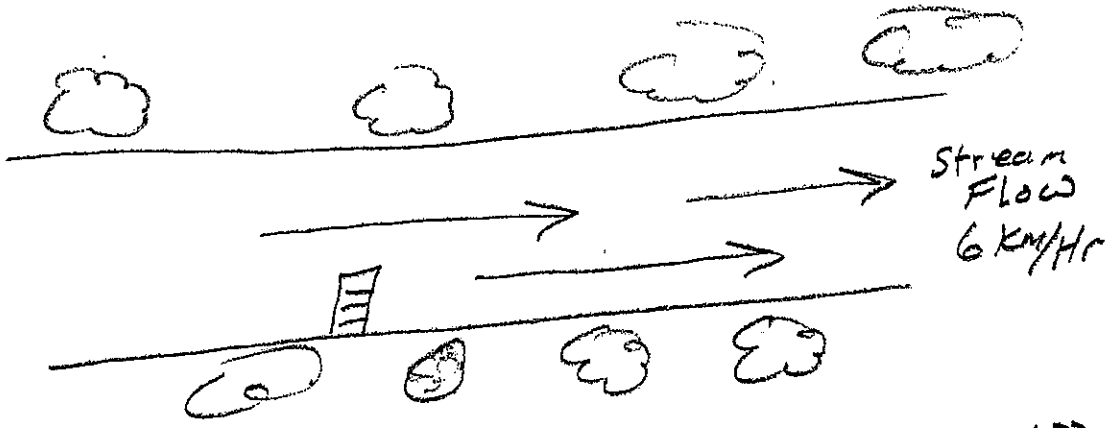
(4)



Both Plane and package move Horizontally @ 50m/s, AND will continue to move Horizontally @ 50m/s IN THE ABSENCE OF AIR RESISTANCE.

∴ USE $\bar{V} = \frac{s}{t}$ to calculate the separation Horizontally each package is away from each other.

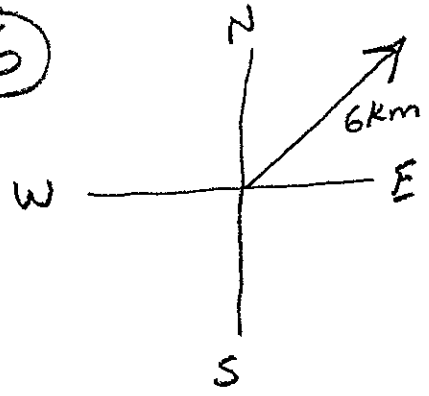
(5)

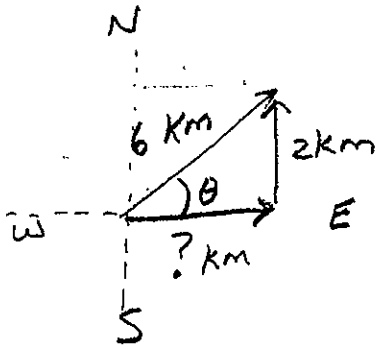


IF MOTORBOAT GOES WITH THE STREAM ADD ITS VECTOR TO STREAM. (SEE QUESTION #1)

USE $\bar{V} = \frac{s}{t}$ to Find Time. Convert TO minutes.

(6)





USE SOHCAHTOA TO SOLVE ANGLE θ.

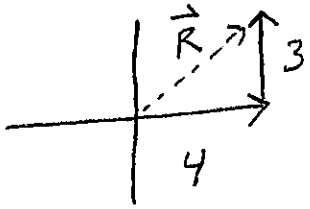
(7)

	x	y
$\vec{A}$	0	1
$\vec{B}$	-1	3
$\vec{R}$	-1	4

$\Leftarrow$ COMPONENTS

(8)

	x	y
$\vec{A}$	1	3
$\vec{B}$	3	0
$\vec{R}$	4	3

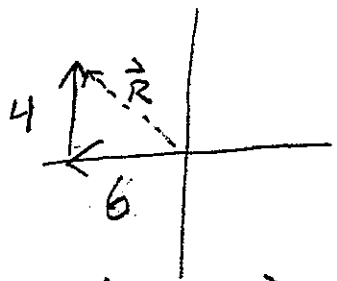


USE PYTHAGOREAN'S THEORUM TO SOLVE

(9)

	x	y
$\vec{A}$	-3	-4
$\vec{B}$	+3	-8
$\vec{A}+\vec{B}=$	0	-12

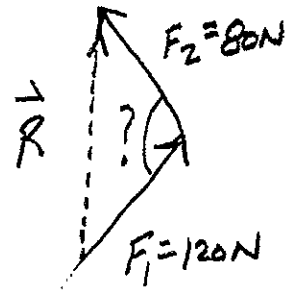
	x	y
$\vec{A}$	-3	-4
$-\vec{B}$	-3	8
$\vec{A}-\vec{B}=$	-6	4



$\vec{C}=\vec{A}-\vec{B}$

NOTE THE DIFFERENCE, AS VECTOR $\vec{B}$ IS MADE NEGATIVE. NOW USE PYTHAGOREAN'S THEORUM TO SOLVE.

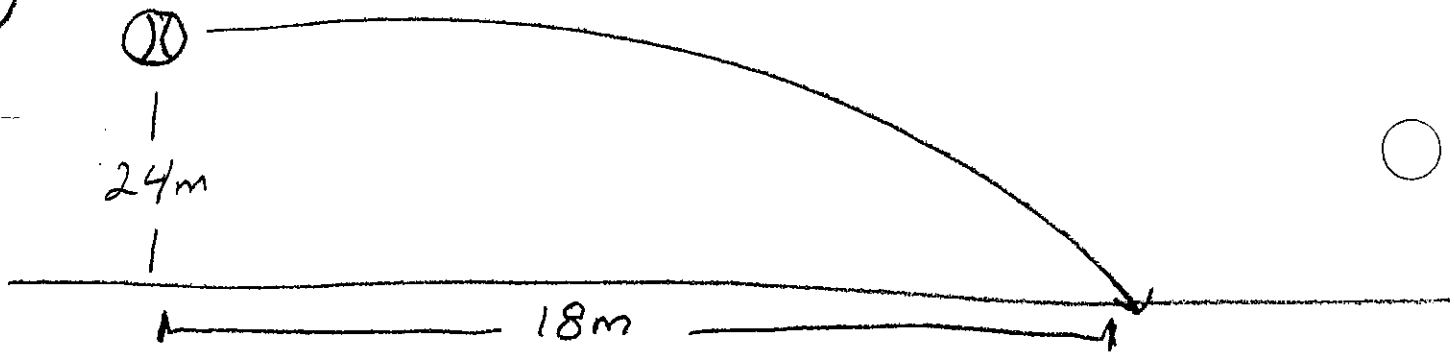
(10) SOLVE THE ANGLE BETWEEN F_2 and F_1. NOW Add these two vectors together - Vectorally by USING "HEAD-TO-TAIL" METHOD.



SOLVE FOR THE INSIDE ANGLE.

NOW USE Law of COSINES TO SOLVE FOR $\vec{R}$.

(11)



THE HORIZONTAL SPEED ($\bar{V}$) DOES NOT CHANGE, AS IT IS PERPENDICULAR TO GRAVITY.

$\therefore \bar{V} = \frac{S}{t}$ WE NEED TIME TO SOLVE ($\bar{V}$).

SOLVE TIME (t) IN THE AIR, BY SOLVING IT USING VERTICAL INFO.

$V_0 = 0 m/s \quad a = 9.8 m/s^2 \quad S = 24m \quad t = ?$

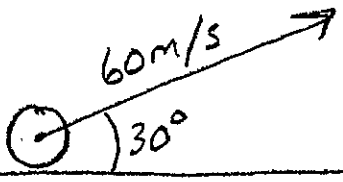
$$S = V_0 t + \tfrac{1}{2} a t^2$$

or

$$S = \tfrac{1}{2} a t^2$$

$$t = \sqrt{\frac{2S}{a}}$$

(12)

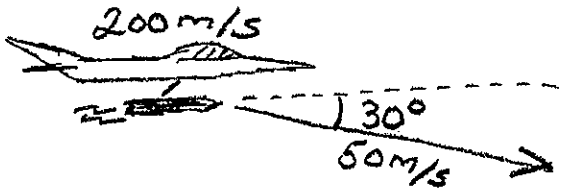


#1 Solve FOR HORIZONTAL AND VERTICAL COMPONENTS

#2 USE VERTICAL COMPONENT TO SOLVE FOR TIME IN THE AIR

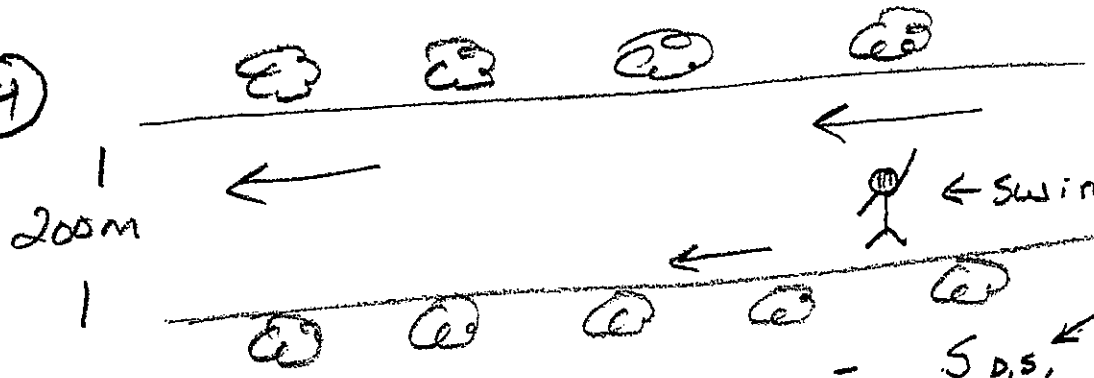
#3 USE THIS TIME WITH HORIZONTAL COMPONENT ($\vec{V}$) TO SOLVE HORIZONTAL DISPLACEMENT

(13)



DETERMINE HORIZONTAL COMPONENT OF PROJECTILE WITH SOHCAHTOA. ADD THIS TO PLANES VELOCITY VECTOR.

(14)



$\bar{V}_{D.S.} = \frac{S_{D.S.}}{t}$ ← D.S. (Down Stream)

$t = 6\text{min } 40\text{sec} = 400\text{sec}$

$S_{D.S.} = 480\text{m}$

$\bar{V}_{D.S.} = ?$

(15) INERTIA - OBJECTS IN MOTION REMAIN IN MOTION UNLESS ACTED ON BY AN UNBALANCED FORCE (F_{NET})

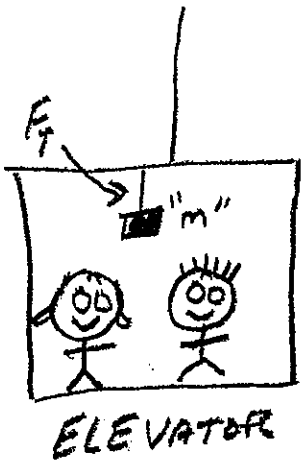
(16) ONLY EXTERNAL FORCES CAN CHANGE AN OBJECTS MOTION THESE ARE NET FORCES.

(17) NET FORCES CAUSE ACCELERATION

(18) 1ST LAW = INERTIA
2ND LAW = ($F=ma$) NET FORCES
3rd LAW = ACTION / REACTION

(19) LARGE OBJECT HAS MORE WEIGHT, THUS MORE GRAVITY PULLING, BUT IT HAS MORE INERTIA WHICH BALANCES THE "MORE" GRAVITY ∴ BOTH OBJECT FALL AT THE SAME RATE.

(20)

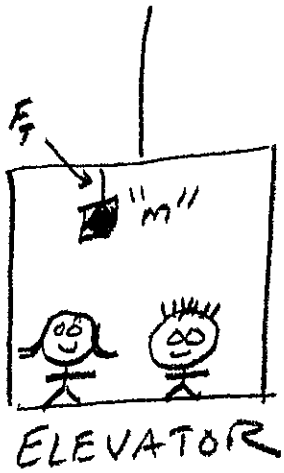


MOVING AT A CONSTANT SPEED MEANS ACCELERATION = 0

$\therefore F_T = mg \pm ma \quad a = 0$

$\therefore F_T = mg$ i.e. NO NET FORCE

(21)



ELEVATOR IS MOVING UP, BUT SLOWING DOWN, OBJECT "m" INERTIA WANTS TO KEEP MOVING UP $\therefore$ REDUCING TENSION (F_T) IN String.

$(F_T = mg - ma)$

(22) Look up Definitions

(23) Coefficient of Friction (μ) ← "mu" is ALWAY Greater FOR STATIC THEN KINETIC FRICTION.

(24) ANYTIME CONSTANT VELOCITY IS MENTIONED, Acceleration = 0
∴ NO NET FORCE, WHICH IS DUE TO FRICTION BALANCING FORCES.

(25) Look up Definition TO "Force Normal"

(26) 

IDENTIFY "GIVENS" & "UNKNOWNS"

$V_0 = 0\ m/s$
$V_f = 8\ m/s$
$t = 2\ sec$
$a = ?$

NET FORCE
$F = ma$
$F = 4kg\ a$

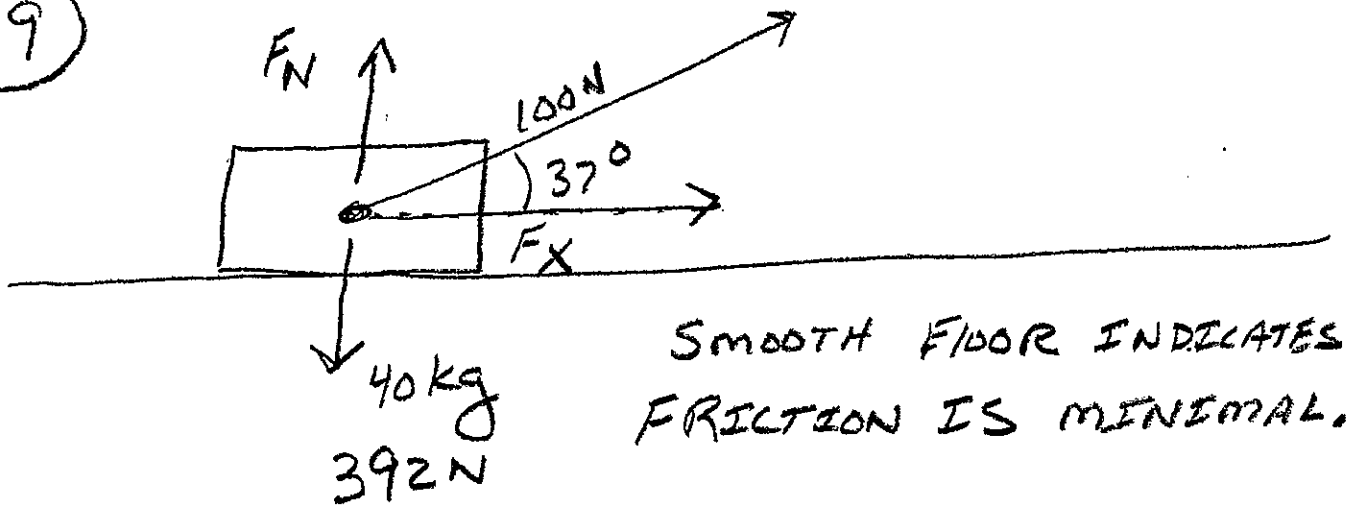
SOLVE For "a", then PUT INTO NET FORCE FORMULA.

(27) Weight = mg, Substitute AND SOLVE

(28) SCALE READS Apparent Weight WHEN Accelerating or Decelerating

$F = mg \pm ma$ Decide to use "+" or "−".

(29)

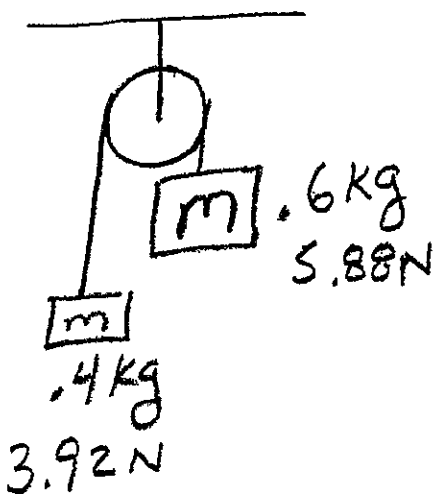


SMOOTH FLOOR INDICATES FRICTION IS MINIMAL.

DRAW FREE-BODY DIAGRAM.

SOLVE "F_X". SINCE BOOKS Accelerate Horizontally, WE NEED A Horizontal Force (F_X) THEN USE $F=ma$ TO SOLVE "a".

(30)



#1. SoLve mass INTO Weights

#2. THEY PULL AGAINST EACH OTHER

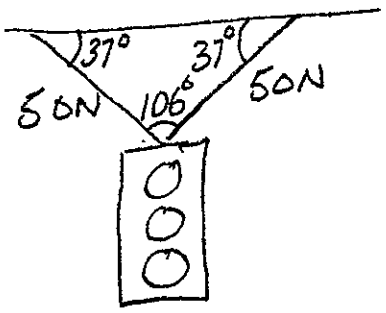
#3. DETERMINE "NET FORCE"

#4. USE $F=ma$ TO CALCULATE "a"

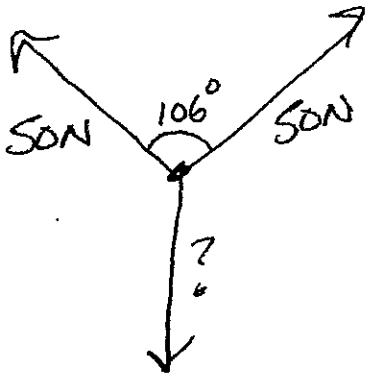
#5. !! IMPORTANT

NOTE: How much mass is moving By the Net FORCE!?

(31)



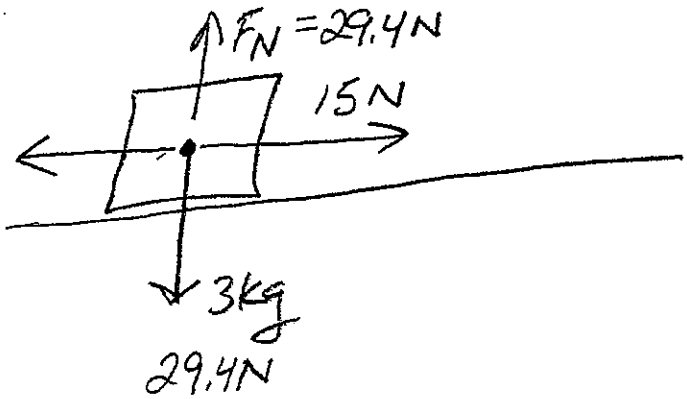
DRAW FREE-BODY DIAGRAM



SOLVE LIKE DONE IN LAB, SOLVE FOR $\vec{R}$ OF BOTH 50N VECTORS. EQUILIBRANT IS THE TRAFFIC LIGHT.

REMEMBER TO CONVERT NEWTONS BACK TO "kg". $F=ma$ $m=\frac{F}{a}$

(32)



$F_{fr} = \mu F_N$

$F_{fr} = 0.3(29.4N)$

$F_{fr} = 8.82N$

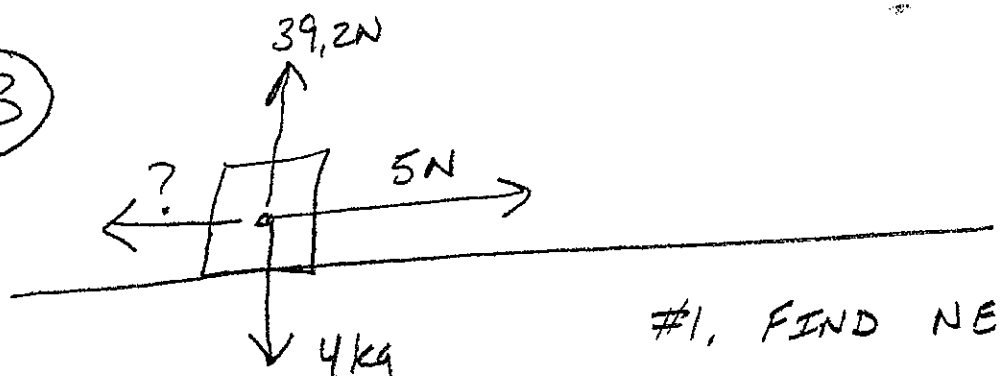
$\mu_s = 0.4$

$\mu_K = 0.3$

STATC COEFFICIENT CREATS 11.76N OF Friction [$F_{fr} = 0.4(29.4N)$] TO START BUT DROPS TO 8.82N AS SOON AS IT BEGINS TO MOVE

∴ Acceleration is based on μ_K.

(33)



#1, FIND NET FORCE

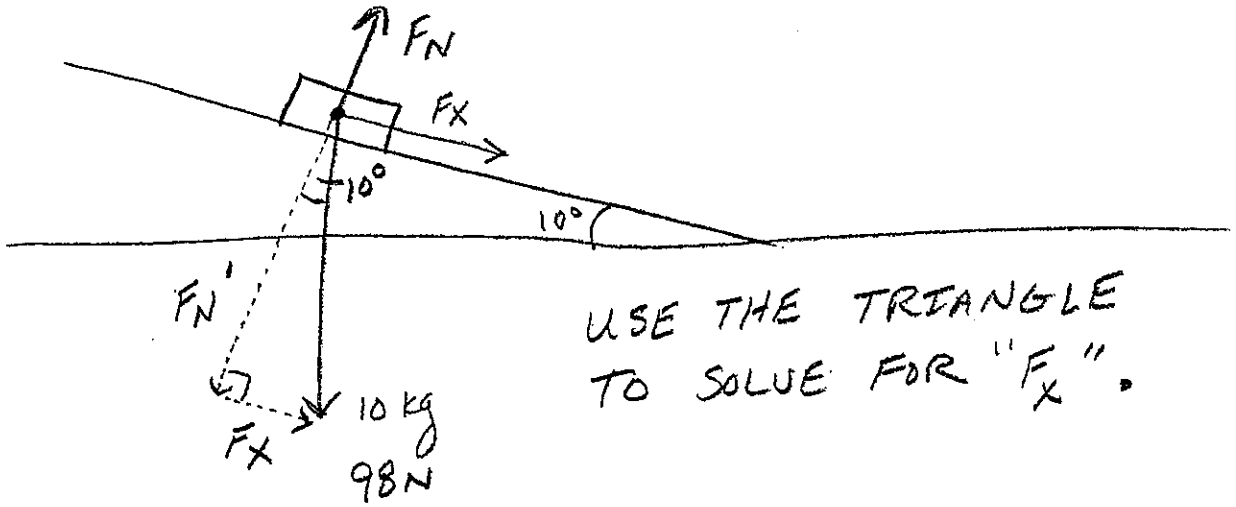
$F = ma$

$F = 4kg(0.5m/s^2)$

$F_{NET} = 2N$

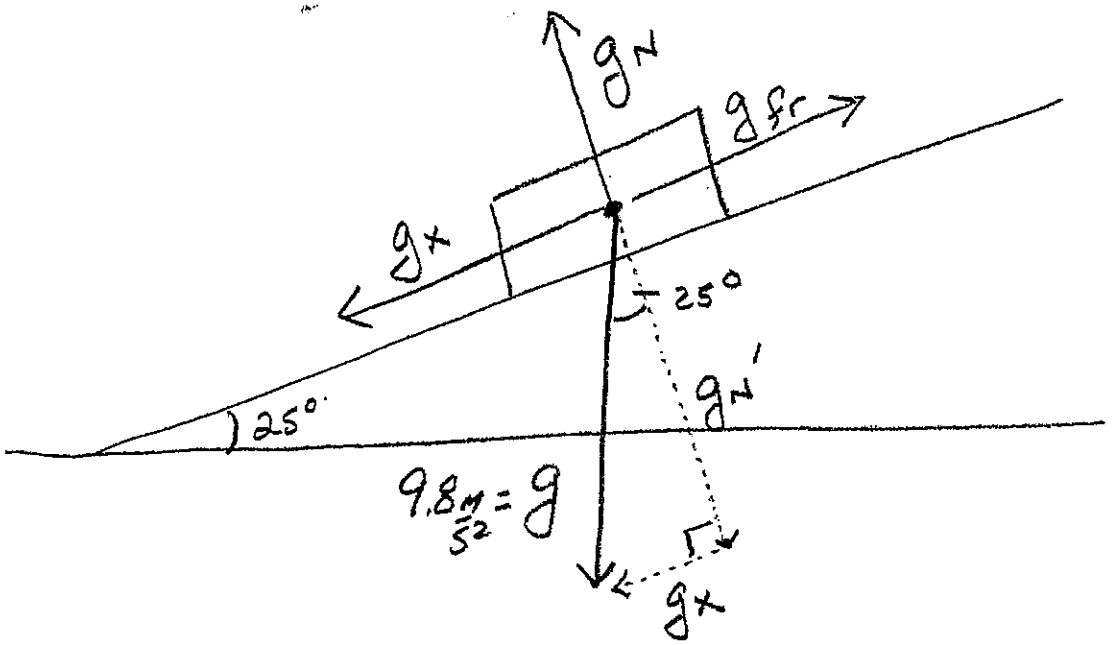
#2. ∴ IF NET FORCE IS 2N, to the right (positive X-direction) FRICTION must BE 3N.

(34)



USE THE TRIANGLE TO SOLVE FOR "F_X".

35



Interesting since mass is NOT Given, ∴ Instead of using "Force" which is a product of mass x gravity, we will just use gravity. NOTE THE Labels on the above diagram.

#1. Solve For "g_x", "g_N". "g_x" = 4.14 m/s²
"g_N" = 8.88 m/s²

#2. NOTE: PROBLEM STATES BLOCK SLIDES AT CONSTANT VELOCITY ∴ "g_x" = "g_{fr}" WHICH BASICALLY MEANS THE COMPONENT OF "g" (gravity) That goes downhill ("g_x") is equal to the friction component.

#3. $F_{fr} = \mu F_N$ ∴ $mg_x = \mu m g_N$ ∴ $g_x = \mu g_N$

$4.14\,m/s^2 = \mu(8.88\,m/s^2)$ $\mu = \frac{4.14\,m/s^2}{8.88\,m/s^2} = \boxed{0.47}$

* MY FAVORITE ON THIS TEST ☺