Physics 200 **Name: _____**

Midterm Review (Newton's Laws / Forces)

Part 1: Multiple Choice

1. If the sum of all forces on an object is zero (i.e. $F_{Net} = 0$), then the object
   A. must have a velocity v = 0.
   B. must have an acceleration a = 0.
   C. must remain in the same position.
   D. must be accelerating with a = g.

2. Which has the greatest inertia?
   A. A 2.0-kg object moving at 10.0m/s
   B. A 5.0-kg object moving at 2.0 m/s
   C. A 7.0-kg object at rest

3. For a given object, which of these will be the same on the Earth's surface and the Moon's surface?
   A. mass B. weight C. acceleration due to gravity

4. A person weighing 525 N stands on a bathroom scale in an elevator. When the elevator moves downward at constant velocity, the scale reading is:
   A. 525 N B. less than 525 N C. more than 525 N

5. Two horizontal forces, one 90.0 N and the other 120.0 N, are exerted by hockey sticks in opposite directions on a hockey puck on a frictionless ice surface. What is the net horizontal force on the hockey puck?
   A. 30.0 N B. 90.0 N C. 105.0 N D. 120.0 N E. 210.0 N

6. A mass of 5.0 kg
   A. weighs 5.0 N.
   B. weighs 50 N.
   C. has a mass of 1.0 N.
   D. has a mass of 50 N.

7. The SI unit of weight is
   A. m/s B. m/s^2 C. g D. kg E. N

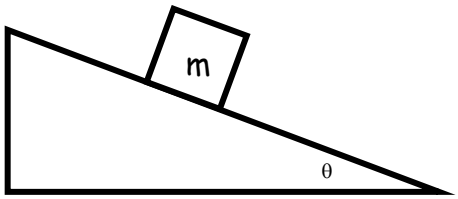
8. A single horizontal force acts on a mass lying on a frictionless horizontal floor. If the force triples, what happens to the acceleration?
   A. 0.11 X B. 0.33 X C. No change D. 3.0 X E. 9.0 X

9. The velocity of a 4.0 kg block is observed to increase from 1.0 m/s to 7.0 m/s over a period of 2.0 seconds on a horizontal frictionless surface. What is the net horizontal force applied to this block?
   A. 2.0 N B. 3.0 N C. 6.0 N D. 12 N E. 56 N

10. What is the tension in the cable of a 400-kg elevator accelerating upwards 10 m/s^2?

A. 12,000 N B. 8000 N C. 6400 N D. 4000 N E. 3200 N

11. A block of mass m sits on a frictionless incline plane shown on the right. What is the acceleration of the block down the plane?



A. $g \sin \theta$
B. $g \cos \theta$
C. $mg \sin \theta$
D. $mg \cos \theta$
E. $\mu mg \cos \theta$

12. The same block of mass m now moves down an incline plane <u>with</u> friction. What is the frictional force on the block?

A. $g \sin \theta$ B. $g \cos \theta$ C. $mg \sin \theta$ D. $mg \cos \theta$ E. $\mu mg \cos \theta$

13. A 10-kg block is pulled along a horizontal surface with a force of 50 N. The coefficient of kinetic friction between the block and the surface is $\mu_k = 0.2$. What is the acceleration of the block?

A. 1 m/s^2 B. 2 m/s^2 C. 3 m/s^2 D. 4 m/s^2 E. 5 m/s^2

14. A 70-kg skydiver jumps from a plane and reaches terminal velocity after 25 seconds. What is the drag force F_D at t = 30 seconds?

A. 70 N
B. 700 N
C. 350 N
D. 2100 N
E. Cannnot be determined from this information

<u>Multiple Choice Answers</u>:

1. B
2. C
3. A
4. A
5. A
6. B
7. E
8. D
9. D
10. B
11. A
12. E
13. C
14. B

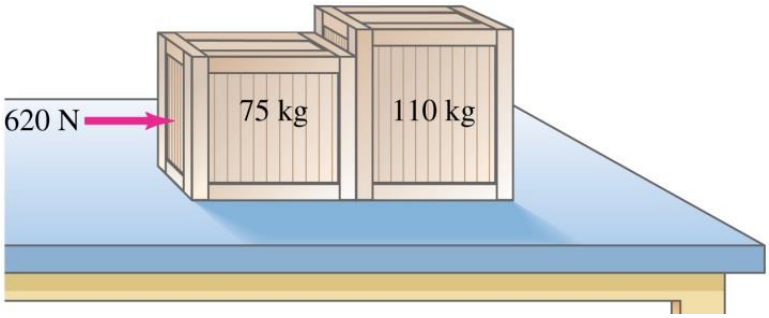
Part 2: Newton's Laws / Forces – Problems in 1D and 2D

1. A 0.140-kg baseball traveling strikes the catcher's mitt, which, in bringing the ball to rest, recoils backward 11.0 cm. What was the average force applied by the ball on the glove?

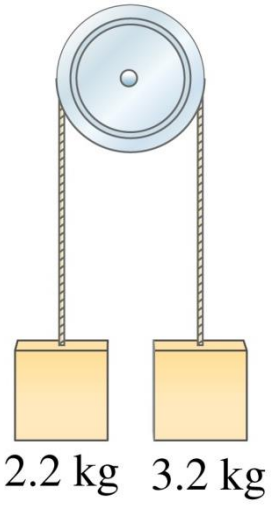
2. Each bucket in the adjacent diagram has a mass of 10.0kg. The balloons provide an upward pull of 150N. Find the acceleration of the buckets and the tension in the rope between the buckets.

If the lower rope is cut, find the acceleration of the remaining mass.

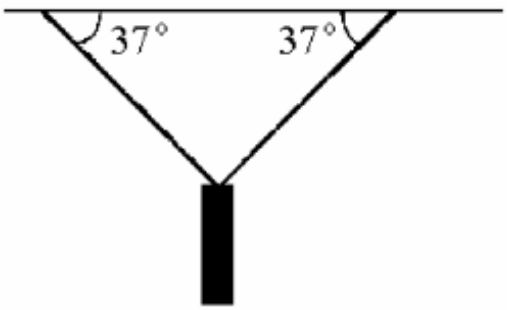
3. If the boxes slide with constant velocity, find the coefficient of friction and the force of interaction between the 2 boxes.



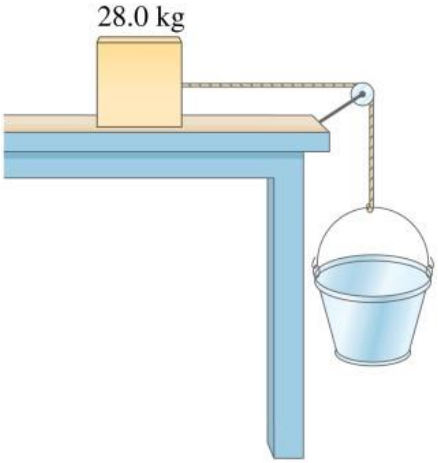
4. The masses on the right are connected by a rope of negligible mass that is slung over a frictionless pulley. Find the tension in the rope that connects the 2 masses.



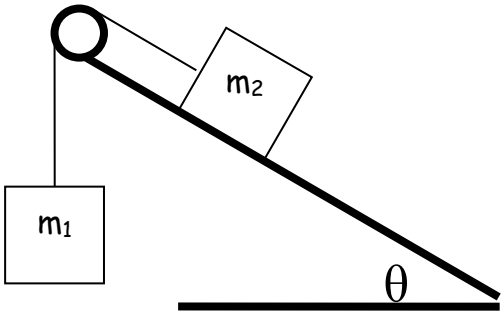
5. A traffic light is supported by two ropes as shown. If the tension in each rope is 750N, what is the mass of the traffic light?



6. Sand is gradually added to the hanging bucket shown on the right. The 28 kg mass begins to accelerate when the mass of the hanging bucket and sand equals 15 kg. What is the coefficient of static friction between the 28 kg box and the table?



7. Consider the conditions given in the text box. Will the system accelerate? If so, find the acceleration of the system and the tension in the cable that connects them.



Conditions

$\mu_s = 0.5$

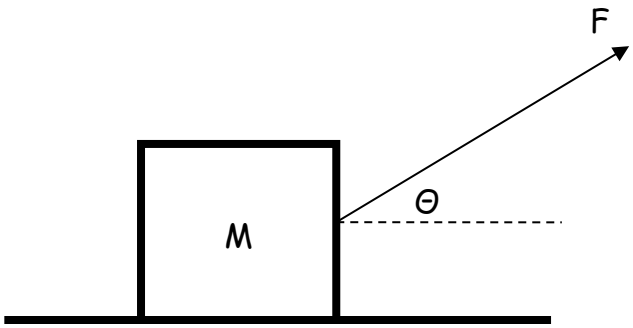
$\mu_k = 0.3$

$m_1 = 10.0$ kg

$m_2 = 5.0$ kg

$\theta = 70^o$

8. A force of 150 N is applied at an angle of 15 degrees. If the coefficient of friction is 0.30, find the acceleration of the 12 kg mass.



Answers to Newton's Laws Problems (for solutions, see website)

1. 573N
2. Part 1: $a=-2.3 m/s^2$, T=75N
2. Part 2: $a=+5.2 m/s^2$
3. $\mu_k=0.34$, F=369N
4. T=25.6N
5. m=92kg
6. $\mu_s=0.54$
7. $a=3.1 m/s^2$
8. $a=10.1 m/s^2$