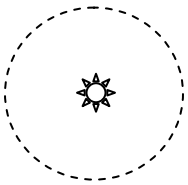
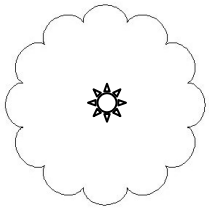
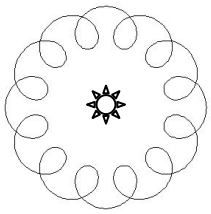
Exam 2
Phys 220
Fall 2012

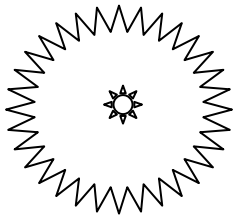
Name: _____ Lab group: _____

1. Which of the following best depicts the path of the moon around the sun?

A. 

C. 

B. 

D. 

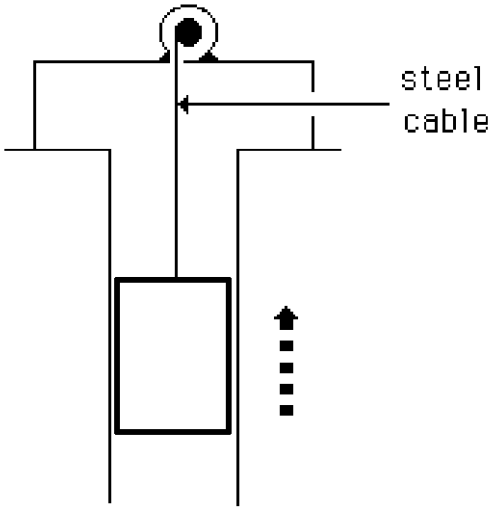
E. The moon does not orbit the sun.

A large truck breaks down out on the road and receives a push back into town by a small compact car as shown in the figure below.

2. While the car, still pushing the truck, is speeding up to get up to cruising speed:
   A. the amount of force with which the car pushes on the truck is equal to that with which the truck pushes back on the car.
   B. the amount of force with which the car pushes on the truck is smaller than that with which the truck pushes back on the car.
   C. the amount of force with which the car pushes on the truck is greater than that with which the truck pushes back on the car.
   D. the car's engine is running so the car pushes against the truck, but the truck's engine is not running so the truck cannot push back against the car. The truck is pushed forward simply because it is in the way of the car.
   E. neither the car nor the truck exert any force on the other. The truck is pushed forward simply because it is in the way of the car.

3. A constant horizontal force, F, is applied on a large box. As a result, the box moves across the floor at a constant speed.
   If the applied force is doubled, the box then moves:
   A. with a constant speed that is double the speed when only the force, F, was applied.
   B. with a constant speed that is greater than the speed when only the force, F, was applied, but not necessarily twice as great.
   C. for a while with a speed that is constant and greater than the speed when only the force, F, was applied, then with a speed that increases thereafter.
   D. for a while with an increasing speed, then with a constant speed thereafter.
   E. with a continuously increasing speed.

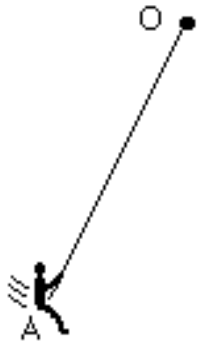
4. An elevator is being lifted up an elevator shaft by a steel cable as shown in the figure below. The elevator is *moving up and speeding up*. All frictional effects including air resistance are negligible. In this situation, forces on the elevator are such that:
   A. the upward force by the cable is greater than the downward force of gravity.
   B. the upward force by the cable is equal to the downward force of gravity.
   C. the upward force by the cable is smaller than the downward force of gravity.
   D. the upward force by the cable is greater than the sum of the downward force of gravity and a downward force due to the air.
   E. none of the above. (The elevator goes up because the cable is being shortened, not because an upward force is exerted on the elevator by the cable).



5. The figure below shows a boy swinging on a rope, starting at a point higher than A.

   Consider the following distinct forces:

   1. A downward force of gravity.
   2. A force exerted by the rope pointing from A to O.
   3. A force in the direction of the boy's motion.
   4. A force pointing from O to A.



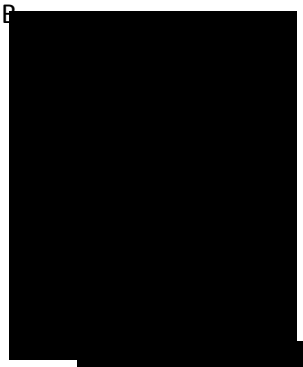
   Which of the above forces is (are) acting on the boy when he is at position A?

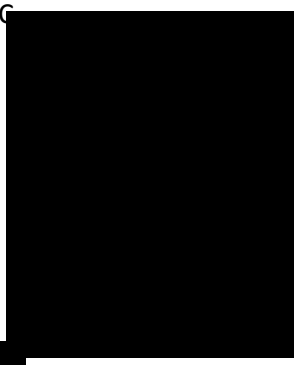
   A. 1 only.
   B. 1 and 2.
   C. 1 and 3.
   D. 1, 2, and 3.
   E. 1, 3, and 4.

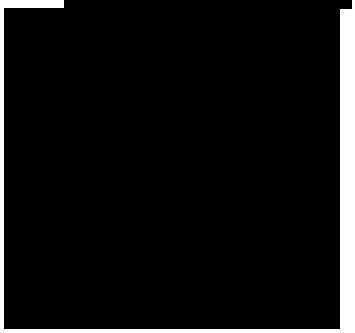
6. A semi's brakes fail as it heads down I-70. Luckily there's a runaway truck ramp near. The semi goes up the ramp and the deep gravel quickly brings the truck to a stop.

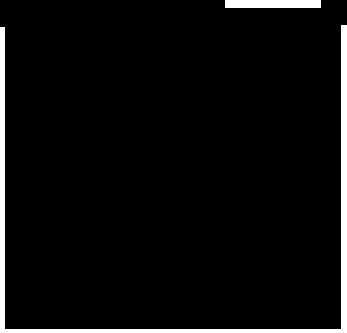
a. Which free body diagram fits this description?

A. 

B. 

C. 

D. 

E. 

b. Indicate, using symbols and words, what each of the above forces on the diagram you choose represent.

7. a. Provide an example that would clearly demonstrate to a classmate that gravity and the normal force are not an action reaction pair. Include a free body diagram and description.

b. Indicate what the force pair is for both the normal force and for the weight in your example above.

8. The back of your text says: Venus has a mass of 4.88×10^{24} kg, it is 1.08×10^{11} m from the sun, it has a radius of 6.06×10^{6} m and it takes Venus 0.615 years to orbit the sun.

a. Find the time it takes for a rock to fall 2.0 meters on Venus.

b. If the same rock were to be put into orbit around Venus at an altitude of 10,000 m, what would it's speed be?

9. An 80kg person is on a Ferris wheel with a radius of 30 meters. The Ferris wheel is traveling at 0.35 radians per second. Determine the person's apparent weight as they reach the highest point in the ride. Show all work including a free body diagram and sum of forces that you use to calculate the apparent weight.

$G = 6.67 \times 10^{-11}\ Nm^2/kg^2$ $F_G = \frac{Gm_1m_2}{r^2}$ 1 radian = 57.3°

$T^2 = \frac{4\pi^2}{GM} r^3$ $v = \frac{2\pi r}{T} = \sqrt{\frac{GM}{r}}$

$v = \omega r$ $a = \frac{v^2}{r} = \omega^2 r$ $f = \frac{1}{T}$

$w = mg$ $\Sigma \vec{F} = m\vec{a}$ $g = 9.8 m/s^2$

$v_x = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{\Delta t}$ $a_x = \frac{\Delta v_x}{\Delta t} = \frac{v_{xf} - v_{xi}}{\Delta t}$

$x_f = x_i + v_{xi}\Delta t + \frac{1}{2} a_x(\Delta t)^2$ $v_{xf} = v_{xi} + a_x\Delta t$ $v_{xf}^2 = v_{xi}^2 + 2a_x(\Delta x)$

sin θ = opp/hyp cos θ = adj/hyp tan θ = opp/adj $a^2 + b^2 = c^2$

Linear	**Angular**
Δx – displacement	Δθ - angular displacement
v – velocity	ω – angular velocity (omega)
$v = \Delta x/\Delta t$	$\omega = \Delta\theta/\Delta t$

——— $v = \omega r$ ———

$a = v^2/r = \omega^2 r$

$F = ma$ $F = ma = m\, v^2/r = m\, \omega^2 r$