Physics 122 **Exam Review Practice Problems** June 2017

1. A car is initially moving 7.5 m/s [N]. After 3.0 seconds it is moving 10.0 m/s [E40°N]. Calculate:
   a) The acceleration. *(a = 2.57 m/s2 [E8.1°S])*
   b) The velocity after 6.0 s if the acceleration remains constant. *(V_f = 16.2 m/s [E19°N])*

2. On a boat, you are sailing 6.5 m/s [E20°S]. A gust of wind provides an acceleration equal to 2.1 m/s^2 [E60°N] for 18 seconds.
   a) What is your velocity after the 18 seconds? (*v = 39.5 m/s [E51°N])*
   b) What is the displacement during that time? (*d = 379 m [E42°N]*)

3. A glider is flying 9.2 m/s [E25°N]. A gust of wind changes the glider's trajectory to 11 m/s [E14°S] in 7.9 seconds.
   a) What was the acceleration of the glider? (*a = 0.88 m/s^2 [E71°S]*)
   b) What was the displacement of the glider during that time? (*d = 75 m [E 3.7°N]*)
   c) What was the average force if the glider has a mass of 55 kg? (*F = 48 N [E70°S])*

4. A coast guard boat (with a helicopter) is 75 km [E67°N] from port. A distress call comes in from a fishing vessel located 93 km [E26°S] from port.
   a) How far is the fishing boat from the coast guard boat? (*d = 122 km [E64°S])*
   b) What is the minimum velocity of the helicopter to reach the boat in distress within 0.5 hours? *(v = 244 km/h [E64°S])*

5. A stone is thrown horizontally at a speed of 5.0 m/s from the top of building that is 78.4 m high.
   a) How long does it take the stone to reach the ground? *(t = 4 sec.)*
   b) How far from the base of the building will the stone land? *(d_{fx} = 20.0 m)*
   c) What is the velocity of the stone just as it hits the ground?
   (V_f = 39.6 m/s, 82.7° to the horizontal)

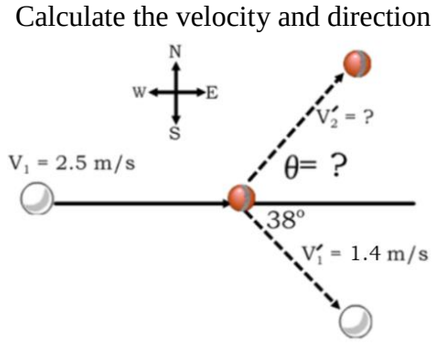
6. A stone is thrown horizontally from a cliff 15.0 m high. The initial velocity is +24.0 m/s.
   a) How far from the base of the cliff does the stone strike the ground? *(d_{fx} = 42.0 m)*
   b) What is the final vertical velocity of the stone just before the stone hits the ground? *(V_f = -17.17 m/s)*
   c) Calculate the velocity of the stone just before the stone hits the ground? *(29.5 m/s, [E35.6°S])*

7. While hiking in the wilderness, you come to the top of a cliff that is 60.0 m high. You throw a stone from the cliff, giving it an initial velocity of 21 m/s at 35° above the horizontal. How far from the base of the cliff does the stone land? (*85 m*)

8. During baseball practice, you go up into the bleachers to retrieve a ball. You throw the ball back into the playing field at an angle of 42° above the horizontal, giving it an initial velocity of 15 m/s. If the ball is 5.3 m above the level of the playing field when you throw it, what will be the velocity of the ball when it hits the ground of the playing field? (*18 m/s, at 52° below the horizontal*)

9. Large insects such as locusts can jump as far as 75 cm horizontally on a level surface. An entomologist analyzed a photograph and found that the insect's launch angle was 55°. What was the insect's initial velocity? (*2.8 m/s*)

10. A pool ball with a mass of 0.155 kg traveling at 2.5 m/s strikes another ball, which is stationary and has a mass of 0.125 kg. The collision is illustrated below (not to scale). Calculate the velocity and direction of ball #2. *(v'_2 = 2.0 m/s, 32° up from the positive x axis)*



11. You accidently drop a 3.5 kg glass platter which explodes into three pieces on the floor. Piece #1 had a mass of 1.3 kg and moved off with a velocity of 1.8 m/s at an angle of 52° counterclockwise from the positive x axis. Piece #2 had a mass of 1.2 kg and moved off with a velocity of 2.5 m/s at an angle of 61° clockwise from the negative x axis. Find the mass and the velocity of piece #3. *(v'_3 = 4.5 m/s, 89.8° down from the positive x axis)*

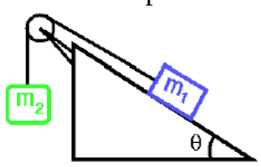
12. A 75.0 kg cart on a flat surface is pushed so that it moves under a net force of 15.0 N. The applied force necessary is 535 N at an angle of 28.0° to the horizontal. Calculate the coefficient of kinetic friction. *(μ = 0.46)*

13. A traffic light is to be hung as shown in the diagram to the right. The cable being used will break if its tension reaches 1750 N. What is the largest mass that can be hung? *(m = 151 kg)*

14. A 33 kg block is sliding down a 35° incline. The coefficient of kinetic friction is 0.13. Calculate the applied force up the ramp necessary so the block accelerates with a magnitude of 0.75 m/s^2 down the ramp. (*127 N up the ramp*)

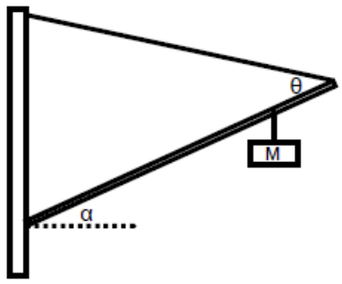
15. A 25 kg box is placed on a 33° incline. The coefficient of kinetic friction is 0.38. Calculate the acceleration of the box. *(2.2 m/s^2 down the ramp*)

16. A counterweight is used to slide an object up an inclined plane of 20°. The counterweight has a mass of 25 kg and is suspended with a string (negligible mass) and a frictionless pulley. The coefficient of friction on the plane is 0.19. What is the acceleration of a 16 kg object? *(a = -4.0 m/s^2)*

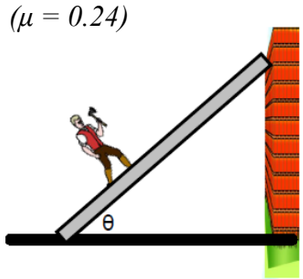


17. A uniform 150 kg beam, 10.0 m long, supports a 275 kg box that is 2.5 m from the right support column. Calculate the magnitude of the forces on the beam exerted by each of the vertical support columns. *(F_4 = 2759 N, F_1 = 1410 N)*

18. The cable in the diagram will break if the tension reaches 1800 N. The beam is 15 m long, has a mass of 60 kg, and makes an angle of 30°with the horizontal. The cable makes an angle of 60° with the beam and the hanging mass is located 10 m from the hinge.
    a) Calculate the maximum mass that can be attached. *(230 kg)*
    b) Calculate the net force on the hinge for that mass. *(Fnet = 2493 N, 22° up from the beam)*



19. Some guy with an axe (*Seriously? Doesn't that diagram look ridiculous?*) has a mass of 75 kg and is standing 1.5 m up from the base of a ladder that is 5.0 m long. The ladder has a mass of 25 kg and makes an angle of 55° with the ground. What must be the coefficient of static friction between the ladder and the ground to prevent the ladder from sliding backwards? *(μ = 0.24)*



20. Get yourself a drink of water and a snack, then take a nap ☺ You've earned it!