P110 Final

Answer the following questions by filling in the appropriate circle on your scantron sheet. You may use 4 cheat sheets and a calculator.

1. To maximize the range of a uphill throw (i.e., one that is launched from a point elow the landing area) it should be thrown

    (a) at an angle of more than 45^0
    (b) at an angle of 45^0
    (c) at an angle of less than 45^0
    (d) at an angle of 90^0

2. In class we saw that it takes about 360 lbs of force to stop a pole vaulter in 2 meters. How much force would it take to stop the vaulter in 4 meters?

    (a) 720 lbs
    (b) 180 lbs
    (c) 360 lbs
    (d) 3600 lbs
    (e) 40 lbs

3. For $\kappa = 0.83$, what is the approximate ball speed produced by a 120 mph swing speed (assume the same m/M as in class)?

    (a) 0
    (b) 60 mph
    (c) 100 mph
    (d) 175 mph
    (e) 120 mph

4. Two equal mass hockey players collide with a coefficient of restitution of one. If one player (A) is initially stationary and the other (B) moves with velocity v, which velocities are possible after the collision?

    (a) $v_A = -v$ and $v_B = v$
    (b) $v_A = 0$ and $v_B = 0$
    (c) $v_A = v/2$ and $v_B = v/2$
    (d) $v_A = 0$ and $v_B = v$
    (e) $v_A = v$ and $v_B = 0$

5. A golf ball is dropped on the floor and returns to one quarter of its original height. What is the coefficient of restitution?

    (a) 0.5
    (b) 0.83
    (c) 0.25
    (d) 0.7
    (e) 1

6. The force of a driver capable of hitting a golf ball at 175 mph is estimated to be is about 800 lbs for the 1 ms of driver-ball contact. If a new driver is advertised which results in the same ball speed but with half the contact time, what is the force?

    (a) 1600
    (b) 400
    (c) 800
    (d) 100

7. A rope climber moving at constant velocity expends 2000 W of power while climbing a 5 meter rope in 2 seconds. What is the power of a climber that does the 2.5 meter climb in 2 seconds?

    (a) 2000 W
    (b) 1000 W
    (c) 500 W
    (d) 4000 W

8. A pole vaulter has a kinetic energy of about 4000 J when they land in the pit. The new pit is designed to stop the vaulter in 0.4 meters rather than the 0.2 meters of the old pit. How does the new pit's spring constant compare to the old?

    (a) same
    (b) twice as big
    (c) four times bigger
    (d) twice as small
    (e) one fourth as big

9. A bungee jumper stands atop a 200 m tall bridge and quickly calculates that her kinetic energy without a bungee cord would be about 120,000 Joules when she hits the ground. Workers tell her that Bungee cord A ($k_A = 1.5$ N/m) will remove 60,000 Joules when stretched to 200 m. Other Bungee cords are labled only by spring constant. Which choice just keeps her from hitting the ground?

    (a) 3.0 N/m
    (b) 0.75 N/m
    (c) 1.5 N/m
    (d) 6.0 N/m

(e) 10 N/m

10. In the bungee problem above, the girl's significant other (who weighs twice as much) needs to choose a "just right" bungee cord after watching his girlfriend jump. Which cord does the job?

   (a) 3.0 N/m
   (b) 0.75 N/m
   (c) 1.5 N/m
   (d) 6.0 N/m
   (e) 10 N/m

11. An NFL lineman can produce 500 lbs of horizontal force while blocking, enough to accelerate a fellow 120 kg lineman at around 20 m/s^2. What acceleration would this lineman produce on a 60 kg trainer?

   (a) same
   (b) 40 m/s^2
   (c) 80 m/s^2
   (d) 10 m/s^2
   (e) 40 m/s

12. Impulse (the product of average force and the time the force acts) is the change in

   (a) kinetic energy
   (b) acceleration
   (c) momentum
   (d) work

13. A cue ball moving at 1 m/s strikes an 8 ball in a collision with $\kappa = 1$. What is the velocity of the 8 ball after the collision?

   (a) zero
   (b) 1 m/s in the same direction as the incoming cue ball
   (c) 1 m/s in the opposite direction as the incoming cue ball
   (d) 0.5 m/s in the opposite direction as the incoming cue ball
   (e) 0.5 m/s in the same direction as the incoming cue ball

14. Which collision is closest to $\kappa = 1$?

(a) golf ball and driver

(b) silly putty and floor

(c) quaterback sack

(d) golf ball and soft green

15. The world's best rock climbers can go at constant 1 mph (0.5 m/s) for about 10 seconds. Estimate the power they expend.

   (a) 1 W

   (b) 1000 W

   (c) 0.1 W

   (d) 500 W

   (e) 0 W

16. How much bigger is the drag force on your hand when it hangs out the window at 70 mph relative to 35 mph?

   (a) twice

   (b) four times

   (c) eight times

   (d) same

17. If the power lost to drag on your hand at 35 mph is 1 Watt, what is the power lost at 70 mph?

   (a) 2 W

   (b) 4 W

   (c) 8 W

   (d) same

18. A sky diver falls through air at a terminal velocity of 200 mph. Estimate the terminal velocity of a high diver in water just after impact. The drag factor in air is 10^{-3}m^{-1} and water is 10^3 denser than air.

   (a) 7 mph

   (b) 70 mph

   (c) 100 mph

   (d) 0.2 mph

19. Compare the power lost to drag by a Tour de France time trialist (30 mph) to that of a sprinter (50 mph).

(a) 5/3 as much power lost by the sprinter

(b) power loss is the same for both

(c) sprinter loses 4 times as much power

(d) sprinter loses 10 times as much power

20. Assuming a maximum power output of 300 W for a cyclist in 1 hour events, how high of a mountain should the be able to climb in 1 hour? (Hint: put the 300 W into climbing power and estimate the velocity. Recall that there are 3600 seconds in one hour).

(a) 180 m

(b) 1800 m

(c) 3600 m

(d) 5000 m