Forces and…

INSTRUCTIONS

The questions below are based upon the reading and homework that you completed before class and are intended to ensure that you are ready for the activities that we will do in the coming days of the unit. This RAT will have two parts: and individual and a team component.

For the individual part:

You are to work on your own – collaboration at this stage will be considered cheating! For each question, please select the best answer and fill it in on your scantron. Do not forget to also write your name on your scantron and bubble in your SPIRE-ID. **You may only choose one answer per question!** You are permitted to use only the equation sheets provided (which are the same ones you will get on the exam) and a calculator. There should be sufficient space on this twiz to do your work, but we have additional blank scratch paper at the front if you require it. I recommend that, in addition to your scantron, that you write down your answer to each question on this quiz to help you participate in the team part.

When you are complete:

Place your scantron in your team's folder. When everyone on your team is complete, have one team member bring your folder to the front. You will then get an IF-AT sheet to re-do the Twiz as a team. You are allowed to use your quiz from the individual portion as well as your calculators. **This part is still closed notes.**

In general, TAs and I are not available to help you with these questions! They may help with interpretation but that is all!

EQUATION SHEET ON NEXT PAGE
QUESTIONS BEGIN ON PAGE 3

EQUATIONS

$$\mu = \frac{1}{n}\sum_{i}^{n} x_i \qquad \sigma^2 = \frac{1}{n}\sum_{i}^{n}(x_i - \mu)^2 \qquad \vec{v} = \frac{\Delta\vec{x}}{\Delta t} \qquad \Delta x = \langle v_x \rangle \Delta t$$

$$\vec{a} = \frac{\Delta\vec{v}}{\Delta t} \qquad \sum \vec{F} = m\vec{a} \qquad \vec{F}_{A\to B} = -\vec{F}_{B\to A} \qquad F = k\Delta x$$

$$f^k = \mu_k N \qquad f^s_{\max} = \mu_s N \qquad F^B = \rho g V \qquad F^w = mg$$

$$g = 9.8\,\frac{\mathrm{N}}{\mathrm{kg}}$$

$$\vec{J} = \vec{F}_{\mathrm{avg}}\Delta t \qquad \vec{J} = \Delta\vec{p} \qquad \vec{p} = m\vec{v} \qquad W = Fd\cos\theta$$

$$W = P\Delta V \qquad W^{\mathrm{net}} = \Delta K \qquad K = \frac{1}{2}mv^2 \qquad P = \frac{F_\perp}{A}$$

$$P = P_0 + \rho g h \qquad \tau = rF_\perp \qquad \sum \vec{\tau} = 0 \qquad \sum \vec{p}_i = \sum \vec{p}_f$$

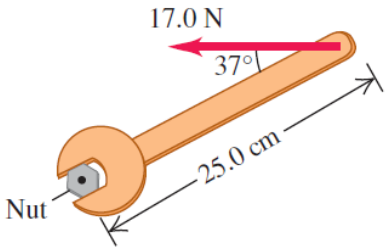
$$\Delta U_g = mg\Delta h \qquad \Delta U_s = \frac{1}{2}k(\Delta L)^2 \qquad U_i + K_f + W_{\mathrm{non}} = U_f + K_f$$

RAT #3

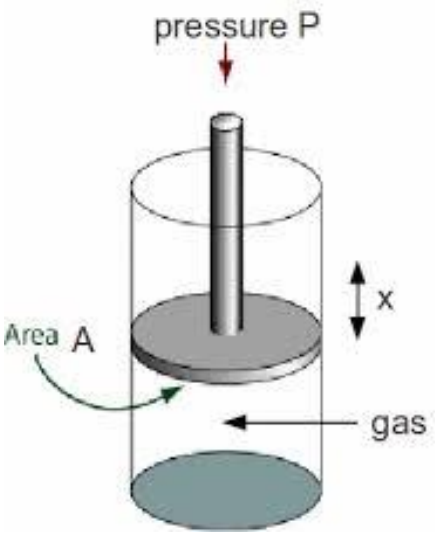
Spring 2016

QUESTIONS

1) A machinist is using a wrench to loosen a nut. The wrench is 25.0 cm long, and he exerts a 17.0-N force at the end of the handle at 37° with the handle. What is the torque on the nut?
   a) 4.25 N·m
   b) 3.39 N·m
   c) 2.55 N·m
   d) 425 N·m



2) The gas in the figure does +300J of work on the piston shown in the figure. The area of cylinder is $0.1m^2$ and the distance *x* the piston is pressed is 0.25m. What pressure *P* is being exerted by the gas and does the piston move up or down?
   a) 3 kPa, piston moves down
   b) 3 kPa, piston moves up
   c) 1.2 kPa, piston moves down
   d) 1.2 kPa, piston moves up



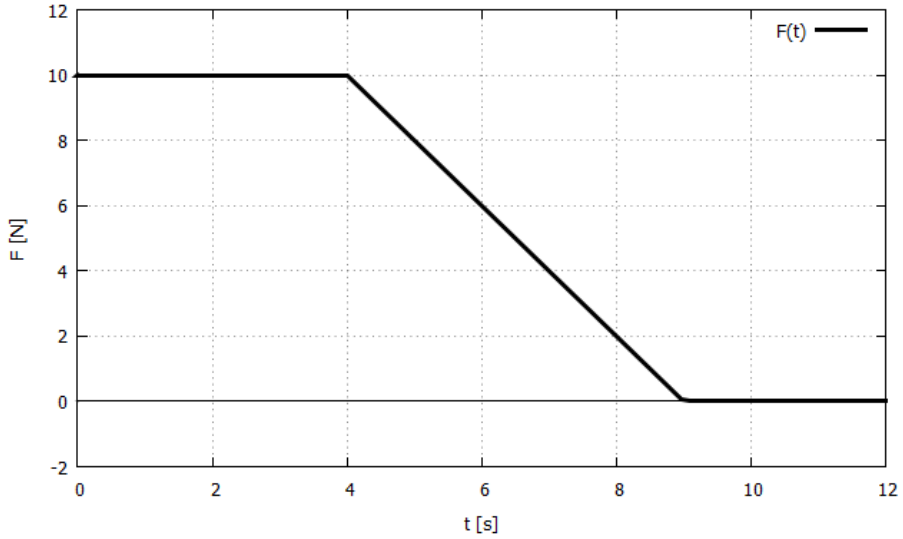
3) Three masses are located in the *x*-*y* plane as follows: a mass of 6 kg is at (0 m, 0 m), a mass of 4 kg is at (3 m, 0 m), and a mass of 2 kg is at (0 m, 3 m). Where is the center of mass, written (x,y), of the system?
   a) (2m, 1m)
   b) (0.5m, 1m)
   c) (1m, 1m)
   d) (1m, 0.5m)
   e) (1m, 2m)

4) A rubber ball and a lump of clay have equal mass. They are thrown with equal speed against a wall. The ball bounces back with nearly the same speed with which it hit. The clay sticks to the wall. Which one of these objects experiences the greater momentum change?
   a) The ball
   b) The clay
   c) Both of them experience the same non-zero momentum change
   d) Both of them experience the same zero momentum change

5) Which of the following quantities is related to the distance over which a force is applied?
   a) Torque
   b) Impulse
   c) Work
   d) Pressure
   e) Momentum

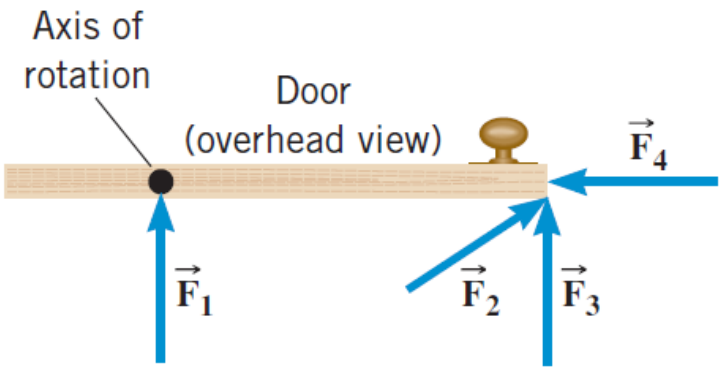
6) Which of the following is NOT part of the definition of center of mass?
   a) If an object is suspended, then the center of mass will be below the suspension point
   b) The center of mass is the geometric center of the object
   c) The center of mass must be above the base of support for the object to balance
   d) The center of mass is a mass-based average position of the object
   e) The center of mass is the point where gravity can be said to act

7) Consider the F(t) plot shown. Which attribute of the graph represents the total impulse delivered to the object?



a) The value of the graph at t = 2s.
b) The slope of the graph at t = 6s.
c) The impulse delivered to this object is non-zero but neither of these methods will yield the correct value
d) The impulse delivered to this object is zero.

8) The drawing illustrates an overhead view of a door and its axis of rotation. The axis is perpendicular to the page. There are four forces acting on the door, and they have the same magnitude. Rank the torque τ that each force produces, largest to smallest.



a) $\tau_4 > \tau_3 > \tau_2 > \tau_1$
b) $\tau_2 > \tau_4 > \tau_3 > \tau_1$
c) $\tau_1 > \tau_4 > \tau_3 > \tau_2$
d) $\tau_2 > (\tau_3 = \tau_4) > \tau_1$
e) $\tau_3 > \tau_2 > (\tau_1 = \tau_4)$

9) A golf ball of mass 0.050 kg is at rest on the tee. Just after being struck, it has a velocity of 102 m/s. If the club and ball were in contact for 0.81 ms, what is the average force exerted on the ball by the club?

a) 0 kN
b) 4.9 kN
c) 5.5 kN
d) 6.3 kN
e) 7.1 kN

10) Calculate the pressure exerted on the ground by a person with a weight of 862.4N standing on one foot. Assume that the bottom of the person's foot is 0.13m wide and 0.28m long.
   a) 6.0×10^3 Pa
   b) 2.4×10^3 Pa
   c) 6.0×10^4 Pa
   d) 5.5×10^3 Pa
   e) 2.4×10^4 Pa

11) A 3kg box is sliding across the floor at 2m/s when a force is applied to it parallel to the direction of motion for 6m. At the end of this 6m the speed of the box is 4m/s. What is the change in the kinetic energy of the box?
   a) 36 J
   b) 18 J
   c) 12 J
   d) 6 J
   e) None of these