

Classwork and review
Turn in one per person at the end of class

Name _____ and at least one other person you completed this with: _____

I. A few practice bits from early in Chapter 17 on Temperature and Heat.

1. When temperature is measured in Kelvin, the pressure in a constant-volume gas thermometer is directly proportional to the temperature.

$$\frac{T_2}{T_1} = \frac{p_2}{p_1}$$

The Kelvin scale is related to the Celsius scale as

$$T_K = T_C + 273.15$$

If the pressure in a room is zero C at 1 atmosphere of pressure, at what temperature C would the pressure be doubled?

Answer: 273 C or 273x2 Kelvin.

2. The zeroth law of thermodynamics says that if some object C is in thermal equilibrium with objects A and B, then A and B are also in thermal equilibrium with each other. Give an example of two objects that are out of thermal equilibrium with each other. Offer a way to bring them into thermal equilibrium.

You take a pan out of the oven, set it on the counter. Heat flows from the pan onto the counter and into the air until the counter and the air and all the things in your kitchen are at the same temperature, i.e., in thermal equilibrium.

II. Physics review. For each of the following problems, discuss and identify the primary physical principle or approach needed to solve the problem.

A. Linear kinematics B. Angular kinematics C. $F=ma$ or $\tau=I\alpha$

D. Conservation of linear momentum E. Conservation of angular momentum

F. Conservation of Energy G. Archimedes principle

H. Work-Energy theorem I. Bernoulli's equation

A cd player spinning at 500 rpm is subject to an angular acceleration of -2 rad/s^2 . How long does it take to come to a stop?

B

Xena the warrior-ess pushes with a force of 100 N perpendicular to a dungeon door of mass 200 kg and width 1 m. How long does it take to close the door?

C, also B perhaps.

A simple pendulum of mass 1 kg and length 1 m hanging at rest is struck by a bullet of mass 10 g traveling at 300 m/s. What is the speed of the bullet+pendulum combined mass immediately after impact of the bullet embeds itself in the pendulum?

D

A simple pendulum of mass 1 kg and length 1 m hanging at rest is struck by a bullet of mass 10 g traveling at 300 m/s. If the bullet embeds itself in the pendulum, how high does the pendulum rise from its equilibrium position?

F

A space ship orbits the earth in an elliptical orbit. If it is traveling 100 m/s when it is 10^8 m from earth, how fast is it traveling when it is 10^7 from earth?

F

Xena the warrior-ess fires a 200 g arrow at 80 m/s into a dungeon door of mass 200 kg and width 1 m. The arrow embeds itself in the door at 0.5 m from the hinges. How long does it take the door to close through a distance of 90 degrees?

E and B/C are needed.

Xena the warrior-ess fires a 200 g arrow at 80 m/s into a rodent of unusual size which falls off a 10 m high ledge. How fast is the rat falling when it hits the floor?

F

A 10 kg box slides initially at 5 m/s across a wooden floor with coefficient of kinetic friction 0.3. How far does it slide before coming to rest?

H

A 10 kg wooden box is falling at 20 m/s when it lands on one side of a teeter-totter with radius 3 m. A rodent of unusual mass (20 kg) sits on the other side of the teeter-totter. With what speed is the rat initially launched into the air as it becomes airborne?

F and E

A motionless 10,000 kg space station shaped like a square slab is struck at its center by a 5 kg meteor travelling at 1000 m/s perpendicular to the slab. The meteor is vaporized by the impact. What is the change in velocity of the space station?

D

A motionless 10,000 kg space station shaped like a square slab is struck at one of its corners by a 5 kg meteor travelling at 1000 m/s perpendicular to the slab. The meteor is vaporized by the impact. What is the angular velocity of the space station?

E

What is the linear velocity?

D

A distant 10,000,000 kg asteroid initially at rest 10^{10} km away with respect to the moon is attracted toward the moon by their mutual gravitational force. With what speed does the asteroid hit the moon?

F

A 10,000,000 kg asteroid moving at 11 km/s hits the moon at its equator (tangentially). How much does the rotation period of the moon change?

E

How much does the velocity of the moon change?

F

Xena the warrior-ess fires a 200 kg rodent at a velocity of 100 km/s up at 30 degree incline over a massless string and massless pulley toward a distant 1,000,000 kg asteroid with a coefficient of friction 0.2. If the air density is 1 kg/ cubic meter, what color is the rat?

ZZ

III. In science and engineering it is very important to be able to verbalize the meaning of mathematical expressions. Write a couple of grammatically correct sentences that tell what these expressions mean.

1. $x_1 = x_0 + v_0 t + \frac{1}{2} a t^2$

2. $F_f = \mu F_N = \mu m g \cos \theta$

3. $W = \int \vec{F} \cdot d\vec{l}$

4. $K_1 + U_1 + W_{other} = K_2 + U_2$

5. $\vec{\tau} = \vec{r} \times \vec{F}$

6. $x = Ae^{-(2b/m)t} \cos(\omega t + \phi)$

7. $P_1 + \rho g y_1 + 1/2 \rho v_1^2 = P_2 + \rho g y_2 + 1/2 \rho v_2^2$

IV. Describe, from your perspective, the most challenging aspect of physics class this semester.

Again from your perspective, and keeping in mind the effort you have put into this class, offer one idea for making learning physics more effective.