

Instructor:

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Text book:

Physics For Scientists and Engineers, Jewet and Serway,. Seventh Edition, Thomson

Recommended References:

1. Physics, Kane and Sternheim, 3rd Ed, Wiley (1988)
2. Principles Of Physics, Marion and Hornyak, Saunders (1984)

Objectives:

This course covers the fundamental principles, basic laws and concepts in mechanics, heat and thermodynamics, electricity and magnetism that were not covered in first two general physics courses (Ph03022101, Ph0302102).

Syllabus:

1. Static Equilibrium and Elasticity (12.1 - 12.4). ✓
2. Universal Gravitation (13.1 - 13.7). ✓
3. Fluid Mechanics (14.1 - 14.7). ✓
4. Oscillatory Motion (15.1 - 15.7). ✓
5. Wave Motion (16.1 - 16.6). ✓
6. Heat and First Law of thermodynamics (20.1 - 20.7). ✓
7. The Kinetic Theory of Gases (21.1 - 21.7). ✓
8. Heat Engines, Entropy, and Second Law of Thermodynamics (22.1, 22.6). ✓
9. Magnetic Fields (29.5, 29.6). *
10. Sources of the Magnetic Fields (30.7, 30.8, 30.9) *
11. Inductance (32.1 - 32.6). ✓
12. Alternating Current Circuits (33.1-33.7). ✓

Class Evaluation

- First Exam: 20%
- Second Exam: 30%
- Final Exam: 50%

✓ Item completed.

* Item not completed

University of Jordan
Department of Physics
Name:

Physics 104
Final Exam

Date: 09/01/2011
Time: 09:00-11:00

No:

1. If an $R = 4 \text{ k}\Omega$ resistor, a $C = 2 \text{ }\mu\text{F}$ capacitor, and an $L = 0.1 \text{ H}$ inductor are connected in series with a $V = 200 \sin(377t)$ volts source,
- Calculate the current delivered by the source $i(t)$?
 - Determine the maximum voltage across the capacitor.
 - What average power is delivered to this circuit?

(10 points)

2. A 100-turns solenoid with length 30 cm and cross sectional area 5 cm^2 is connected in series with a $40 \text{ k}\Omega$ resistor, a switch and a 12-volt battery.
- Calculate the inductance of the solenoid.
 - What is the time constant of the circuit?
 - How long after the switch is closed will the current reach 50 percent of its final value?

(10 points)

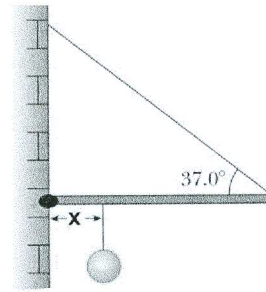
3. A 3.0 mol sample of a monatomic ideal gas expands adiabatically from initial volume 5 ltr and initial pressure 2500 Pa to a final volume 12 ltr. Calculate the final pressure and temperature.

(6 points)

4. A travelling sinusoidal wave travelling in negative x direction has an amplitude of 20 cm, and frequency 10 Hz and wavelength 30 cm. If at $t=0$ and $x=0$, the vertical displacement of an element of the medium is 10 cm, calculate
- The phase constant
 - The wave speed.

(8 points)

5. One end of a uniform 6m long rod with mass 10 kg is supported by a cable at an angle 37 is an the Figure. The other end is attached to the wall by a pin connection. If the sphere mass is 2 kg and exist at a distance ($x=0.3$ m) from the wall, Calculate the force exerted by the pin on the rod.



(10 points)

6. A liquid of density 800 kg/m^3 moves from horizontal tube of radius 0.2 cm into another horizontal tube of radius 0.1 cm at the same elevation as the first tube. If the pressure difference is 3 kPa between the liquid in one tube and the liquid in the other tube, calculate the speed of the liquid in each tube.

(6 points)

Useful data:

$$\mu_0 = 4\pi \times 10^{-7} \text{ T} \cdot \text{m/A}$$

$$1 \text{ atm} = 1.013 \times 10^5 \text{ Pa}$$

$$1 \text{ ltr} = 1000 \text{ cm}^3$$

$$\gamma \text{ of an ideal monatomic gas } 1.67$$

$$R = 8.31 \text{ Jole/mol} \cdot \text{K}$$

Name:

No:

Questions (1-6) choose the right answer (18 points):

1. Gas in a container expands at a constant pressure of 3 atm. Find the work done (in J) on the gas if the initial volume is 5 liters and the final volume is 10 liters.
 - a. 0
 - b. -150
 - c. 150
 - d. -1500
 - e. -1.5

2. In an isothermal process
 - a. the volume remains constant.
 - b. no work is done.
 - c. no heat is transferred between a system and its surroundings.
 - d. the pressure remains constant.
 - e. the internal energy is constant.

3. If $y = 0.02 \sin(30x - 400t)$ (SI units) and if the mass density of the string on which the wave propagates is $.005 \text{ kg/m}$, then the transmitted power is
 - a. 1.03 W
 - b. 2.13 W
 - c. 4.84 W
 - d. 5.54 W
 - e. 106 W

4. A body oscillates with simple harmonic motion along the x-axis. Its displacement varies with time according to the equation $x = 5.0 \text{ m} \cos(3.14t)$. The acceleration (in m/s^2) of the body at $t = 1.0 \text{ s}$ is approximately
 - a. 3.5
 - b. 49
 - c. 14
 - d. 43
 - e. 4.3

5. Write the equation of a wave, traveling along the $+x$ axis with an amplitude of 0.05 m, a frequency of 300 Hz, and a speed of 330 m/sec.
- $y = 0.05 \sin [600\pi (x/330 - t)]$
 - $y = 0.05 \cos [600\pi x/330 - 300t]$
 - $y = 0.05 \sin [600\pi(x/330 + t)]$
 - $y = 0.05 \sin [600\pi x/330 + 300t]$
 - $y = 0.05 \cos [2\pi(x/330 + 300t)]$
6. A 100-m long transmission cable is suspended between two towers. If the mass density is 2.01 kg/m and the tension in the cable is 3.00×10^4 N, what is the speed of transverse waves on the cable?
- 60 m/s
 - 122 m/s
 - 244 m/s
 - 310 m/s
 - 1500 m/s
7. Cube of ice with mass=0.1 kg and temperature at 0C is placed into 0.2 kg of water initially at 90 C. If all ice is melted, what would be the final temperature of the mix.
(6 points)
8. A 10.6 kg object is attached to a spring with a spring constant 2.05×10^4 N/m. The effect of air resistance is represented by damping coefficient=3.0 N.s/m
Calculate
- The frequency of damped oscillation
 - By what percent does the amplitude of the oscillation decrease in each cycle.
 - The time interval that elapses while the total energy of the system drops to 5% of its initial value.

(6 points)

Specific heat of water=4186 J/kg.C

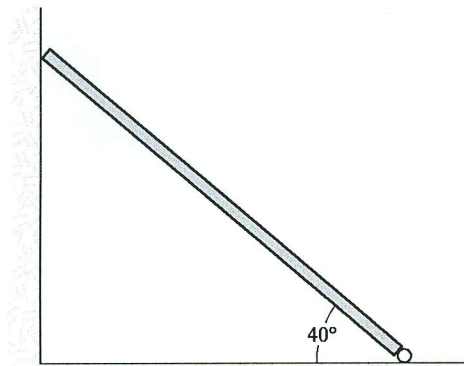
$$L_f = 3.33 \times 10^5 \text{ J/kg}$$

$$L_v = 2.26 \times 10^6 \text{ J/kg}$$

$$1 \text{ atm} = 1.013 \times 10^5 \text{ Pa}$$

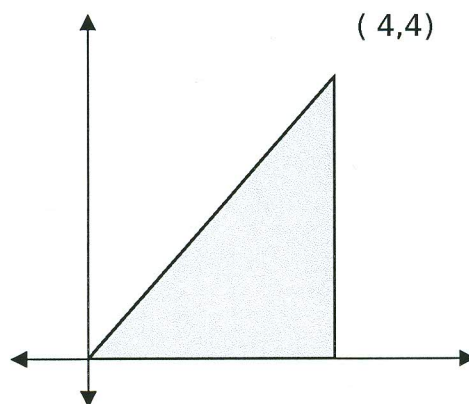
1. How large a force is necessary to stretch a 2-mm diameter copper wire ($Y = 11 \times 10^{10} \text{ N/m}^2$) by 1%?
a. 2 163 N b. 3 455 N c. 6 911 N d. 11 146 N e. 5 420 N
2. The period of a satellite circling planet Nutron is observed to be 84 s when it is in a circular orbit with a radius of $8.0 \times 10^6 \text{ m}$. What is the mass of planet Nutron?
a. $6.2 \times 10^{28} \text{ kg}$ b. $5.0 \times 10^{28} \text{ kg}$ c. $5.5 \times 10^{28} \text{ kg}$
d. $4.3 \times 10^{28} \text{ kg}$ e. $3.7 \times 10^{28} \text{ kg}$
3. Two stars of masses M and $6M$ are separated by a distance D . Determine the distance (measured from M) to a point at which the net gravitational force on a third mass would be zero.
a. $0.41 D$ b. $0.33 D$ c. $0.37 D$ d. $0.29 D$ e. $0.14 D$
4. What is the kinetic energy of a 200-kg satellite as it follows a circular orbit of radius $8.0 \times 10^6 \text{ m}$ around the Earth? (Mass of Earth = $6.0 \times 10^{24} \text{ kg}$.)
a. $5.0 \times 10^9 \text{ J}$ b. $1.0 \times 10^{10} \text{ J}$ c. $1.5 \times 10^{10} \text{ J}$ d. $2.0 \times 10^{10} \text{ J}$ e. $2.5 \times 10^9 \text{ J}$
5. A supertanker filled with oil has a total mass of $6.1 \times 10^8 \text{ kg}$. If the dimensions of the ship are those of a rectangular box 300 meters long, 80 meters wide, and 40 meters high, determine how far the bottom of the ship is below sea level. ($\rho_{\text{sea}} = 1020 \text{ kg/m}^3$.)
a. 10 m b. 15 m c. 20 m d. 25 m e. 30 m
6. Water is flowing at 4.0 m/s in a circular pipe. If the diameter of the pipe decreases to 1/2 its former value, what is the velocity of the water downstream?
a. 1.0 m/s b. 2.0 m/s c. 8.0 m/s d. 16 m/s e. 4.0 m/s

7. A uniform beam having a mass of 60 kg and a length of 2.8 m is held in place at its lower end by a pin. Its upper end leans against a vertical frictionless wall as shown in the figure. What is the magnitude of the force the pin exerts on the beam?



- a. 0.68 Kn b. 0.57 kN c. 0.74 kN d. 0.63 kN e. 0.35 kN

8. The mass of a rigid body in the form of triangle as show below is M. What is the x coordinate of the center of mass?



- a. 3.1 b. 1.3 c. 2.7 d. 2.0
e. 1.8

-end of questions-