Instructor(s): *N. Sullivan*

PHYSICS DEPARTMENT

PHY 2004 Midterm Exam 3 November 9, 2016

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g = 9.8 m/s^2 R = 8314 J/kmole K

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1. (4 points) A coin of mass 50 grams sits on the perimeter of a disc rotating at a constant angular speed of 100 revolutions per minute. What is the minimum value of the coefficient of friction required to prevent the coin from flying off the disc if the radius of the disc is 5 cm.

(1) 0.56 (2) 0.06 (3) 2.14 (4) 0.84 (5) 0.14

w =100*6.28/60 v=rw = 0.53 a=v^2/r=5.6 F=ma=umg solve for u

2. (3 points) A weight of 10 N is hung from a 1 meter length of rubber cord that has a cross-section of 1 cm^2. If the Young's modulus of rubber is 2MPa, how far is the rubber stretched?

(1) 5.0 cm (2) 0.15 cm (3) 12.5 cm (4) 1.25 cm (5) 0.50 cm

DL=L* (F/A)*(1/Y) =10/10^(-4) *(1/2 10^6) =(1/20)m

3. (3 points) A force of 9N is applied to the rim of a wheel that has a radius of 20 cm. The resulting torque accelerates the wheel form rest to 3 revolutions/sec in 15 sec. Calculate the moment of inertia of the wheel.

(1) 1.43 kg m^2 (2) 143 kg m^2 (3) 4.29 kg m^2 (4) 42.9 kg m^2 (5) 0.043 kg m^2

Alpha = 3*6.28/15 =1.26 tau=I alpha =1.8 I=1.8/1.26

4. (4 points) One of the deepest trenches in the Gulf of Mexico is 4380 m. If the density of the sea water is 1025 kg/m^3, what is the pressure at the bottom of this trench?

(1) 44 MPa (2) 86 MPa (3) 6.5 MPa (4) 156 MPa (5) 203 MPa

P=rho*gh rho= 1.03*10^3 g=9.8 h=4.3=38 *10^3

5. (3 points) A solid cylinder of plastic foam floats in water with 27% of its volume above water. If the density of water is 1000 kg/m^3, what is the density of the cylinder?

(1) 730 kg/m^3 (2) 1270 kg/m^3 (3) 97 kg/m^3 (4) 23 kg/m^3 (5) 2490 kg/m^3

Upthust =0.73Vrho(water)*g =weight = Vrho(Plastic)*g

6. (3 points) An ideal gas at a pressure of 3 atmospheres at 20°C is compressed from 6 liters to 1 liter. If the final pressure is 30 atmospheres, what is the final temperature of the gas?

(1) 215°C (2) 162°C (3) 312°C (4) 84°C (5) 127°C

T(IN)=293 T(final)=T(IN)* P(F)V(F)/P(IN)V(IN)

Instructor(s): *N. Sullivan*

PHYSICS DEPARTMENT

PHY 2004 Midterm Exam 4 November 13, 2015

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$g = 9.81$ m/s^2 $R = 8314$ J/kmole K

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1. (4 points) A 10 m^3 tank of propane gas has an absolute pressure of 400 kPa at a temperature of 27°C. What is the mass of gas in the tank if 1 kmole of propane weighs 44 kg? $R = 8314$ J/kmole K.

(1) 70.6 kg (2) 642 kg (3) 192 kg (4) 24.2 kg (5) 8.65 kg

m=M*(PV)/RT =44*4 10^5*10/(8.3 10^3 *300

2. (3 points) A log of wood floats in water with 11% of its volume above the water level. If the density of the water is 1000 kg/m^3, what is the density of the log?

(1) 890 kg/m^3 (2) 1100 kg/m^3 (3) 989 kg/m^3 (4) 445 kg/m^3 (5) 1540 kg/m^3

Upthrust = 0.89rho(W)Vg = Weight = rho(object)Vg

3. (3 points) An ant is sitting on the rim of a disc of radius 10 cm. If the disc is rotating at 13 radians/sec, what is the tangential velocity experienced by the ant?

(1) 1.3 m/s (2) 4.1 m/s (3) 13 m/s (4) 41 m/s (5) 21 m/s

V=rw =1.3

4. (3 points) A 10 m length of aluminum is warmed from 27°C to 40°C. If the coefficient of thermal expansion of aluminum is 22 ppm, what is the change in length of the aluminum rod?

(1) 2.9 mm (2) 12 cm (3) 1.3 mm (4) 40 mm (5) 26 cm

DL = alpha *L* DT

5. (3 points) A 5 kg mass of metal is heated from 0°C to 12°C. If the amount of heat applied is 2400 J, what is the heat capacity of the metal?

(1) 40 J/kg K (2) 800 J/kg K (3) 160 J/kg K (4) 3600 J/kg K (5) 960 J/kg K

6. (4 points) A wheel has a moment of inertia of 2 kg m^2. What value of torque must be applied to accelerate the wheel from rest to an angular velocity of 7 rad/s in 2 seconds?

(1) 7.0 N m (2) 1.75 N m (3) 14.0 N m (4) 0.875 N m (5) 3.5 N m

Tau=I*alpha =2 *3.5

Instructor(s): *N. Sullivan*

PHYSICS DEPARTMENT

PHY 2004 Midterm Exam 3 April 6, 2012

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$g = 9.80$ m/s^2 $R = 8314$ J/kmole K

1. (5 points) A cubic block of wood floats in water with 11% of its volume above water. If the density of water is 1,000 kg/m3, what is the density of the wood?
   (1) 890 kg/m^3 (2) 1100 kg/m^3 (3) 2200 kg/m^3 (4) 490 kg/m^3 (5) 110 kg/m^3
   rho(object)Vg = rho(water)(0.99V)g

2. (4 points) A steel beam has a length of 10 m and a cross-sectional area of 1 cm^2. If the length of the beam changes by 5 mm with an applied force of 10,000 N, what is the Young's modulus of steel?
   (1) 200 GPa (2) 112 GPa (3) 15 Gpa (4) 2000 GPa (5) 7,200 GPa
   Y= (F/A)/(DL/L) = [10^4/10^(-4)] *10/(5*10^(-3)

3. (4 points) A 2 m^3 steel gas cylinder contains natural gas at a pressure of 200 kPa at a temperature of 27°C . If the gas is compressed to 300 kPa, what is the final temperature?

4. (1) 177°C (2) 300°C (3) 57°C (4) 200°C (5) 427°C
   T(IN)=300 T(F) = T(IN) *(P(F)V(F)/P(IN)V(IN)

5. (4 points) A 15 m^3 volume of ideal gas is compressed adiabatically. If the work done by the outside force is 2700 J, what is the change in internal energy of the gas?
   (1) 0 J (2) –2700 J (3) 1350 J (4) –1350 J (5) 2700 J
   Q=0 (adiabatic) DU=-W =_ (-2700)

6. (3 points) A 2 meter length of steel changes length by 2.4 mm during the course of a day. If the coefficient of thermal expansion of steel is 12 parts per million per °C, what is the change in temperature of the steel?

   (1) 100°C (2) 24°C (3) 12°C (4) 373°C (5) 273°C
   DL= alpha *L*DT
   DT= (DL/L) *(1/alpha)

7. (3 points) The heat capacity of an object is 3500 J/kg K. Calculate the amount of heat required to raise the temperature of the object by 1.5°C if its mass is 60 grams.
   (1) 315 J (2) 720 J (3) 7.5 J (4) 1350 J (5) 125 J

DQ =mCDT

8. (5 points) A piece of metal is weighed in air and then weighed while immersed in oil of density 600 kg/m^3. If the weight in air is 2.2 kg and the weight in the oil is 1.5 kg, calculate the density of the metal.

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*(1) 0.7890 kg/m^3 (2) 8.86 kg/m^3 (3) 135.1 kg/m^3 (4) 3.68 kg/m^3 (5) 1.89 kg/m^3

Upthrust = (2.2g-1.5g =0.7g +Vrho(oil)g V = 0.7/600
rho(object0 =m/V = 2.2*600/

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PHYSICS DEPARTMENT

PHY 2004 Midterm Exam 3 November, 2011

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$g = 9.80\ m/s^2$ $R = 8134$ J/kmole K

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1. (4 points) A volume of gas initially at 37°C is compressed by a factor of 10 ($V_{Final} = 1/10 V_{Initial}$). If the pressure increases from 112 kPa to 1904 kPa, what is the final temperature?

(1) 254°C (2) 855°C (3) 473°C (4) 0°C (5) 1250°C

T(IN) = 310 K T(F) = T(IN)* 1904/112 * 1/10 =527 K = 254 C

2. (5 points) A small piece of rock is weighed in air and then weighed while immersed in oil of density 800 kg/m^3. If the weight in air is 21.5 N and the weight in the oil is 11.8 N, calculate the density of the rock.

Upthrust= 21.5-11.8 = 9.7 N = rho(oil)Vg V=1/800 rho(object) =(21.5/9.8)* 800

(1) 1750 kg/m^3 (2) 202.7 kg/m^3 (3) 1.38 kg/m^3 (4) 13.68 kg/m^3 (5) 9710 kg/m^3

3. (4 points) A 15 meter length of steel with a cross-sectional area of 20 cm^2 is compressed with a force of 10,000 N. If the Young's modulus of steel is $200 \times 10^9 N/m^2$, what is the change in length of the steel beam?

(1) 0.38 mm (2) 2.3 cm (3) 4.47 mm (4) 0.19 cm (5) 12.5 mm

DL/L = (F/A) *(1/Y)

4. (4 points) A $10m^3$ tank of compressed natural gas has an absolute pressure of 400 kPa at a temperature of 27°C. What is the mass of the gas in the tank? 1 kmole of natural gas weighs 16 kg. R = 8134 J/kmole K.

(1) 25.6 kg (2) 288 g (3) 196 g (4) 16.1 kg (5) 642 kg

m=M*(PV)/(RT) M = 16 P=4*10^5 T=300 R=8134

5. (4 points) A 200 meter length of steel rail changes temperature by 30°C during the course of a day. If the coefficient of thermal expansion of steel is 12 parts per million per °C, what is the change in length of the steel?

(1) 72 mm (2) 1.44 cm (3) 14.4 mm (4) 1.8 m (5) 3.66 mm

DL = alpha L *DT

6. (3 points) How much water at 0°C is required to cool a 200 kg human by 1°C. The heat capacity of the human body is 3500 J/kg/K and the heat capacity of water is 4184 J/kg/K.

(1) 167 kg (2) 239 kg (3) 83.5 kg (4) 23.9 kg (5) 200 kg

Not in exam 3 in 2018

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7. (3 points) An engine operating in an ideal Carnot cycle involves an isothermal compression of 2 m^3 of helium gas at 200°C and an isothermal compression of the gas at 50°C. What is the efficiency of this engine?

(1) 31.7% (2) 75% (3) 100% (4) 63.4% (5) 87%

N = 1-T(cold)/T(hot) =

8. (4 points) A steel cylinder contains helium gas at a gauge pressure of 100 kPa and at a temperature of 27°C. The gas is heated and moves a piston in the cylinder 8 cm with the pressure held constant. If the area of the piston is 150 cm^2 and the mass is 7 kg, calculate the work done by the gas.

(1) 120 J (2) 1200 J (3) 256 J (4) 2560 J (5) 0 J

W = PV P =10^5 V = 8*10^(-2) *150* 10^(-4)

Instructor(s): *N. Sullivan*

PHYSICS DEPARTMENT

PHY 2004 Exam 3 November 19, 2010

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$g = 9.80$ m/s^2 $R = 8314$ J/kmole/K

1. (4 points) In the compression chamber of a diesel engine the volume of a gas mixture initially at 27°C is compressed by a factor of 20($V_{Final} = 1/20 V_{Initial}$). If the pressure increases from 1 atmosphere to 50 atmospheres, what is the final temperature?

(1) 477°C (2) 954°C (3) 273°C (4) 0°C (5) 1430°C
T(F) =T(IN) *[P(F)V(F)]/[P(IN)V(IN)]

2. (5 points) A misshapen lump of metal is weighed in air and then weighed while immersed in oil of density 800 kg/m^3. If the weight in air is 2.2 kg and the weight in the oil is 1.2 kg, calculate the density of the metal.

(1) 1760 kg/m^3 (2) 2650 kg/m^3 (3) 92 kg/m^3 (4) 36.8 kg/m^3 (5) 13.5 kg/m^3
Upthrust= (2.2-1.2)g= rho(oil)Vg use to find V rho(metal) = 2.2/V

3. (4 points) A 5 meter length of steel with a cross-sectional area of 20 cm^2 is compressed with a force of 20,000 N. If the Young's modulus of steel is 200×10^9 N/m^2, what is the change in length of the steel beam?

(1) 0.25 mm (2) 2.5 cm (3) 5.5 cm (4) 0.11 cm (5) 12.5 mm
DL=L* [(F/A))/Y]

4. (5 points) A cylinder of radius b has a moment of inertia $I = (1/2)mb^2$. The cylinder is rolled along a flat horizontal surface at speed v so that when it hits a ramp, it will travel to a height of 50 cm and then stop. What is the initial speed v of the cylinder?

(1) 2.6 m/s (2) 5.25 m/s (3) 12.2 m/s (4) 1.22 m/s (5) 52.5 m/s
(1/2)mv^2 + (1/2) Iw^2 =mgh use v=bw

5. (4 points) An object has a moment of inertia of 2.56 kg·m^2. What is the value of the torque needed to accelerate the rotation of the object from rest to a rotation of 5 revolutions per second in 30 seconds?

(1) 2.68 N·m (2) 1.34 N·m (3) 0.27 N·m (4) 4.02 N·m (5) 0 N·m

alpha= 5*6.28/30 tau=I*alpha

6. (4 points) A 5m^3 tank of compressed helium gas has an absolute pressure of 4 kPa at a temperature of

Instructor(s): *N. Sullivan*

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27°C. What is the mass of the helium in the tank? 1 kmole of helium weighs 4 kg.

(1) 33 g (2) 13.5 g (3) 1.61 kg (4) 0.35 kg (5) 6.42 kg

m =M [(PV)/(RT)]

7. (4 points) A 100 meter length of steel changes temperature by 30°C during the course of a day. If the coefficient of thermal expansion of steel is 12 parts per million per °C, what is the change in length of the steel?

(1) 3.6 cm (2) 7.2 cm (3) 14.4 mm (4) 1.8 m (5) 0.18 cm

DL = alpha *L *DT