Instructor(s): *N. Sullivan*

PHYSICS DEPARTMENT

PHY 2004   Exam 3   November 19, 2010

Name (print, last first): _____   Signature: _____

On my honor, I have neither given nor received unauthorized aid on this examination.

YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.
(1) **Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number).** Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY**. Code your UFID number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) Do all scratch work anywhere on this exam that you like. **Circle your answers on the test form.** At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.
(4) **Blacken the circle of your intended answer completely, using a #2 pencil or <u>blue</u> or <u>black</u> ink.** Do not make any stray marks or some answers may be counted as incorrect.
(5) **The answers are rounded off. Choose the closest to exact. There is no penalty for guessing. If you believe that no listed answer is correct, leave the form blank.**
(6) Hand in the answer sheet separately.

$$g = 9.80 \text{ m/s}^2 \qquad R = 8314 \text{ J/kmole/K}$$

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 $20(V_{\text{Final}} = 1/20 V_{\text{Initial}})$. 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) $1430°C$

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

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 $200 \times 10^9 \text{ N/m}^2$, 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

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

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

6. (4 points) A 5m^3 tank of compressed helium gas has an absolute pressure of 4 kPa at a temperature of $27°C$. 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

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