

Instructor(s): *N. Sullivan*PHYSICS DEPARTMENT
Midterm Exam 3

November, 2011

PHY 2004

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 blue or black 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.

$$g = 9.80 \text{ m/s}^2 \qquad R = 8134 \text{ J/kmole K}$$

1. (4 points) A volume of gas initially at 37°C is compressed by a factor of 10 ($V_{\text{Final}} = 1/10V_{\text{Initial}}$). 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
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.
 - (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 $200 \times 10^9 \text{ N/m}^2$, 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
4. (4 points) A 10 m^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. $R = 8134 \text{ J/kmole K}$.
 - (1) 25.6 kg
 - (2) 288 g
 - (3) 196 g
 - (4) 16.1 kg
 - (5) 642 kg
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 $^\circ\text{C}$, 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
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
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%
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

