

PHY 262 Exam 3-----preview----- 8/7/2012 **NAME** _____

This exam is closed book and closed notes, but open calculator. You have about 80 minutes to complete the exam (~ 9:30 – 10:50). The actual exam will be 50 questions long and each question is worth 2 points. There is also a 10 point written, bonus question. The scantron sheet must be used to record ALL of the m/c and t/f answers. You must return your exam and the scantron to get credit for this exam. There are TWO versions of this exam (white and color). Please write the color of your exam somewhere on your scantron. You may write on the test. The equations below are what you will see on your exam. Have a wonderful remainder of the summer break!

Be careful with your time. *Be careful with your time.* *Be careful with your time.*

 $\Delta L = \alpha L \Delta T$ $\beta = 3\alpha$ $PV = nRT$ $R = 8.314 \text{ (mks)}$ $1 \text{ calorie} = 4.186 \text{ Joules}$

$Q = mC\Delta T$ $Q = mL$ $\text{Work} = - \int_{V_i}^{V_f} P dV$ $T_k = T_c + 273.15$

$\text{Power} = kA(dT/dx)$ $\text{Power} = \sigma AeT^4$

$\frac{1}{2} kT$ of energy per (quadratic) degree of freedom

$V \text{ (most probable)} = \sqrt{2kT/m}$ $V \text{ (average)} = \sqrt{8kT/\pi m}$

$V \text{ (rms)} = \sqrt{3kT/m}$ $\Delta E = Q + W$

Each of the following 50 questions are worth 2 points each.

Answer “a” = true “b” = false

- 75 The coefficient of thermal expansion of water at 20°C is $0.207 \times 10^{-3} \text{ K}^{-1}$. A thin glass tube contains a 150.0 cm column of water at 20°C. If the thermal expansion of the glass tube is negligible, by how much does the length of the column of water expand when it is heated to 80°C?

A) 18.6 mm B) 6.2 mm C) 24.8 mm D) 8.2 mm E) 56 mm

Ans: A

- 76 The gas tank of your car can hold 60 L of gasoline. Do you get more gasoline in terms of the number of moles when you fill your tank when the gasoline is cold or hot? The coefficient of volume expansion for gasoline = $930 \times 10^{-6}/\text{K}$ and that of steel is $33 \times 10^{-6}/\text{K}$.

A) Gasoline is sold by volume so it does not make any difference.
B) Gasoline expands when the temperature increases, so you get more when it is hot.
C) Gasoline expands when the temperature increases, so you get less when it is hot.
D) Both gasoline and the tank expand so they cancel each other out.
E) It depends on whether it is regular or premium gasoline.

Ans: C

88 An ideal gas is heated so that it expands at constant pressure. The gas does work W . What heat is added to the gas?

- A) W B) $-W$ C) zero D) more than W E) less than W

Ans: D

89 The pressure of a gas in an isobaric expansion remains constant. In such an expansion,

- A) no work is done.
B) work is done by the gas.
C) work is done on the gas.
D) "isobaric" and "expansion" are contradictory terms.
E) work is or is not done depending on whether the temperature of the gas changes.

Ans: B

90 The work done by an ideal gas in an isothermal expansion from volume V_1 to volume V_2 is given by the formula:

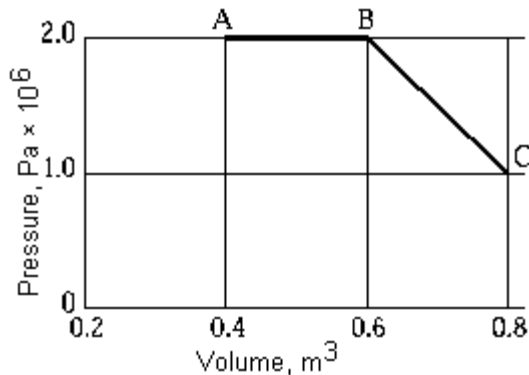
$$W = nRT \ln(V_2/V_1)$$

Standard atmospheric pressure (1 atm) is 101.3 kPa. If 1.0 L of He gas at room temperature (20°C) and 1.0 atm of pressure is compressed isothermally to a volume of 100 mL, how much work is done on the gas?

- A) 5.6 kJ B) 4.7×10^2 J C) 4.7×10^2 kJ D) 2.3×10^2 kJ E) 2.3×10^2 J

Ans: E

91



A gas expands along path ABC. The work done by the gas in this expansion is

- A) 4.0×10^5 J D) 7.0×10^5 J
B) 5.0×10^5 J E) 8.0×10^5 J
C) 6.0×10^5 J

Ans: D

Please continue to use the PV diagram above for these next questions. It shows part of a cycle using one mole of a monatomic, ideal gas as the working fluid.

92 What is the heat capacity at constant volume of this gas?

- A) $3R$ B) $3R/2$ C) $5R$ D) $5R/2$ E) 0

93 What is the heat capacity at constant pressure of this gas?

- A) $3R$ B) $3R/2$ C) $5R$ D) $5R/2$ E) 0

94 What is the total change in the internal energy during a full cycle from A to A.

- A) PV B) $2PV$ C) $3PV$ D) $6PV$ E) 0

95 What is the temperature at point C compared to the temperature at point A?

- A) The same B) double C) triple D) six times E) cannot be found

96 Describe the direction of Q_2

- A) into the system B) out of the system C) it is actually zero for an isobar

97 What is the magnitude of work done for one complete cycle?

- A) PV B) $2PV$ C) $3PV$ D) $6PV$ E) 0

98 What is the total change in the entropy during a full cycle from A to A.

- A) $3R$ B) $3R/2$ C) $5R$ D) $5R/2$ E) 0

99 What is the Carnot efficiency for this engine?

- A) 6 B) $1/6$ C) $1 - 1/6$ D) $1/2$ E) $1/3$

100 The French Academy of Sciences, in 1775, got smart and voted not to consider any further patents involving perpetual motion machines. It took the U.S. until 1856. This is a true freebie. I wish you perpetual motion. Have a great and productive life!

The questions are numbered 75 – 100 because they are from a previous final exam that was cumulative.