When you sit, Leave space between your neighbors
No Phone and Internet Use during the Exam
Use only a Calculator and a pen or pencil
Tear this page and use it as your worksheet for MC questions

PHYS 202 Spring 2018 Test #1 Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

$T\_{F}=\frac{9}{5}T\_{C}+32$   $T\_{K}=T\_{C}+273$ $∆T\_{F}=\frac{9}{5}∆T\_{C}$ $∆T\_{K}=∆T\_{C}$
A. Select the correct answer for the following multiple choice questions and write your answer in the line next to the question number.

\_\_\_\_1. Express the temperature 4.2oF in the K unit?
 a. 223 b. 258 c. 275 d. 277 e. 313

\_\_\_\_2. What is the difference in Co of the two temperatures, -45oF and 63oF?
 a. 42 b. 10 c. 60 d.- 7.8 e. 194

\_\_\_\_3. What is the thermometric property of a resistance thermometer?
\_\_\_\_4. What is the thermometric property of a constant volume gas thermometer?
Answers for 3 & 4
a. Length of a liquid column b. Volume of gas c. Pressure of a gas
d. Infrared radiation e. Ultraviolet radiation f. Resistance

\_\_\_\_5. The zeroth law of thermodynamics is,
\_\_\_\_6. The third law of thermodynamics is,
Answers for 5 & 6
a. The law of conservation of energy.
b. Heat flows spontaneously from a substance at a higher temperature to a substance at a lower temperature.
c. Heat flows spontaneously from a substance at a lower temperature to a substance at higher temperature.
d. If two systems individually in thermal equilibrium with a third system, then the two systems are in thermal equilibrium with each other.
e. It is not possible to lower the temperature of any system to absolute zero in a finite number of steps.

\_\_\_\_7. Suppose you want to heat a gas so that its temperature will be as high as possible. Would you heat it under conditions of constant pressure or constant volume?
a. constant pressure b. constant volume

\_\_\_\_8. The drawing shows a pressure-volume graph for a gas being compressed. The area under the curve represents \_\_\_\_\_\_\_\_\_\_\_

1. the change in the internal energy of the gas.
2. the work done *by* the gas.
3. the work done *on* the gas.
4. the heat gained by the gas.
5. the heat lost by the gas.



\_\_\_\_9. In thermodynamics the collection of objects upon which attention is being focused is called the ***system,*** while everything else in the environment is called the ***surroundings.*** What is the system for an automobile engine?
a. Engine b. Radiator c. Wheels d. Body e. burning gasoline/air mixture

\_\_\_\_\_10. Walls that permit heat to flow through them are called,
a. *diathermal walls*  b. *adiabatic walls.*

\_\_\_\_11. Identify the isothermal expansion below:
\_\_\_\_12. Identify the adiabatic expansion below:
Answers for 11 & 12
a. 1 b. 2 c. 3 d. 4



\_\_\_\_13. Which one of the following is the correct order of the four strokes of the internal combustion gasoline engine:
a. Power, Intake, Compression, Exhaust
b. Intake, Compression, Power, Exhaust
c. Intake, Power, Compression, Exhaust
d. Compression, Intake, Power, Exhaust
e. Exhaust, Compression, Intake, Power

\_\_\_\_14. Conductors have free\_\_\_\_\_\_\_\_\_\_\_\_\_.
A. Protons B. Neutrons C. Electrons D. Nucleons E. Atoms

\_\_\_\_15. An object is charged by contact using a positively charged rod. What type is the charge on the charged object?
\_\_\_\_16. An object is charged by induction using a positively charged rod. What type is the charge on the charged object?
Answers for 15 -16:
A. Positive B. Negative C. No charge

 $∆A=2αA\_{0}∆T$ $∆V=βV\_{0}∆T$ $β=3α$, for solids

B. Most automobiles have a coolant reservoir to catch radiator fluid that may overflow when the engine is hot. A radiator is made of copper and is filled to its 18.0-L capacity at 5.0 0C. What volume of radiator fluid will overflow when the radiator and fluid reach their****operating temperature?
Radiator fluid’s volume coefficient of expansion is ****
The linear coefficient of thermal expansion for copper is: α copper = 17x10-6(Co)-1

C. An ideal gas is taken through the three processes (A→B, B→C, and C→A) shown in the drawing.
1. Name the process **AB** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

2. For the three processes shown in the drawing, fill in the eight missing entries in the following table. First Law of thermodynamics: ∆U = Q - W. Work = W= P.∆V

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|  |  |  |  |
| --- | --- | --- | --- |
| Process | W | Q | ∆U |
| A→B | a. | +2,500 J | b. |
| B→C | c. | d. |  +3100 J |
| C→A | e. | g. | f. |

 |

D. $Q=mc∆T$ $ Q=mL$
(Specific heat of water = 4186 J/(kg.K), Specific heat of ice = 2000 J/(kg.K), Latent heat of fusion of ice = 33.5 x 104 J/kg)

D1. An unknown metal alloy of mass 0.15 kg is submerged in ice-water mixture until the metal reaches the freezing point of water. This metal is quickly transferred to 0.25 kg of water at 280C. The final equilibrium temperature is 210C. Determine the specific heat of the unknown metal?

D2. Researchers are developing heated airport runways to melt ice and snow quickly to avoid long delays. How much heat is necessary to melt 35 kg of ice at -150C? Express your answer in MJ with 3 significant figures.

E. Schematic diagram for a heat engine is shown below. Sketch a similar diagram for a refrigerator in the box below. Also write an expression/equation involving *QH, QL, and W.*

|  |  |  |
| --- | --- | --- |
| http://edugen.wiley.com/edugen/courses/crs1650/art/images/halliday8019c20/image_t/tfg008.gif |  | Expression/equation involving *QH, QL, and W.* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  |
| Heat Engine | Refrigerator |

F. Coulomb’s law is given by:  Coulomb’s constant = k = 9 x 109 (SI)
1. Express the SI unit of the Coulomb’s constant:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Figure below shows three point charges that lie along the *x* axis in a vacuum, with no gravity.
a. Draw a free-body diagram for the charge *q3*.
b. Determine the magnitude and direction of the net electrostatic force on q3.
