Manoura University
Faculty of Engineering
Building & Construction Engineering Program
Fall Semester 2012/2013
Course Title: Physics 1
Course Code: PHYS 011

فيزياء ١

Final Exam (50%)
Time: 2 hours
Date : 15th Jan 2013

Answer All Questions

Questions No. 1: (13 Marks)

1-a) Draw the heating curve of water. (2 Degrees)

1-b) Write down the advantages and disadvantages of constant volume gas thermometers. (2 Degrees)

1-c) A 100 g of ice at -15 °C is added to 200 g of water at 12 °C. (i) What is the final temperature of the system? (ii) Find the composition of the system after equilibrium. Take the specific heat for water is 4186 J/Kg°C and for ice is 2100 J/Kg°C and the latent heat of fusion for ice is 3.337×10^5 J/Kg. (4 Degrees)

1-d) A long-thin wire of steel was stretched at 25 °C between two rigid points so that the wire had an initial tensile stress of 1.2×10^7 Pa. (i) At what temperature the wire will be released from the stress? (ii) What is the magnitude of stress at 15 °C? (iii) What is magnitude of stress at 50 °C? Take the linear expansion coefficient of steel is 12×10^{-6} C^{-1} and the Young's modulus is 2×10^{11} Pa. (5 Degrees)

Questions No. 2: (12 Marks)

2-a) A box with a total surface area of $0.2m^2$ and a wall thickness of 7 mm is made of insulating material. A 30-W electric heater inside the box maintains the average temperature of the inside surface of the box is 17 °C above that of the outside surface. Find the thermal conductivity of the insulating material. (4 Degrees)

2-b) An ideal gas with an initial volume of 0.01 m^3 and an initial pressure of 2.0 MPa expands to final volume of 1 m^3. The relationship between pressure and volume during the expansion is PV = const. Determine, (i) the value of the constant, (ii) the work done, w, (iii) the heat, Q, and (iv) the change in the internal energy, ΔU. (5 Degrees)

2-c) An ideal gas is taken through a Carnot cycle. The isothermal expansion and compression processes were at 300 °C and 50 °C, respectively. If the gas absorbs 1000 J of heat during the isothermal expansion, find (i) the work done by the gas in each cycle and (ii) the heat expelled to the cold reservoir in each cycle and. (4 Degrees)

Mechanical properties of metals and waves

Question 3

a- A rock climber hangs freely from a nylon rope that is 14 m long and has a diameter of 8.3 mm. If the rope stretches 4.9 cm, what is the mass of the climber? ($E = 8 \times 10^8\ N/m^2$) [2 marks]

b- For a damped oscillator, m = 250 g , k = 85 N/m, and b = 70 g/s.
i) What is the period of the motion? ii) What is the ratio of the amplitude of the damped oscillations to the initial amplitude at the end of 20 cycles? [4 marks]

c- The displacement of a block attached to a horizontal spring whose spring constant is 12 N/m is given by $x = 0.5 \sin(4t - 0.6)$ m. Find i) The mass of the block, ii) The total energy, and iii) The first time $t > 0$ when the acceleration equal one-half the maximum value. [6 marks]

d- Sketch : **i**) The variation of the kinetic energy, potential energy, and total energy as a function of position for simple harmonic motion **(SHM).**
ii) The displacement of all types of damped motion as a function of time. [4 marks]

Question 4

a- With what tension must a string with length 2.5m and mass 0.12 kg be stretched for transverse waves of frequency 40 Hz to have a wavelength of 0.75m? [3 marks]

b- Two independent sound sources individually produce intensity levels of 80 dB and 85 dB at a point. What is the total intensity level at that point? [3 marks]

c- The siren of a police car moving at 40m/s has a natural frequency of 600 Hz. A truck ahead of the car is moving at 20m/s in the same direction. What is the frequency of the sound heard by the truck. (speed of sound = 340 m/s) [3 marks]

my best wishes