Menofia University Faculty of Engineering, Shebin El-Kom Basic Engineering Science Department 1st Semester Examination,2014-2015 Date of Exam: 13 / 1 / 2015	جامعة المنوفية	Subject: PHYSICS Code: BES022 Year: Preparatory Year Time Allowed : 3 hours Total Marks : 75 marks

الامتحان صفحتين (اجب كل جزء منفصل)

Answer all the following questions:

Part 1

Question (1) (12 Marks)

a) Prove that the total energy of a body moves in a simple harmonic motion is conserved.

b) Consider the motion of a comet in an elliptical orbit around a star. The eccentricity of the orbit is 0.4 and the distance between the perihelion and the aphelion is 12×10^{10} m.

i) Find the distance of nearest and farthest approaches of the comet.

ii) If the speed of the comet is 80km/sec at the perihelion, what is its speed at aphelion?

c) A mass of 300 g moves along the x- direction under the influence of a spring with spring constant 0.05 N/cm. At t = 0 sec , the mass is at the origin and moving with a speed of 60 cm/sec in the +ve x – direction.

(i) At what time does the mass first arrive at its maximum extension.

ii) Determine the maximum extension.

Question (2) (13 Marks)

a) Describe and explain Kepler`s second law

b) Prove that the acceleration of gravity varies with altitude, and determine where the acceleration is vanished from the center of Earth?

c) A steel rod of length 8m and cross-sectional area 10^{-4} m^2 is fixed at one end and stretched with a force of 500 N at the other end. Find the stress, the strain, and the final length of the rod. (Young`s modulus $Y = 20 \times 10^{10} N/m^2$)

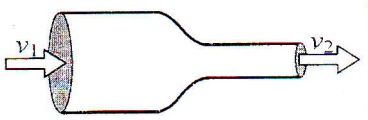
d) Prove that the height of water in a capillarity tube is inversely proportional to its radius.

Part 2

Question (3) (12 Mark)

a) State the physical meaning of the continuity equation (without prove)

b) A Horizontal pipe has a smooth reduction in its diameter, as in the figure. If the pressure difference "ΔP" between the two ends of the pipe is doubled, what will happen to the velocity of the fluid at the smallest end "v_2"?



c)A glass-window is 3.00 *mm* thick and has dimensions of 3.00 *m* and 2.00 *m*. If the outside temperature is 5°*F* and the inside temperature is 295°*K*, how much heat in joules does it conduct in each hour? (K_{glass} = 0.84 *J/s.m.°C*)

Question (4) (13 Marks)

a) Define: (i) the coefficient of viscosity, (ii) the thermocouple, and (iii) specific heat (c).

b) Why the latent heat of vaporization of water (L_v) is so much larger than the latent heat of melting (L_m)?

c) A 175 g copper block at 90°C is dropped into an aluminum calorimeter cup initially at 20°C. The calorimeter cup has a mass of 400 g and contains 430 g of water, also at 20°C. What is the final temperature of the system?

($c_{Cu} = 0.093\ kcal/kg\ °C$, $c_{Al} = 0.22\ kcal/kg\ °C$, $c_{water} = 1\ kcal/kg\ °C$)

Part 3

Question 5 (12 marks)

a) Explain and prove that, why the molar specific heat at constant pressure (C_p) of an ideal gas is greater than its specific heat at constant volume (C_V)

b) O_2 gas of 10 moles initially at 0°C when its volume doubles isothermally.
Calculate: i) the work done by the gas ii) the change in its entropy (ΔS) (R =8.314 J/mole.K)

c) A heat engine performs 200 J of work in each cycle and has an efficiency of 30%. For each cycle, how much thermal energy is (i) absorbed (Q_h) and (ii) expelled (Q_c)?

Question 6 *(13 marks)*

a) Using the pressure of an ideal gas $P = \frac{1}{3}\rho\overline{v^2}$, prove that the root – mean square velocity of an ideal gas is given by $v_{rms}=\sqrt{\frac{3RT}{M}}$

b) Two ideal gases Hydrogen (M = 2g/mole) and Oxygen (M = 32g/mole) are at the same temperature. If the v_{rms} velocity of the Oxygen molecules is 4m/s, calculate the v_{rms} velocity of the Hydrogen molecules.

c) 10 mole of a sample of an ideal gas is put through the cycle of operations shown in the figure where BC is an adiabatic process.

i) What are the values of T_A, T_B and T_C.

ii) Find the heat (Q), work (W) and ΔU for each process.

($Take\ Cv = \frac{3}{2}R$)

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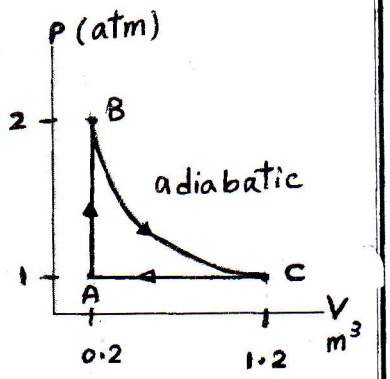

With our Best Wishes

This exam measures the following ILOs																
Question Number	Q2-c	Q5-d	Q1-a	Q1-a	Q3-a	Q4-a	Q1-c	Q6-c	Q2-c	Q2-a	Q3-b	Q4-b	Q4-b	Q6-a	Q3-c	Q4-c
Skills	a1-1	a1-2	a2-1	a2-1	a1-2	a1-2	b4-1	b4-1	b2-1	b4-1	b4-1	b4-1	c9-1	c9-1	c4-3	c3-3
	Knowledge &Understanding Skills						Intellectual Skills						Professional Skills			