KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2010/2011

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

SCE 113: PHYSICS 1

DATE: **Tuesday 30th November 2010** **TIME: 11.00a.m -1.00p.m**

INSTRUCTIONS

1. Answer questions ONE and any other TWO questions.
2. The following constants and table may be useful:
   Speed of light in air $c = 3 \times 10^8$ m/s $g = 9.81$ m/s^2

Q1. (a) (i) In words, explain what is meant by simple harmonic motion? (1 mark)

(ii) A body of mass 3 kg is attached to a spring with $k = 0.05$ N/m. If it is stretched and released what is the period. (3 marks)

(b) (i) In words, explain what is meant by a conservative force? (1 mark)

(ii) Show that force due to a spring is conservative. (1 mark)

(c) (i) In words, what is meant by work-energy theorem? (1 mark)

(ii) A child of mass 30 kg takes a ride on an irregularly curved slide of height 3 m. Determine the speed of the child at the bottom, assuming there is no friction present. (3 marks)

(d) (i) In words, what is meant by first law of thermodynamics. (1 mark)

(ii) Two moles of a gas kept at constant temperature of 273 K, is compressed from a volume of 4 l to 1 l. What is the work done on the gas? (3 marks)

(e) (i) What is meant by the kinetic theory of gases? (1 mark)

(ii) A cylinder contains 3 moles of helium gas at a temperature of 300 K. How much heat must be transferred to the gas to

increase its temperature to 500 K if the gas is heated at constant volume and C_v for helium is 12.5 J/molK?

(f) (i) In words, what is meant by Youngs' modulus. (1 mark)

(ii) What is the Youngs' modulus of a material of a material 0.05 m long and 2 mm in diameter which stretches 0.15 mm when stressed by a 10 kg weight? (3 marks)

(g) (i) In words, what is meant by viscosity of a fluid? (1 mark)

(ii) A metal plate of area 0.15 m^2 is connected to an 8-kg mass via string that passes over a massless-frictionless pulley. A lubricant with a film thickness of 0.3 mm is placed between the plate and the surface. When released the plate moves with a speed of 0.085 m/s. Find the coefficient of viscosity of the lubricant. (3 marks)

(h) Differentiate between thermal conductivity and specific heat capacity. (2 marks)

Q2. (a) A ball of mass 0.5 kg is dropped from a height of 100 m above the ground. Determine the

(i) speed of the ball when it is at a height of 40 m above the ground (5 marks)

(ii) speed of the ball when it is at a height of 40 m above the ground if it is given an initial speed 10 m/s. (5 marks)

(b) A pendulum consists of a sphere of mass 100 g attached to a light cord of length 1 m. The sphere is released from rest when the cord makes an angle 40° with the vertical. Determine the

(i) speed of the sphere when it is at its lowest point. (5 marks)

(ii) tension in the cord when the sphere is at its lowest point (5 marks)

Q3. (a) One mole of an ideal monoatomic gas starts at a point A in Fig 1.

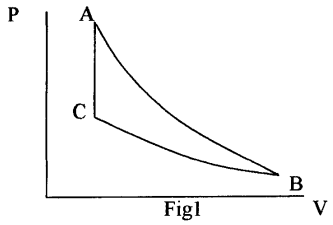

Fig1

($T_A = 273$ K, $P_A = 1$ atm) and undergoes an adiabatic expansion to point B where $V_B = 2V_A$. This is followed by an isothermal compression to the original volume at C where $V_C = V_A$ and a pressure increase at constant volume back to the original pressure. Taking $\gamma = 5/3$, calculate the

(i) temperature at point B. (3 marks)
(ii) pressure at point C. (3 marks)
(iii) total work done for this cycle. (3 marks)

(b) A reversible heat engine carries 1 mole of an ideal monoatomic gas around the cycle shown in Fig 2.

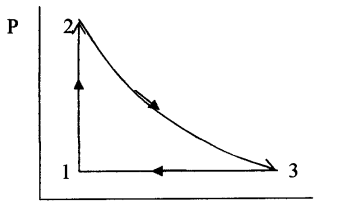

Fig 2

Calculate

(i) Q_{12}, W_{12} and ΔU_{12}. (3 marks)
(ii) Q_{23}, W_{23} and ΔU_{23}. (3 marks)
(iii) Q_{31}, W_{31} and ΔU_{31}. (3 marks)
(iv) P_2 and P_3 if $P_1 = 1$ atm. (2 marks)

Q4. A horizontal spring is found to be stretched 7.5 cm from its equilibrum position when a force of 0.34 kg acts on it. Then a 1.125 kg body is attached to the end of the spring and is pulled 10 cm along the horizontal frictionless table from the equilibrium position. What is the

(i) spring constant (2 marks)
(ii) force exerted by the spring on the 1.125 kg body just before it is released? (2 marks)
(iii) period of ascillation after release. (2 marks)
(iv) amplitude of the motion (2 marks)
(v) maximum speed of the vibrating body (3 marks)
(vi) maximum acceleration of the body (3 marks)
(vii) total energy of the oscillating system (3 marks)
(viii) equation of the displacement of the body as a function of time (3 marks)

Q5. (a) A speeder traveling at a constant speed of 100 km/h passes a waiting police car which immediately starts from rest with a constant

acceleration of 2.5 m/s^2.

(i) How long will it take the police car to catch the speeder? (5 marks)

(ii) How fast will the police car be travelling when it catches with the speeder? (3 marks)

(iii) How far will the police car have travelled? (3 marks)

(b) A ball is thrown vertically upward from a 100 m high building with an initial velocity of 50 m/s.

(i) How high does it take to reach its maximum height. (3 marks)

(ii) How much time does it take to reach its maximum height? (3 marks)

(iii) How long does it take to return to the top of the building? (3 marks)

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