THE KENYA POLYTECHNIC

SURVEYING & MAPPING DEPARTMENT

DIPLOMA IN LAND SURVEY

END OF YEAR I EXAMINATIONS

NOVEMBER 2006

PHYSICS

3 HOURS

INSTRUCTIONS TO CANDIDATES:

You should have the following for this examination:

Answer booklet

Calculator/Mathematical tables

Answer any FIVE of the following EIGHT questions.

All questions carry equal marks and the maximum marks for each part of a question are as shown.

This paper consists of 4 printed pages.

1. (a) A half-metre rule pivoted at the 30^{th} cm mark balances with 25g at the 40^{th} cm mark. Calculate its mass. (5 marks)

   (b) A car covers 200m in accelerating at $4m/s^2$ for 5 seconds. Calculate its initial velocity. (5 marks)

   (c) Calculate the time taken for a stone thrown vertically upwards at 3m/s to start returning. (5 marks)

   (d) Calculate the maximum height reached by the stone in (c) above. (5 marks)

2. (a) If a ball kicked at 0.9m/s lands 70m into the field, calculate the angle at which it was kicked. (5 marks)

   (b) Calculate the maximum height reached by the ball in (a) above. (5 marks)

   (c) The centripetal force of a vehicle traveling at 8m/s on a round about of radius 40m was found to be 3200N. Calculate the mass of the vehicle. (5 marks)

   (d) A 500kg car and a 2 ton vehicle traveling at 20m/s after collision have a common velocity of 22m/s. Calculate the velocity of the car before collision. (5 marks)

3. (a) How do force and distance affect a moment? (1 mark)

   (b) Differentiate between linear velocity and angular velocity. (4 marks)

   (c) Prove that for a horizontal pendulum $v^2 = gr\tan\theta$, where v is its linear velocity, r is the radius of the circle described by the pendulum and θ is the angle of the pendulum. (10 marks)

   (d) Given the following specific heat capacities for the liquids listed, rank the liquids in terms of suitability as coolants, starting from the best.

LIQUID	**SPECIFIC HEAT CAPACITY, J/kgK**
A	3200
B	500
C	100
D	1200
E	800

(5 marks)

4. (a) 4000J of work were done in pushing a lawn mower inclined at 45^0 with a force of 50N. Calculate the distance covered. (5 marks)

(b) Find the distance between a 50kg person and another of 80kg is the gravitational force between them is $3x10^{-10}$N, given $G = 6.673 \times 10^{-11} Nm^2 / kg^2$. (5 marks)

(c) A certain quantity of water at 25^0C boils after absorbing $1.6x10^6$J of heat. Calculate the mass of water if its specific heat capacity is 4200J/kgK. (5 marks)

(d) Prove that the force of a moving body is the product of its mass and acceleration. (5 marks)

5. (a) Define the coefficient of cubical expansion. (2 marks)

(b) A rod of material 5cm radius and 70J/smK conductivity whose ends are at 20^0C and 80^0C respectively is losing heat at the rate of 20J/s. Calculate the length of the material. (5 marks)

(c) State Newton's laws of cooling. (2 marks)

(d) Draw a labeled diagram of the simpler method of verifying Boyle's law. (11 marks)

6. (a) Under what conditions does an ideal gas tend to behave like a real gas? (2 marks)

(b) Calculate the new pressure of $50cm^3$ of gas at 40^0C and 3 atmospheres pressure that contracts to $10cm^3$ on cooling to 15^0C. (5 marks)

(c) Using a sketch, describe the properties of an image formed by a convex mirror. (13 marks)

7. (a) Draw a diagram illustrating refraction where the first medium is denser than the second. (5 marks)

(b) Find the angle of incidence of a ray that is refracted at 20^0 in glass of refractive index 1.5. (5 marks)

(c) Calculate the apparent depth of a 20m deep pool of water of refractive index 1.33. (5 marks)

(d) Find the total deviation of a ray incident on a prism if the first angle of incidence is 20^0, the second 30^0, the first angle of refraction is 10^0 and the second is 15^0. (5 marks)

8. (a) Draw a diagram showing how a prism can be used to turn an inverted image upright. (5 marks)

(b) Using the graph paper at the back of your answer sheet, diagrammatically derive the nature and position of the image formed by an object placed 7cm in front of a convex lens of focal length 5cm. (15 marks)