UGANDA ADVANCED CERTIFICATE OF EDUCATION
REGISTRATION EXAMINATIONS 2016
PHYSICS
PAPER 1
2HOURS 30MINUTES

Instructions

Answer five questions including atleast one but not more than two questions from each of the sections A, B and C.

- *Assume where necessary.*
- *Acceleration due to gravity* g $= 9.81 ms^{-2}$
- *Electron charge* e $= 1.6 \times 10^{-19} C$
- *Electron mass* $= 9.11 \times 10^{-31}$ *kg*
- *Radius of earth* $= 6.4 \times 10^{6}$ *m*
- *Plank's constant* h $= 6.6 \times 10^{-34}$ *JS*
- *Speed of light in vacuum,* C $= 3.0 X 10^{8} ms^{-1}$
- *Stefan's Boltzmann's constant* δ $= 5.67 \times 10^{-8} Wm^{-2}K^{-4}$
- *Specific heat capacity of water* $= 4.2 \times 10^{3} Jkg^{-1} K^{-1}$
- *Gas constant, R* $= 8.31 Jmol^{-1}K^{-1}$
- *Universal gravitational constant G* $= 6.67 \times 10^{-11} Nm^{2} Kg^{-2}$
- *Avogatro's number* N_A $= 6.02 X 10^{23} mol^{-1}$
- *One electron volt (eV)* $= 1.6 \times 10\text{-}19 J$
- *Mass of the earth Me* $= 5.97 \times 10^{-31} kg$
- *Electron charge the mass ratio* e/m $= 1.8 \times 10^{11} Ckg^{-1}$
- *Specific heat capacity of copper* $= 400 Kg^{-1}K^{-1}$

SECTION A

1. a) Distinguish between a conservation force and a non-conservation force giving any one example of each. (3marks)

b) A body of mass 200g is thrown vertically upwards from a point 10m from the ground which later falls to the ground.
i) Sketch a displacement time graph for motion of the body. (2marks)
ii) State the energy changes of the body from the time it's thrown to the time it falls to the ground. (2marks)
iii) If it takes 10s to reach maximum height, determine the velocity at which it was thrown and hence the maximum height from the ground. (5marks)

c) i) Define the term moment of a force. (1mark)
ii) State conditions for a body to be in mechanical equilibrium. (2marks)
iii) A builder of mass 60kg climbs up a 2m long ladder leaning against a smooth vertical wall and a rough horizontal ground whose coefficient of friction is 0.25. If the ladder makes 40^0 with the horizontal, determine how far the builder is from the ground for the ladder to just slide down. (5marks)

2. a) i) Define the term simple harmonic motion. (1mark)
ii) State four practical examples of simple harmonic motion. (2marks)
iii) Use graphical illustrations to distinguish between damped and free oscillations. (4marks)
iv) Give any one reason why the oscillations of bodies executing simple harmonic motion ultimately die out. (1mark)

b) Define the following terms as used in circular motion.
i) Angular velocity
ii) centripetal acceleration. (2marks)

c) A stone of mass 20g is whirled in a vertical circle using an inelastic thread of length 1.0m. If the frequency of oscillation is 25Hz, determine the maximum tension in the thread. (4marks)

d) i) State Newton's law of Universal gravitation. (1mark)
ii) What is meant by the term parking orbit in gravitation? (1mark)

iii) Describe how geostationary satellites are used in world wide communication. (4marks)

3. a) Distinguish between brittle and ductile materials. (2marks)

b) i) Define the term tensile stress and tensile strain. (2marks)
ii) Sketch using the same axes, the stress strain graphs for glass and rubber. (3marks)
iii) Explain the shapes of the graphs drawn in b(ii) above. (3marks)

c) A mass of 20kg is suspended from a length of copper wire of radius 1.0mm. The wire then suddenly breaks.
i) Explain why the temperature of the wire increases when it breaks suddenly. (3marks)
ii) Calculate the change in temperature of the wire. (3marks)
[E= 1.2 X 10^{11}Nm^{-2}, Density = 9000kgm^{-3}, SHC = 420Jkg^{-1}k^{-1}]
d) Show that the energy stored per unit volume in a stretch material is given by ½ (stress)(strain). (4marks)

4. a) i) Define surface tension. (1mark)
ii) Explain the occurrence of surface tension using the molecular theory. (3marks)
b) A u-tube with limbs of diameter 8.0mm and 3.0mm contains water of surface tension 7 X 10^{-2}Nm^{-1} and angle of contact as zero. Find the difference in the levels of water in the two limbs. [Density of water = 1000kgm^{-3}]. (4marks)

c) i) State Archimedes Principle. (1mark)
ii) An alloy of silver and gold weighs 35.2g in air and 33.13g when fully submerged in water. Given that the densities of silver and gold are 10.5gcm^{-3} and 18.90gcm^{-3} respectively. Find the mass of silver within the alloy. (4marks)
d) i) Write Bernoulli's equation and define the symbols used. (2marks)
ii) State any one practical application of Bernaoulli's principle. (1mark)
iii) A tank filled with water has a hole of radius 2.0cm at a point 4.0cm below the water level. Calculate the mass of water that flows out of the hole per second. (4marks)

SECTION B

5. a) i) What is a thermometric property? (1mark)
ii) Give four examples of thermometric properties. (2marks)

b) i) Define the terms heat capacity and specific heat capacity of a substance.
(2marks)
ii) Describe the electrical method of determining the specific heat capacity of a metal. (5marks)

c) i) A solid of mass 0.5kg and specific heat capacity of $400Jkg^{-1}k^{-1}$ at a temperature of 90^0C is placed into a mixture of ice and 0.1kg of water at standard pressure in a well lagged calorimeter. The final temperature in the calorimeter is found to be 10^0C. Find the mass of ice that was in the mixture. (4mark)

ii) State any two advantages of the continuous method of determining the specific heat capacity of a liquid over the method of mixtures. (2marks)

d) i) What is meant by specific latent heat of fussion? (1mark)
ii) Explain why the specific latent heat of vaporization of a substance is higher than the specific latent heat of fussion of the same substance.
(3marks)
6. a) i) What is meant by a black body? (1mark)
ii) State Stefan's law of black body radiation. (1mark)

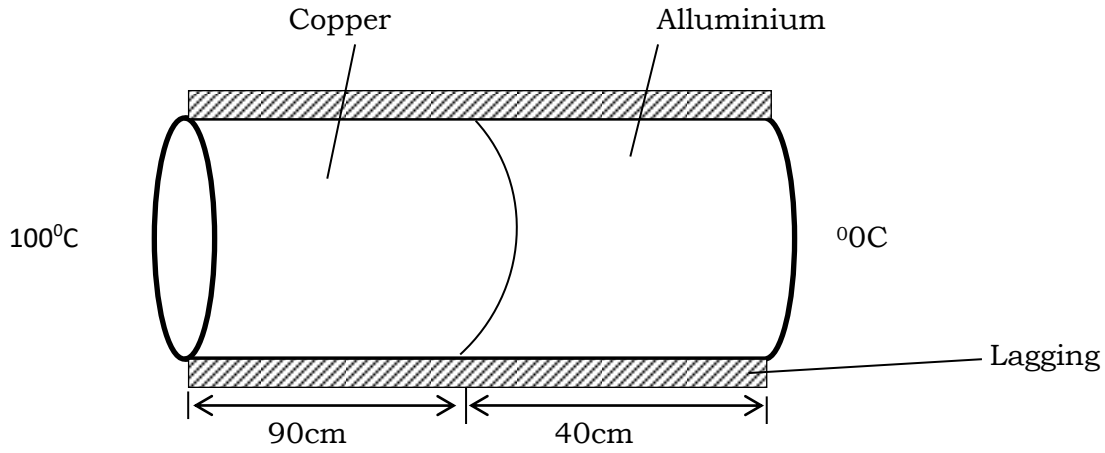
b) The filament of an electric bulb that radiates as a black body is 0.5m long and has a radius of 0.1mm. The filament melts when connected across a 240V supply and the current through it is 0.4A. (4marks)
i) Calculate the temperature at which the filament melts. (4marks)
ii) Find the wave length for which the energy radiated by the filament is maximum.(Wein's constant = $2.9 \times 10^{-3}mk$). (2marks)

c) i) Define the term thermoconductivity and state its S.I unit. (2marks)

ii) In an experiment to determine the thermo conductivity of a poor conductor of heat give a reason as to why the specimen must be thin and of large cross-sectional area. (2marks)

iii) Sketch a graph for temperature gradient for a lagged metal. (2marks)

d) A uniform composite metal of diameter 4.0cm is made of copper and aluminium and arranged as shown in the figure below.



Given that the thermo conductivities of copper and alluminium are 390 and 210Wm^{-1}k^{-1} respectively, calculate for;

i) Temperature at the interface (4marks)

ii) Rate of heat flow through the solid. (2marks)

7. a) i) Distinguish between a real and an ideal gas. (3marks)

ii) State four assumptions made in the derivation of the kinetic theory expression for pressure of an ideal gas. (4marks)

iii) Which assumptions in a(ii) above have to be modified for real gasses. (1mark)

iv) Derive the expression mentioned about in e(ii) above where the terms take their usual meaning. (6marks)

b) i) State Newton's Law of cooling. (1mark)

ii) Describe an experiment to verify Newton's law of cooling. (5marks)

SECTION C

8. a) i) State the laws of photo electric effect. (4marks)

ii) Explain clearly how the classical theory fails to account for the existence of photo electric effect. (5marks)

b) Explain what is meant by the following terms as used in photo electric emission.

i) Stopping potential (1mark)

ii) space charge (2marks)

iii) Saturation value of current (2marks)

c) An effective point source emits monochromatic height of wave length 4.5 X 10^{7}m at a rate of 0.2W. Light from the source is emitted uniformly in all directions and falls normally on a cathode of area 3.14 X $10^{-4}m^{2}$ of a photocell at a distance of 50cm from the source.

i) How many photons leave the source per second.

ii) Calculate the photo current assuming that 20% of the photons hitting the cathode liberate electrons. (3marks)

d) What is photon? (1mark)

***END** **