**P510/1**

**Physics**

**Paper 1**

**2 ½ hours**

**July/August 2019**



**KAYUNGA SECONDARY SCHOOLS EXAMINATIONS COMMITTEE (KASSEC)**

**JOINT MOCK 2019**

***Uganda Advanced Certificate of Education***

**PHYSICS**

**PAPER ONE**

**2 HOURS 30 MINUTES**

**INSTRUCTIONS TO CANDIDATES:**

* Answer **five** questions, including at least one, but not more than two from each of the sections **A, B** and **C**.
* Any additional question (s) answered will not be marked.
* Non programmable scientific calculators may be used.
* Assume where necessary
  + - Acceleration due to gravity, g = 9.81ms – 2
    - Electron charge’ e = 1.6 x 10 – 19C
    - Electron mass = 9.11 x 10 – 31kg
    - Mass of the earth = 5.97 x 1024kg
    - Plank’s constant, h = 6.6 x 10 – 34 JS
    - Stefan’s constant, σ = 5.67 x 10 – 8 WM – 2 K – 4
    - Radius of the earth = 6.4 x 106M
    - Radius of the sun = 7.0 x 108M
    - Radius of earth’s orbit about the sun = 1.5 x 1011M
    - Speed of light in a vacuum, C = 3.0 x 108MS – 1 .
    - Thermal conductivity of copper = 390WM – 1 K – 1
    - Thermal conductivity of aluminium = 210WM – 1K – 1
    - Universal gravitational constant G = 6.67 x 10 – 11 NM2Kg – 2
    - Avogadro’s number, NA = 6.02 x 1023mol – 1
    - Surface tension of water = 7.0 x 10 – 2 NM – 1
    - Density of water = 1000kgm – 3
    - Gas constant, R = 8.31Jmol – 1K – 1
    - Charge to mass ratio, e/m = 1.8 x 1011Ckg – 1
    - The constant = 9.0 x 109F – 1 M
    - Faraday’s constant, F = 9.65 x 104 Cmol – 1.

**SECTION A**

1.(a) State the laws of friction. (03 marks)

(b) A car of mass 1000kg, moving along a straight road with a speed of 72kmh – 1 is brought to rest by a steady application of the brakes in a distance of 50m. Find the coefficient of kinetic friction between the tyres and the road. (04 marks)

(c) A bullet of mass 0.012kg and horizontal speed 70ms – 1 strikes a block of wood of mass 0.4kg and instantly comes to rest with respect to the block. The block is suspended from the ceiling by mean of a thin string.

(i) Calculate the height to which the block rises (03 marks)

(ii) Estimate the amount of heat produced in the block. (02 marks)

(d) Define the following terms

(i) momentum (01 mark)

(ii) Impulse (01 mark)

(e) (i) State the work – energy theorem. (01 mark)

(ii) Two identical balls A and B of mass 1.5kg are moving with velocities 15ms – 1 and 5ms – 1 respectively. It is found out that after collision the total kinetic energy lost by the balls is 37.5J.

Find the velocities with which the balls move after collision. (05 marks)

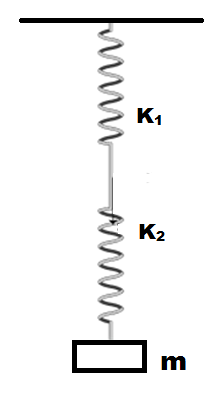
2.(a) Define the following terms as applied to oscillatory motion.

(i) Amplitude (01 mark)

(ii) Period (01 mark)

(b) State four characteristics of simple harmonic motion (02 marks)

(c) A mass, m of 0.1kg is suspended from a rigid support by a combination of two springs of force constants K1 = 100Nm – 1 and K2= 150Nm – 1 respectively as shown in the diagram below.



(i) Find the total energy stored in the springs (03 marks)

(ii) The mass is pulled down through a small distance and released. Calculate the frequency of oscillation of the systems. (04 marks)

(d) A piston in a car engine performs simple harmonic motion of frequency 12.5Hz. If the mass of the piston is 0.5kg and its amplitude of vibration of 45mm, find the maximum force on the piston. (03 marks)

(e) Describe an experiment to determine the acceleration due to gravity, g using a spiral spring of known force constant. (06 marks)

3.(a) Define the following;

(i) Gravitational field strength, (01 mark)

(ii) Gravitational potential (01 mark)

(iii) Parking orbit (01 mark)

(b) (i) State Newton’s law of gravitation. (01 mark)

(ii) With the aid of a labelled diagram, describe an experiment to determine the gravitational constant G. (06 marks)

(c) A satellite of mass 200kg is launched into an orbit about the earth at a height of 3.6 x 107m above the earth’s surface.

(i) Calculate the mechanical energy of the satellite. (03 marks)

(ii) Calculate the period of this satellite. (03 marks)

(iii) Briefly comment on the value obtained in (ii) above with respect to the earth. (02 marks)

(d) Sketch a graph to show the variation of acceleration due to gravity with distance from the centre of the earth. (02 marks)

4.(a) What is meant by;

(i) uniform circular motion, (02 marks)

(ii) centripetal acceleration? (01 mark)

(b) A body of mass, mkg moving with a constant speed, V, describes a circular path of radius, r. Derive an expression for the centripetal force on the body. (04 marks)

(c) A motor cycle rider moves round a circular track of radius, R at a constant speed, V.

(i) Draw a sketch diagram to show the forces acting on the motor cycle. (02 marks)

(ii) Show that the angle, θ, of inclination of the motor cycle to the vertical is given by θ = tan – 1 (03 marks)

(iii) Calculate the maximum angle of inclination to the vertical for safe riding given that the coefficient of limiting friction between the tyres and the ground is 0.4. (02 marks)

(d) A pendulum bob of mass 0.2kg is attached to one end of an inelastic string of length 1.2m. The bob moves in a horizontal circle with the string inclined at 300 to the vertical. Calculate the;

(i) tension in the string (02 marks)

(ii) period of the motion (04 marks)

**SECTION B**

5(a) (i) State the assumptions made in the derivation of gas equation P =

(02 marks)

(ii) State Dalton’s law of partial pressures. (01 mark)

(iii) Use the expression P = to deduce Dalton’s law stated in (ii) above (03 marks)

(b) Explain;

(i) What happens to the pressure of a fixed mass of a gas in a sealed container when the temperature of that gas is raised. (04 marks)

(ii) Why water on top of a high mountain boils at a lower temperature than that at the bottom of the mountain. (04 marks)

(c) Two hollow spheres A and B of volume 500cm3 and 250cm3 respectively are connected by a narrow tube fitted with a tap. Initially the tap is closed and A is filled with an ideal gas at 100C at a pressure of 3.0 x 105Pa and B is filled with an ideal gas at 1000C at a pressure of 1.0 x 105pa. Calculate the;

(i) equilibrium pressure when the tap is opened. (03 marks)

(ii) resulting temperature when the tap is opened. (03 marks)

6.(a) (i) What is meant by a black body? (01 mark)

(ii) Sketch the spectral curves of relative intensity against wave length of a black body at three different temperature and state the main features of the curves. (05 marks)

(b) (i) State stefan’s law of black body radiation. (01 mark)

(ii) The sun is a black body of surface temperature 6000k. If the radius of the earth’s orbit about the sun is 1.5 x 1011m, estimate the equilibrium temperature of the earth. (05 marks)

(c) Define thermal conductivity of a material and state its units. (02 marks)

(d) A double glazed window has two glass sheets each of thickness 3.0cm. They are separated by a layer of air of thickness 1.0cm. If the two inner air-glass surfaces have steady temperatures of 200C and 40C respectively, find the;

(i) temperatures of the outer air – glass surfaces. (03 marks)

(ii) amount of heat that flows across a 2m2 cross sectional area in 2 hours. (03 marks)

(Conductivity of glass = 0.72wm - 1K – 1 and that of air = 0.025wm – 1 K – 1)

7.(a) (i) Define specific heat capacity of a substance. (01 mark)

(ii) Explain why the specific heat capacity of a body in solid state is lower than its specific heat capacity in liquid state. (03 marks)

(b) (i) With the aid of a labelled diagram describe the method of mixtures to determine the specific heat capacity of a solid. (06 marks)

(ii) State two advantages of the continuous flow method over the method of mixtures in the determination of specific heat capacity. (02 marks)

(iii) In a continuous flow calorimeter experiment, water flows at a rate of 5.0gs – 1 and a liquid X must flow at 8.0gs – 1 to maintain the same temperature difference and power supply as in the case of water. Find the specific heat capacity of liquid X. (03 marks)

(c) (i) Explain why the temperature of a liquid does not change when the liquid is boiling. (02 marks)

(ii) Explain how a Kelvin scale of temperature can be established. (03 marks)

**SECTION C**

8.(a) Explain briefly how positive rays are produced. (03 marks)

(b) An electron of charge, e and mass, m, is emitted from a hot cathode and then accelerated by an electric field towards the anode. If the potential difference between the cathode and the anode is V, show that the speed of the electron, u, is given by.

U = (03 marks)

(c) (i) A beam of electrons is accelerated through a potential difference of 600V. The beam enters midway between two parallel plates of length 12cm and are 4cm apart. If the potential difference across the plates is 800V, Find the velocity of an electron as it leaves the region between the plates. (08 marks)

(ii) Explain the path of the electron beam as it emerges out of the electric field. (02 marks)

(d) Explain how line emission spectra are produced. (04 marks)

9.(a) A beam of alpha particles is directed normally to a thin metal foil.

Explain why

1. most of the alpha particles passed straight through the foil, (02 marks)
2. few alpha particles are deflected through angles more than 900. (02 marks)

(b) Calculate the least distance of approach of a 4.0MeV alpha particle to the nucleus of a gold atom. (Atomic number of gold = 79) (04 marks)

(c) State the laws of photo electric emission. (04 marks)

(d) Sodium has work function of 2.0eV and is illuminated by radiation of wave length 150nm. Calculate the maximum speed of the emitted electrons. (03 marks)

(e) With the aid of a labelled diagram, describe how stopping potential of a metal can be measured. (05 marks)

10.(a) Define binding energy of a nuclide (01 mark)

(b) (i) Sketch a graph showing how binding energy per nucleon varies with mass number (01 mark)

(ii) Describe the main features of the graph in b(i) above (03 marks)

(c) Distinguish between nuclear fission and nuclear fusion and account for energy released. (03 marks)

(d) With the aid of a labelled diagram, describe the working of an ionisation chamber. (06 marks)

(e) (i) What is meant by half life and decay constant as applied to radioactivity? (02 marks)

(ii) A Geiger – Muller tube placed 20cm from a 2.0g of Radon gives a count rate of 85 counts per second. If the entrance window of the Geiger – Muller tube has an area of 10cm2, Calculate the half – life of Radon. (04 marks)

**END**