P510/1

**PHYSICS**

PAPER 1

**JUNE 2016**

2½ HOURS

**DEPARTMENT OF PHYSICS**

**MOCK 1 EXAMINATIONS, JUNE 2016**

**UGANDA ADVANCED CERTIFICATE OF EDUCATION**

**PHYSICS**

**PAPER 1**

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**.

Non – programmable scientific calculators may be used.

**Assume where necessary:**

Acceleration due to gravity ***g***

Electron charge

Election mass

Mass of earth

Planck’s constant

Stefan’s – Boltzmann’s constant, **σ**

Radius of Earth

Radius of the sun

Radius of earth’s orbit about the sun

Speed of light in vacuum

Thermal conductivity of Copper

Specific heat capacity water

Universal gravitational constant,

Avogadro’s number,

Density of water

Gas constant,

Specific heat capacity of copper

**SECTION A**

1. (a) Define the following terms:

(i) uniform acceleration (01mk)

(ii) angular velocity (01mk)

(b) (i) What is meant by a banked track? (01mk)

(ii) Derive an expression for the angle of banking, for a car of mass, ,

moving at speed, round a banked track of radius. (03mks)

(c) A bob of mass, , is tied to an inelastic thread of length, and whirled with constant speed in a vertical circle.

(i) With the aid of a sketch diagram, explain the variation of tension in

the string along the circle. (04mks)

(ii) If the string breaks at one point along the circle, state the most likely

position and explain the subsequent motion of the bob. (01mk)

(d) Describe the action of a centrifuge. (03mks)

(e) A car travels round a bend banked at an angle of . If the radius of curvature

of the bend is and the co – efficient of friction between the tyres of the car and the road surface is , calculate the maximum speed at which the car negotiates the bend without skidding. (06mks)

2. (a) (i) What is meant by simple harmonic motion? (01mk)

(ii) State two practical examples of simple harmonic motion. (01mk)

(iii) Using graphical illustrations, distinguish between under damped and

critically damped oscillations. (04mks)

(b) (i) Describe an experiment to measure acceleration due to gravity using

a spiral string. (06mks)

(ii) State two limitations to the accuracy of the value obtained in b(i). (02mks)

(c) (i) State Archimede’s principle. (01mk)

(ii) A cube of rubber of volume floats with half of it volume

submerged in a liquid of density Find the depth of which

the cube will be submerged in a liquid of density . (03mks

(d) Explain why velocity of a liquid at wide part of tube is less than that at a

narrow part. (02mks)

3. (a) (i) Distinguish between conservative and non – conservative forces. (02mks)

(ii) Show that the sum of kinetic energy and potential energy is constant

for a body falling vertically downwards from a point above the grounds

(04mks)

(b) A truck of mass is moving at down a plane inclined at to the horizontal. The truck collides with another truck of mass moving into the same direction with a velocity of . If the trucks stick together after collision, find:

(i) the velocity of the trucks immediately after collision. (03mks)

(ii) the velocity of the trucks 6s after collision given that the co – efficient

of kinetic friction is 0.20. (03mks)

(c) State the conditions for equilibrium of a rigid body under the action of coplanar

Forces. (02mks)

(d) A 3m long ladder rests at an angle of to the horizontal against a smooth vertical wall on a rough ground. The ladder weighs 5kg and its centre of gravity is one third from the bottom of the ladder.

(i) Draw a sketch diagram to show the forces acting on the ladder. (02mks)

(ii) Find the reaction of the ground on the ladder. (04mks)

4. (a) (i) Sketch using the same axes, the stress – strain curves for a glass wire,

a metal wire and a rubber band. (03mks)

(ii) Discuss briefly the main features of the curves. (06mks)

(b) Describe the energy transformations that take place during elastic and plastic

deformations. (04mks)

(c) (i) Explain the origin of surface tension. (03mks)

(ii) Describe an experiment to determine surface tension of a liquid by

capillarity method. (05mks)

(iii) Explain why one needs to blow hard to start a ballon growing. (02mks)

**SECTION B**

5. (a) (i) Define specific latent heat of vaporization. (01mk)

(ii) Describe an electric method for the determination of the specific latent

heat of vaporization of water. (05mks)

(iii) State two advantages of using the method in (a) (ii) above. (02mks)

(b) Explain why the specific latent heat of fusion and specific latent heat of

vaporization of a substance at the same pressure are different. (04mks)

(c) When water was passed through a continuous flow calorimeter the rise in

temperature was from to , the mass of water flowing was in one minute, the potential difference across the heating coil was and the current was 1.5A. Another liquid at was then passed through the calorimeter and got the same change in temperature and potential difference was changed to the current to 1.2A and the rate of flow to 120g in one minute. Calculate the specific heat capacity of the liquid. (05mks

(d) Using the expression for the kinetic pressure of an ideal gas, deduce the ideal

gas equation if (03mks)

6. (a) (i) Define thermal conductivity. (01mk)

(ii) Explain the mechanism heat transfer in metals. (03mks)

(b) A copper kettle containing 1.00kg of water has a base of thickness 2.0mm and

area Calculate:

1. the steady difference in temperature between the inner and outer surfaces of the base which must be maintained so that the temperature

of the water rises at a rate of . (03mks)

1. the specific latent heat of vaporization of water. If it is allowed to boil under the same conditions for and the mass of water remaining . (03mks)
2. Describe an experiment to determine the thermal conductivity of rubber. (06mks)

(c) (i) Define a perfect black body. (01mk)

(ii) Using the same axes, sketch graphs to show the distribution of energy

in the spectrum of radiation from a black body at three different

temperatures. (03mks)

7. (a) (i) What is meant by a thermometric property? (01mk)

(ii) State the qualities that make a particular property suitable for use

in a practical thermometer. (02mks)

(b) Describe with the aid of a diagram how a platinum resistance thermometer

can be used to determine the room temperature. (05mks)

(c) Use the kinetic theory of matter to explain the following observations:

(i) saturated vapour pressure of a liquid increases with temperature. (03mks)

(ii) saturated vapour pressure is not affected by a decrease in volume at

constant temperature. (03mks)

(d) Explain why it is possible to make water boil below its normal boiling point.

(02mks)

(e) Two cylinders and each of volume are joined in the middle by a closed

tap , and placed in a constant temperature both at . contains a vacuum while contains air and saturated water vapour. The total pressure in is . When is opened, equilibrium is reached with the water vapour remaining saturated. If the final pressure in the cylinders is . Calculate the saturation pressure of water at . (04mks)

**SECTION C**

8. (a) (i) What is meant by the terms; radioactive decay, half life and decay

constant? (03mks)

(ii) Show that the half life of a radio isotope is given by:

where is decay constant.

(Assume the decay law ) (03mks)

(b) (i) With the aid of a labelled diagram, describe the structure and action

of Diffusion cloud chamber. (05mks)

(ii) Sketch the curve of ionization current against applied p.d and explain

it’s main features. (04mks)

(c) During the fusion of Uranium, of energy is released.

Calculate the energy in Joules released when of Uranium takes part in

a bomb explosion. (03mks)

(d) Explain the application of carbon – 14 in carbon dating. (03mks)

9. (a) (i) What are cathode rays? (01mk)

(ii) With the aid of a diagram, describe an experiment to show that cathode

rays travel in a straight line. (04mks)

(b) A beam of electrons is accelerated through a potential difference of . The beam enters mid way between two similar parallel plates of length and are apart. If the potential difference across the plates is , find:

(i) the deflection of the electrons as they emerge out of the field. (03mks)

(ii) the velocity of an electron as it leaves the region between the plates.

(04mks)

(c) (i) Explain the emission of x – ray characteristic spectra. (03mks)

(ii) Briefly explain the x – ray diffraction by a crystal. (03mks)

(iii) Under what conditions does x – ray diffraction occur? (02mks)

10. (a) State the laws of the photo electric effect. (04mks)

(b) Describe an experiment to determine the stopping potential of a metal surface.

(05mks)

(c) In a millikan’s oil drop experiment the plates were apart. With no electric field present, a drop of oil of mass fell with a steady velocity of with a potential difference of applied across the plates the drop rose with same velocity. Neglecting upthrust due to air, calculate the number of electron charges on the drop. (06mks)

(d) Sketch the current – potential difference characteristics of a thermionic diode

for two difference operating temperatures and explain their main features.

(05mks)

**END**