**P510/1**

**PHYSICS**

Paper 1

**June 2017**

**2 ½ hours**

# RESOURCE MOCK EXAMINATION, 2017

*Uganda Advanced Certificate of Education*

**S.6**

PHYSICS

**Paper 1**

2 hours 30 minutes

## INSTRUCTIONS:

*Answer* **five** *questions in all, attempting* **utmost three** *from each section* **A** *and* **B**.

*Write in* **blue** *or* **black** *ink only. You may use pencil for diagrams or graphs only.*

*Silent non-programmable scientific calculators may be used.*

*Assume where necessary,*

| | | |
|---|---|---|
| Acceleration due to gravity, $\boldsymbol{g}$ | = | $10ms^{-2}$ |
| Mass of the earth | = | $5.7 \times 10^{24}kg$ |
| Radius of the earth | = | $6.4 \times 10^{6}m$ |
| Radius of the sun | = | $7 \times 10^{8}m$ |
| Electron charge, $\boldsymbol{e}$ | = | $1.6 \times 10^{-19}C$ |
| Avogadro's number, $\boldsymbol{N_A}$ | = | $9.11 \times 10^{31}kg$ |
| Planks constant, $h$ | = | $6.6 \times 10^{-34}Js$ |
| Universal gravitational constant, **G** | = | $6.67 \times 10^{-11}Nm^2kg^{-2}$ |
| Gas constant, R | = | $8.31\ Jmol^{-1}K^{-1}$ |

| | | |
|---|---|---|
| Density of water | = | 1000kg $m^{-3}$ |
| Thermal conductivity of copper | = | 390$Wm^{-1}k^{-1}$ |
| Thermal conductivity of aluminium | = | 210 $Wm^{-1}k^{-1}$ |
| Specific heat capacity of water | = | 4200 $JKg^{-1}k^{-1}$ |

## SECTION A

**1 a) Define** the following

i) Friction (1)
ii) Centre of gravity (1)

b) (i) State the work-energy theorem (1)

(ii) Using molecular theory, explain the laws of solid friction. (6)

c) (i) Describe briefly an experiment to locate centre of gravity of an irregular object. (4)

(ii) List two dangers and two uses of friction (2)

d) A block of mass 2.0kg initially at rest on a horizontal floor moves under the action of a force of 12.9N. If the coefficient of kinetic friction between the block and floor is 0.25,

Calculate the;

i) distance moved by the block in 5 second (3)
ii) change in kinetic energy of the block (2)

**2(a)** Define the following.

(i) Escape velocity (1)
(ii) Parking orbit (1)

b i) State Newton's law of gravitation (1)

(ii) Derive the expression for total mechanical energy E of satellite of mass. m in orbit of radius, r round the earth of mass M. (4)

c) Describe an experiment to determine the universal gravitational constant, G using the laboratory method. (6)

d) Explain the term weightlessness as applied to a space craft (2)

e) A bob of mass 50g is suspended from a light string of length 1.5m. The bob is displaced through a small angle to the vertical and released. The bob moves round a circle of radius 20cm at a speed of $10ms^{-1}$. Calculate the

i) tension in the string (3)
ii) period of bob (2)

**3a)** Define the following;

i) Pressure (1)
ii) Up thrust (1)
a) State the law of flotation (1)
b i) Using a solid of density, ρ and height, h placed in a liquid of density σ, verify Archimedes principle (5)
ii) Describe an experiment to determine the density of a solid which floats in water (4)
iii) Explain the effect of increase in temperature on the viscosity of air (3)
b) A block of mass 100g is suspended from a spring balance. When the block is fully immersed in oil the spring balance reads 0.70N and reads 0.63N when immersed in water.
Calculate the;
i) density of the block (3)
ii) density of oil (2)

**4a)** Define:

i) Uniform velocity (1)
ii) Momentum (1)

b) Sketch the following graphs.

i) a displacement –time graph showing uniform acceleration. (1)

ii) Velocity time graph for a body projected vertically upwards. (2)

c i) Distinguish between scalar and vector quantities (2)

ii) List two examples of each type of quantity (2)

d). explain how the velocity of a rocket increases during its propulsion. (4)

e). A wooden block of mass 0.5kg is suspended from a ceiling by thin wires of negligible mass. A bullet of mass 10g and moving with a horizontal speed of $100ms^{-1}$ strikes the block and gets stuck in the block. Calculate the

i) height to which block rise. (4)

ii) amount of heat produced in the block (3)

## SECTION B

**5. a** Define the following;

(i) reversible process and
(ii) critical temperature (2)

(ii) State the kinetic theory of matter (1)
b. Explain briefly the following

i) occurrence of the saturated vapour (2)
ii) effect of increase in temperature on the saturated vapour pressure (3)

c). With the aid of a labeled diagram, describe an experiment to determine the saturated vapour pressure (S.V.P) of water.
d). Show that the work done, W by a gas expanding from volume $v_1$ to $v_2$ under varying pressure is given by $w = P_1V_1 \ln (v_2/v_1)$
e). A gas contained in a cylinder has initial volume of $0.01m^3$ at a pressure of $10^5$ pa and temperature of 300K. The gas is cooled at constant pressure until its volume is $0.006m^3$. Calculate the;

i) final temperature of the gas.
ii) work done on the gas

**6 a)** Define the following and give two examples of each
i) Fixed point (2)
ii) Thermometric property (2)

bi) With the aid of a labeled diagram, clearly describe an experiment to determine the specific heat capacity a metal solid by the electrical method. (6)
(ii) State two disadvantages of the continuous flow method in the determination of specific heat capacity of a liquid. (2)

c). Explain the steps taken to obtain a cooling correction in the method of mixtures. (3)
d). Steam at 100°C is passed into a copper calorimeter of mass 150g containing 340g of water initially at 15°C. The steam is passed until the temperature of mixture is 71°C. On reweighing the new mass of calorimeter and its Contents was 525g, calculate the specific latent heat of vaporization of water (5)

**7a)** Define the following;
i) Thermal conductivity (1)
ii) Black body (1)

b). With the aid of a labeled diagram describe an experiment to detect radiation by use of a thermopile. (5)

c). i) state the laws of black body radiation (2)

ii) Explain briefly how to approximate a black body in practice.

d). In an experiment to determine the thermal conductivity of copper metal steam is let in at one end of the insulated copper bar. The other end is cooled by water passing through the metal tubing at 150g per minute.

The temperatures of the water at the inlet and outlet to the pipes are 250c and 160c respectively. If the copper bar is of diameter 50mm and temperatures along its length 150mm apart are 74°C and 55°C, calculate the thermal conductivity of copper. (4)

e). explain the green house effect and how it may lead to global warming. (4)

## SECTION C

**8.a)** Define the following;

i). mass number (1)

ii). binding energy (1)

b1) Show that the half life, $T_{\frac{1}{2}}$ of a radioisotope is given by $T_{\frac{1}{2}} = \frac{0.693}{\lambda}$, where

$\lambda$ is the decay constant. (2)

ii) Explain why a neutron is more suitable for bombarding a heavy nucleus to produce a radioisotope (2)

c.i) with the aid of a labeled diagram, describe the structure and action of a cloud chamber. (6)

ii) Explain briefly how the half life of radioactive material can be determined graphically. (3)

d) Living wood sample has an activity of 15 counts per minutes per gram of carbon. A sample of dead wood is found to have an activity of 17 counts per minute for 5 grams. Given the half-life of carbon is 5.6 x103 years,

Calculate the age of the sample of dead wood. (5)

**9. a i)** State Rutherford's model of the atom (1)

ii) Define the terms electron volt and ionization energy (2)

b i) Draw and label the parts of an x-ray tube (2)

ii) Explain how x-rays are produced (3)

iii) State the energy changes in an x-ray tube in operation (2)

c). Explain the following;

i) production of the characteristic line spectrum in an x-ray tube (2)

ii) Variation of intensity of x-rays with filament voltage. (2)

d) Monochromatic light of wavelength 550nm is incident on a metal surface in a vacuum photocell to produce photoelectric emission. The emission can be stopped by applying a positive potential of 1.40V to the metal plate. Calculate the;

i.) work function of the metal. (3)

ii.) Maximum kinetic energy of emitted photo electrons when the plate potential is zero. (3)

**10. a)** Define the terms

(i) space charge (1)

ii) rectification (1)

b i) with the aid of a labeled diagram, explain how full wave rectification can be achieved (5)

ii) Sketch anode current – anode voltage curves for a thermionic diode for two different filament currents and explain their main features. (4)

C i) Draw and label the main parts of a cathode ray oscilloscope (CRO).

ii) State two advantages of the CRO in voltage measurement. (2)

d).Two vertical parallel plates are spaced 20mm apart. A charged oil droplet falls between the plates at a constant speed of $0.08mm^{5-1}$ vertically downwards. Given the viscous drag on droplet is $2.27 \times 10^{-14}N$,

Calculate the (2)

(i) mass of the droplet

(ii) charge on the droplet if a p.d of 480V across the plates makes it move downwards at $45^{o}$ to the vertical at steady speed. (3)

**END**