

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
TABORA HIGH SCHOOLS EXAMINATION ASSOCIATION (TAHISEA)
FORM SIX PRE NATIONAL EXAMINATION

131/1

PHYSICS 1

Wednesday 5th March 2025

TIME: 3 Hours

Instructions

1. This paper consists of sections A and B with total of **ten (10)** questions.
2. Answer **all** questions in A and any **two (2)** questions from section B.
3. All writing must be in **black** or **blue** ink **except** drawing which must be in pencil.
4. Cellular phones are not allowed in examination room.
5. Write your **Examination number** on every page **of** your answer sheet(s).
6. Where necessary the following information may be useful.
 - a. Acceleration due to gravity due to gravity, $g = 9.8\text{m/s}^2$
 - b. Gravitational constant, $G = 6.67 \times 10^{-11}\text{Nm}^2\text{kg}^{-2}$
 - c. Mass of the earth, $M_e = 6.0 \times 10^{24}\text{kg}$
 - d. Radius of earth, $R_e = 6.4 \times 10^6\text{m}$
 - e. Distance of the moon from the earth = $3.8 \times 10^5\text{km}$
 - f. Latent heat of melting ice, $L = 80\text{cal/g}$
 - g. Density of water = 1000kg/m^3

wazaelimu.com

SECTION A (70 Marks)

Answer ALL questions from the section

1. (a) (i) Explain one failure of the principle of Homogeneity in dimensional analysis (01mark)
(ii) The escape velocity V depends on acceleration due to gravity g and the radius of the planet R . Using dimensional analysis, establish the expression of escape velocity. (03marks)
- (b) (i) How systematic errors can be minimized in the measurement of physical quantities? Give two points. (02marks)
(ii) A physical quantity P is related to four observables a , b , c and d as follows; $P = \frac{a^3 b^2}{\sqrt{cd}}$. The percentage errors in a , b , c and d are 1%, 3%, 4% and 2% respectively. Determine the percentage error in P . (04marks)
2. (a) (i) Give two differences between the elastic collision and inelastic collision (02marks)
(ii) A 10g bullet is fired with a velocity of 300m/s into pendulum bob which has a mass of 990g. How high does the pendulum bob with the bullet embedded swing after the collision? (03marks)
- (b) (i) A boy throws a stone vertically upwards and catches it later. Is the stone considered as a projectile motion? Give a reason to support your answer (02marks)
(ii) A ball thrown into the air lands 40m away 2.44s later. Find the angle of projection and magnitude of the initial velocity (03marks)
3. (a) (i) Why are roads and railway lines bends banked on curves? (02marks)
(ii) A highway road designed for an average speed of 72km/h has a radius of 50m. To what minimum angle should the road be banked so that cars travelling may not overturn? (03marks)
- (b) (i) Identify two practical examples of bodies executing simple harmonic motion (02marks)
(ii) The velocity of a particle executing simple harmonic motion is 16cm/s at a distance of 8cm and 12cm/s at a distance $\sqrt{17}$ cm from the mean position. Calculate the amplitude of the motion (03marks)
4. (a) (i) Why an Astronaut in an orbiting space craft is not zero gravity although he is in weightlessness? (02marks)
(ii) The mass of one of the small spheres of a Cavendish balance is 0.001kg. The mass of the large spheres is 0.5kg and the center-to-center distance between the spheres is 0.05m. Calculate the gravitational force on each sphere (03marks)
- (b) (i) Why divers and skaters regulate their rotation motion by moving their arms and legs inwards or outwards (02marks)

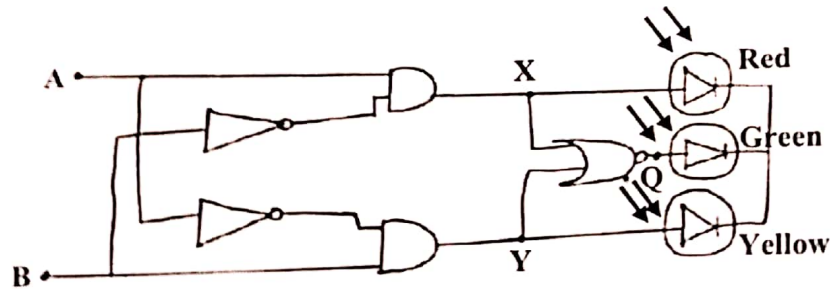
- (ii) A sphere, a disc and a ring of the same radius are allowed to roll down an inclined plane. If they are released at the same instant and rolling without slipping from the same height, Determine the order showing the shape which will arrive at the bottom first **(03marks)**
5. (a) (i) Explain any three qualities of a thermometric property **(03marks)**
 (ii) Describe how mercury in glass thermometer can be made sensitive **(02marks)**
 (b) (i) Name any two procedures in establishing temperature scale **(02marks)**
 (ii) A thermometer was wrongly calibrated as it reads the melting point of ice as -10°C and reading a temperature of 60°C in a place of 50°C . What would be the temperature of the boiling point of water on this scale? **(03marks)**
6. (a) (i) Explain the observation that a piece of a wire when steadily heated up appears reddish in color before turning bluish **(03marks)**
 (ii) A rod 1m long and made of material of thermal conductivity $420\text{WM}^{-1}\text{K}^{-1}$ has one of its ends in melting ice and the other end in boiling water. If its area of the cross-sectional is 10cm^2 . What is the amount of ice that melts in 1minute? **(03marks)**
- (b) The slope of an adiabatic curves is always greater than that of an isothermal curve. With the aid of equations verify this statement **(04marks)**
7. (a) (i) Explain the four basic methods for extracting wave energy **(04marks)**
 (ii) Using the elastic rebound theory, explain the formation of earth quakes **(03marks)**
- (b) Explain any three sources of carbon monoxide in the environments **(03marks)**

SECTION B (30 marks)

Answer only **TWO** questions from this section

8. (a) (i) Why bulb get dim when a high power component is connected to the circuit **(02marks)**
 (ii) A wire of resistivity ρ is stretched to double its length. What will be its new resistivity **(02marks)**
 (iii) Explain why sometimes balance point is not obtained on potentiometer wire **(02marks)**
- (b) A lead wire and an Iron are connected in parallel. Their respective specific resistances are in the ratio 49:24. The former carries 80 percent more current than the latter and the latter is 47 percent longer than the former. Determine the ratio of their cross-sectional areas **(04marks)**
- (c) Use any relevant circuit diagram, sketch the graphs on the same axes showing the variation of impedances and current with frequency, and briefly explain how the frequency relate with impedances **(05marks)**
9. (a) (i) Name two factors on which electrical conductivity of a pore semiconductor at a given temperature depends **(02marks)**

- (ii) By using the concepts of energy bands explain why all metals are opaque to light of all wavelengths? **(02marks)**
- (b) Design base resistor bias circuit for CE amplifier such that operating point is $V_{CE}=8V$ and $I_C=2mA$. You are supplied with a fixed 15V dc supply and a silicon transistor with $\beta=100$. Take base-emitter voltage $V_{BE}=0.6V$. Calculate also the value of base and load resistance **(04marks)**
- (c) An engineer designed the circuit in order to compare the logic state represented by X and Y



- (i) State which LED, RED, GREEN or Yellow will conduct when $A < B$, $A = B$ and $A > B$ **(03marks)**
- (ii) Draw the symbol of a single logic gate which will produce the same output as that detected at Q **(02marks)**
- (iii) Implement the digital circuit in 9c(ii) above using NOT, AND and OR gates only **(02marks)**
10. (a) Explain the five components of a transmitter **(05marks)**
- (b) (i) Explain the function of each component of a multi-vibrator **(03marks)**
- (ii) State any two applications of Astable multi-vibrator **(02marks)**
- (c) Radio station which broadcast on the long wave region of the electromagnetic spectrum must use a carrier frequency in the range 140KHZ to 280KHZ. They must limit the sidebands to within $\pm 4.5KHZ$ of the carrier frequency.
- (i) Sketch a graph to show the variation with frequency of the power of typical long wave radio transmission with a carrier frequency of 200KHZ. **(02marks)**
- (ii) State the bandwidth of each station in the long wave band. **(01mark)**
- (iii) Calculate the maximum number of radio stations. **(02marks)**