



TANZANIA HEADS OF ISLAMIC SCHOOLS COUNCIL
FORM SIX INTER ISLAMIC MOCK EXAMINATION
PHYSICS 1

(For Both School and Private Candidates)

131/1

TIME: 3 Hours

Tuesday, 3rd March 2026 a.m.

Instructions

1. This paper consists of sections A and B with a total of **ten (10)** questions.
2. Answer **all** questions in section A and **two (2)** questions from section B.
3. Section A carries **seventy (70)** marks and section B carries **thirty (30)** marks.
4. Mathematical tables and non-programmable calculators may be used.
5. Communication devices and any unauthorized materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. The following constants may be useful:
 - Acceleration due to gravity $g = 9.8\text{m/s}^2$.
 - Pie (π) = 3.14
 - Thermal conductivity of dry sand soil = $0.27\text{ w/m}^\circ\text{C}$.
 - Charge of an electron, $e = 1.6 \times 10^{-19}\text{C}$
 - Universal gas constant = 8.3 J/mol K
 - Stefan's constant = $5.67 \times 10^{-8}\text{Wm}^{-2}\text{K}^{-4}$
 - Moment of inertia of a solid sphere at an axis through its centre = $\frac{2}{5}mr^2$, where m is mass of sphere and r is its radius.

SECTION A (70 Marks)

Answer **all** questions in this section

1.
 - (a)
 - (i) Dimensions can be treated as algebraic quantities. Explain this statement
(02 marks)
 - (ii) After being deformed a spherical drop of liquid will execute periodic vibration about its sphere. The frequency “f” of vibration of the drop will depend on the surface tension (γ), its density (ρ) and radius (r) of the drop. Using the method of dimensional analysis obtain an expression for the frequency of these vibrations in terms of the related physical quantities.
(04 marks)
 - (b)
 - (i) On one occasion here in Tanzania it was reported that the average mass of a newly born baby is $(4 \pm 0.25)\text{kg}$. What does this statement mean?
(02 marks)
 - (ii) A micrometer screw gauge has a pitch of 1.0mm and 200 divisions on the circular scale. Do you think it is possible to increase the accuracy of the micrometer screw gauge arbitrarily by increasing the number of divisions on the circular scale? Why?
(02 marks)
2.
 - (a)
 - (i) In the game of swing in a circus, the man falls on the net after leaving the swing but he is not injured. Why?
(02 marks)
 - (ii) A bullet of mass 20g is fired horizontally into a suspended stationary wooden block of mass 380g with a velocity of 200m/s. At what height from the equilibrium will the wooden block rise?
(03 marks)
 - (b)
 - (i) Does a rocket flight depict projectile motion? Explain. (02 marks)
 - (ii) If the range of projectile is 120m and its time of flight is 4 seconds, determine the angle of projection and its initial velocity of projection.
(03 marks)
3.
 - (a)
 - (i) Briefly explain why does a motorbike rider bend while going through a corner?
(02 marks)
 - (ii) A small mass of 1kg is attached to the lower end of the string 1m long whose upper end is fixed. The mass is rotated in a horizontal circle of radius 0.6m. If the circular speed of mass is constant, find the period of the motion.
(03 marks)

- (b) (i) What makes a particle executing simple harmonic motion (SHM) to quickly complete a cycle? **(01 mark)**
- (ii) Briefly explain the importance of energy interchange in simple harmonic motion (SHM). **(02 marks)**
- (iii) A particle is executing SHM of amplitude, A. At what distance from the mean position its K.E is equal to its P.E? **(02 marks)**
4. (a) (i) Why do you use a single finger to turn the door but you use a thumb and finger to open a bottle cork? **(02 marks)**
- (ii) A solid sphere rolls down two different inclined planes at the same heights but different angles of inclination. Show whether it will reach the bottom with the same speed in each case. **(03 marks)**
- (b) (i) According to Newton's law of universal gravitation, gravitational force is mutual force. Why then only objects "fall" towards the earth and not the earth "falling" towards other objects in its vicinity? **(02 marks)**
- (ii) A rocket is launched vertically from the surface of the earth with initial velocity V_0 . Show that its velocity V at a height h is given by
- $$V^2 = V_0^2 - \frac{2gh}{1 + \frac{h}{R}} \quad \textbf{(03 marks)}$$
- Where R is the radius of the earth and g is the acceleration due to gravity.
5. (a) (i) Explain why in cold districts here in Tanzania, windows of modern buildings are double glazed. **(02 marks)**
- (ii) You are required to determine the Celsius temperature scale defined by property X that corresponds to a temperature of 50°C on gas thermometer. If the value of property X of a certain substance is given by $X_\theta = X_0 - 0.5\theta + 2 \times 10^{-4}\theta^2$ where θ is the temperature in degree Celsius. **(03 marks)**
- (b) (i) Why does warm air rise? Explain **(02 marks)**
- (ii) A spherical black body of radius 12cm radiates 450W at 500K. If the radius of the spherical black body was halved and temperature was doubled, what will be the power radiated? **(03 marks)**

6. (a) (i) A gas is contained in a thin – walled metal cylinder and compressed by a piston moving with constant velocity. Explain whether the change is approximately an adiabatic or isothermal as the piston moves with high or low velocity. **(03 marks)**
- (ii) The amount of heat required to raise the temperature of 3.00 mol of a polyatomic gas at constant pressure from 320K to 370K is 4.99kJ. Calculate the values of C_p , C_v and atomicity (γ). **(03 marks)**
- (b) (i) State two limitations of first law of thermodynamics. **(02 marks)**
- (ii) In the same axis plot the p-v diagram for isobaric, isochoric, isothermal and adiabatic process. **(02 marks)**
7. (a) (i) What is the influence of oxygen and carbon dioxide gases to plant growth? **(02 marks)**
- (ii) If the temperature difference across a 43cm thick dry sand soil is 23 °C, calculate the total heat per unit area transferred in 3 hours under steady condition. **(03 marks)**
- (b) (i) Why renewable energy sources are usually regarded as environmentally friendly? **(02 marks)**
- (ii) Explain briefly how the epicenter of an earthquake can be determined. **(03 marks)**

SECTION B (30 Marks)

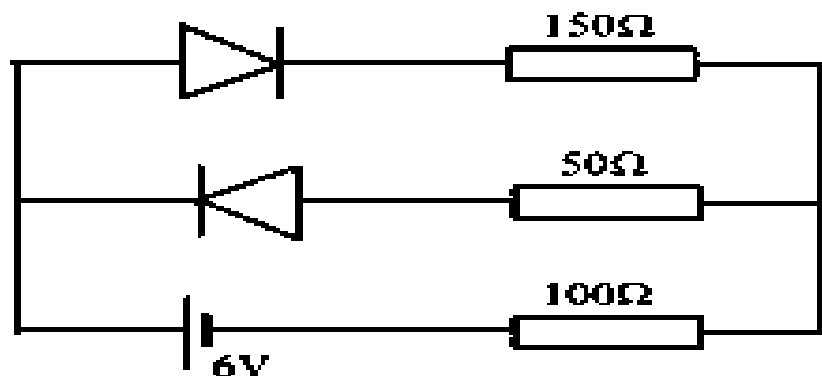
Answer **two (2)** questions from this section

8. (a) (i) The thermal speeds of electrons are very large. Despite their speeds, why they fail to escape from the surface of a metal conductor? **(02 marks)**
- (ii) Although the drift velocity of electrons is very small, the lamp lights up as soon as a switch is put on. Explain this observation. **(02 marks)**
- (iii) A copper wire of area of X – section 4mm^2 is 4m long and carries a current of 10A. The number density of free electrons is $8 \times 10^{28}\text{m}^{-3}$. How much time is required by an electron to travel the length of the wire? **(03 marks)**
- (b) (i) What is the basis of Kirchhoff's voltage law? **(01 mark)**
- (ii) Three cells are connected in parallel with their like poles connected together with wires of negligible resistance. If the e.m.fs of the cells are

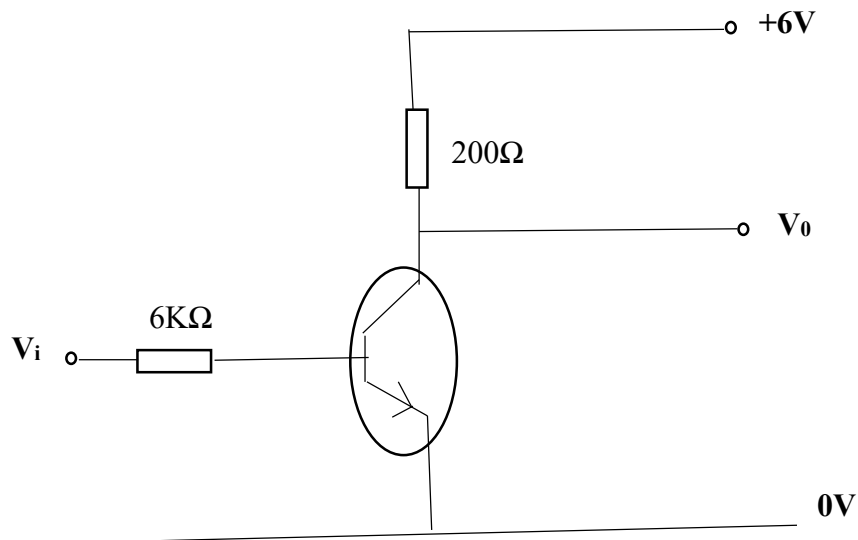
2V, 1V and 4V respectively and their internal resistances are 4Ω , 3Ω and 2Ω respectively, find the current through each cell. **(03 marks)**

- (c) (i) For a very high frequency a.c supply a capacitor behaves as a pure conductor, why? **(01 mark)**
- (ii) Determine the phase angle and power factor for an R-L-C series circuit containing a resistor of 50Ω , a capacitor of $10\mu\text{F}$ and an inductor of 0.45H , when connected to a power supply of frequency 60Hz . **(03 marks)**

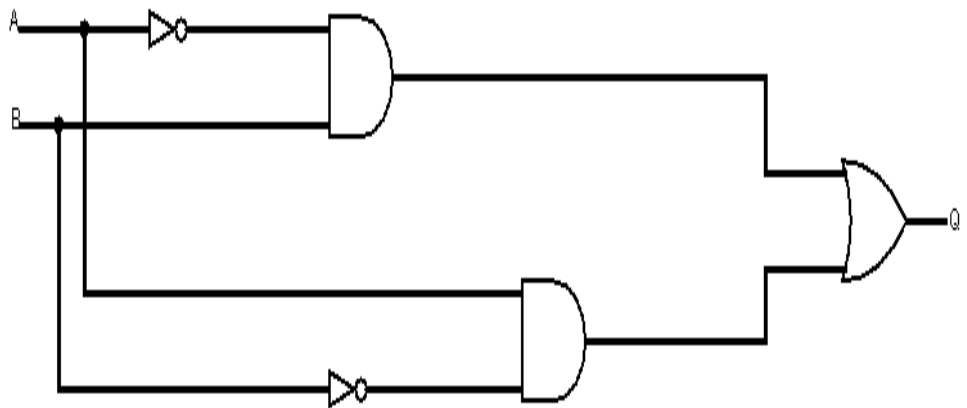
9. (a) (i) How does the electrical conductivity of silicon material varies with the increase in temperature? **(02 marks)**
- (ii) The circuit in the figure below shows two diodes each with forward resistance of 50Ω and infinity reverse resistance. If the battery voltage is 6V , what is the current through the 100Ω resistor? **(02 marks)**



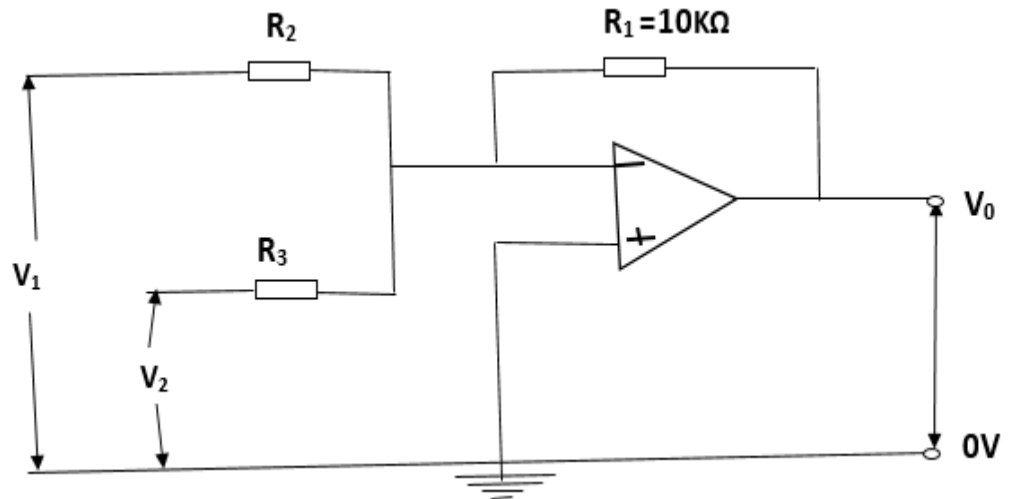
- (iii) With examples explain the donor and acceptor impurities and how they help in conduction of electricity in conduction of electricity. **(04 marks)**
- (b) (i) Why is the NPN transistor commonly used in electronic devices? **(02 marks)**
- (ii) Briefly explain the effect of temperature on transistor performance. **(02 marks)**
- (iii) The figure below shows a circuit incorporating an npn transistor whose amplification factor $h_{fe}(\beta) = 50$, ignoring the base – emitter voltage. Calculate the base current (I_B), emitter current (I_C) and output voltage V_O when the input voltage $V_i = 1.5\text{V}$. **(03 marks)**



10. (a) (i) How does the use of NOR gate contribute to the effectiveness of a burglar alarm circuit. **(02 marks)**
- (ii) Deduce the Boolean expression represented by the logical gates shown in figure below and use the result to draw the simplest logic gate circuit. **(04 marks)**



- (b) (i) What is a closed loop voltage gain as it is applied in op-pamps? Explain its advantages. **(03 marks)**
- (ii) The figure below is an op-amp circuit where V_1 and V_2 are independent input voltages. What values of R_2 and R_3 would give an output, $V_0 = (4V_1 + 0.5V_2)$? **(03 marks)**



- (c) With help of a block diagram briefly explain three components of communication system. **(03 marks)**

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