

TANZANIA HEADS OF ISLAMIC SCHOOLS COUNCIL

FORM SIX INTER ISLAMIC MOCK EXAMINATION

PHYSICS 1

131/1

(For both School and Private candidates)

Time: 3 Hours

Monday 4th March, 2024 p.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. Cellular phones 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 information may be useful:
 - (a) Acceleration due to gravity, $g=9.8\text{m/s}^2$.
 - (b) Ratio of specific heat capacities, $\gamma=1.67$
 - (c) Thermal conductivity of Copper, $K=380\text{JS}^{-1}\text{ }^\circ\text{C}^{-1}$
 - (d) Molar gas constant, $R=8.31\text{JK}^{-1}\text{mol}^{-1}$
 - (e) Density of air, $\delta=1.3\text{kg/m}^3$.
 - (f) Pie, $\pi=3.14$

SECTION A (70 Marks)

Answer **all** questions from this section

1. (a) (i) “Today accurate measurement is an important part of physics. But no measurement is absolutely precise.” Explain the meaning of the above statement. **[02 marks]**
(ii) The period of oscillations of simple pendulum in an experiment are recorded as 2.63s, 2.56s, 2.42s, 2.71s and 2.80s respectively. Find the mean time period and absolute error in each observation and their percentage error. **[03 marks]**
- (b) (i) The diameter of steel rod is given as (56.47 ± 0.02) mm. What does this statement mean? **[01 mark]**
(ii) Discuss how errors can be computed from the straight line graphs. **[02 marks]**
(iii) Suppose the slope of the best fit line is 1.0 and the slopes of maximum and minimum worst lines are 1.16 and 0.81 respectively. Estimate the value of the slope of graph. **[02 marks]**
2. (a) (i) “Newton’s second law of motion is a real law of motion.” Discuss. **[03 marks]**
(ii) A jet engine on a test bed takes in 40kg of air per second at a velocity of 100m/s, burning 0.8kg of oil per second. After compression and heating, the exhaust gases are ejected at 600m/s relative to the aircraft. Calculate the thrust of the engine. **[02 marks]**
- (b) A projectile is thrown with an initial velocity of 20m/s from the base of an inclined plane of 45° with projection angle of 75° . Find:
 - (i) Time of flight **[01 mark]**
 - (ii) Range on an inclined plane **[02 marks]**
 - (iii) Maximum height reached on an inclined plane **[02 marks]**
3. (a) Briefly explain the following
 - (i) Why does a pilot not fall when his aeroplane loops a vertical loop? **[01 mark]**
 - (ii) In rain, generally the scooter slips at the turning of road. Why? **[01 mark]**

- (iii) Why are passengers in car rounding a curve thrown outward? **[1 mark]**
3. (b) A body oscillates vertically in SHM with amplitude of 30mm and frequency of 5.0Hz. Calculate the acceleration of the particle
- (i) At the extremities of the motion **[03 marks]**
- (ii) At the centre of the motion **[02 marks]**
- (iii) At the position midway between the centre and extremities. **[02 marks]**
4. (a) (i) State Kepler's laws of planetary motion. **[03 marks]**
- (ii) When a body is taken from the centre of the earth to the moon, explain the changes in the weight of the body. **[02 marks]**
- (b) (i) Define a term radius of gyration. **[01 mark]**
- (ii) A 5kg disc of moment of inertia 0.1kgm^2 about its centre rest on an inclined plane at 30° to the horizontal. Estimate the angular velocity it has rolled 2m down the slope. **[04 marks]**
5. (a) What type of thermometer would you use to measure each of the following? In each case give the reason of your choice.
- (i) The boiling point of water on the mountain. **[01 mark]**
- (ii) The temperature just after the ignition in a cylinder of an internal combustion engine. **[01 mark]**
- (iii) Temperature of the filament of an electric lamp **[01 mark]**
- (iv) The normal melting point of Zinc. **[01 mark]**
- (b) (i) Form V students in KWETU Ilismaic Seminary had a practical of shaking bottles vigorously containing hot liquids. Their corks blow off. Explain why so? **[02 marks]**
- (ii) One end of Copper rod 2m long and having a radius of 1cm is maintained at 250°C . When the steady state is reached, the rate of heat flow across any section is 2.1J/s . Estimate the temperature of the other end. **[04 marks]**
6. (a) (i) Physics teachers in Tanzania have researched recently that in practice, completely reversible process is not possible. Explain clearly conditions on how it can be possible. **[02 marks]**
- (ii) One mole of an ideal gas which is Kept at a temperature of 320k is compressed isothermally from its initial volume of 8 litres to a final volume of 4 litres. How do you think the total work done in the whole process could be? **[03 marks]**

- (b) (i) In an industrial refrigerator, ammonia is vaporized in a cooling unit to produce a low temperature. Why would evaporation of ammonia reduce the temperature in refrigerator? **[02 marks]**
- (ii) A vessel contains $2.5 \times 10^{-3} \text{m}^3$ of an ideal gas at a pressure of $8.5 \times 10^4 \text{Nm}^{-2}$ and temperature of 35°C . The gas is compressed isothermally to a volume of $1 \times 10^{-3} \text{m}^3$, it is then allowed to expand adiabatically to the original volume. Calculate the final temperature of the gas and hence draw the graph of process. **[03 marks]**
7. (a) (i) Briefly explain any four disadvantages of particulate matter in the atmosphere. **[04 marks]**
- (ii) Explain why the small ozone layer on the top of the stratosphere is crucial for human survival? **[02 marks]**
- (b) A solar cell of surface area 100cm^2 is illuminated by a monochromatic light of wavelength 760nm and power density of 1000Wm^{-2} . The open circuit voltage is 0.67V when the cell temperature is 300K . Estimate the dark current I_0 , assuming a 100% quantum efficiency. **[04 marks]**

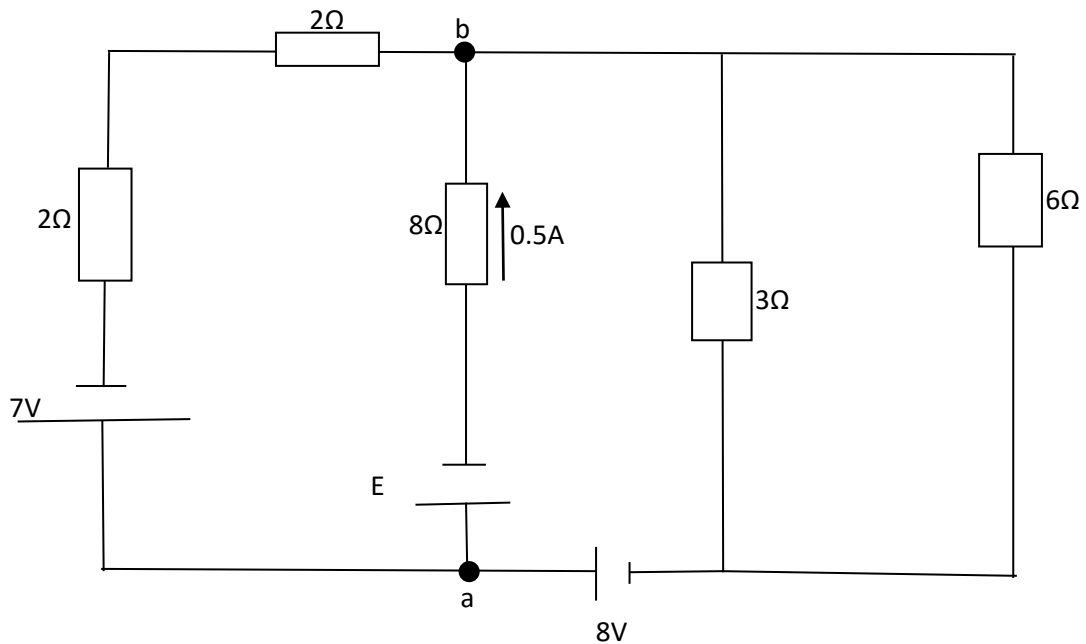
SECTION B (30 Marks)

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

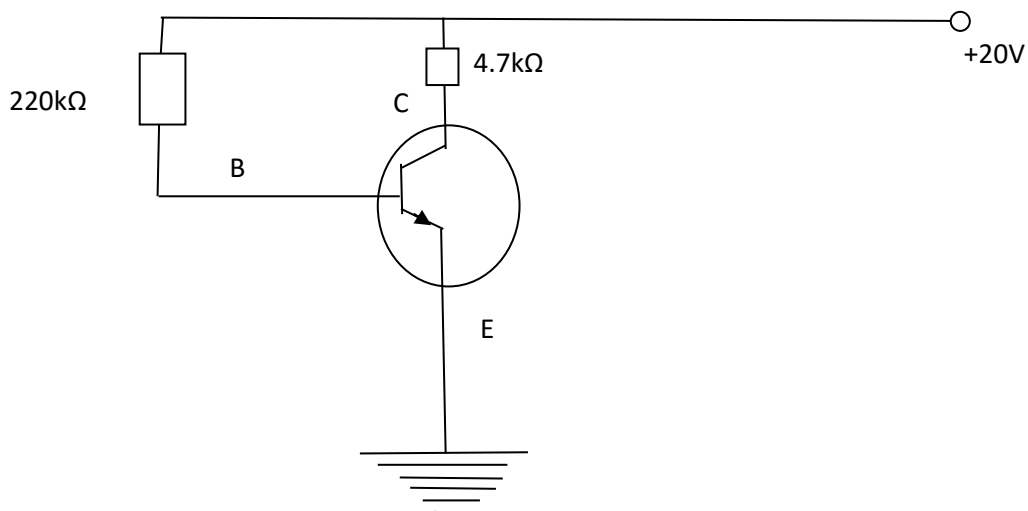
8. (a) (i) Explain the term “resistance matching” as applied to a simple electric circuit. **[01 mark]**
- (ii) A cell of e.m.f, E and internal resistance, r is used to drive a current I through a load resistance R . Show that for maximum power to be transferred to the load, a load resistor R must be equal to the internal resistance r of a cell. **[04 marks]**
- (b) (i) Our homes are supplied with an a.c voltage whose equation should be $E = E_0 \sin \omega t$. But we always say that the a.c voltage in our home is 230V . How do you explain this difference? **[02 marks]**
- (ii) A series circuit has a capacitor of $2 \mu\text{F}$ with a frequency 1 kHz and the root mean square current flowing of 4mA . Estimate the potential difference across the capacitor and the current flowing when root mean square voltage of 10V , 50Hz is connected to the capacitor. **[03 marks]**
- (c) (i) What is significance of Kirchhoff’s laws? **[02 marks]**

- (ii) In the circuit below, determine the value of E such that a current of 0.5A exist in 8Ω resistor with sense from a to b . What is potential difference $V_a - V_b$?

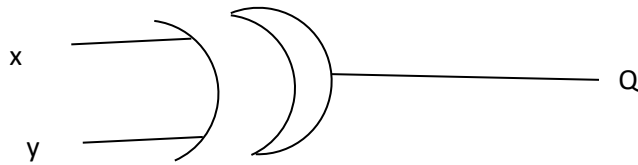
[03 marks]



9. (a) (i) Explain why electrical conductivity of intrinsic semiconductor increases with increase in temperature while that of pure conductor decreases with increase in temperature? [02 marks]
- (ii) An intrinsic germanium has a resistivity of $0.47\Omega\text{m}$ at a room temperature. Estimate the intrinsic carrier concentration if the mobilities of electrons and holes are $0.39\text{m}^2/\text{volt-sec}$ and $0.19\text{m}^2/\text{volt-sec}$ respectively. [03 marks]
- (b) In the circuit below, the value of β is 100. Find I_B , V_{CE} , V_{BE} and V_{BC} when $I_C = 2\text{mA}$. Is that transistor in active, cut-off or saturation state? [05 marks]



9. (c) Study the logic circuit shown in the figure below



- (i) What is the name of the logic gate above? **[0.5 mark]**
 - (ii) Write down its Boolean algebra **[0.5 mark]**
 - (iii) Draw the truth table for the circuit above **[1.5 marks]**
 - (iv) Sketch the waveform for inputs and outputs signal **[1.5 marks]**
10. (a) With the good diagram explain how differentiator (OP-AMP) can produce an output voltage that is proportional to the rate of change of inputs voltage. **[05 marks]**
- (b) Explain advantage of FM over AM. Give four points. **[04 marks]**
- (c) A sinusoidal carrier voltage of frequency 2MHz and amplitude 70V is amplitude modulated with sinusoidal voltage of frequency 4 KHz producing modulation factor of 55%. Estimate the band width and the amplitude of upper and lower side band. **[06 marks]**

Wabillah Tawfiq