

**THE UNITED REPUBLIC OF TANZANIA**  
**PRESIDENT'S OFFICE - REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT**  
**THE CITY COUNCIL OF DODOMA**  
**HOME PACKAGE FORM FOUR EXAMINATION**

031/1

**PHYSICS I**  
**(For Both School and Private Candidates)**

**TIME: 3 Hours.**

**APRIL, 2019**

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**Instructions**

1. This paper consists of section **A, B** and **C**.
2. Answer **all** questions in section **A** and **B**, and **One(1)** question from section **C**.
3. **Calculators** and cellular **phones** are **not** allowed in the examination room.
4. Write **Examination number** on every page of your answer sheets.
5. Where necessary the following constants may be used:
  - i) Acceleration due to gravity,  $g = 10\text{m/s}^2$
  - ii) Density of water =  $1\text{g/cm}^3$  or  $1000\text{kg/m}^3$
  - iii) Linear expansivity of steel =  $0.000011/\text{K}$

**SECTION A: (30 Marks)**

1. For each of the items (i)-(x), choose the correct answer from among the given alternatives and write its letter beside the item number in the answer sheet(s) provided.
- i) A body of mass 20kg moving with uniform acceleration has an initial momentum of 200kgm/s and after 10 seconds the momentum is 300kgm/s. The acceleration of the body is:  
A.  $0.50\text{m/s}^2$     B.  $5\text{m/s}^2$     C.  $25\text{m/s}^2$     D.  $50\text{m/s}^2$     E.  $100\text{m/s}^2$
- ii) A converging lens is used to form an image of a bright object on a white screen. If the lower half of the lens is covered with a sheet a metal, then:  
A. The image disappears entirely  
B. The lower half of the image disappears  
C. The upper half of the image disappears  
D. The brightness of the image is reduced  
E. The image is unchanged.
- iii) A uniform metre rule is pivoted at its centre. A 20g mass is placed at the 10cm mark and 50g at the 40cm mark. At what mark must a second 50g mass be placed for the system to be in rotational balance?  
A. 40cm    B. 64cm    C. 76cm    D. 87cm    E. 93cm.
- iv) We feel the heat form a coal fire by:  
A. Convection    B. Conduction  
C. Regelation    D. Diffusion    E. Radiation.
- v) The pressure of air inside a car tyre increases if the car stands for some time in full sunlight. According to kinetic theory this is due to an increase inside the tyre of:  
A. The size of the molecules  
B. The number of air molecules  
C. The speed of air molecules  
D. The average distance between the air molecules.  
E. The total mass of the air molecules.
- vi) A student can only hear sound with frequencies between 30HZ and 16KHZ. What is the shortest wavelength of sound she can hear if the speed of sound is 340m/s?  
A. 0.013m    B. 0.0213m    C. 0.0882m    D. 11.3m    E. 47.1m
- vii) A force of 10N acting continuously increases the kinetic energy of an object from 20J to 60J. The distance moved by the object is then:  
A. 400m    B. 200m    C. 60m    D. 20m    E. 4m
- viii) Colours are produced when white light passes through glass prism because:  
A. The light waves interferes  
B. The glass colours the light  
C. Different colours travel at different speeds in glass  
D. The different colours are filtered  
E. Diffraction of light occurs

- ix) A solid metal cube has each side doubled to make a solid cube of the same metal eight times bigger in volume. The ratio of resistivity of new cube to resistivity of the old cube is:  
 A.  $\frac{8}{1}$       B.  $\frac{6}{1}$       C.  $\frac{1}{1}$       D.  $\frac{1}{6}$       E.  $\frac{1}{8}$
- x) The wires each of resistance  $12\Omega$  can be arranged to form a combined resistance of: A.  $48\Omega$       B.  $32\Omega$       C.  $18\Omega$       D.  $12\Omega$       E.  $6\Omega$

2. Match the items in List A with the responses in List B by writing the letter of the correct response beside the item number in the answer sheet(s) provided.

LIST A	LIST B
i) The effective resistance is smaller than individual resistances.	A. Wire
ii) An accumulator with large plates placed close together.	B. Open circuit
iii) Potential difference is equal to the electromotive force of a cell.	C. Ammeter
iv) Accurate determination of resistance of a conductor.	D. Galvanometer
v) Same potential difference across resistors.	E. Cell
vi) Have negligible resistance.	F. Appliances in series
vii) It varies circuit current by changing the length of conductor.	G. Low internal resistance
viii) Transforms chemical energy into electrical energy	H. Closed circuit.
ix) Ohmic conductors.	I. Appliances in parallel.
x) It measures small amount of currents.	J. Rheostat
	K. Generator
	L. Constant resistance, constant temperature.
	M. High internal resistance
	N. Ammeter-volmeter method.
	O. Resistance increases with temperature.
	P. Metre Bridge.
	Q. Voltmeter.

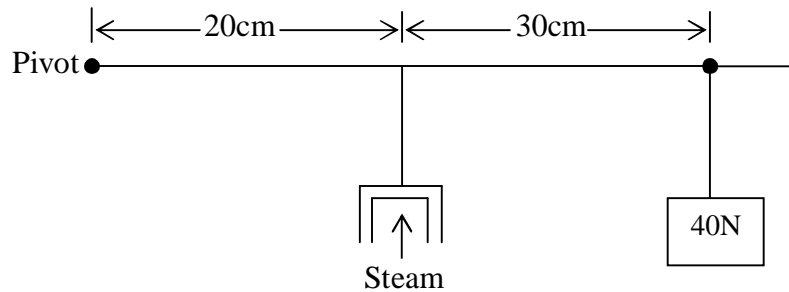
3. For each of the items (i)-(x), fill the blank spaces by writing the correct answer on the answer sheet(s) provided.

- i) The vector that results from addition of two or more vectors is called \_\_\_\_\_
- ii) The mixing of coloured lights occurs according to the principle of \_\_\_\_\_
- iii) Materials placed between plate in capacitor to increase their capacitance is called \_\_\_\_\_
- iv) The temperature scale whose lower fixed point is absolute zero is \_\_\_\_\_

- v) The vacuum space in a thermos flask help to reduce heat loss by \_\_\_\_\_
- vi) The phenomenon which explain the spherical shape of a raindrop is \_\_\_\_\_
- vii) The process of splitting up the nucleus to form daughter nucleus and release of energy is called \_\_\_\_\_
- viii) The refreezing process which demonstrate the effect of pressure on the melting point of ice is \_\_\_\_\_
- ix) The direction of force on a current carrying conductor in a magnetic field is determined by \_\_\_\_\_
- x) The angle between geographical north and magnetic north is \_\_\_\_\_

**SECTION B: (60 Marks).**

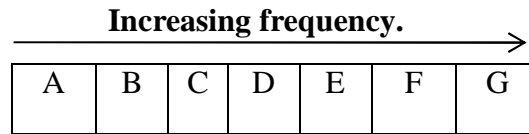
4. a) i) Define the term pressure and state its SI unit.  
 ii) State the principle of moments.
- b) Use figure 1 below to calculate the pressure of steam in the cylinder which would just raise the valve if the area of the valve in contact with the steam is  $2\text{cm}^2$ . Atmospheric pressure is  $10^5\text{N/M}^2$ .



**Figure 1.**

- c) i) State Boyle's law.  
 ii) A uniform tube 96cm long sealed at end, is lowered vertically with its open end downwards into mercury until the length of the enclosed air column is 84cm. with the aid of a diagram, find the depth of immersion of the tube in the mercury if the atmospheric pressure is 77cm of mercury.
5. a) i) Explain why a duck remain floating at one place as the wave passes by water in a lake  
 ii) Explain why it is not advisable for soldiers to march across the bridge in rhythm.
- b) Draw a waveform of:  
 i) A loud, low-pitched note.  
 ii) A soft, high pitched note.

- a) The diagram below shows the electromagnetic spectrum. Region D represents visible light

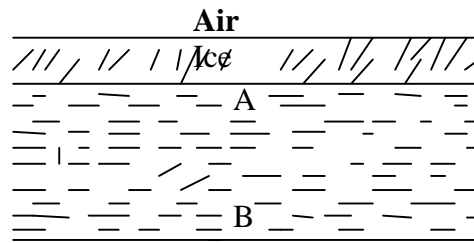


**Figure 2.**

which region represents radiations

- i) Capable of promoting the production of vitamin D in the skin?
  - ii) Used in rada system?
  - iii) Produced in nuclear reactors?
6. a) i) Draw a well-labelled diagram of a hydrometer.  
 ii) Briefly explain how hydrometer can be used to measure the relative density of a liquid.
- b) A hydrometer is used to measure the densities of liquids over the range 0.80 to 1.00g/cm<sup>3</sup>. If the area of cross-section of the stem is 0.50cm<sup>2</sup> and the distance between the 0.80 and 1.00 divisions is 18cm, determine:
- i) The volume of the hydrometer below the 1.00 graduation.
  - ii) The position of the 0.90 graduation.
7. a) i) State Snell's law.  
 ii) The refractive index of liquid is found to be 1.6. Using a graphical construction, determine the critical angle for the liquid.
- b) i) Could a camera with a concave lens instead of a convex lens still take Picture? Explain.  
 ii) Use a diagram to explain why short-sighted people cannot see distant objects clearly.  
 iii) Explain using a diagram, the effect of inserting a suitable lens infront of the eye which will correct its defect.
- c) A simple magnifying glass produces an enlarged erect image when an object is situated 10cm from the lens. If the length of the image is twice that of the object, calculate the focal length of the lens.
8. a) Define the following terms.  
 i) Heat capacity.  
 ii) Linear expansivity of a solid.
- b) i) Why a bimetal strip made of brass and invar is curved outside with brass?  
 ii) A steel tape of correct length at 15<sup>0</sup>C is used to measure distance on a day when the temperature is 10<sup>0</sup>C. What is the error in measuring a distance of 20m?

- c) In figure 3 below, the temperature of air in contact with a thin layer of ice which has formed on the surface of a pond is just below  $0^{\circ}\text{C}$ .

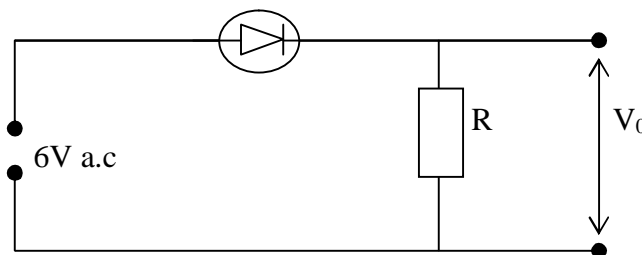


**Figure 3.**

- i) State the probable temperatures of the water at the positions A and B.  
 ii) What fact concerning the density of water do these temperatures indicate?  
 iii) Why will it take a long time for the pond to freeze even if the air temperature falls well below  $0^{\circ}\text{C}$ ?
9. a) i) Explain how a non-magnet can become a magnet by means of magnetic shielding  
 ii) Mention two applications of earth's magnetic field in daily life
- Page 5 of 6
- b) i) State the Maxwell's Right hand screw Rule.  
 ii) Using the Maxwell's Right hand screw Rule, show the direction of the field on two parallel current carrying conductor in the same direction. Show the direction of force.
- c) A transformer is designed to work from 240V a.c mains to give a supply at 8V to ring house bells. The primary coil has 4800 turns.  
 i) About how many turns would you expect it to have?  
 ii) State how the voltage so required is reduced?  
 iii) How is the efficiency of this transformer made as higher as possible?  
 iv) Explain why the primary current decreases when a bell is being rung.  
 v) What would happen if the transformer were connected to 240V d.c mains?

**SECTION C (10MARKS)**

10. a) i) What is meant by thermionic emission?  
 ii) Does the process obey Ohm's law?
- b) Figure 4 below show a circuit diagram for rectification of an alternating current.



- i) Sketch the graph of the output across resistor and explain why output voltage is so rectified.
    - ii) If a large capacitor is connected across the resistor R, sketch the resulting graph of the output across R.
  - c)
    - i) Draw a circuit diagram for single stage amplifier in common emitter mode to show how a p-n-p transistor conducts electric current.
    - ii) From the circuit in (c) (i) above. Write down the relation between currents  $I_C$ ,  $I_B$  and  $I_E$ .
- 11.
  - a) Explain the use of radioactivity in
    - i) Radioactive dating.
    - ii) Radioactive tracer in plants.
  - b)
    - i) What is meant by a radioisotope?
    - ii) When a nuclear of  ${}^{14}_7\text{N}$  is bombarded with a certain particle, the nucleus  ${}^{14}_6\text{C}$  is formed together with a proton. What is the bombarding particle?
    - iii) Write the nuclear reaction in (b) (ii) above.
  - c) The half life of uranium X is 24 days. A sample contains 0.64g, plot the graph to represent the decay of the sample and hence determine.