THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION NOVEMBER 1994

031/1

PHYSICS PAPER 1

(For Both School and Private Candidates)

TIME: 3 Hours

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1. This paper consists of sections A and B.
2. Answer ALL questions in section A and any FIVE (5) questions from section B in the answer book provided.
3. Wherever calculations are involved, you are expected to show clearly all the steps in your work in a systematic manner.
4. The intended marks for questions or parts of questions are given in brackets.
5. Wherever necessary, make use of the following:

   Acceleration due to gravity, $g = 10ms^{-2}$

   $\pi = \frac{22}{7}$

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SECTION A (50 MARKS)

Answer ALL questions in this section.

1. (a) State the conditions under which a body remains in equilibrium when acted upon by parallel coplanar forces.

   (b) What is meant by

   (i) Stable equilibrium
   (ii) Unstable equilibrium
   (iii) Neutral equilibrium? (3 marks)

2. (a) What do you understand by the term ECHO? (1 mark)

   (b) List four factors which affect the pitch of a note given by a stretched string. (2 marks)

   (c) The frequency obtained from a plucked string is 400 Hz when the tension is 2N. Calculate its frequency when the tension is increased to 8N. (2 marks)

3. (a) Explain how an ebonite rod rubbed with fur acquires a negative charge. (2 marks)

   (b) With the aid of a well labelled diagram, explain how you would use an ebonite rod and fur to charge a gold-leaf electroscope positively. (3 marks)

4. (a) State Hooke's law for a material in the form of a wire or rod. (2 marks)

   (b) Draw a load-extension graph for a wire made of

   (i) a ductile material
   (ii) a brittle material (2 marks)

   Point out the main features shown by each curve. (1 mark)

5. (a) Define "The Principal Focus of a lens." (1 mark)

   (b) An object is placed 20cm from a converging lens. An image is found 60cm on the other side of the converging lens. What is the focal length of this lens? (2 marks)

   (c) A rectangular tank 5m deep is full of water. By how much does the bottom appear to be raised if the refractive index of water is 1.33? (2 marks)

6. (a) Draw Rutherford-Bohr models of the three hydrogen isotopes. (3 marks)

   (b) Write the name of the particle represented by each of the following symbols.

   (i) $^{1}_{0}n$ (ii) $-1e$ (2 marks)

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7. (a) Draw a diagram of a dry cell and label the 8 main parts. (3 marks)

(b) Briefly explain why iron screws are never used on ships to fasten copper fittings exposed to salty water. (2 marks)

8. (a) When does thermionic emission of electrons occur? (1 mark)

(b) The radium nucleus, $^{226}_{88}Ra$ decays to radon (Rn) by α- particle emission. Write the nuclear equation for this change. (2 marks)

(c) Write the nuclear equation for the change of a radio-isotope of sodium, $^{24}_{11}Na$ which emits β - particles and turns into magnesium. (2 marks)

9. (a) Briefly explain how a transformer works. (2 marks)

(b) Giving reasons, explain why you would expect the efficiency of a transformer to be less than 100%. (3 marks)

10. (a) What is a voltameter?

(b) A steady current of 2A flows through a copper voltameter. Find the thickness of the layer of copper deposited uniformly on the electrode of surface area $40cm^2$ in 30 minutes. (Density of copper = $9000kg/m^3$; Mass of copper deposited per coloumb = $3.3 \times 10^{-7}kg/C$.) (3 marks)

SECTION B (50 Marks)

Answer any FIVE (5) questions from this section.

11. (a) What is meant by the "absolute zero temperature"? (2 marks)

(b) State Charles' law. (2 marks)

(c) Using Charles' law, show graphically how the volume of a given gas varies with temperature. (2 marks)

(d) To what temperature must 2 litres of a gas at 17^oC be heated at constant pressure in order to increase its volume to 3 litres? (4 marks)

12. (a) What is meant by each of the following terms?

(i) Machine

(ii) Lever

(b) Name the three classes of levers. (2 marks)

(c) How is the efficiency of a machine related to its velocity ratio and mechanical advantage? ($1\frac{1}{2}$ marks)

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(d) A fitting tackle has three pulleys in each block. What is its velocity ratio?
The lower or hanging pulley block was just balanced by a mass of 2kg.
(i) What was the total effort required to raise a load of 24kg?
(ii) What was the mechanical advantage of the tackle? (5 marks)

13. (a) Define "wave intensity" and state the "inverse square law" for electromagnetic radiation in free space. (4 mark)

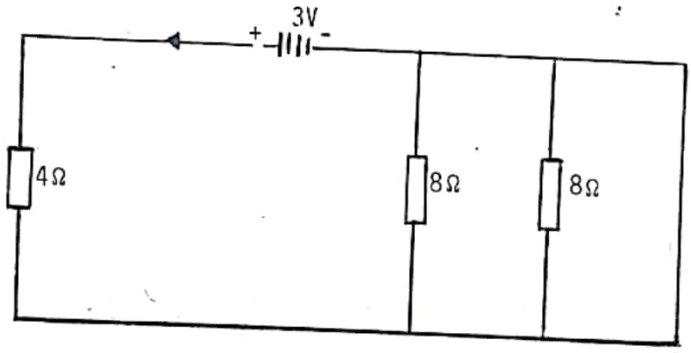
(b) Given the following types of magnetic radiations:
ultra-violet, gamma rays, radio waves.
State which of the radiations has the
(i) longest wavelength
(ii) highest frequency. (2 marks)

(c) Calculate the frequency of a radio wave whose length is 300m.
(Speed of light in air = $3 \times 10^{8} ms^{-1}$) (4 marks)

14. (a) Distinguish between electromotive force (e.m.f.) and potential difference (p.d.) of a cell. (2 marks)

(b) (i) What is meant by polarisation in a voltaic cell? (2 marks)
(ii) How can polarisation be prevented in a simple cell? (1 mark)

(c)



Use the above circuit diagram to calculate the
(i) current flowing through the battery
(ii) potential difference (p.d.) across the 4Ω resistor. (5 marks)

15. (a) State the two laws of reflection of sound.
(b) What is meant by each of the following? (4 marks)
(i) Reverberation
(ii) Reverberation time.
(4 marks)

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(c) A man determines the width of a dam by using a steamer sailing in the dam. The man sees a stream from the steamer's whistle, 3 minutes later he hears the whistle and 4 seconds after that he hears an echo from a high wall directly behind the steamer. What is the width of the dam? (Velocity of sound in air = $330ms^{-1}$) (6 marks)

16. (a) Distinguish between static friction and dynamic friction. (4 marks)

(b) Briefly describe the relationship between friction and the weight of the pressing body. (3 marks)

(c) Name three ways by which friction can be reduced. (3 marks)

17. (a) Define

(i) Work done

(ii) Power (2 marks)

(b) A man raises a 100kg load from the ground to a height of 20 metres. Calculate the work done by the man. (4 marks)

(c) An electric kettle contains a heating unit operating on 240V main and carrying a current of 4 amperes. Calculate the power consumed by the heating unit. (4 marks)

18. (a) Define

(i) Heat capacity

(ii) Specific heat capacity. (4 marks)

(b) The temperature of a piece of copper of mass 250g at $10^{o}C$ is raised to $100^{o}C$ and then it is transfered to a well-lagged aluminium can of mass 10g containing 120g of methylated spirit at $10^{o}C$.

Calculate the final steady temperature after the spirit has been well stirred.

(Neglect the heat capacity of the stirrer and any losses from evaporation.

Specific heat of aluminium = 900J/Kg ^{o}C

Specific heat of copper = 400J/Kg ^{o}C

Specific heat of spirit = 2400J/Kg ^{o}C)

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