THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

NOVEMBER 1997

031/1 PHYSICS PAPER 1

(For both School and Private Candidates)

TIME: 3 Hours.

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INSTRUCTIONS

1. This paper consists of Sections A, B and C.
2. Answer ALL questions in Section A and B and any FOUR (4) questions from Section C in the answer booklet provided.
3. Wherever calculations are involved, you are expected to show clearly all the steps in your work in a systematic manner.
4. Marks for questions or parts of questions are given in brackets.
5. Wherever necessary use the following constants:

   Electrochemical equivalent of copper, 0.00000033kg/C

   Acceleration due to gravity, $g = 9.8 m/s^2$

This paper consists of 6 printed pages.

## SECTION A (15 MARKS)

Answer ALL questions in this section. Choose the most correct answer from the four alternatives given under each item and write its corresponding letter in the answer book provided.

1. (i) The centre of gravity G of a body can be defined as:

   A. The centre of attraction of the earth
   B. The focus of the solar system
   C. The point through which the resultant of the weights of all particles of the body acts.
   D. The point through which the lines of symmetry of a body passes.

   (ii) The best statement of Archimedes's principle is that:

   A. The upthrust experienced by a body when partially or totally immersed in a fluid, is equal to the weight of the fluid displaced.
   B. Upthrust is equal to apparent loss in weight when a body is partially or totally immersed in a fluid
   C. When a body is partially or totally immersed in a fluid it displaces its own weight of the fluid in which it is immersed.
   D. When a body is partially or totally immersed in a fluid it experiences a loss in weight.

   (iii) If a body of mass 4.5 kg falls freely from rest for 2.0 seconds before it strikes the ground, the maximum kinetic energy it will gain is:

   A. 900J
   B. 864.4J
   C. 1000J
   D. 450J

   (iv) The S.I. unit of power is the:

   A. joule
   B. horse power
   C. joule second
   D. watt.

   (v) A wheel and axle of efficiency 75% is used to raise a load 1500N. If the radius of the wheel is 40cm and that of the axle is 4cm, then the effort required to overcome the load is:

   A. 150N
   B. 200N
   C. 2000N
   D. 20000N

(vi) The property of a material to recover its original shape and size on removal of a stretching force is called:

A. Elasticity
B. Plasticity
C. Hooke's law
D. Cohessivity.

(vii) The irregular motion of tiny particles suspended in a fluid is called:

A. Mobility
B. Kinetic motion
C. Random motion
D. Brownian motion.

(viii) If 38 kilojoules of heat energy are required to raise the temperature of a metal block of mass 2kg from 40°C to 90°C, then its specific heat capacity is:

A. 0.38 J/kg°C
B. 3.8 J/kg°C
C. 3800 J/kg°C
D. 380 J/kg°C

(ix) An object placed infront of a diverging lens of focal length 0.15m produces an image at a distance of 0.10m from the lens. This implies that the distance of the object from the lens is:

A. 0.3m
B. - 0.3m
C. 0.06m
D. -0.06m

(x) Good emitters of heat energy are also:

A. good reflectors of heat
B. good transmitters of heat
C. good absorbers of heat
D. poor absorbers of heat.

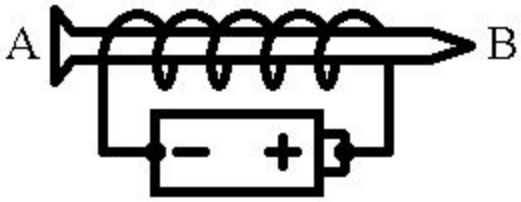
(xi) If the velocity of sound in a solid is 1.4 km/s, then a sound wave of frequency 700Hz has a wavelength of:

A. 2.0m
B. 0.2m
C. 0.2km
D. 2.0km.

(xii) The zig-zag path traversed by electrons from a negatively charged cloud towards a positively charged one is called:

A. radar
B. lightning
C. thunder
D. field emission.

(xiii) An iron nail AB is inserted in a coil made of an insulated copper wire whose ends are connected to the terminals of a dry cell as shown in the figure here under:




The correct way of labelling the poles of the resulting electromagnet is:

A. A is N and B is S
B. A is S and B is N
C. A and B change alternately between N and S
D. A and B are both neutral points.

(xiv) The theory of astronomy which explains convincingly the occurrence of day and night and which is the basis of the solar system is:

A. The Geocentric theory
B. The law of gravitation
C. The heliocentric theory
D. The tectonic theory.

(xv) The truth about X rays is that:

A. they can be deflected by both electric and magnetic fields
B. they are fast moving electrons
C. they are of very low frequency and very long wavelength
D. they are electromagnetic waves.

## SECTION B (45 MARKS)

Answer ALL the questions in this section. All working for each question attempted must be shown clearly.

2. (a) Explain the meaning of each of the terms:
Mass, Inertia and Impulse (3 marks)

(b) A bullet of mass 250g is fired from a gun of mass 5kg, exerting a force of 30N against the gunman which persisted for 2 seconds. Find the velocities of the bullet and recoil of the gun. (6 marks)

3. (a) Describe a simple experiment to demonstrate that water and petrol have different thermal expansivities. (5 marks)

(b) The volumes of a liquid at 15°C and 65°C are $6.0 \times 10^{-5}$ m$^3$ and $6.1 \times 10^{-5}$m$^3$ respectively. Find the apparent volume expansivity of the liquid. (4 marks)

4. (a) Define the terms:
Ampere, Ohm, Resistance and Conductance as referred to in electricity (4 mark)

(b) Each of two new dry cells has an e.m.f. of 1.5 volts and internal resistance of 1.0 ohm. The two cells are connected in parallel and the combination connected to a 10 ohm resistor. Find the current and heat developed per second on the 10 ohm resistor. (5 marks)

5. (a) Explain how radioactivity differs from any type of chemical reaction. (3 marks)

(b) Write in summary form, two properties of each of $\alpha$, $\beta$ and $\gamma$ radiations. (6 marks)

6. (a) What is meant by the terms
Electrochemical Equivalent, Voltameter, Cathode and Anode as applied in electrolysis? (4 mark)

(b) How long will it take to deposit 99 mg of copper in a copper voltameter which carries a current of 3.0A. (4 marks)
On which electrode is the deposition of copper taking place? (1 mark)

## SECTION C

Answer any FOUR questions from this section.

7. (a) Identify any two different forms of energy and name the device which can convert each form of energy to the other (4 marks)

(b) Pangani falls are 45 metres high. Determine the potential energy of 20 litres of water at the top relative to the bottom. What is the Kinetic Energy of water molecules just before reaching the bottom and explain what happens to the energy after the water reaches the bottom? (6 marks)

8. (a) How is the amount of light energy reaching the film of a camera controlled? (2 marks)

(b) A camera has a lens of focal length 4cm. It is used;

(i) first for taking a photograph of an object a long distance away and then

(ii) for taking a photograph of an object 2.0m away from the camera.

Through what distance must the lens be moved and in what direction, in order to take the photograph in (ii)? (8 marks)

9. (a) Identify three characteristics of sound which distinguish one note from another. Hence state the physical factors which correspondingly define the mentioned characteristics. (6 marks)

(b) A resonance tube whose one end is closed and the other open, resonates to a note of frequency 560 Hz when the length of the air column is 15 cm.

Determine the wavelength of this sound in air. What is the shortest length of the air column which resonates in similar conditions to a note of frequency 1000 Hz. (4 marks)

10. (a) Define resistivity and conductivity as referred to in electricity. (2 marks)

(b) Two wires A and B are made of the same material. A has half the length and twice the diameter of B. What is the ratio of the resistance of B to that of A? (8 mark)

11. (a) Draw a labelled diagram of a simple d.c. motor. (6 marks)

(b) Explain why the coil will rotate when the current flows in it and why it will turn in a specific direction. (3 mark)

(c) Why does such a motor occasionally not start to rotate when the current is switched on but will give continuous rotation after a slight push? (1 mark)

12. (a) State one way in which cathode rays differ from electromagnetic waves and describe an experiment which illustrates this difference. (6 marks)

(b) Draw a labelled diagram of a longitudinal section view of the cathode ray oscilloscope tube showing its main features. (4 mark)

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