THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/1 **PHYSICS 1**

(For Both School and Private Candidates)

TIME: 3 Hours 8 November 2000 A.M.

Instructions

1. This paper consists of sections A, B and C.
2. Answer ALL questions in Section A and B and any FOUR questions from Section C.
3. Write your answers neatly and systematically in the answer booklet(s) provided.
4. Marks for questions or part thereof are given in parentheses.
5. Write your examination Number on every page of your answer booklet(s).
6. Wherever necessary use the following constants:

   Acceleration due to gravity, $g = 10 m/s^2$

This paper consists of 7 printed pages.

SECTION A (15 Marks)

Answer ALL questions in this section. Each item carries 1 mark.

Write the letter of the best answer in the answer booklet.

1. (i) A vernier scale reads -0.2 mm when closed and 5.7 mm when used to measure the diameter of a piece of wire. What is the true diameter of the wire?

A. 0.2 mm B. 5.9 mm C. 5.5 mm D. 5.7 mm

(ii) Which of the following three quantities are vectors?

A. Force, work and energy
B. Weight, work and power
C. Velocity, acceleration and power
D. Displacement, velocity and momentum.

(iii) A bus which is heavily overloaded on its basement carrier is unlikely to overturn because:

A. it will run fast downhill
B. its centre of gravity is high
C. its centre of gravity is low
D. its equilibrium is neutral.

(iv) The three advantages of mercury over alcohol in thermometer are that mercury

A. has high B.P, coloured and does not stick to the wall
B. is very sensitive to heat, has low B.P and coloured
C. is colourless, has high B.P, and does not stick to the wall
D. is sensitive, has low B.P. and does not stick to the wall.
E. Atomisation.

(v) The basic condition for diffraction of a wave to occur is that the

A. wave must travel at a high speed
B. width of the slit is about the same size as the wavelength of the wave
C. wavelength of the wave must be greater than the size of the slit
D. wavelength of the wave must be greater than the size of the slit

(vi) What will happen to the leaf of a negatively charged leaf electroscope if alpha particles strike its cap? The leaf will

A. rise further and stay up
B. fall and stay down
C. rise further and then fall
D. fall and then rise again.

(vii) The galaxy in which the solar system is a part is called

A. constellation
B. the universe
C. the milky way
D. a group of stars.

(viii) Two characteristics of the image formed by a plane mirror are

A. laterally inverted and virtual
B. magnified and laterally inverted
C. virtual and smaller than the object
D. always larger and at the same distance behind the mirror as the object is in front.

(ix) A magnetic material can be a magnet when

A. all its domains are aligned in different directions
B. its domains are aligned such that the N-poles face in one direction and the S-poles in another direction
C. its domains are demagnetized
D. its domains are aligned such that their poles face in one direction.

(x) Lenz's law can be applied to predict the

A. magnitude of back emf in a circuit
B. magnitude of induced current in a circuit
C. direction of applied emf across the circuit
D. direction of the induced emf or back emf in a circuit.

(xi) When a radioactive source was tested by adding sheets of different material between the source and a G.M. counter, the results were as follows.

Sheet added	Effect on G-M counter
Paper	Large fall in the count rate
3 mm aluminium	No significant change
Thick lead	Count rate decreases, but not to zero

The source therefore was emitting

A. α-particles and β-particles
B. α-particles and γ-rays
C. β-particles and γ-rays
D. α-particles,β-particles and γ-rays

(xii) The half-life of an element is 12 hours.
What fraction of the element has disintegrated in 72 hours?

A. $\frac{1}{64}$ B. $\frac{1}{16}$ C. $\frac{1}{32}$ D. $\frac{1}{72}$

(xiii) The main function of an electric motor is to

A. produce motion from electric current
B. make magnetism
C. produce electricity from motion
D. form an electromagnet.

(xiv) A horizontal electron beam passes between two parallel horizontal plates X and Y, plate X being above Y. An electric field is set up such that plate Y is at a positive potential. What will happen to the beam? It will deflect

A. upwards
B. sideways to the left
C. downwards
D. sideways to the right

(xv) The main difference between p n p and n p n transistor is that

A. the majority charge carriers in p n p are electrons but in n p n are holes
B. the majority charge carrier in p n p are holes but in n p n are electrons
C. the minority charge carriers in p n p are holes but in n p n are electrons
D. in n p n holes are repelled from the negative terminal but in p n p the electrons are repelled.

SECTION B (45 Marks)

Answer ALL questions. Each question carries 9 marks.

2. (a) What is meant by the moment of a force at a point? State its SI unit. (02 marks)

(b) State the conditions for a body to be in equilibrium when subjected to a number of parallel forces. (03 marks)

(c) A uniform wooden bar AB of length 120 cm weighing 1.2 N rests on two sharp edged supports C and D placed 10 cm from its either ends. A 0.20 N load hangs from a loop of a string 3 cm from A and a 0.90 N load hangs at 40 cm from B. Find the:

(i) reaction at C (02 marks)

(ii) reaction at D (02 marks)

3. (a) Differentiate between heat and temperature. (02 marks)

(b) Explain why water is not used as a thermometric liquid. (03 marks)

(c) (i) The specific heat capacity of a certain substance is 800 J/kg°C; what does this statement mean? (01 mark)

(ii) Calculate the specific heat capacity of mercury, if 980 J of heat is required to raise the temperature of 7 g of mercury from 0°C to 1000°C. (03 marks)

4. (a) Define an echo. (01 mark)

(b) Name any two factors that affect the speed of sound in air. (02 marks)

(c) Explain briefly why sound produced in a hall with many people is heard more clearly than when the hall has a few people. (03 marks)

(d) A person standing 99 m from the foot of a mountain claps his hands and hears an echo 0.6 seconds later. Calculate, the speed of the sound in the air. (03 marks)

5. (a) Define the ampere and the potential difference. . (02 marks)

(b) Derive the expression for the equivalent resistors R_1, R_2 connected in parallel. (03 marks)

(c) Three cells each of emf 1.5 V and internal resistance 0.6 Ω are joined in series to form a battery and connected across a 5 Ω resistor. Calculate

(i) the current and (02 marks)

(ii) the p.d. between the terminals of the cell. (02 marks)

6. (a) Define the terms: astronomy, galaxy and constellation. (03 marks)

(b) (i) Explain why the sun looks much bigger and hotter than the rest of the stars. (01 mark)

(ii) Name three heavenly bodies which are closest to the sun. (03 marks)

(c) Differentiate between a comet and a meteorite. (02 marks)

SECTION C (40 Marks)

Answer any FOUR (4) questions

7. (a) (i) Define the term pressure. (01 mark)

(ii) Mention any two phenomena which show that air exerts pressure. (02 marks)

(b) Explain

(i) how the chain and ball flushing tank works. (02 marks)

(ii) what will happen to the tank when the atmospheric pressure decreases. (01 mark)

(c) A tube has a flat rectangular end which measures .4 m by 0.3 m. Calculate the thrust exerted on this end by the atmosphere, if the atmospheric pressure is 1.01×10^5 N/m^2. (03 marks)

8. (a) What is meant by the principal focus of a converging lens? (01 mark)

(b) What happens to the image of an object placed between the principal focus and a converging lens? Illustrate your answer by using a ray diagram. (03 marks)

(c) An object 4 cm high is placed 20 cm from a converging lens of focal length 8 cm. Determine

(i) the distance of the image from the lens. (02 marks)

(ii) the magnification. (02 marks)

(iii) the height of the image formed. (02 marks)

9. (a) What is meant by

(i) the angle of declination? (01 mark)

(ii) the angle of dip? (01 mark)

(iii) a magnetic pole? (01 mark)

(b) How can you test the polarity of a magnet? Explain briefly why is attraction not a sure test for polarity. (03 marks)

(c) (i) What is the difference between a magnetic field and an electric field? (02 marks)

(ii) How are neutral points obtained in an electric field and (01 mark)
in a magnetic field? (01 mark)

10. (a) State Faraday's law of electromagnetic induction. (02 marks)

(b) (i) What are the eddy currents? (01 mark)

(ii) Mention one advantage and one disadvantage of eddy currents. (02 marks)

(c) Calculate the current that will flow through a 3 Ω resistor connected to a secondary coil of a transformer of 60 turns if the primary coil of 1200 turns is connected to a 240 a.c. supply. Assume no losses. (05 marks)

11. (a) What are

(i) alpha, α-particles (01 mark)

(ii) beta, β-particles (01 mark)

(iii) gamma, γ-rays? (01 mark)

(b) A radon nucleus ^{222}Rn emits an α-particle followed by a β-particle. What are the atomic number and mass number of the nuclei formed after emission? (03 marks)

(c) A radioactive element has a half-life of 3 minutes. If the initial count rate is 512 per minute, how long does it take to reach a count rate of 64 per minute? What fraction of the original element is left? (04 marks)

12. (a) (i) How are intrinsic and extrinsic semi conductors different? (02 marks)

(ii) Explain briefly how an extrinsic semiconductor is made. (02 marks)

(b) When a transistor is connected into a circuit to determine the characteristic curve, the following results are obtained.

I_b (μA)	20	40	60	80	100
I_c (mA)	1.1	2.3	3.2	4.4	5.5

(i) Plot the graph of I_c against I_b.

(ii) Draw the best straight line through the points.

(iii) Calculate the slope.

(iv) What property of a transistor does its slope represent? (06 marks)