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 **07 November 2002 a.m.**

Instructions

1. This paper consists of sections A, B and C.
2. Answer **ALL** questions in section A and B, and **TWO (2)** questions from section C.
3. Write your answers neatly and systematically in the answer booklet(s) provided.
4. Marks for each question or part thereof are indicated beside the question.
5. Cellular phones are not allowed in the examination room.
6. Electronic calculators are not allowed in the examination room.
7. Write your Examination Number on every page of your answer booklet(s).
8. Wherever necessary use the following constants:

   Density of water, $\varrho_w = 1000 \text{kg m}^{-3}$

   Density of sea water, $\varrho_s = 1030 \text{ kg m}^{-3}$

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

This paper consists of 7 printed pages.

SECTION A (20 Marks)

Answer **ALL** questions in this section.

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. Each item carries 1 mark.

   (i) Each scientific instrument is limited in accuracy. What is the shortest length that can be accurately recorded or measured by a metre rule?

   A 0.02 mm B 0.2 mm C 0.2 cm D 0.02 cm E 0.2 m.

   (ii) A body weighs 10 N in air and 8 N when completely immersed in water. Neglecting upthrust in air, its weight in a liquid of density 1.5 g/cm^3 will be

   A 3 N B 18 N C 10 N D 2 N E 7 N.

   (iii) Mercury forms spherical drops when split on a wooden bench because

   A its velocity is very high B it has high relative density C it has high cohesive force

   D it has low surface tension E it is subjected to high atmospheric pressure.

   (iv) When a person perspires on a hot day

   A evaporation occurs and helps to cool the body

   B heat is conducted away from the body

   C latent heat keeps the body warm

   D the body is insulated from the warm air

   E condensation occurs and helps to cool the body.

   (v) The planet in the solar system that is surrounded by rings is

   A Mars B Venus C Earth D Jupiter E Saturn.

(vi) Polarization is

A the cell defect caused by impurities in zinc plate

B the formation of hydrogen gas around the positive plate of an electric cell

C the formation of tiny cells around zinc plate

D the cell defect that can easily be corrected by amalgamation

E the process of giving polarity.

(vii) Compared to cool air, warm air can hold

A more water vapour

B less water vapour

C the same amount of water vapour

D no water vapour

E more or less the same amount of water vapour.

(viii) Which phenomenon causes the dispersion of white light into a spectrum by a prism?

A Diffraction B Absorption C Interference D Refraction E Reflection.

(ix) Which of the following is correct about a capacitor?

A Does not need an insulator between its plates

B Has very high capacitance when air is between its plates

C Must have metal plates to store a charge

D Has capacitance defined by C = V/Q

E Has no voltage across it when working in a radio receiver.

(x) If the resistance is doubled and the potential difference across it is reduced to one third, what is the ratio of old current to new current

A $^{3}/_{2}$ B $^{2}/_{3}$ C $^{1}/_{3}$ D $^{6}/_{1}$ E $^{1}/_{6}$

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. Each item carries 1 mark.

List A	**List B**
(i) Pressure depends on the area of contact	A The percentage of output work to input work
(ii) Light's velocity is greater than sound's velocity	B Ratio of load to the effort
(iii) Doping process	C Earth is between the sun and moon
(iv) Electroplating	D Moon is between the sun and earth
(v) Mass	E The fractional increase in length of a solid per degree Celsius
(vi) Efficiency	F Used in forming thick and real images
(vii) Lunar eclipse	G Cells with conducting materials used in electrolysis
(viii) Iris	H Impure semiconductor with a hole
(ix) Linear expansivity	I Angle of incidence in denser medium which produces the angle of refraction equal to 90°
(x) Critical angle	J Extrinsic semiconductor
	K The fractional increase in area of a solid per degree Celsius
	L Depends on area of a base
	M Measure of inertia
	N Camels are well adapted for working on soft sand
	O The opening which lets light into the eye
	P The lightning is normally observed after the thunder is heard
	Q The ratio of effort to load
	R The lightning is normally observed before the thunder is heard
	S Accelerating rusting or corrosion
	T For a pleasing appearance or protection against rusting or corrosion

SECTION B (60 Marks)

Answer **ALL** questions in this section.

3. (a) Define the following terms

(i) Momentum

(ii) Kinetic energy

(iii) Work. (3 marks)

(b) Calculate a constant force required to bring an object of mass 2.0 kg moving with a velocity of 4.0 ms^{-1} to rest in

(i) 0.1 sec

(ii) 2 m. (4 marks)

(c) Gas is expelled vertically downwards from a rocket pipe at a rate of 100 kg/s on ignition. If the velocity of the exhaust gas is 300 m/s, find the approximate weight of the rocket which can just be raised on ignition. (3 marks)

4. (a) (i) How is kinetic energy of gas molecules related to the temperature of the gas? (1 mark)

(ii) Distinguish the three states of matter in terms of volume, motion of molecules and intermolecular forces. (3 marks)

(b) Discuss briefly the behaviour of one molecule of a liquid during the process of evaporation and subsequent condensation of the liquid. (2 marks)

(c) (i) Explain the term linear expansivity? (1 mark)

(ii) A metal rod is 10 m long at 20°C. At what temperature would it's length increase by 5 cm if its linear expansivity is 2×10^{-6}K. (2 marks)

5. (a) (i) What is meant by the term real image? (1 mark)

(ii) Give two differences between images formed in plane mirrors and in a pin hole camera. (2 marks)

(b) (i) Define the principle focus in terms of a convex lens. (1 mark)

(ii) Draw a sketch diagram to show position of object and image in a concave mirror such that the image is virtual. (3 marks)

(c) An object is placed 20 cm from a concave mirror of unknown focal length. A real image is formed whose height of the object. Calculate the position of the image and focal length of the mirror. (3 marks)

6. (a) Define the following:

(i) Capacitor

(ii) Inductor. (2 marks).

(b) Briefly state the variation of the following over a pear-shaped conductor.

(i) Potential .

(ii) Charge density (2 marks)

(c) (i) What will the effect on an electron be as it passes between two plates A and B one of which carrying a + ve charge and the other carrying a - ve charge? (2 marks)

(ii) Describe briefly the construction and mode of action of a lightning conductor (4 marks)

7. (a) Define

(i) emf of a cell

(ii) resistivity. (2 marks)

(b) (i) Three cells each of emf 1.5 V and internal resistance of 3 Ω are connected in series to an external resistor of 11 Ω. What is the current in the resistor? (2 marks)

(ii) If the same cells are connected in parallel to each other and the combination placed in series with the 11 Ω resistor. What will the current in the resistor be? (2 marks)

(c) A cell conected in series with a 2 Ω resistor gives a current of 0.25 A. When a second 2 Ω resistor is connected in parallel with the first the current becomes 0.30 A. Calculate the

(i) emf of the cell (2 marks)

(ii) internal resistance of the cell. (2 marks)

8. (a) Define a star and give the name of the one closest to the Earth. (3 marks)

(b) (i) Name the largest planet in the solar system. (1 mark)

(ii) Name two brightest planets in the solar system. (2 marks)

(c) A communications satellite appears to be stationary over one point on the earth's surface when it is moving in a circular orbit of radius 42,000 km. Find its speed in km/h given that it must complete one orbit in 24 hours. (4 mark)

SECTION C (20 marks)

Answer any **TWO (2)** questions from this section.

9. (a) State

(i) the law of flotation

(ii) the Archimede's principle. (2 marks)

(b) A piece of corke of density 250 kgm^{-3} has a mass of 0.02 kg. What fraction of the cork is immersed when it floats in water? (3 marks)

(c) (i) A ship of mass 1200 tones floats in sea water. What volume of seawater does it displace? (2 marks)

(ii) If the same ship (in 9 (c) (i) above) enters fresh water, what mass of a cargo must be unloaded so that the same volume of fresh water is displaced as before? (3 mark)

10. (a) Explain how an extrinsic semiconductor is constructed.

(b) Describe the mode of action and application of PN junction diode. (2 marks)

(c) The diagram below (Fig. 1) shows a circuit in which important components A and B are removed.

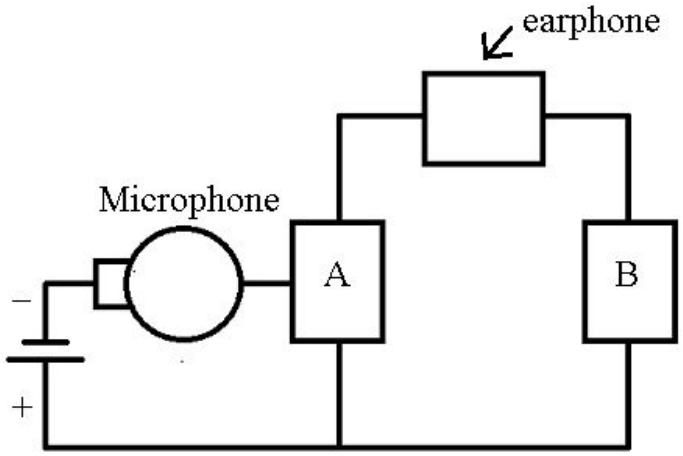


Fig. 1

Answer the following questions with reference to Fig 1:

(i) What does A and B represent? (2 marks)

(ii) Describe briefly the purpose of component A in the circuit (2 marks)

(iii) Draw a well labelled circuit diagram for the circuit above. (2 marks)

11. (a) (i) What are the two types of x-rays? (2 marks)

(ii) X-rays are said to have harmful effect to human beings when used for a long time. Explain the effect that X-rays cause to human beings. (1 mark)

(b) Describe how X-rays are produced in the X-ray tube. (3 marks)

(c) Show the three main parts of Cathode Ray Oscilloscope on a well labelled diagram. (4 marks)