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 ***Friday morning 19/10/2007***

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. Section A carries 20 marks, section B carries 60 marks and section C carries 20 marks.
4. Cellular phones are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).
6. Where necessary use the following constants:

Acceleration due to gravity	g	=	$9.8\ m/s^2$
Pi	π	=	$\frac{22}{7}$

This paper consists of 8 printed pages.
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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.

   (i) A stone is thrown horizontally from the top of a building at a speed of 12 m/s. How long does it take to fall 45 metres vertically? (Assume negligible air resistance).
   A 1.0 sec. B 5.0 sec. C 3.0 sec. D 8.0 sec. E 2.14 sec.

   (ii) Which of the following statements is correct?
   A Friction acts in the same direction as motion.
   B Air friction can cause a body to become hot.
   C Certain lubricants can reduce friction to zero.
   D For a given body the frictional force depends on the area in contact with the surface.
   E Walking would be made easier if friction did not exist.

   (iii) The dew point is defined as the
   A rate at which water vapour present in the atmosphere evaporates
   B amount of water on grass found in the morning
   C amount of water vapour required to saturate air
   D water vapour content of the atmosphere
   E temperature at which water vapour present in air is just sufficient to saturate it.

   (iv) When a pipe is played a sound wave x is produced inside the pipe and a sound Y is heard outside the pipe, then
   A x is transverse and Y is longitudinal
   B x and Y are both transverse waves
   C x is progressive and Y is stationary
   D x is stationary and Y is a progressive wave
   E x is progressive and Y is longitudinal.

   (v) When a lighted match is brought near the negatively charged electroscope, the leaf of the electroscope collapses because the
   A heat increases molecular vibrations which knock off the electrons from the cap
   B flame provides energy for the electrons to escape from the cap
   C match emits γ-rays
   D positive charges from the air ionized by the flame are attracted by the cap
   E match emits α-particles.

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(vi) In the circuit shown in figure 1 the battery and the ammeter have negligible internal resistance. What will be the ammeter reading?

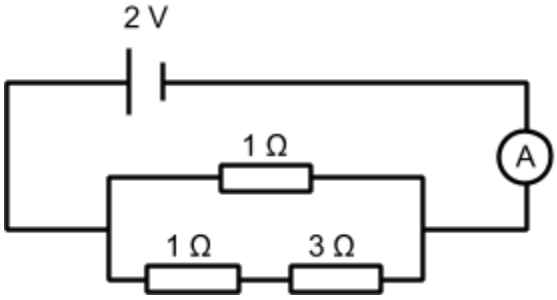
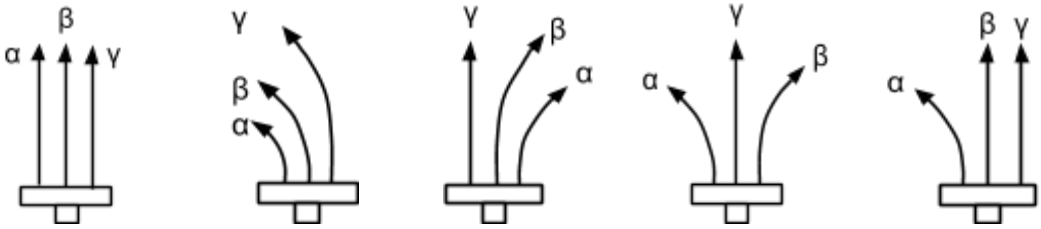


Fig. 1

A 2.5 A B 0.4 A C 0.5 A D 1.6 A E 2.0 A

(vii) A conductor becomes a magnet when
A it is wrapped with a coil of wire
B a soft iron core is used
C an electric current flows through it
D its resistance is increased
E It is passed through an electric field

(viii) A mixed beam of α-particles, β-particles and γ-rays enters a magnetic field at right angles to teh direction of the beam. Which of the following best represent the correct paths taken by the radiations?



(ix) A semi conductor diode is used for
A producing a.c. from a d.c. power supply
B rectification
C controlling energy losses
D amplification
E supplying heat in some electrical devices.

(x) Saturn as a member of the solar system
A is the largest planet with no known satellites
B is the planet seen by naked eye satellites with a temperature -200°C
C is the planet only seen through telescope and is the furthest from the sun
D has five moons and a ring system
E is the second largest planet with known natural satellites and a ring system.

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2. Match the responses in **List B** with the words/phrases in **List A** by writing the letter of the correct response beside the item number.

List A	List B
(i) Hooke's law	A Electrophorus
(ii) Transfer of heat by radiation	B Converts sound waves into electric currents
(iii) Total internal reflection	C Occur in gases and vacuum
(iv) Production of many positive charges in small amounts	D Extensions is proportional to plasticity
(v) Ohm's law not applicable	E Positively charged particles of the nucleus
(vi) Longitudinal waves	F Detects and counts all radioactive radiations and x-rays
(vii) Proton	G Converts electric currents into sound waves
(viii) Telephone earpiece	H Extension of spring is proportional to the applied force
(ix) Geiger-muller counter	I Van der Graaf generator
(x) Collector-base in common base mode	J Detects and counts α-particle radiation only
	K Light must pass from a denser medium to a less dense medium
	L Helium nucleus
	M Emitter-base is reverse biases
	N When physical conditions of a wire are altered
	O Light passes from less dense to a denser medium
	P Travel parallel to the direction of the wave
	Q Reversed biased
	R Occur in the atmosphere
	S Travel perpendicular to the direction of the wave
	T When there occurs no loss of p.d. in an electric circuit.

SECTION B (60 marks)

Answer **all** questions in this section.

3. (a) (i) Define relative density **(1 mark)**

In an experiment using Hare's apparatus, the lengths of methanol and water columns were found to be 16 cm and 12.80 cm respectively.

(ii) Find teh relative density of methanol. **(2 marks)**

(iii) If the length of methanol column was altered to 21.50 cm what would be the new height of the water column? **(1 mark)**

(b) The letter "g" can be used to denote an acceleration or the amount of force. State the conditions and the SI units under each use. **(2 marks)**

(c) An uniform half metre rule is freely pivoted at the 15 cm mark and balances horizontally when a body of mass 40 g is hung at the 2.0 cm mark.

(i) Make a clear sketch to show the forces and their positions in the arrangement. **(2 marks)**

(ii) Calculate the mass of the half-metre rule. **(2 marks)**

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4. (a) What is meant by
   (i) upper fixed point?
   (ii) lower fixed point? **(1 mark)**

   (b) (i) List down the **four (4)** advantages of mercury over alcohol as thermometric liquids. **(2 marks)**
   (ii) Give **two (2)** similarities and **two (2)** differences between a maximum thermometer and a minimum thermometer. **(2 marks)**

   (c) (i) How are the heat losses in a thermos flask checked? **(2 marks)**
   (ii) Determine the final temperature obtained when 500 g of water at 100°C was mixed with 500 g of water at 10°C and well stirred. (Note: The specific heat capacity of water C = 4,20 J kg^{-1} $°C^{-1}$). **(3 marks)**

5. (a) (i) State the conditions necessary for total internal reflection to occur. **(2 marks)**
   (ii) Why does an object appear coloured when light falls onto it? **(1 mark)**

   (b) (i) What is meant by the term complimentary colours? **(1 mark)**
   (ii) Explain why the result of mixing blue and yellow paints is very different from that of mixing blue and yellow lights? **(3 marks)**

   (c) A screen is placed 80 cm from an object. A lens is used to produce on the screen an image with magnification 3. Calculate the
   (i) distance between the object and lens. **(1 mark)**
   (ii) focal length of the lens. **(2 marks)**

6. (a) (i) What are the essential features of a capacitor? **(1 mark)**
   What role does a capacitor play when used in
   (ii) d.c. circuits?
   (iii) a.c. circuits?
   Give one example for each. **(2 marks)**

   (b) (i) What happens when a wire is connected to a charged capacitor? **(1 mark)**
   (ii) An insulated plate A having a negative charge is joined to a plate B of positive charge by a resistance wire. If a charge of 10^6 C flows through the wire of resistance 2 **Ω** in 10^{-6} seconds how much heat is dissipated in the wire? **(1 mark)**

   (c) Discuss the charge distribution on
   (i) the surface of a solid conductor of irregular shape
   (ii) a hollow conductor
   (iii) a lightning conductor as clouds pass over its spikes. **(2 marks)**

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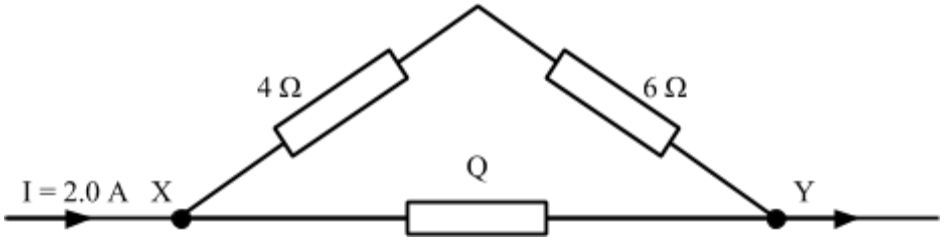
7. (a) (i) **List three (3)** factors that affect the resistance of a wire and discuss how they affect the resistance. **(3 marks)**

(ii) In the circuit shown in figure 2 the total resistance between X and Y is 2.0 Ω. Calculate the unknown resistance Q. **(2 marks)**



(b) (i) How does the electromotive force e.m.f. differ from the potential difference of a cell?

(ii) Would you expect two identical cells in parallel to drive more current through a resistor than one cell does? Explain. **(2 marks)**

(c) A 2.0 m long resistance wire of cross section 0.5 mm^2 has a resistance of 2.2 Ω. Find the

(i) resistivity of the material

(ii) length of the wire that would give a total resistance of 1.0 Ω when placed in parallel. **(3 marks)**

8. (a) (i) Name **three (3)** basic radiation that occur naturally.

(ii) Discuss briefly the properties of the radiations mentioned in 8(a)(i) above in terms of penetrating power **(3 marks)**

(b) (i) Define mass number and atomic number **(2 marks)**

(ii) Thorium disintegrates in the following manner

$^{232}_{90}Th \rightarrow {}^{228}_{88}Ra \rightarrow {}^{228}_{89}Ac \rightarrow {}^{228}_{90}Th \rightarrow {}^{224}_{88}Ra$

State the particles emitted at each part of the disintegration. **(2 marks)**

(c) A thorium 228 radioactive source placed in a polythene bottle decayed into a radioactive gas thoron. The decay process was recorded by the Geiger-Muller (G-M) tube as follows:

Time in minutes	0	4	8	12	16	20
Count rate	40	30	20	14	10	7

(i) Draw the graph of the count rate against time.

(ii) From the graph determine the half-life of thoron. **(3 marks)**

SECTION C (20 marks)

Answer **two (2)** questions from this section.

9. (a) (i) State Archimede's principle. **(1 mark)**

A block of metal of density 2700 kg/m^3 has a volume of 4.0×10^{-2} m^3. Calculate the:

(ii) mass of the block **(1 mark)**

(iii) apparent weight when immersed in brine of density 1200 kg/m^3. **(1 mark)**

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(b) What energy transformation occurs in the following
(i) bullet fired from the nozzle of a gun. **(1 mark)**
(ii) battery used to light a bulb torch. **(1 mark)**

(c) How is kinetic energy distinguished from potential energy? **(1 mark)**

A bullet of mass 3.0 g moving at 400 ms^{-1} hits a tree trunk and comes to rest inside the tree after penetrating a depths of 60 mm, calculate the:
(i) kinetic energy of the bullet as it hits the tree. **(2 marks)**
(ii) average force of retardation as it passes through the tree. **(2 marks)**

10. (a) (i) State Ohm's law. **(1 mark)**
(ii) Describe the factors affecting resistance. **(2 marks)**
(iii) A 5 Ω resistor and a 1 Ω resistor are connected in parallel to a cell of e.m.f. 6 V and internal resistance 0.5 Ω. Calculate the current flowing round the circuit. **(2 marks)**

(b) (i) Why is it economical to transmit electricity over long distances by high voltages rather than low voltages? Explain. **(1 mark)**

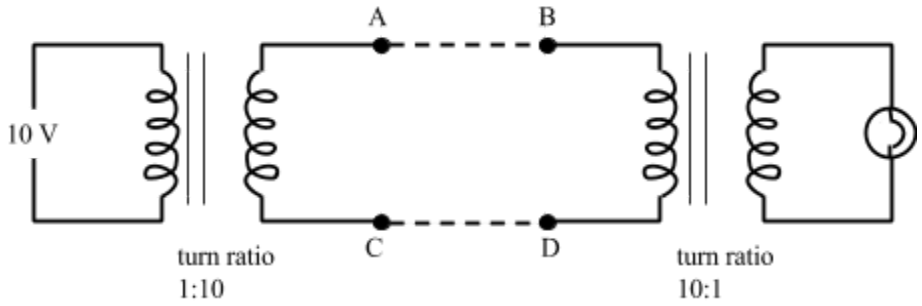

Fig. 3

Figure 3 shows a model of an electrical transmission system. AB and CD each represent a long length of cable each having a resistance of 4 Ω. The current in AB is 0.1 A, find the:
(i) power lost by AB and CD.
(ii) p.d. across BD.
(iii) current through the bulb. **(3 marks)**

(c) State the factors which determine the size of an induced e.m.f. **(1 mark)**

11. (a) (i) Explain why cathode ray tubes (CRT) are evacuated. **(1 mark)**
(ii) What happens to the CRT when a gas is maintained? **(1 mark)**
(iii) If a gas is maintained in a CRT, will the image be formed onto the screen? Explain. **(1 mark)**

(b) In the production of x-rays what are the roles of
(i) low voltage?
(ii) high voltage?
(iii) tungsten target? **(3 marks)**

(c) How are hard x-rays produced? **(1 mark)**

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(d) (i) Discuss the differences between conductors and semiconductors in terms of their sensitivities and conduction bands. **(2 marks)**

(ii) Use the following information to calculate the current gain of a C-E amplifier.

$I_B \times 10^{-6}$ A	100	200	300	400	500
$I_C \times 10^{-3}$ A	5	10	15	20	25

(1 mark)

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