**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** **2006/10/13 a.m.**

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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 **two (2)** questions from section C.
3. Cellular phones are **not** allowed in the examination room.
4. Electronic calculators are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).
6. Whenever necessary use the following constants:

| | | | |
|---|---|---|---|
| Acceleration due to gravity | g | = | 9.8 $m/s^2$ |
| Specific heat capacity of water | $C_w$ | = | 4200 J/kg K |

**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) Metals conduct heat better than non-metals because:

A metals are good conductors of electricity
B metals have free electrons while non-metals have not
C molecules of metals have higher velocity than that of non-metals
D metals are normally of high specific heat capacity
E the crystalline structure of metals is more compact than that of non-metals.

(ii) A metre rule is pivoted at point A as illustrated by the diagram below and balanced by a force of 2.5 N.

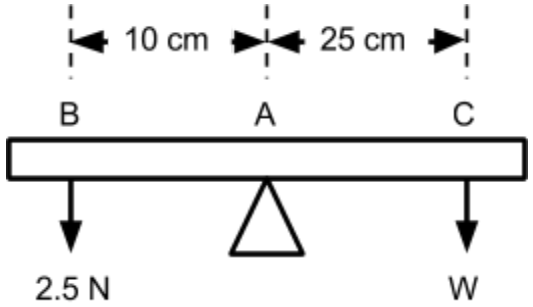


Fig. 1

The mass of the metre rule in kilogram is given by:

A 0.15 B 2.50 C 0.10 D 0.25 E 1.50

(iii) Which of the following will not affect the rate of evaporation of water in a dam?

A Surface area B Depth C Humidity
D Barometric pressure E Temperature.

(iv) Aluminium has a specific heat capacity more than twice that of copper. Identical masses of aluminium and copper, both at 0°C are dropped together into a can of hot water. When the system has come to equilibrium

A aluminium is at a higher temperature than copper
B aluminium and copper are at the same temperature
C copper is at a higher temperature than aluminium
D temperature difference between the copper and aluminium depends on the amount of water in the can
E the temperatures of the copper and aluminium will be higher than that of water.

(v) In the diagram below (fig. 2) a beam of white light entering a triangular glass prism is refracted and dispersion of colour occurs.

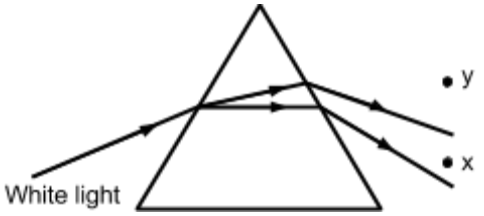


Fig. 2

A thermometer placed at Y records a rise in temperature from the radiation produced. The correct name for this radiation is

A ultra violet B x-rays C gamma rays
D infra-red E beta particles

(vi) A wire of uniform cross-sectional area has a length of 10 m, a resistance of 2 Ω and a resistivity of $2 \times 10^{-7}$ Ωm. The cross sectional area in $m^{2.}$ is

A $2 \times 10^{-4}$ B $1 \times 10^{-5}$ C $0.5 \times 10^{-5}$
D $1 \times 10^{-6}$ E $5 \times 10^{-4}$

(vii) When the plastic pen is rubbed against dry hair, the pen attracts small pieces of paper. This means that the:

A hair becomes negatively charged
B hair becomes positively charged
C pen loses electrons
D hair gains electrons
E paper loses electrons.

(viii) Electric pressure is measured in

A current B volts C watts D ampere E force.

(ix) In the circuit diagram below (fig. 3) A, B, C and D are just positions and the switch is closed.

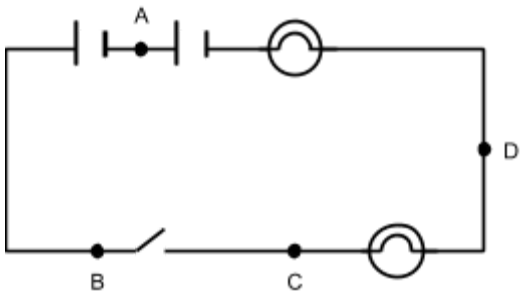


Fig. 3

Choose the correct statement.

A The current at A will be different from the current at B
B The two lamps are wired in parallel
C The current reaches B before it reaches C
D With an extra lamp at D the current will be low
E With an extra lamp at A the batteries will run down immediately.

(x) The property which distinguishes longitudinal waves from transverse waves is the
A ability to be refracted
B need for a material medium
C relative directions of oscillations and propagation
D wavelength
E the speed of propagation.

2. Match the items in list A with responses in list B by writing the letter of the correct response beside the item number.

| List A | | List B | |
|---|---|---|---|
| (i) | Internal resistance | (a) | Material whose resistance increases with temperature |
| (ii) | Short sighted person | (b) | Laminated soft iron core |
| (iii) | Thermistor | (c) | Stretching force produces extension |
| (iv) | Eddy current | (d) | Coloured images from convex lenses |
| (v) | Elasticity | (e) | Coloured images from concave lenses |
| (vi) | Thermopile | (f) | Same element different masses |
| (vii) | Chromatic aberration | (g) | Same element with different atomic number |
| (viii) | Secondary colours | (h) | Use of solenoid |
| (ix) | Electrolysis | (i) | A temperature dependent resistor |
| (x) | Isotopes | (j) | Restoring force brings body to original shape |
| | | (k) | Converts radiant energy to heat energy |
| | | (l) | Converts radiant energy to electric energy |
| | | (m) | Resistance of a cell caused by an induced electromotive force |
| | | (n) | Normally uses bi-concave lenses |
| | | (o) | Decomposition of electrons in an electrolyte by the passage of current |
| | | (p) | Normally uses bi-convex lenses |
| | | (q) | Magenta, cyan and green |
| | | (r) | Magenta, cyan and yellow |
| | | (s) | Decomposition of an electrolyte by the passage of an electric current |
| | | (t) | Caused by the chemical reaction within the cell |

## SECTION B (60 Marks)

Answer **all** questions in this section.

3. (a) A rocket taking off vertically, pushes out 25 kg of exhaust gas every second at a velocity of 100 m/s. If the total mass of the rocket is 200 kg,
(i) what is the resultant upward force on the rocket? **(2½ marks)**
(ii) what is the upward acceleration of the rocket? **(2 marks)**

(b) Calculate the acceleration of the rocket in 3(a) above when it has burned off 100 kg of fuel. **(3 marks)**

(c) A simple weighing machine is made of a uniform bar 125 cm long and mass 5 kg and pivoted 2.5 cm from one end. Find the mass that must be suspended at the end of the long arm so as to balance a mass of 320 kg suspended at the end of the short arm. **(2½ marks)**

4. (a) State briefly:
   (i) The cause of refraction of light when passing through transparent media. **(1 mark)**
   (ii) Position of image in concave mirror, of a very distant object. **(1 mark)**
   (iii) Cause for a blurred image in concave mirrors or convex lenses. **(1 mark)**

   (b) Explain the following:
   (i) Condition giving rise to critical angle and total internal reflection. **(1½ mark)**
   (ii) Two principles in Physics used to make telescopes. **(1½ mark)**

   (c) A telescope of 5.0 m diameter reflector of focal length 18.0 m is used to focus the image of the sun. using the distance of the sun from the earth and diameter of the sun as $1.5 \times 10^{11}$ m and $1.4 \times 10^{9}$ m respectively, calculate the:
   (i) position of the image of the sun. **(2 marks)**
   (ii) diameter of the image of the sun. **(2 marks)**

5. (a) Define the following terms:
   (i) Ampere (ii) Coulomb (iii) Volt (iv) Ohm **(4 marks)**

   (b) (i) State Ohm's law and **two (2)** of its limitations. **(2 marks)**
   (ii) Determine the internal resistance of a cell and the value of R given that the p.d. of the cell in open circuit is 1.5 V, when connected to a 10 Ω resistor its p.d. becomes 1.0 V, but when connected to a resistor of R Ω the p.d. falls to 0.5 V **(2 mark)**

   (c) A 200 g of liquid at 21°C is heated to 51°C by a current of 5 A at 6 V for 5.0 minutes. What is the specific heat capacity of the liquid? **(2 marks)**

6. (a) (i) Differentiate between heat and temperature. **(2 marks)**
   (ii) With the aid of a sketch graph explain the importance of the anomalous expansion of water. **(2 mark)**

   (b) Give reasons for the following
   (i) A gap is left between two successive rails. **(1 mark)**
   (ii) A glass tumbler breaks when hot liquid is poured. **(1 mark)**

   (c) Define the coefficient of linear expansivity. **(1 mark)**
   A copper pipe of length 100 cm at 15°C increases its length by 0.15% when a steam at 100°C passes through. Find the coefficient of linear expansivity of copper. **(3 marks)**

7. (a) A radioactive source is known to emit one type of radiation only i.e. $\alpha$, $\beta$ or $\gamma$. The source was placed in a holder as shown in fig. 4 below, first without a magnet and then a magnet was introduced. A detector was placed at positions 1, 2 and 3 and the count rates recorded in the table below.

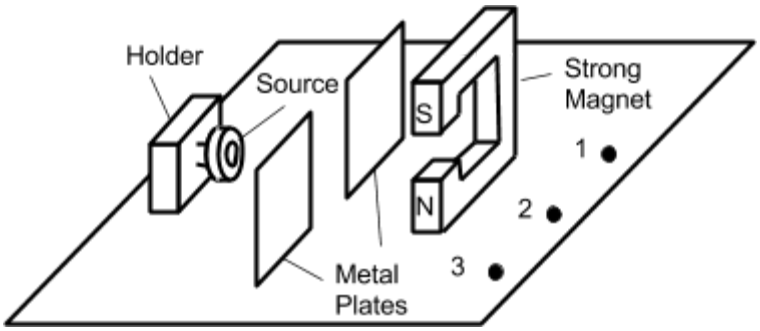


Fig. 4

Table

| | Counts per minute | |
|---|---|---|
| **Detector position** | **Magnet not present** | **Magnet present** |
| 1 | 26 | 295 |
| 2 | 300 | 28 |
| 3 | 28 | 26 |

(i) What is the reason for placing the two metal plates in front of the source?
(ii) What is the value of the background counts per minute?
(iii) Define the background count. **(3 marks)**

(b) What is meant by the half-life of a radioactive element? **(1 mark)**

(c) A radioactive element has an initial count rate of 1200 counts per minute measured by a scale and this falls to 150 counts per minutes in 15 hours.
(i) Determine the half-life of the element. **(3 marks)**
(ii) If the initial number of atoms in another sample of this element is $3.0 \times 10^{20}$, how many atoms will have decayed in 25 hours? **(3 marks)**

8. (a) (i) How does a conductor differ from a semiconductor in terms of energy levels? **(2 marks)**
(ii) By means of a well labelled diagram, describe the electric and magnetic effects on the cathode beam deflection in a c.r.o. **(3 marks)**

(b) (i) What is a diode? **(1 mark)**
(ii) Make a sketch of the output voltage against time for half-wave rectification. explain why the output flows in pulses. **(2 marks)**

(c) Describe and explain how a full-wave rectification is achieved by using two diodes. **(2 marks)**

## SECTION C (20 marks)

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

9. (a) What do you understand by the following terms
   (i) Triple point of water. **(1 mark)**
   (ii) Specific latent heat of fusion. **(1 mark)**

   (b) State **three (3)** differences between evaporation and boiling. **(3 marks)**

   (c) A tin contains water at 290 K and is heated at a constant rate. It is observed that the water reaches boiling point after 2 minutes and after further 12 minutes it is completely boiled away. Calculate the specific latent heat of steam. **(5 marks)**

10. (a) Explain the meaning of
   (i) Magnetic induction. **(1 mark)**
   (ii) Magnetic screening. **(1 mark)**

   (b) Draw a circuit diagram of an electric bell and explain how it works. **(4 marks)**

   (c) (i) Draw the symbols for PNP and NPN transistors. **(2 mark)**
   (ii) Sketch the simple circuit for NPN transistor amplifier. **(2 marks)**

11. (a) (i) Distinguish between speed and velocity. **(2 marks)**
   (ii) Define uniform velocity and uniform acceleration. **(2 marks)**

   (b) Sketch the diagram of a body which starts from rest and accelerates uniformly for sometimes to a constant velocity and then maintains this velocity for a certain period of time before decelerating uniformly to a stop. **(2 marks)**

   (c) A car moving with a uniform velocity of 100 m/s is decelerated at 2.5 $m/s^2$ to a stop. Calculate
   (i) The time taken for the car to stop. **(2 marks)**
   (ii) The distance travelled by the car before it is brought to rest. **(2 marks)**