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

035 **ENGINEERING SCIENCE**
(For Both School and Private Candidates)

Time: 3 Hours **Friday November 05, 2004 a.m.**

Instructions

1. This paper consists of sections A, B and C.
2. Answer **all** questions in sections A and B and **three (3)** questions from section C.
3. Electronic calculators are **not** allowed in the examination room.
4. Cellular phones are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).
6. Acceleration due to gravity, $g = 9.8\ m/s^2$.

This paper consists of 4 printed pages.

SECTION A (10 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) If a solid weighs 1960 N in air, 1568 N when totally immersed in water and 1176 N when totally immersed in liquid x, then the density of liquid x is ---------- g/cm^3

A 4.0
B 2.0
C 4.0
D 5.0
E 3.0

(ii) In order to keep a body moving in a circle, there must be a force on it directed towards the centre. This force is called

A tensional angular
B centrifugal
C centripetal
D frictional
E gravitational

(iii) Potential and kinetic energies are similar in that

A both produce heat
B both are measured in watts
C both are forms of electrical energy
D one is a substitute of the other
E both are forms of mechanical energy.

(iv) A given mass of gas has a volume of 100 cm^3 at 750 mmHg pressure. At what pressure, in mm Hg, is its volume 60 cm^3?

A 120
B 130
C 125
D 135
E 140

(v) If the e.m.f. and internal resistance of a battery are 1.5 V and 0.4 Ω respectively, the current that the battery will supply to a resistor of 14.6 Ω will be ---------- A

A 15
B 10
C 1.0
D 0.1
E 0.25

(vi) If the refraction index of water is $\frac{4}{3}$, then the critical angle of the water-air interface is

A 48° 35'
B 45°
C 42°
D 36° 51'
E 30°

(vii) The area under velocity against time graph represents

A displacement
B velocity
C distance
D acceleration
E average velocity.

(viii) The SI units of linear momentum is

A N S
B Kgm/sec
C Kg/ms
D Js
E Nm.

(ix) Three common methods of magnetization are

A natural, electrical and chemical
B electrical, magnetic and induction
C stroking, induction and electrical
D stroking, chemical and natural
E forced, heating and stroking

(x) An instrument which consists of a solenoid wound around soft iron whose magnetism disappears when the current is switched off is called

A an electromagnetic
B an electric bell
C a magnetic relay
D a solenoid
E an electroscope.

SECTION B (30 marks)

Answer **all** questions in this section.
All working must be shown clearly.

2. An object is place 20 cm in front of a concave mirror of focal length 12 cm. Find the nature and position of the image.

3. (a) Define power.

(b) Calculate the power of a pump which can lift 100 kg of water through a height of 3 m in 5 seconds (assume $g = 10\ m/sec^2$).

4. In a hydraulic press, the radius of the big piston is 80 mm while that of the small piston is 20 mm. Calculate the velocity ratio of the press.

5. A lamp is rated 240 V – 60 W

(a) What does this mean?

(b) Calculate the resistance of the filament when the lamp is used.

6. What do you understand by "anomalous expansion of water"?

7. State **three (3)** factors affecting the velocity of sound.

8. What is polarization and how is it prevented in the Leclanche' cell?

9. A body which moves from rest with uniform acceleration, travels 18 m during the third second. What will be its velocity at the end of the eighth second?

10. Explain why burns produced by steam at 100° C are more severe than those produced by hot water at 100° C.

11. Distinguish between resistivity and temperature coefficient of a material.

SECTION C (60 marks)

Answer **three (3)** questions from this section.

12. Give a diagram of a single string pulley system with a velocity ratio of 6.

Calculate the efficiency of a single string pulley if an effort of 1000 N is required to raise a load of 4500 N.

Find the energy wasted when a mass of 500 kg is lifted through 2 m.

13. (a) State the law of flotation.

(b) What volume of brass of density 8.5 g/cm^3 must be attached to a piece of wood of mass 100 g and density 0.2 g/cm^3 so that the two together will just submerge beneath water?

14. (a) Define the coefficient of linear expansion of a material.

(b) An iron tyre of diameter 50 cm at 15°C is to be shrunk on to a wheel of diameter 50.35 cm. To what temperature must the tyre be heated so that it will slip over the wheel with a radial gap of 0.5 mm? (Coefficient of linear expansion of iron = 0.000012/° C).

15. (a) State ohm's law.

(b) Two cells each having an e.m.f of 2.5 V and internal resistance of 2 Ω are connected in (i) series (ii) parallel.

Find the current in each case when the cells are connected to a 5 Ω resistance.

16. (a) State the laws of electromagnetic induction.

(b) A transformer is designed to operate a 6 V lamp from a 240 - volts a.c mains.

(i) What is the ratio of primary to secondary turns?

(ii) What should be the ratio of primary current to secondary current if there is no energy loss in the transformer?