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

035 ENGINEERING SCIENCE

(For Both School and Private Candidates)

TIME: 3 Hours 8 November 2000 A.M.

Instructions

1. This paper consists of sections A, B, C and D.
2. Attempt ALL questions in section A and any FIVE (5) questions from sections B, C and D choosing at least one question from each of these sections.
3. Write your Examination Number on every page of your answer booklet(s).
4. Take $g = 10 m/s^2$

This paper consists of 3 printed pages

SECTION A

1. (a) Name the instruments you would use for the following measurements:

   (i) Diameter of a piece of wire

   (ii) Internal and external diameters of a tube of about 4 cm bore.

   (b) Name the SI unit of force and define it.

2. (a) Distinguish between force of gravity and centripetal force

   (b) Name three types of equilibrium.

   (c) Name two types of friction

3. (a) A garden roller is pulled with a force of 10 N acting at an angle of 50° to the ground level. Find by calculation the effective force pulling the roller along the ground

   (b) Define

   (i) uniform velocity (ii) relative velocity.

4. (a) Distinguish between specific heat capacity and thermal capacity.

   (b) Define elasticity and state Hooke's law

5. (a) Define the term "beats"

   (b) Calculate the frequency of a radio wave of wavelength 150 m.

6. (a) Explain how you would test the polarity of a magnet

   (b) State the right hand rule.

7. (a) Define

   (i) the ampere (ii) the coulomb.

   (b) How long will it take to liberate 1.10 g of copper by electrolysis using a current of 0.5 A? (E.C.E. of copper = 0.00033 g/C)

8. A battery consists of three accumulators in series each having an emf of 2 V.
   A secondary battery consists of four dry cells also connected in series, each having an emf of 1.5 V.
   What is the total emf of each battery?

9. Find (a) the current taken (b) the resistance of the filament of a lamp rated 240 V, 60 W.

10. By means of a diagram, explain what is meant by the annular eclipse.

SECTION B

11. A piece of copper of mass 250 g is heated to 100° C and then transferred to a well-lagged aluminium can of mass 10.0 g containing 120 g of spirit at 10.0° C. Calculate the final steady temperature after the spirit has been well stirred. Specific heat capacities:

    Copper = 400 J/kg°C
    Aluminium = 900 J/kg°C
    Methylated spirit = 2400 J/kg°C.

12. (a) Define the kilowatt hour.

    (b) Find the cost of running five 60 W lamps and four 100 W lamps for 8 hours if electric energy costs shs. 20 per unit.

13. Calculate the time required to plate on one side only of a tray whose area is 559 cm^2, with a coating of silver 0.2 mm thick using a current of 2 A.

    E.C.E. of silver = 0.001118 g/C
    Density of silver = 10.5 g/cm^3

SECTION C

14. (a) State the law of floating bodies.

    (b) A piece of iron of mass 156 g and density 7.8 gm/c.c. floats on mercury of density 13.6 gm/c.c. What is the minimum force required to submerge it?

15. When tested in a cool garage at 10° C a motor tyre is found to have a pressure of 1.2 kgf/cm^2. Assuming the volume of the air inside remains constant, what would you expect the pressure to become after the tyre has been allowed to stand in the sun so that the temperature rises to 37° C? (Atmospheric pressure = 1.0 kgf/cm^2).

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

SECTION D

17. Two cells each having an e.m.f. of 1.5 V and internal resistance of 2 Ω are connected (a) in series (b) in parallel. Find the current in each case when the cells are connected to a 1 Ω resistor.

18. A concave mirror produces a real image 1 cm tall of an object 2.5 mm tall placed 5 cm from the mirror. Use Real – is - positive convention to find the position of the image and the focal length of the mirror.

19. A coil of resistance R is immersed in a liquid in a calorimeter of a total heat capacity 950 J/°C. If the temperature rises from 9° C to 29° C in 5 minutes when a steady current of 4 A is passed, find

    (a) the resistance R of the coil

    (b) the p.d. across it.