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

035

ENGINEERING SCIENCE

(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 sections A and B, and THREE (3) questions from section C.
3. Read the questions catefully before you start answering them.
4. Cellular phones are **not** allowed in examination room.
5. Electronic calculators are not allowed in examination room.
6. Write your Examination Number on every page of your answer booklet(s).
7. Acceleration due to gravity $g = 9.8\ m/sec^2$.

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SECTION A (10 marks)

Answer **ALL** question 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 liquid x needs 2000 J to be heated through 5 °C. An equal mass of water with specific heat 4200 J/kg°C needs 6000 J to be heated through 10 °C. The specific heat capacity of x in J/kg °C is

A 2800 B 1400 C 1000 D 700 E 420.

(ii) A car has a velocity of 72 km/h. How far does it travel in ½ minute?

A 600 m B 240 m C 36 m D 60 m E 1000 m.

(iii) The absolute zero temperature is equivalent to

A. 273 °K B 0 °C C –273 °C D –100 °C E 273 ° K.

(iv) If a bottle capable of holding 200 g of a liquid of density 800 kg/m^3 is allowed to hold 160 g of sand of density 3200 kg/m^3 the mass of water needed to fill up the bottle is

A 200 g B 40 g C 90 g D 150 g E 100 g

(v) Equal and opposite parallel forces form what is called

A couple B centre of gravity C torque D equilibrium E stability.

(vi) Given an electric kettle with the heating element labelled 3 kW 240 V. The resistance of the element of the kettle is

A 20.5 Ω B 19.2 Ω C 0.205 Ω D 0.0192 Ω E 1.92 Ω

(vii) The direction of the induced current when a straight conductor moves through a magnetic field can be determined by applying the

A Maxwell's cork screw rule
B Fleming's right hand rule
C Right hand grip rule
D Fleming's left hand rule
E Ampere's swimming rule.

(viii) The perceived loudness of sound **does not** depend on the

A amplitude of sound wave
B velocity of the soundwave
C wave length of sound wave
D back ground sounds
E frequency of sound.

(ix) Which of the following statements is **not true** for a slide projector?

A A converging lens is used
B A condenser is necessary
C The image is magnified and real
D A lamp is essential
E The image brightness is increased by the lens.

(x) A force F Newtons gives a mass of 2 kg an acceleration of 4 m/sec^2. A force of 3F Newtons will give a mass of 8 kg an acceleration of

A 1 ms^{-2} B 3 ms^{-2} C 6 ms^{-2} D 12 ms^{-2} E 24 ms^{-2}

SECTION B (30 marks)

Answer **ALL** questions in this section. All workings for each question must be shown clearly.

2 (a) An object of mass 1 kg rests on 0.1 m^2 of a table. What is the pressure exerted on the table?

(b) Convert the standard pressure 76 cm of mercury to N/m^2 given that the density of mercury is 13600 kg/m^3

3 A motor car is uniformly retarded and brought to rest from a speed of 108 km/h in 15 seconds. Find its acceleration.

4 Distinguish between "density" and "relative density".

5 A man weighing 500 N runs up a staircase and in 5 seconds rises 3.75 m. Calculate his power.

6 Distinguish between resistivity and temperature coefficient of resistance of a material.

7 Calculate the single resistance which could be used in a circuit instead of 2, 3 and 4 ohms respectively connected in parallel.

8 A pulley rotates 100 times per minute. If the pulley has a diameter of 50 cm and is used to drive a belt, what will the velocity of the belt in m/sec be?

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

10 A gas occupies a volume of 400 ml at a pressure of 490 kN/m^2 and a temperature of 30 °C. Calculate its volume at s.t.p.

11 How many kilograms of copper can be raised from 15° to 60° by the absorption of 80 kJ of heat assuming the specific heat capacity of copper is 390 J/kg°C.

SECTION C (60 marks)

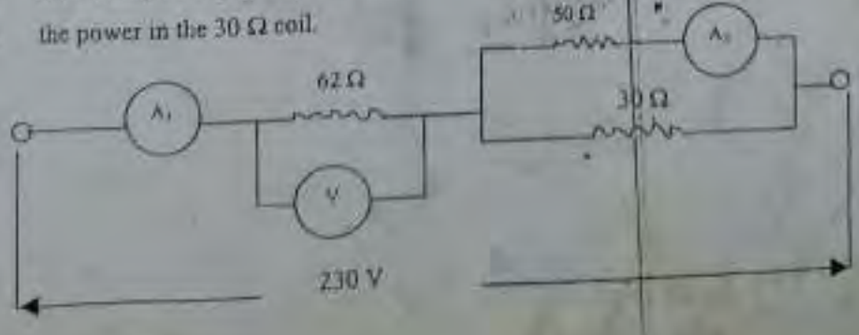
Answer **THREE (3)** questions from this section.

12 A uniform horizontal beam 6 m long rests on two supports A and B, 4 metres apart. A is at one end of the beam. The mass of the beam is 20 kg. Calculate the reactions of the supports on the beam.

13 The diagram below shows an electric circuit connected to a 230-V supply. Determine

(a) the reading of the voltmeter V and each of the ammeters A_1 and A_2

(b) the power in the 30 Ω coil.



14. A train has a uniform acceleration of 0.2 m/sec^2 along a straight track.

Calculate

(a) the velocity after an interval of 16 seconds from rest

(b) the time required to attain a velocity of 50 km/h

(c) the distance travelled from rest until the train attains a velocity of 50 km/h

(d) the time taken for the velocity to increase from 30 km/h to 50 km/h and the distance travelled during that time.

15. A body having a mass of 200 kg is resting on top of a screw- jack. The screw has a pitch of 8 mm and an effort of 36 N has to be applied tangentially at a radius of 250 mm to lift the load.

Calculate (a) the velocity ratio

(b) the mechanical advantage

(c) the efficiency.

16. Two kilograms of dry ice at 0 °C are placed in a vessel containing 5 kg of water at 38 °C. The water equivalent of the vessel is 0.2 kg. Calculate the temperature of the water when the ice is completely melted, assuming there is no loss or absorption of heat from outside the vessel. Take the specific latent heat of fusion of ice as 335 J/kg.

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