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 **2006/10/13 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, $g = 9.8\ ms^{-2}$
7. Density of water $1000\ kg/m^3$

This paper consists of 5 printed pages.

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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) A person standing on a bus which starts to move forward, suddenly tends to fall backward because he/she is obeying

A Newton's gravitational pull
B Newton's first law of motion
C Newton's second law of motion
D Newton's third law of motion
E The principle of equilibrium.

(ii) If the velocity of sound is 1.4 km/s, the sound wave of frequency 700 Hz has a wavelength of

A 2.0 m
B 0.2 m
C 0.002 km
D 2.0 km
E 500 km.

(iii) The centre of gravity, G, of a body can be defined as

A centre of attraction of the earth
B focus of the solar system
C point through which the line of symmetry of a body passes
D point through which the resultant of the weights of all particles of the body acts
E geometrical allocation of the centre of the body.

(iv) A set of new year tree lights consists of 20 identical lamps connected in series to a 250 V main supply. What is the potential difference across each lamp?

A 12 V
B 20 V
C 240 V
D 250 V
E 12.5 V.

(v) A wheel and axle of efficiency 75 % is used to raise a load of 1500 N. If the radius of the wheel is 40 cm; the effort required to overcome the load is

A 150 V
B 200 V
C 2000 N
D 300 N
E 600.5 N

(vi) These are instruments used to measure length

A metre rule, engineer callipers and beam balance
B micrometer screw gause, metre rule and lever balance
C thermometer, metre rule and tape measure
D vernier callipers, metre rule and micrometer screw gauge
E vernier callipers, pressure gauge, metre rule and micrometer screw gauge.

(vii) Equal and opposite forces form what is called

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

(viii) The knowledge about conduction, convection and radiation is important in the construction of

A thermometer
B thermos flask
C radiation thermometer
D thermostan
E starter.

(ix) 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 Ampere's swimming rule
C Fleming's left hand rule
D Right hand grip rule
E Fleming's right hand rule.

(x) 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, then 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

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SECTION B (30 marks)

Answer **all** questions in this section.

All working for each question must be clearly shown.

2. Define the following:

   (a) Light energy.

   (b) Sound energy.

3. Mention **three (3)** fundamental quantities in Engineering Science and state their corresponding S.I. units.

4.

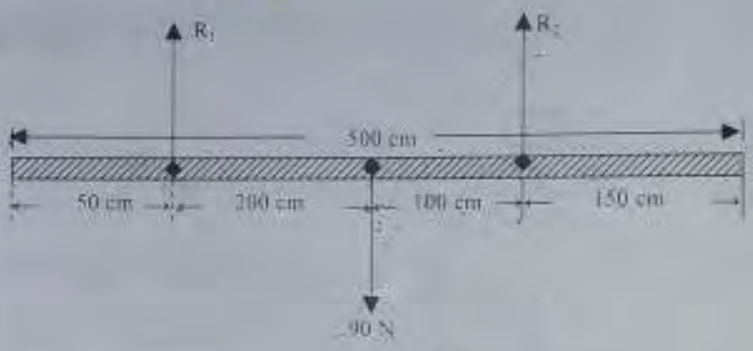


Fig. 1

Given figure 1 above, calculate the reactions R_1 and R_2.

5. A 60 W bulb is left burning for 10 hours every night. Assuming that electricity costs Tshs. 200/- per kwh; calculate the total cost after 10 nights.

6. The mass of a piece of cork of density 0.25 g/cm^3 is 20 g. What fraction of the cork is immersed when it floats in water?

7. Three cells each of 1.5 V and 1 Ω internal resistance are connected in series. What will be the current supplied by the battery through a 5 ohms resistor?

8. A radio station sends out waves with a frequency of 250 kHz. If the wavelength is 1,200 cm, what will be the speed of the radio waves through the air?

9. State the principle of parallelogram of forces and the triangle of forces.

10. (a) Define elasticity.

    (b) State Hooke's law.

11 A force of 25 N acts on a body of mass 0.5 kg for 20 seconds, if the body starts from rest, find

(a) its final velocity

(b) the distance covered.

SECTION C (60 marks)

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

12 The Niagara river falls has a flow of about 600 m^3/s and the falls are about 49 metres high. Calculate the potential energy that becomes converted to kinetic energy every second as the water goes over the falls.

13 A bullet of mass 20 g, travelling with a velocity of 16 m/s penetrates a sandbag and is brought to rest in 0.05 sec. Find the

(a) depth of penetration

(b) average retarding force of the sand in Newtons

14 An ammeter gives a full scale reading for a current of 0.1 A and its resistance is 0.5 Ω. Explain how you would adapt it

(a) to give a full scale of 2 A.

(b) for use as a voltmeter to read up to 100 V.

15 (a) An object is 4 cm from a concave mirror of a focal length 5 cm. Find the:

(i) nature of image

(ii) position of image.

(b) State whether the image in 15 (a) above is magnified, diminished or the same as the object.

16 (a) A solid of mass 100 g is immersed in water and displaces 40 cm^3 of water. What is the density of the solid?

(b) 10 cm^3 of copper sulphate solution of density 1.2 g/cm^3 is mixed with 70 cm^3 of water. What is the density of the resulting mixture?

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