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 **Monday, 11th October 2010 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. 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: $g = 9.81\ m/sec^2$.

This paper consists of 6 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) A quantity of lead shots was found to have a mass of 100g. When placed in a measuring cylinder partly full of water, the water level rose from a reading of 80 ml to a reading of 88.8 ml. The density of lead is

A 8.8 g/ml
B 1.25 g/ml
C 11.4 g/ml
D 11.4 ml/g
E 8.88 g/ml

(ii) A wheel rotating at 5 rad/s accelerates uniformly at 1 rad/s^2 for 30 second. The angular velocity after 30 second is

A rad/s
B 15 rad/s
C 20 rad/s
D 35 rad/s
E 10 rad/s

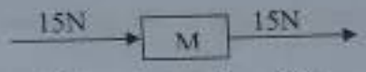
(iii) The heat energy that produces a change in the temperature of a substance is called

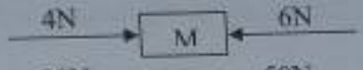
A Specific heat capacity
B Sensible heat
C Latent heat
D Hidden heat
E Source of energy

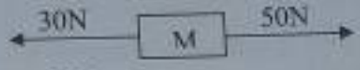
(iv) Colours are produced when white light passes through a glass prism because

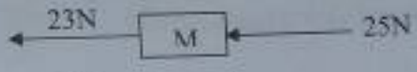
A the light waves interfere
B the glass colours the light
C different colours travel at different speeds in glass
D the different colours are filtered
E diffraction of light occurs

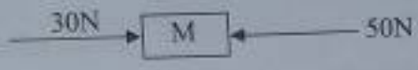
(v) Two forces act on a block of mass M. Which arrangement gives the block the greatest acceleration?

A 

B 

C 

D 

E 

(vi) Observe Figure 1 and identify the statement which is correct.

Figure 1

A x, y and z are fulcrum, load and effort respectively
B x, y and z are load, fulcrum and effort respectively
C x, y and z are effort, load and fulcrum respectively
D x, y and z are fulcrum, effort and load respectively
E x, y and z are load, effort and fulcrum respectively

(vii) At what average rate is electrical energy being converted into potential energy when an electric motor raises a weight of 30N through a distance of 3m in 5s?

A 0.5W
B 2.0W
C 18W
D 50W
E 450W

(viii) Which of the following sentences is wrong?

A A vector quantity has both magnitude and direction
B A vector quantity has magnitude but has no direction.
C A scalar quantity has magnitude only
D A scalar quantity has no direction
E Mass is a scalar quantity

(ix) The property of a material to recover its original shape and size on removal of the stretching force is called

A Hooke's Law
B Plasticity
C Elasticity
D Cohesively
E Brittle.

(x) The positive pole of a dry cell is made of

A carbon rod
B zinc can
C ammonium chloride
D copper rod
E manganese dioxide.

SECTION B (30 Marks)

Answer **all** questions in this section.

2. (a) Define the following terms as they are used in waves:

(i) Amplitude

(ii) Resonance

(b) Define reverberation and explain its two features.

3. An accuracy measurement of length can be measured with:

(a) A Micrometer screw gauge.

(b) A Vernier caliper.

4. An object of mass 2kg falls from a height of 20m above the ground. Calculate the loss in potential energy just before the mass strikes the ground.

5. Find the resultant of the system of forces shown in Figure 2.

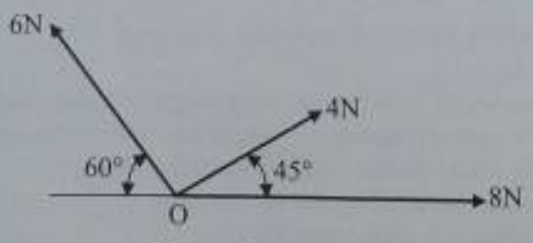


Figure 2

6. Calculate the power of a pump which can lift 200kg of water through a vertical height of 6m in 10 seconds.

7. (a) Mention the effects of an electric current.

   (b) Give one example in each effect of an electric current mentioned in question 7 (a).

8. The length of a copper wire is 40m at 10°C. If the coefficient of linear expansion of copper is 17×10^{-6}/°C. What is the increase in the length of the wire when the temperature rises to 45°C?

9. (a) Define stress.

   (b) Find the stress in the wire 1mm diameter under a load of 120N.

10. (a) State the laws of refraction.

    (b) Define the Refractive index.

11. State the Newton's laws of motion.

SECTION C (60 Marks)

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

12. A Block and Tackle system of 5 pulleys is used to raise a load of 500N steadily through a height of 20m. The work done against friction is then 2000J. Calculate the;

    (a) Work done by the effort.

    (b) Efficiency of the system.

    (c) Effort applied.

13. A vehicle starts from rest with constant acceleration of $2m/sec^2$ and this acceleration is maintained for 15 seconds. The velocity is then kept constant for a period, after which the vehicle is brought to rest with uniform deceleration in 15sec. The total distance traveled is 750m. By using a sketch of velocity – time graph, determine the;

    (a) Constant velocity.

    (b) Deceleration.

    (c) Total time for the journey.

14. (a) Define:

(i) Volt

(ii) Ampere

(iii) Ohm

(b) Two cells each having an emf of 1.5V and an internal resistance of 2 ohm as connected in

(i) series

(ii) parallel

Calculate the current flow in each case when the cells are connected to an external resistor of 1 ohm.

15. The angular velocity of a car wheel increases from 5rad/sec to 50rad/sec in 30sec. If the wheel has a radius of 350mm, what is the

(a) Average angular acceleration?

(b) Average linear acceleration of a point on the rim of the wheel?

(c) Number of revolution made

(i) in radian? and

(ii) in revolution?

16. An ordinary hydrometer of mass 28g floats with 3cm of its stem out of water. The area of cross-section of the stem is $0.75am^2$. Find the total volume of the hydrometer and the length of stem above the surface when it floats in a liquid of relative density 1.4.