Student's Assessment Number.....

THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

FORM TWO NATIONAL ASSESSMENT

035 **ENGINEERING SCIENCE**

Time: 2:30 Hours **Year: 2022**

Instructions

1. This paper consists of sections **A, B** and **C** with a total of **ten (10)** questions**.**
2. Answer **all** questions.
3. Section **A** and **C** carry **fifteen (15)** marks each, section **B** carries **seventy (70)** marks.
4. Cellular phones and any unathorized materials are **not** allowed in the assessmenmt room.
5. Write your **Assessment Number** at the top right hand corner of every page.

FOR ASSESSOR'S USE ONLY		
QUESTION NUMBER	**SCORE**	**ASSESSOR'S INITIALS**
1		
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SECTION A (15 MARKS)

Answer **all** questions in this section

1. Choose the correct answer from the given alternatives and write its letter in the box provided.

   i) A student threw upwards an apple of mass 'm' (kg) from his hands to a height of 'h' (m). If the acceleration is not 'acceleration due to gravity' owing to environmental location, what will be the acceleration of an apple during upward motion?

   A. $\frac{v}{2h}$ C. $-\frac{v^2}{2h}$ ☐

   B. $\frac{v^2}{2h}$ D. $-\frac{mv^2}{2h}$

   ii) In every aspect of engineering studies, physical quantities are divided into fundamental quantities and derived quantities. Which of the following quantities can be categorized under derived physical quantities?

   A. Weight, Length, Velocity and Pressure ☐

   B. Length, Density, Pressure and Volume

   C. Velocity, Volume, Pressure and Density

   D. Volume, Pressure, Mass and Length

   iii) A student poured liquid L into a measuring cylinder and noticed that, it had concave meniscus. Which of the following is most likely to be in liquid L?

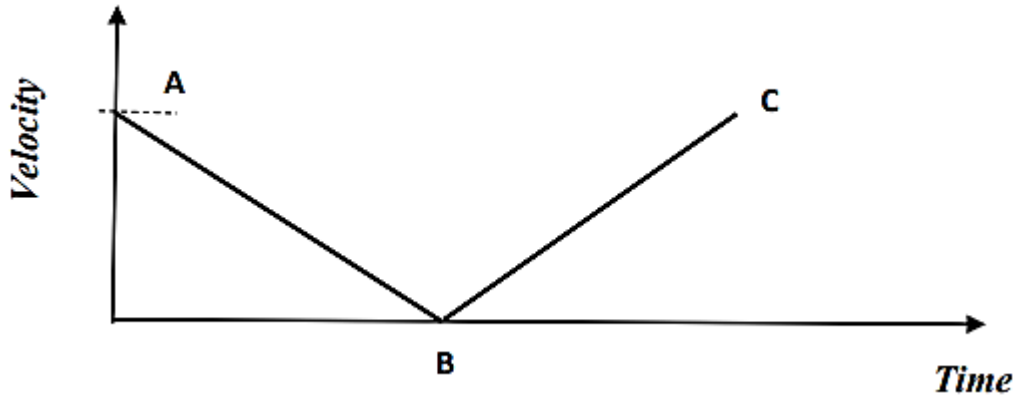
   A. Ethanol

   B. Water

   C. Soda ☐

   D. Mercury

iv) A teacher threw a stone vertically upwards from the ground and presented a motion of the stone by a velocity-time graph as shown in figure 1. What is the correct statement regarding the velocity of the stone at different position in air?



A. Velocity is maximum at A and minimum at C

B. Velocity is maximum at B and minimum at C

C. Velocity is maximum at A and minimum at B

D. Velocity is maximum at C and minimum at A

v) An old ship burned charcoal in an engine room so as to manage the ship to sail. What type of energy transformation is this?

A. Heat energy to mechanical energy

B. Chemical energy to heat energy

C. Chemical energy to mechanical energy

D. Heat energy to chemicalenergy.

vi) Four Form Two girls; Bupe, Minja, Muza and Tutindaga were singing loudly while standing 10m in front of a tall building and found a closely reflected sound which gave them a problem to distinguish their sounds. They all argued about this problem as follows:

a) Bupe said, we can't distinguish our sound because it is too close to stand 10m from the building and be able to distinguish our sound, it is supposed to

be 17 m.

b) Minja said no Bupe, 10m and even 17m from the building is enough for us to distinguish our sound but the problem is the huge building.

c) Muza said, we can't distinguish our sound because we are too far to the building. We were supposed to be not less than 10m from the building.

d) Tutindaga said, 17m is correct for us to distinguish our sound because from the distance less than 17m we can't distinguish our sound.

From their arguments who was right?

A. (a) and (b).

B. (a) and (d).

C. (b) and (d)

D. (c) and (d).

vii) A form one student carried out an experiment to study the laws of reflection of light. The student directed a touch ray to the mirror through a small hole or a cardboard so that the reflected ray makes an angle 'S' with the plane mirror as shown in Figure 2. What observation will the student make while measuring angles P, Q R and S?

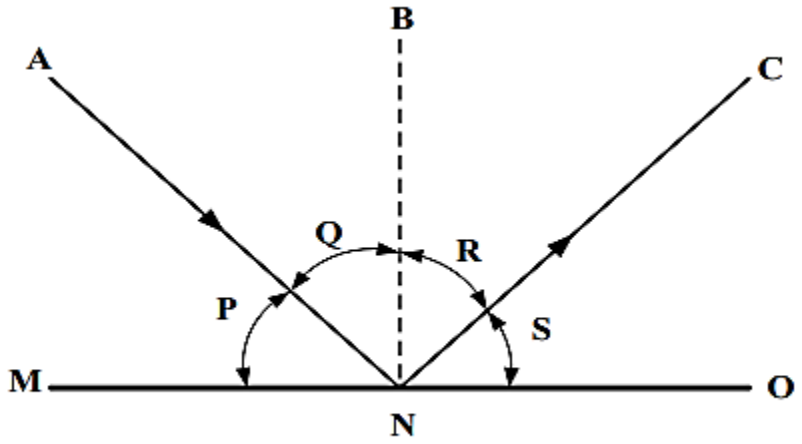


Figure 2

A. Angle Q is less than angle R.

B. Angle Q is equal to angle R.

C. Angle P is less than angle S.

D. Angle P is equal to angle S.

viii) Students were arguing on parameter, which changes the coefficient of friction. The students' comments were as follows:

1. If metals of different properties are replaced, the coefficient of friction is changed
2. Normal force and density of material can change the coefficient of friction
3. Area of contact and frictional force can change the coefficient of friction
4. Only material of metals in contact can change the coefficient of friction.

From their arguments, which statement is correct?

A. 1 and 3

B. 2 and 4

C. 1 and 4

D. 2 and 3

ix) Figure 3 shows the diagram with centre of gravity '**o**' seated on horizontal as in (a). It was slightly tilted to rise up its centre of gravity as in (b). When was released after being tilted the object returned to its original position as in (c). In which state does the object in Figure 3 (a) is said to be?

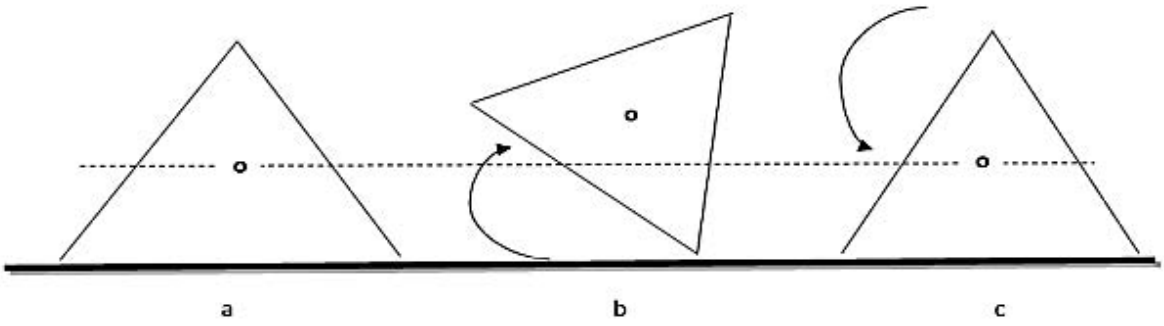


Figure 3

A. At neutral equilibrium

B. At static equilibrium

C. At stable equilibrium

D. At unstable equilibrium.

x) A tailor uses a scissor for cutting clothes, people use wheelbarrow for carrying loads while a carpenter uses seesaw for cutting wood and masonry uses shovel for mixing concrete. Which activities is an application of a third class of lever?

A. Cutting clothes

B. Carrying loads

C. Mixing concrete

D. Cutting wood.

2. Match the fluid mechanics measurements in List A with the corresponding measuring instruments in List B by writing the letter of the correct answer in the table provided.

LIST A	**LIST B**
i) Measures the pressure of a gas ii) Measures relative density of liquid iii) Measures the atmospheric pressure iv) Measures the gauge pressure v) Measures the difference between the absolute pressure and atmospheric pressure	A. A Barometer B. Bourdon gauge C. Pressure gauge D. Hydrometer E. Hygrometer F. Manometer G. Thermometer H. Thermostat

List A	**(i)**	**(ii)**	**(iii)**	**(iv)**	**(v)**
List B					

SECTION B (70 MARKS)

Answer **all** questions from this section

3. With the aid of sketches, write down the steps you will follow while measuring the density of irregular object.

4. (a) A Coca Cola company experiences an excessive consumption of electrical power due tovarious frictions developed on the mechanical drives. What are the four laws which both static friction and kinetic friction depend on?

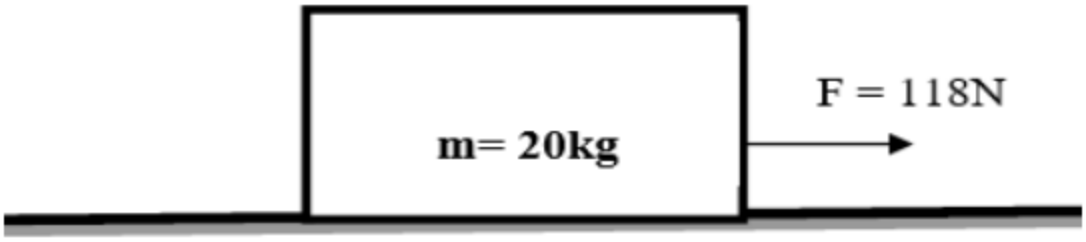
    (i) .....

    (ii) .....

    (iii) .....

    (iv) .....

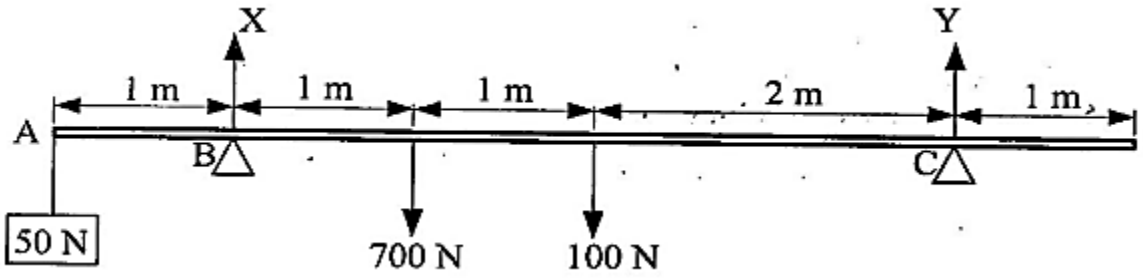
    (b) The figure below shows a box of 20 kg, which is pushed by a student on a horizontal surface by using a force of 118N. Calculate the coefficient of friction between the two surfaces in contact.



5. When a body travels in a straight line with an initial velocity 'u' m/s accelerates uniformly by 'a' m/s2until it reaches a final velocity of 'v' m/s at a time 't' and cover a distance 's'. Prove that

$$s = ut + \frac{1}{2}at^2.$$

6. A uniform scaffold plank 6 m long and weight 100 N rests on supports at B and C as shown in the figure below. A man of weight 700 N stands 2 m from end A where there is a hanged weight of 50 N.



a) Calculate the reaction X and Y at the supports.

b) What additional weight at A would make the plank just tilt about B thus endangering the safety of the man?

7. A group of students was assigned to put a load of 5000 N into the vehicle at a height of 2m above the ground by using an inclined plane. The efforts required to haul the load was 50N. The students were required to select inclined plane to be used for a job with lengths 5m or 7m respectively. Which inclined plane would you advise the students to use with consideration to their efficient?

8. (a) A laboratory technician heated a piece of wire by $1^{o}C$ and it increased in length by 1 unit.Then, he heated a small piece of rectangular sheet by $1^{o}C$ and it increased in length by 1 unit. How would you differentiate the increment between both scenarios?

(b) You are given an iron tyre of diameter 50cm at $15^{o}C$ to shrink it on a wheel of diameter 50.35cm. To what temperature will you heat the tyre so that it will slip over the wheel with a radial gap of 0.5mm? (Linear expansivity of iron is 0.000012/K).

9. Two cells each having an e.m.f of 1.5V and internal resistance of 2Ω were connected in series and then in parallel.

    a) Find the current in each case when the cells are connected to a 1Ω resistor.

    b) If the 1Ω resistor is substituted by an 11Ω resistor, calculate the new current in both cases.

    c) Advise a better connection for 1Ω and11Ω resistors.

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SECTION C (15 MARKS)

Answer **all** questions from this section

10. Afarmer threw an arrow of mass 15g at a speed of 50m/s after a monkey which was in a farm of maize. Unfortunately, the arrow penetrated a depth of 5cm in a soft body of the tree. Calculate the power on the arrow.

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