THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL OF TANZANIA

FORM TWO NATIONAL ASSESSMENT

035 **ENGINEERING SCIENCE**

Time: 2:30 Hours. **Year: 2024**

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 carries **15** marks; section B carries **70** marks and section C carries **15** marks.
4. All writing must be in **black** or **blue** ink and drawings must be in **pencil**.
5. Cellular phones and unauthorized materials are **not allowed** in the examination room.
6. Write your **Assessment Number** at the top-right hand corner of every page.

FOR EXAMINER'S USE ONLY		
QUESTION NUMBER	**SCORE**	**EXAMINER'S INITIIALS**
1		
2		
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10		
TOTAL		
CHECKER'S INITIALS		

SECTION A (15 Marks)

Answer **all** questions in this section

(i) A car burns large amount of fuel to provide energy when climbing up a hill at an increased speed. What kind of energy does the car transform.

A Heat energy to Mechanical energy.

B Chemical energy to Heat energy.

C Chemical energy to Mechanical energy.

D Heat energy to Chemical energy.

(ii) What are the applications of plane mirrors.

A Plane mirrors are used in hair salons.

B Plane mirrors are used as domestic shaving mirrors.

C Plane mirrors are used as cars side mirrors.

D Plane mirrors are used in periscopes.

(iii) A domestic vacuum flask thermos prevents loss of heat due to conduction convection and radiation. How does the inner glass vessel with a vacuum between wall prevent heat loss.

A By conduction and radiation.

B By radiation and convection.

C By convection only.

D By convection and conduction.

(iv) A rod of an insulating material with positive charge was rubbed with a piece of fabric. The fabric was then tested for electric charge. Which result would you expect on piece of fabric.

A A positive charge equal to that on the rod.

B A negative charge equal to that on the rod.

C A positive charge less than that on the rod.

D A negative charge greater than that on the rod.

(v) Four students were discussing the measurements of relative density of a substance. Each student stated the meaning of the relative density as follows.

1 Relative density is the ratio of the mass of a substance to the mass of an equal volume of water.

2 Relative density is the ratio of the weight of a substance with certain volume to the weight of water with the same volume as that of substance.

3 Relative density is the ratio of the density of a substance to the density of an equal volume of water.

4 Relative density is the ratio of the volume of a substance to the mass of an equal volume of water.

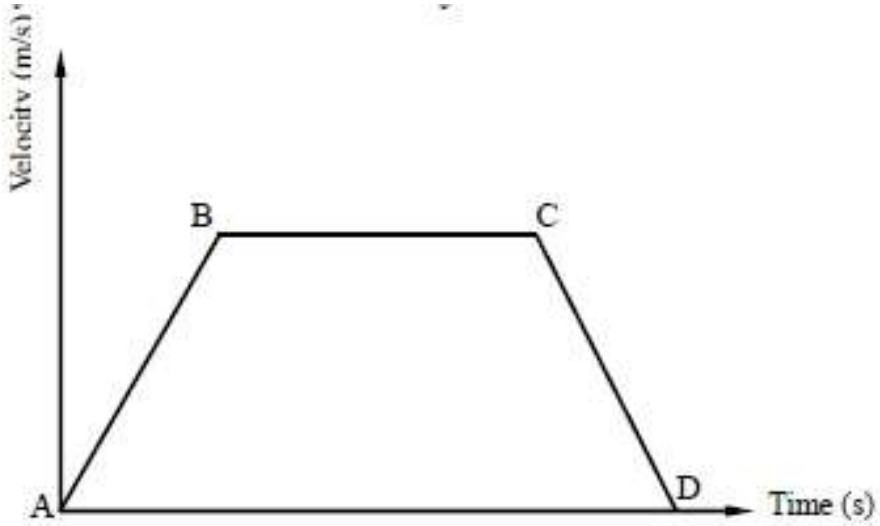
Who were correct among these students.

A 1, 2 and 4. B 1, 3 and 4.

C 1, 2 and 3. D 2, 3 and 4.

(vi) The figure below is a velocity-time graph which represents the motion of a car travelling on a straight road from point A to point D via point B and C.

How would you describe the acceleration of a car.



A Acceleration is positive from A to B zero from B to C and negative from C to D.

B Acceleration is negative from A to B zero from B to C and negative from C to D.

C Acceleration is zero from A to B positive from B to C and negative from C to D.

D Acceleration is zero from A to B negative from B to C and positive from C to D.

(vii) Why is velocity of the sound in air different in summer and in winter period.

A Because density of air is higher in summer period.

B Because pitch of sound halves in summer period.

C Because density of air is lower in summer period.

D Because pitch of air doubles in winter period.

(viii) Teacher asked the Form Two Students why do we apply suitable lubricant to the surfaces of machine parts which slides over each other. Students' responses were as follows.

i To reduce friction between the moving surface.

ii To reduce the wear on the surfaces.

iii To carry away any heat which is generated at the surfaces.

iv To protect the metal surfaces against rust and corrosion.

Which of the stated reasons were correct.

A i ii and iii. B i iii and iv.

C i ii and iv. D ii iii and iv.

(ix) You were given a seesaw with several forces. Thereafter you discovered that the sum of the moments acting on a seesaw was equal to zero but the sum of upward and downward forces was not equal to zero.

What can you conclude.

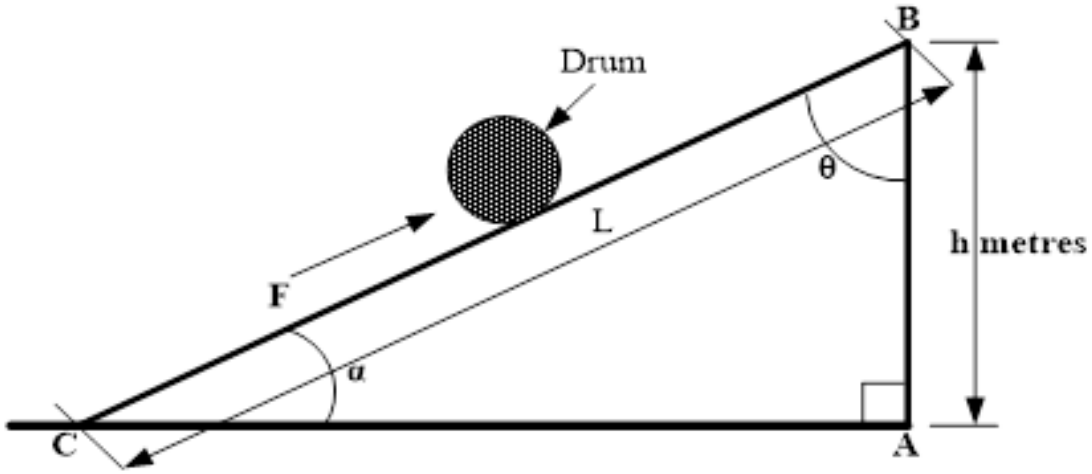
A The seesaw was rotated to clockwise or anticlockwise.

B The seesaw was moved vertically upward or downward.

C The seesaw was remained stationary or moved horizontally.

D The seesaw was tilted to angle 30^0 or 45^0.

(x) A man has to roll an empty drum steadily along an inclined plane from the ground to position B which is h metres above the ground as shown in the figure. In the first attempt a maximum effort F failed to roll the drum steadily to position B. What modification would you recommend so that the drum could be rolled steadily to position B with maximum effort F?



A Reduce the length of the inclined plane L.

B Reduce the size of angle θ.

C Increase the length of the inclined plane L.

D Increase the size of angle α.

2. Match the functions of measuring instruments in List A with their corresponding instruments in List B by writing a letter of the correct response.

List A	**List B**
(i) The measure of its tendency to cause a body to rotate about specific point or axis. (ii) The forces for turning a steering wheel applied by hands at opposite sides with equal forces but opposite in direction. (iii) It continues in its existing state of rest or uniform motion in a straight line, unless is changed by an external force. (iv) It is a measure of the force that can cause an object to rotate about an axis. (v) It is equal to the change of momentum of an object, when mass is constant.	A. Couple B. Equilibrium C. Impulse D. Inertia E. Moment of a force F. Neutral equilibrium G. Stable equilibrium H. torque

Answers

(i)	(ii)	(iii)	(iv)	(v)

SECTION B (70 Marks)

Answer **all** questions from this section

3. (a) Briefly describe the components of an atom. Give three elements.

(i) .....

(ii) .....

(iii) .....

(b) By using sketches comment on the behaviour of the leaf of the electroscope when.

(i) the object has negative charge.

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(ii) the object has positive charge.

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4. A certain mass of gas is contained in a cylinder by a piston. The temperature of the gas is 15^{o}C pressure is 1.3 bar and its volume is 1.6 litres. The gas is allowed to expand to a volume 5.6 litres at a constant temperature and then the temperature is raised to 70^{o}C at a constant pressure. What is the final pressure and volume of the gas.

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5. A driver uses a screw jack to support the axle of his lorry of load 5.6 kN. The screw jack has an effort arm of effective radius of 318 mm and a single-start square thread of 5 mm lead. Determine the efficiency of the jack if an effort of 70 N is required to raise the cars axle.

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6. A uniform bridge 32 m long weigh 50 x 10 3 kg and a lorry weighing 15 x 10 3 kg is positioned 8 m from one end of the bridge. Considering that the weight of the bridge will act at its centre of gravity halfway along it draw the force diagram and find the force exerted on each end support of the bridge.



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7. A force of 50 N is applied to the box containing books to make it slide over a horizontal floor.

   If the coefficient of friction between the box and the floor is 0.5 find the mass of the box.

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8. A man accelerated a 10 tons' vehicle from initial velocity to a velocity of 20 m/s in 3 seconds and he found that, the kinetic energy was changed to 355 kJ. Calculate;

   (a) the initial velocity of the vehicle.

   (b) the acceleration of the vehicle.

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9. A car was driven through corrugated road at a speed of 12 m/s for 6 second and then it was accelerated for 4 seconds to a speed of 25 m/s. This speed was maintained for 4 seconds until the brake was applied for 2 seconds to stop the car. By the aid of velocity-time graph, estimate the total distance covered on this journey.

SECTION C (15 Marks)

Answer question number **ten (10)**

10. (a) When a motor car tyre was tested in a garage at a temperature of 17° C was found to have a pressure of 290 $\times 10^3$ Pa. assume that the volume of the air inside the tyre remains constant, what would be the value of the pressure after the tyre has been exposed in the sun so that its temperature rises to 27° C?

(b) At a temperature of 27° C, a volume of air in a motorcycle tyre at a gauge pressure of 750mmHg is 3000cm^3. Estimate the volume of the air inside the tyre of the motor cycle at the Standard Temperature and Pressure (S.T.P).

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