

07150654C

MECHANICAL PRODUCTION TECHNICIAN LEVEL 6

ENG/OS/MEM/CC/03/6

Apply Mechanical Science Principles

March/April 2026



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION
COUNCIL (TVET CDACC)**

WRITTEN ASSESSMENT

Time: 2 HOURS

INSTRUCTIONS TO CANDIDATE

1. The paper consists of **TWO** sections: **A** and **B**.
2. Answer **ALL** Questions in Section A and any **THREE** in Section B
3. Marks for each question are indicated in the brackets.
4. Candidates are provided with a separate answer booklet
5. **DO NOT** write on this question paper.

This paper consists of FOUR (4) printed pages
Candidates should check the question paper to ascertain that all
pages are printed as indicated and that no questions are missing.

SECTION A (40 MARKS)

Answer ALL Questions in this Section

1. A trainee inflates a vehicle tyre and observes that the tyre pressure changes and the tyre heats up. Define the TWO gas laws that explain this behaviour.
 - a) Boyles law (2 Marks)
 - b) Charles law (2 Marks)
2. Two identical machine components are weighed, one using a digital weighing scale and the other using a spring balance. Differentiate between the quantities being measured by the two instruments in this situation. (4 Marks)
3. A conveyor belt motor starts from rest and gradually increases speed while carrying raw materials.
 - a. State the Newton's Second Law of Motion that governs this movement. (2 Marks)
 - b. Highlight TWO ways how this law governs the motion of the conveyor belt in this operation. (2 Marks)
4. A rotating machine shaft becomes very hot after long periods of operation due to friction force. State FOUR workshop practices used to reduce the effect of this force. (4 Marks)
5. A technician pushes a loaded trolley with a constant force of 400 N through a distance of 3 m inside a factory. Calculate the work done by the technician during this operation. (4 Marks)
6. You are required to tighten a nut using a spanner with a 150 mm handle while applying 50 N during a practical assessment. Determine the turning effect of the force you will apply on the nut. (4 Marks)
7. A beam is supported at a pivot point during fabrication of a steel structure. State the principle that must be satisfied for the beam to remain balanced. (2 Marks)
8. While operating a mechanical system, different forces act on its components. Identify TWO types of forces that the components may experience during operation. (2 Marks)
9. In an experiment you are given a solid steel block of mass 8000g occupies a volume of 0.004 m³. Calculate its density. (4 Marks)
10. A diesel generator converts the chemical energy in fuel into electrical energy used in the workshop.
 - a. State the law that governs this energy conversion. (2Marks)

- b. Explain how this law applies to the operation of the generator. (2Marks)

11. A technician uses a sharp metal cutter to slice through a steel sheet. List FOUR reasons why applying a smaller contact area increases cutting effectiveness.

(4 Marks)

SECTION B (60 MARKS)

Answer any THREE Questions in this Section

12. A maintenance team is installing a 900 kg industrial motor using a pulley system.

- Elaborate any other FIVE simple machines that the team may use during this installation. (10 Marks)
- The pulley system has a velocity ratio of 4 and an efficiency of 75%;
 - Calculate the mechanical advantage of the pulley system (4 Marks)
 - Explain SIX ways in which the calculated value influences safe lifting of the motor. (6 Marks)

13.

- While performing practical tasks in a workshop, a trainee notices that heat from hot machines, tools, or materials spreads to other parts of the environment. Discuss three modes of heat transfer responsible for this heat movement, relating each mode to a practical situation encountered during training. (9 Marks)
- Determine the value of the force P, required to just move the body of mass of 25 kg up the plane shown in the Figure 1 below. Assume that the coefficient of limiting friction, $\mu = 0.3$ and $g = 9.81 \text{ m/s}^2$. (11 Marks)

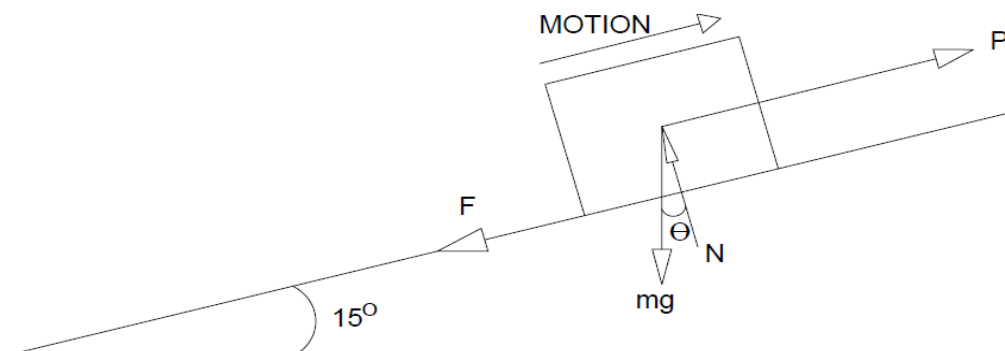


Figure 1

14.

- A horizontal beam shown in Figure 2 below, is 4 meters in length and is supported at points A and B, spaced 2 meters apart. Support A is 0.5 meters from the left end. The beam bears three downward point loads: 600 N at the

left end, 500 N at the midpoint (2 meters from the left), and 400 N at the right end. Determine the magnitude of the support's reaction at A and B.

(10 Marks)

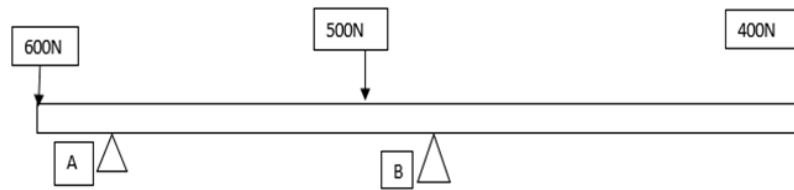


Figure 2

- b. Two force vectors, 30 kN and 120 kN, originate from the same point and form a 60° angle between them. Apply the parallelogram theorem of forces to determine the magnitude of their resultant. (10 Marks)
15. In a motor-vehicle workshop, a mechanic uses a hydraulic jack to raise a car off the ground for routine servicing such as wheel alignment and brake inspection.
- a. Explain how fluid pressure and Pascal's principle operate in this scenario. (10 Marks)
 - b. Discuss FIVE reasons why you would prefer the use of hydraulic systems in such operations (10 Marks)