

MECHANICAL TECHNOLOGY 2

5140

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

Technical and Vocational Education Examination



JUNE XXXX

INTERMEDIATE LEVEL

Subject Title	MECHANICAL TECHNOLOGY
Subject Code No.	5140
Paper No.	TWO

Two Hours Thirty Minutes

Answer any FIVE questions, choosing THREE from Section A, TWO from Section B. All questions carry equal marks.

You are reminded of the necessity for good English and orderly presentation in your answers.

SECTION A: MECHANICAL TECHNOLOGY

Answer THREE questions from this section

1. **FIGURE 1** below represents the mechanical organs of an engine.

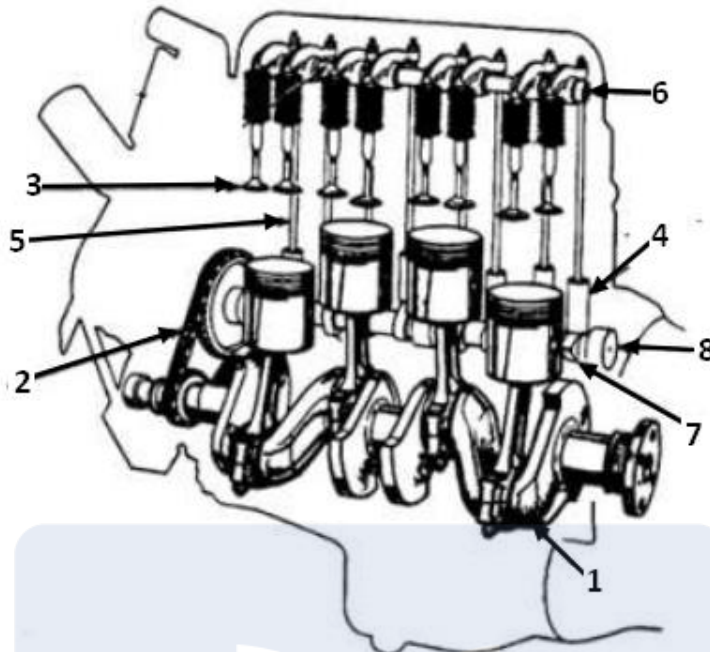


FIGURE 1: mechanical organs of an engine

- List all the numbered components of figure 1. **(0.25X8=4 marks)**
- Give the name of the type of valve layout on figure 1 and explain its operating principles. **(0.5+2=2.5 marks)**
- Low engine power output can occur due to lost of compression, list all the components of this diagram that can cause lost of compression. **(0.5X2=1 mark)**
- Motion is always transmitted from part 1 to part 8 by using part 2. Explain why the pulley of part 1 is always smaller than the pulley of part 8. **(1 mark)**
- Explain how the forces generated during combustion are transmitted to the flywheel. **(1.5 mark)**

2. The **FIGURE 2A** below represents the braking system of a TOYOTA CARINA E vehicle that uses a hydraulic command system. And **FIGURE 2B** represents one of the organs of the braking system.

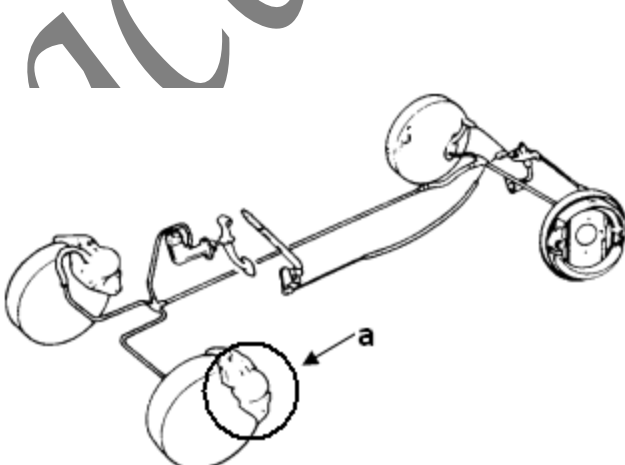


FIGURE 2A: braking system

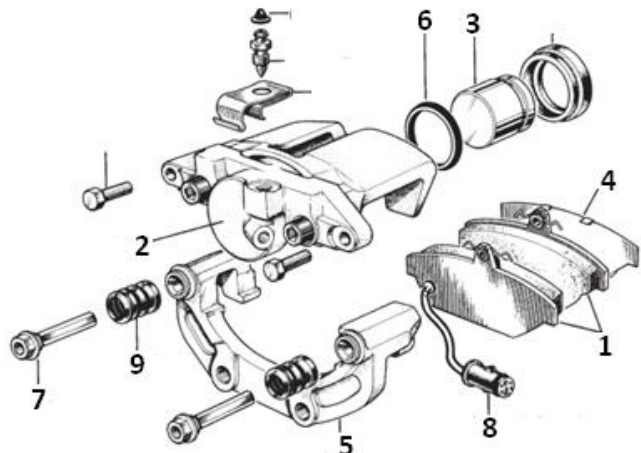


FIGURE 2B: brake organ

- a. What is the name of the brake organ represented by a on **Figure 2A**? (1 mark)
- b. Referring to **Figure 2B**, give the names of the follow parts of this organ (1, 2, 3, 5) (0.5x4=2 marks)
- c. What is the function of part 1, 3 and 8 of **Figure 2B**? (0.5x3=1.5 mark)
- d. Explain the operating principle of **figure 2A**. (3 marks)
- e. The driver of this vehicle complains that, after replacing hydraulic fluid of the system, the braking became spongy. Give two causes of this spongy braking. (0.75x2=1.5 mark)
- f. Which organ in the braking system limit weight transfer during hard braking? (1 mark)

- 3.
- (a) Define the following terms related to motor oils: i) Pour point , ii) Viscosity (2 marks)
- (b) Give FIVE functions of a good motor oil (2.5 marks)
- (c) Give THREE reasons for using cutting fluid when working on the centre lathe (1.5 marks)
- (d) Explain the functions of automatic transmission fluid (2.5 marks)
- (e) Name the type of motor oil and grading that is used in the following systems under Cameroonian conditions: (1.5 marks)
- i) Internal combustion engine
- ii) Manual transmission
- iii) Automatic transmission

4. The diagram in figure3 shows valve operating mechanisms.

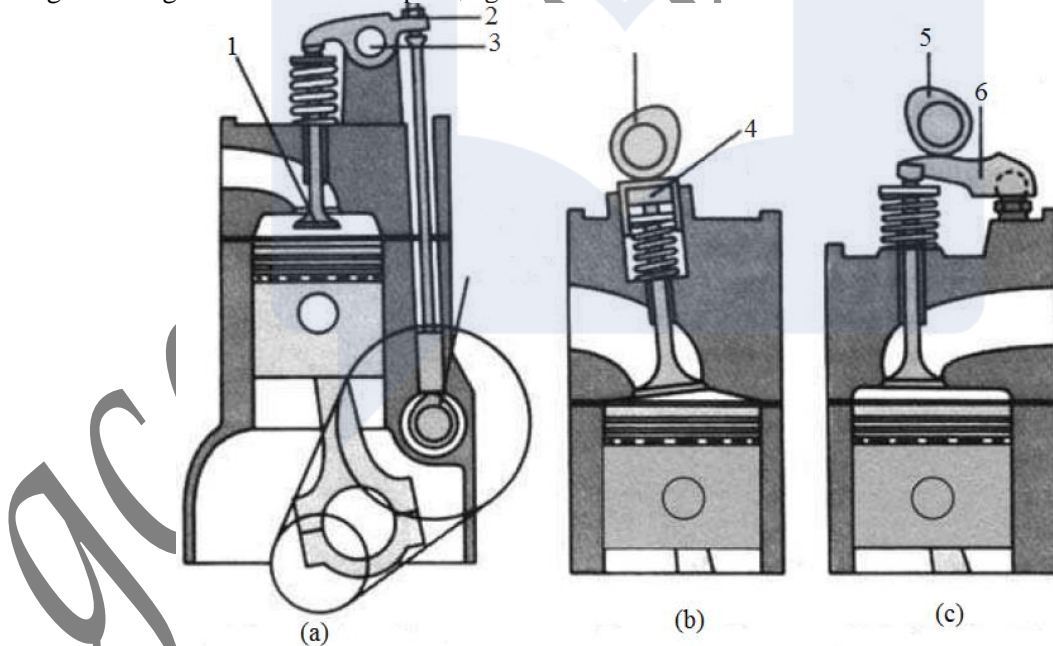
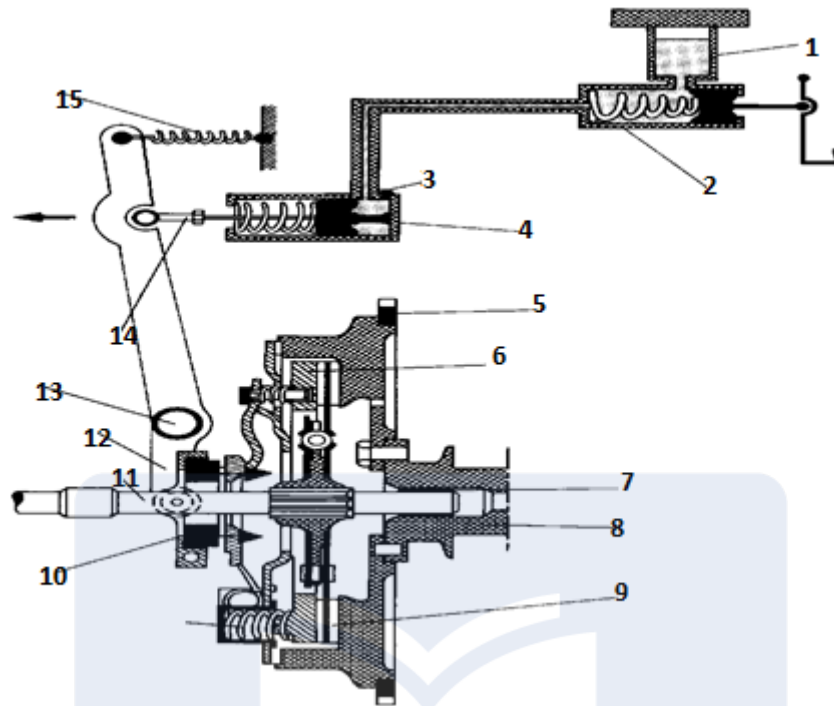


Fig.3 valve operating mechanism

- (a) Identify the valve operating mechanisms of fig.3 (a), (b) and (c). (3 marks)
- (b) Give the names and the functions of the parts numbered 1, 2, 3, 4, 5 and 6. (4.5 marks)
- (c) Give three elements to be incriminated if a tapping noise is heard from an engine. (1.5 marks)
- (d) Give two advantages of the mechanism in fig.2.b over that in fig.2.a (1 mark)

5. The diagram here below is that of an automobile clutch with a hydraulic command system.



- a. Apart from helping the driver to gradually take off from standstill, what is the other function of the clutch in a motor vehicle's transmission system? (1mk)
- b. Give the names of the following components of the system above: 2, 4, 5, 6, 9 and 10. (0.5x6= 3 marks)
- c. What happens to the transmission when the following faults occur in the clutch system? (1x2=2 marks)
 - A worn out clutch disc
 - Air in the hydraulic circuit.
- d. Briefly explain how you can bleed air from the hydraulic circuit during repairs. (2 marks)
- e. What will you regularly check on the above clutch system given that you're in charge of maintaining that car? (1 mark)
- f. What is the difference between the above type of clutch and a torque converter? (0.5 mark)
- g. Which type of transmission systems are equipped with a torque converter? (0.5 mark)

SECTION B: PROFESSIONAL CALCULATION AND SCIENCE
Answer any TWO questions from this section

1.
 - a) Define the following: i) work, ii) power, iii) efficiency, iv) moment (2 marks)
 - b) To rotate a car engine at 40 rev/min an average force of 130 N is applied perpendicularly to the crank arm of the starting handle. The distance from the axis of the starting nut to the point of the applied force is 0.152 m. find:
 - i) Resistance torque; ii) Work done per minute (3 marks)
 - c) The force acting tangential to the pitch circle circumference of a gear wheel is 710 N. If the pitch circle diameter is 135 mm and the gear makes 1350 rev/min, calculate;

- i) The turning moment acting on the shaft carrying the gear ii) The work done in joules per minute as the gear rotates. **(3 marks)**
- d) The power developed in the cylinders of this engine is 56 kW and the power at the flywheel is 49 kW. What is the efficiency of the engine? **(2 marks)**
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2. One of your customer **Mrs. BIH SONITA** brings her vehicle to you having the following parameters, engine torque 190000mmN, a combustion chamber volume of 50949.3mm³, a bore of stroke 78.7mm and compression ratio of 9.8. The engine develops its power at rotational frequency of 5500rpm. The engine has four cylinders each equipped with four valves.

Calculate:

- a. The swept volume of a cylinder **(1.5 marks)**
- b. bore of a cylinder **(2 marks)**
- c. total cylinder capacity **(1 mark)**
- d total engine capacity **(1.5 mark)**
- e The piston speed **(1 marks)**
- f effective engine powers **(2 mark)**
- g explain why the engine is fitted with four valves instead of two? **(1 mark)**
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- 3.
- a. Give the S.I units of the following quantities (a) Area (b) Volume. **(1 mark)**
- b. Define the following terms (i) swept volume (ii) engine capacity (iii) compression ratio. **(1x3=3 marks)**
- c. A hollow gudgeon pin whose length is 55mm and an outer and inner diameter 23mm and 17mm respectively. Calculate the gudgeon pin's volume in cubic centimeters. **(2 marks)**
- d. The value of the bore (d) of an engine's cylinder is 74mm and its stroke (h) is 85mm. Calculate (i) its swept volume (S_v), (ii) its compression ratio (ρ) if the clearance volume is $C_v = 45.077\text{cm}^3$ and (iii) the total engine (C_T) capacity in litres (L) knowing that the engine has 4 cylinders. Note take $\pi = \frac{22}{7}$ **(1x3=3 marks)**
- e. What will happen to the engine when its compression ratio drops **(1 mark)**
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- 4.
- a. Friction is a controversial term used in the motor vehicle terminology. Define friction. **(2 marks)**
- b. State three ways in which friction is useful and two ways in which friction is harmful in the motor vehicle **(5 marks)**
- c. If a vehicle moving on a level land weighs 1000kg and coefficient between the tyres and the ground $\mu=0.65$. Calculate the frictional force. **(3 marks)**

