

GENERAL CERTIFICATE OF EDUCATION BOARD
Technical and Vocational Education Examination

JUNE 2025

INTERMEDIATE LEVEL

Specialty Code	AUTOMOBILE REPAIR MECHANICS - ARM
Subject Title	Electrical and Electronic Technology
Subject Code No.	5135
Paper No.	2

Duration: Two and a Half Hours

INSTRUCTIONS TO CANDIDATES

This Paper has **TWO** Sections

Section A: Answer Any **THREE** Questions

Section B: Answer Any **TWO** Questions

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

SECTION A: ELECTRICAL/ELECTRONIC TECHNOLOGY
Answer Any THREE (03) questions from this Section

1. THE AUTOMOBILE BATTERY

Figure 1 shows a cut-away view of an automobile lead-acid battery.

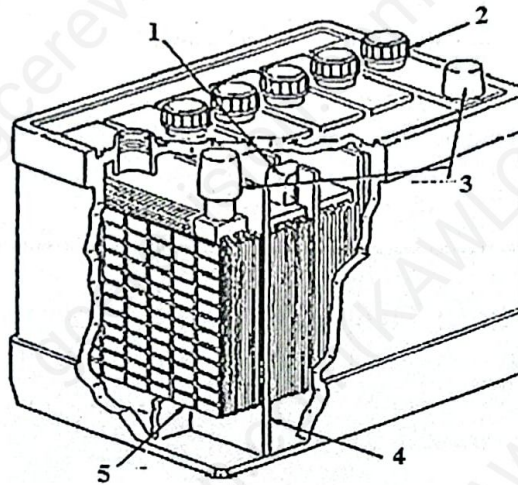


Figure 1.

- a) Give the name as well as the functions of the numbered parts 1,2, 3,4 and 5. (2.5 marks)
- b) Give four (04) factors upon which the capacity of each cell depends on (2 marks)
- c) Define the following battery characteristics: 12V/45Ah/200A (1.5 mark)
- d) Battery sulphation.
 - (i) What is battery sulphation? (1 mark)
 - (ii) Give any TWO methods used to prevent battery sulphation. (1 mark)
- e) Apart from the (+) and (-) labellings on a battery's terminals, what are the other methods of identifying battery terminals when not labelled? (1 mark)
- f) Briefly explain how you can activate a dry lead-acid battery. (1 mark)

2. THE STARTING SYSTEM

- What is the function of the starting system in a vehicle? (1 mark)
- Enumerate THREE types of starter motors that exist. (3 marks)
- What type of starter motor is shown in figure 2.1 below? Justify your answer. (1 mark)
- Give one reason why starter motor cables must be thick and of short length. (1 mark)

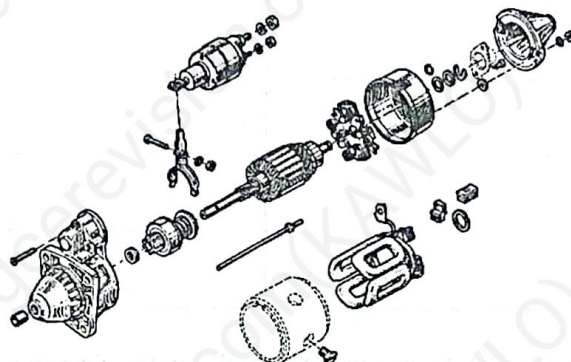


Figure 2.1: Starter motor components

- Copy and complete the table below in your answer booklet in relation to the various checks being carried out on the parts of the starter motor shown in figure 2.1 above.

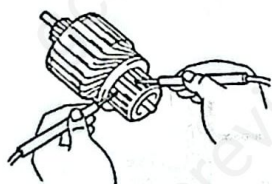


Figure 2.2a

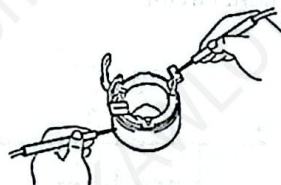


Figure 2.2b



Figure 2.2c

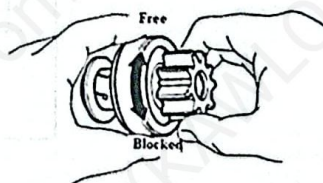






Figure 2.2d

Figures	Checks being carried out (0.5 mark each x 4= 2 marks)	Instruments used.	Values obtained	Conclusions (0.5 mark each x 4= 2 marks)
Figure 2.2a			$R = \infty$	
Figure 2.2b			$R = \infty$	
Figure 2.2c			$R = 0$	
Figure 2.2d			Blocked in both directions	

3. VEHICLE INSTRUMENTATION AND THE CHARGING SYSTEM

- a) Explain the term 'vehicle instrumentation'. (1 mark)
 b) List **THREE** ways in which vehicle instrumentation has improved on vehicle maintenance. (1.5 marks)
 c) Give the name and function of each of the dashboard warning lamps shown in the table below. (2.5 marks)

Ref N ^o	Warning lamp	Name of warning lamp	Its function
1	(!)		
2			
3			
4			
5			

- d) Name and give the functions of 4 main parts that make up the charging system. (2 marks)
 e) Draw a sketch of the charging circuit and label its parts. (2 marks)
 f) What should the output voltage from the generator if it's in a good functional state? (1 mark)

4. AUXILIARY SYSTEM

- a) Name any **FOUR** vehicle electrical systems considered to be vehicle auxiliary systems. (2 marks)
 b) Figure 3 below illustrates a horn circuit.

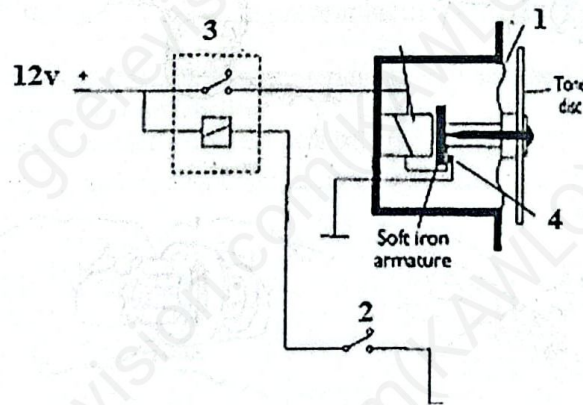


Figure 3: Horn circuit

- Write down the principle of operation of the above type of horn? (2 marks)
 c) Identify the numbered parts 1, 2, 3 and 4 of figure 3 above. (2 marks)
 d) Give **TWO** possible faults of the horn circuit above that can cause poor sound quality. (2 marks)
 e) What shall be the effects on the horn if part 3 has failed? (2 marks)

5. IGNITION SYSTEM

The ignition system has greatly evolved. Figure 4 and 5 below shows two types.

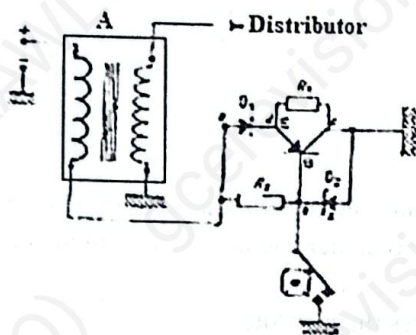


Figure 4

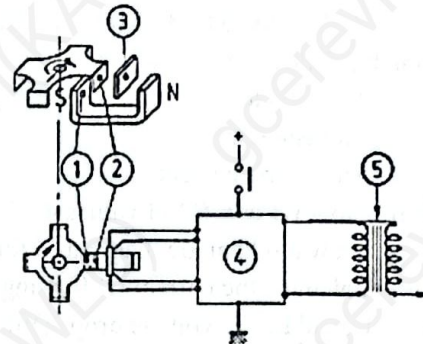


Figure 5

- Give the name and function of the part referenced A in figure 4 above. (1 mark)
- Identify the types of ignition systems shown in figure 4 and 5 above. (2 marks)
- State TWO mechanisms that are used to improve ignition timing in the above systems. (2 marks)
- State FOUR observable malfunctions on a vehicle incriminated to the spark plugs. (2 marks)
- Give TWO advantages and TWO disadvantages of the system presented in figure 5 above. (2 marks)
- Spark plug gap
 - Name an instrument that you can use to adjust the spark plug gap. (0.5 mark)
 - Give a typical value of a spark plug gap that can be used during adjustment. (0.5 mark)

SECTION B: ELECTRICAL/ELECTRONIC CALCULATIONS

Answer Any TWO questions from this section

1. ELECTRICITY AND ELECTRONIC PRINCIPLES

- a) Define the following:
 - (i) A conductor. (0.5 mark)
 - (ii) An insulator (0.5 mark)
 - (iii) An electric current. (0.5 mark)
- b) Two resistors R_1 and R_2 of values 47Ω and 82Ω are connected in series across a $45V$ d.c battery. (1 mark)
 - (i) Draw a schematic diagram of this circuit with a voltmeter and an ammeter included. (1.5 mark)
 - (ii) Calculate the current (I) flowing in the circuit. (1.5 mark)
 - (iii) Calculate the voltage drops (V_{d1}) and (V_{d2}) across the resistors. (1.5 mark)
 - (iv) If the resistor $R_1 = 47\Omega$ is replaced with a 39Ω resistor, will the current flowing in the circuit increase, decrease or remain the same? (1 mark)
 - (v) What will happen to the voltage drop across the 82Ω resistor? (1 mark)
- c) Give one disadvantage of the series circuit with regard to the wiring of a vehicle's headlamps. (1 mark)

2. ELECTRIC CIRCUIT NETWORKS

- a) Name two types of electric circuits. (1.5 mark)
- b) There are three electrical units to Ohm's law. Name the units. (1.5 mark)
- c) State Ohm's law. (1 mark)
- d) A multimeter is used to test a circuit in a starter motor, the following readings were recorded: A current of $3.6A$ passed when a voltage of $7V$ was supplied. Calculate:
 - (i) The resistance of the circuit. (1 mark)
 - (ii) The power used in Watts (W). (1 mark)
- e) In the electrical circuit diagram shown in figure 6, the effective resistance of the circuit is 5.4Ω .

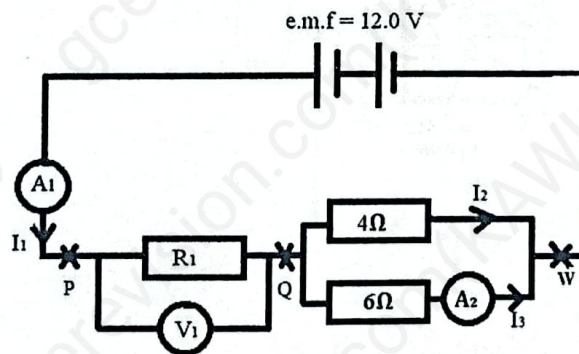


Figure 6

Find:

- (i) The resistance of R_1 (1 mark)
- (ii) The reading of the ammeter (A_1) (1 mark)
- (iii) The reading of the voltmeter (V_1) (1 mark)
- (iv) The reading of the ammeter (A_2) (1 mark)

3. BATTERY CHARACTERISTICS

On your way to your village, you boarded a Toyota Hiace belonging to the Savana Express travelling agency. The vehicle uses a **12V/ 70Ah** maintenance-free battery. Unfortunately, the vehicle had a breakdown. The battery was completely drained as a result of a broken alternator drive belt. The belt was replaced and you had to jump start the car vehicle with another heavy duty battery of **12V/ 70Ah** belonging to another road user.

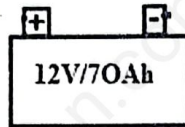


Figure 8

- Realize the jump start circuit (2 marks)
 - What is the total voltage and the total capacity (CAh_{T1}) of the above connection? (2 marks)
 - After jump starting the vehicle, how long shall it take the alternator to fully charge the battery if the alternator is supplying a current of 5A and a voltage of 14V at idling? (2 marks)
 - Calculate the total voltage and capacity (CAh_{T2}) of the circuit if you connect the batteries in series? (2 marks)
 - List Four safety measures to be observed when handling automotive batteries. (2 marks)
-