GENERAL CERTIFICATE OF EDUCATION BOARD

Technical and Vocational Education Examination

JUNE 2021 **INTERMEDIATE LEVEL**

Specialty (Specialty Code)	AUTOMOBILE REPAIR MECHANICS (ARM)
Subject Title	ELECTRICAL AND ELECTRONIC TECHNOLOGY
Subject Code No.	5135
Paper No.	2

DURATION; 2Hours 30Minutes

INSTRUCTIONS

-Answer FIVE Questions; THREE from Section A and TWO from Section B.

-All Questions carry equal marks.

-Non-programmable calculators are allowed.

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

SECTION A: TECHNOLOGY

Answer any THREE questions from this section

1. FUNDAMENTALS OF ELECTRICITY

a) Define
   (i) electric current **(0.5mark)**
   (ii) conductor **(0.5mark)**
   (iii) insulator **(0.5mark)**
   (iv) semiconductor **(0.5mark)**

b) Name TWO types of electric current and represent each on a v-t graph **(2marks)**

c) State TWO effects of electric current and give an automobile application of each **(2marks)**

d) State FOUR safety measures to be observed when working on electrical appliances **(4marks)**

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2. IGNITION SYSTEM

The ignition system has experienced modifications since its creation. Below is a type of ignition system.

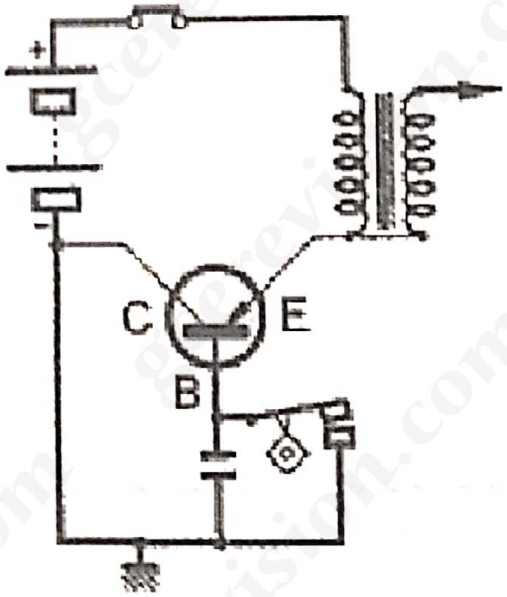

Figure 1

a) How many key switch positions are there in general in ignition switch? Name them. **(0.5+2.5marks)**

b) Identify the type of ignition system on Figure 1. **(1mark)**

c) Identify the type of transistor in the circuit. **(1mark)**

d) Give the function of the transistor in this system. **(2marks)**

e) List THREE disadvantages of a classical coil ignition system. **(3marks)**

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3. FUNDAMENTALS OF ELECTRONICS

a) Give the function of the following electronic components

(i) Relay **(1mark)**

(ii) Zener diode **(1mark)**

(iii) Capacitor **(1mark)**

(iv) Transistor **(1mark)**

(v) Fuse (1mark)

b) Define the following electronic principle terms **(1mark)**

(i) Electrons

(ii) Semiconductor **(1mark)**

(iii) Electromagnetism **(1mark)**

(iv) Ohms law **(1mark)**

(v) Insulator **(1mark)**

(1mark)

4. BATTERY

A storage battery consist of the following indications 12V75AH200A

a) Interpret the designation

(i) 12V **(1mark)**

(ii) 75AH **(1mark)**

(iii) 200A **(1mark)**

b) Write the chemical equation of the battery when charging and discharging. **(2 marks)**

c) You receive five batteries (one 24V60AH and four 12v60AH) and a 24v75AH output battery charger.

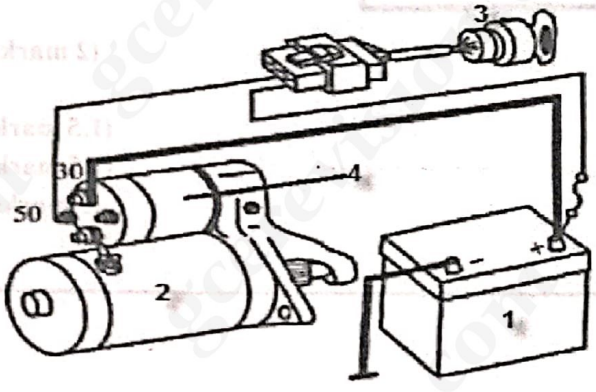
(i) State FOUR test or checks to be carried out on a battery before charging. **(2 marks)**

(ii) In your answer booklet, draw a parallel circuit diagram on how you will connect the batteries during charging. **(2marks)**

d) Give TWO common battery faults. **(1marks)**

5. STARTING SYSTEM

Automobiles are equipped with a starting system, below is a starting system circuit diagram (Figure 2)



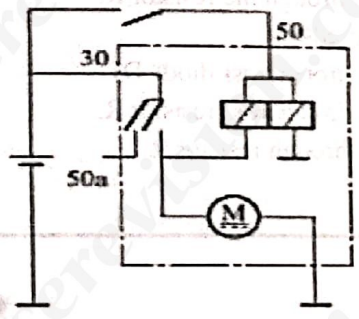


Figure 2

a) What is the function of a starting system in a vehicle? **(1 mark)**

b) Identify the numbered components 1, 2, 3 and 4 of figure 2 above. **(1 mark)**

c) State the function of components 1, 2, 3 and 4 of figure 2 above. **(4 marks)**

d) Briefly explain in not more than six lines, the operation of the starting system (figure 2). **(3 marks)**

e) Why is the starter motor mounted very close to the battery? **(1 mark)**

SECTION B: PROFESSIONAL CALCULATIONS AND SCIENCE

Answer TWO questions from this section

6. **CIRCUIT CALCULATION**

a) State the following fundamental laws of electricity

(i) Ohms law **(1mark)**

(ii) Watts law **(1mark)**

b) A 12V battery supplies three resistors R1=2ohms, R2=5ohms and R3=6ohms in parallel.

(i) Draw a diagram to represent this circuit **(1mark)**

(ii) Calculate the total resistance of the circuit R_T **(2marks)**

(iii) Calculate the total voltage across the circuit V_T **(1mark)**

(iv) Calculate the current flowing through each resistor, hence deduce the total current **(1x4marks)**

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7. **CIRCUIT CIRCULATION**

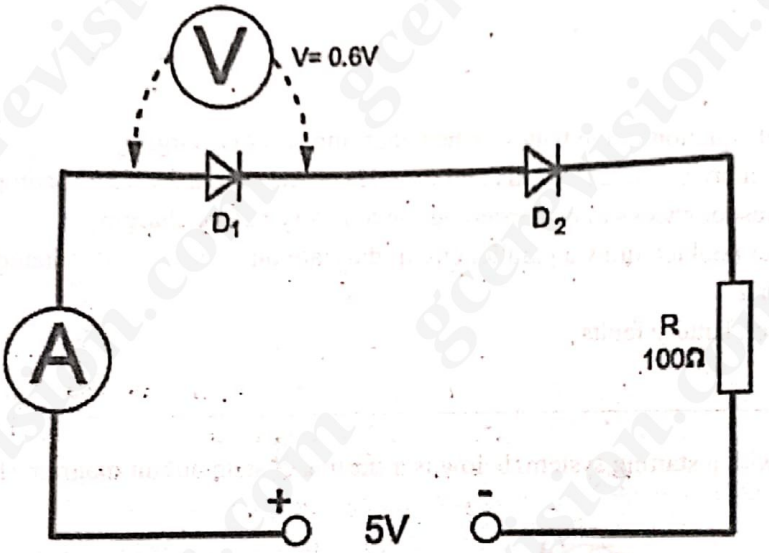
Figure 3 below shows a circuit containing two identical diodes.

Calculate the following when:

a) The circuit is serviceable (as shown)

(i) Voltage drop across both diodes. **(1.5 marks)**

(ii) Voltage drop across the resistor R. **(1.5 marks)**



(iii) Current through the resistor R. **(2 marks)**

b) Diode D2 is shorted-out.

(i) Voltage drop across diode D1. **(1.5 mark)**

(ii) Voltage drop across resistor R. **(1.5 mark)**

(iii) Current through resistor R. **(2 marks)**

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8. **DC MOTORS**

A motor bike equipped with a direct current electric motor powered by a voltage of 18V with a power of 1800W and having a charging time of 5hours.

a) Define the terms
   (i) Power
   (ii) Efficiency **(2 marks)**

b) This motor delivers a mechanical power of 1500W. Calculate its efficiency. **(2 marks)**

c) Knowing that the motor has a resistance of 20ohms, determine the current absorbed, hence the power of this motor. **(2 marks)**

(2+2mks)

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9. **ELECTROMAGNETISM**

a) Define the following terms
   (i) Magnetism
   (ii) Electromagnetism **(1 mark)**

b) Using Fleming's right hand rule, what does the thump, forefinger and second finger each signify? **(1 mark)**

c) Give ONE effect of passing current through a straight conductor. **(1x3marks)**

d) The coil of a loud speaker is subjected to an electromagnetic force of value F=1.35N and a current I=0.25A. **(1 mark)**
   (i) Give TWO things that can be done to increase this electromagnetic force **(0.5x2 marks)**
   (ii) Knowing that the wire of the coil has a length of 12m, calculate the magnetic field of the loud speaker **(2 marks)**
   (iii) What effect does the magnet and the current have on the speaker membrane? **(1 mark)**
