higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

**NATIONAL CERTIFICATE**

# RADIO THEORY N1

(11040851)

**3 August 2021 (X-paper)**
**09:00–12:00**

**Drawing instruments and scientific calculators may be used.**

**This question paper consists of 6 pages and 1 formula sheet.**

169Q1G2103

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# DEPARTMENT OF HIGHER EDUCATION AND TRAINING
# REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
RADIO THEORY N1
TIME: 3 HOURS
MARKS: 100

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**INSTRUCTIONS AND INFORMATION**

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Only use a black or blue pen.
5. Start each question on a new page.
6. Write neatly and legibly.

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## QUESTION 1

Choose a word or words from COLUMN B that matches as description in COLUMN A. Write only the letter (A–J) next to the question number (1.1–1.10) in the ANSWER BOOK.

| COLUMN A | | COLUMN B | |
|---|---|---|---|
| 1.1 | North and south poles | A | sound waves |
| 1.2 | Charged atom | B | compound |
| 1.3 | Longitudinal | C | matter |
| 1.4 | Used as a switch or an amplifier | D | radio waves |
| 1.5 | Combination of different elements | E | ion |
| 1.6 | Can move through a vacuum | F | covalent bonding |
| 1.7 | Anything that occupies space | G | transformer |
| 1.8 | Sharing of electrons | H | attract |
| 1.9 | Step down or step up a voltage | I | Henry |
| 1.10 | The unit of inductance | J | transistors |

(10 × 1) **[10]**

## QUESTION 2

2.1 Explain the difference between a *conductor* and an *insulator*. (4)

2.2 What does the nucleus of an atom comprise of? (2)

2.3 Give the number of electrons in the first shell of an atom. (1)

2.4 Name THREE different forms of matter. (3)

**[10]**

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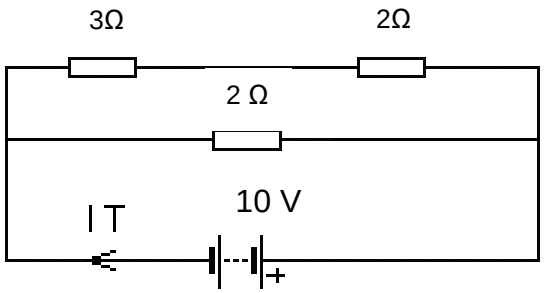
## QUESTION 3

3.1 Study the circuit diagram below and answer the questions that follow.




3.1.1 Calculate the total resistance of the circuit. (4)

3.1.2 Calculate the total current flowing in the circuit. (2)

3.1.3 Calculate the current flowing through the 3 Ω resistor. (2)

3.2 Determine the voltage of a combination of SIX cells of 2 V each connected in series. (2)

**[10]**

## QUESTION 4

4.1 Briefly define *mutual inductance*. (4)

4.2 List the FOUR most important characteristics of flux lines. (4)

4.3 Name the TWO poles of a magnet. (2)

**[10]**

## QUESTION 5

5.1 A moving-coil meter has a coil resistance of 100 Ω. A current of 12 mA flowing through the coil gives full-scale deflection.

Calculate the value of a shunt resistor required to enable the meter to have a range of 0 - 2 A. (3)

5.2 Make a neat, labelled sketch of a series-type ohm meter using a moving-coil meter. (4)

5.3 State THREE disadvantages of a moving-coil meter. (3)

**[10]**

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## QUESTION 6

6.1 Draw a neat, labelled sine wave that represents a 720° spread.

Indicate the peak value, peak to peak value and the time period on the drawing. (4)

6.2 Explain the differences between *direct current* and *alternating current.* (2 × 2) (4)

6.3 Define *frequency*. (2)
**[10]**

## QUESTION 7

7.1 Make a neat, labelled sketch of a simple moving-coil microphone. (4)

7.2 Radio waves travel at the speed of light.

What is the value of the speed of light? (2)

7.3 Classify the following as ELECTROMAGNETIC WAVES or LONGITUDINAL WAVES by writing only 'Electromagnetic' or 'Longitudinal' next to the question number (7.3.1–7.3.4) in the ANSWER BOOK.

7.3.1 Space waves

7.3.2 The output of a speaker

7.3.3 The input to a microphone

7.3.4 Waves emitted from an antenna

(4 × 1) (4)
**[10]**

## QUESTION 8

8.1 Diodes are made of N-type and P-type semiconductor material.

Explain how P-type semiconductor material is made. (3)

8.2 Draw a labelled sketch of the internal structure of a P-N junction diode.

The sketch must show the barrier potential and the depletion region. (4)

8.3 Name the THREE pins or legs of a transistor. (3)
**[10]**

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## QUESTION 9

9.1 Draw the IEC symbols for the following components.

9.1.1 NPN transistor

9.1.2 Coil

9.1.3 Variable resistor

(3 × 1) (3)

9.2 The value of a resistor is 270 kΩ with a tolerance of 5%.

Give the colour codes for this resistor. (4)

9.3 Name THREE factors that affect the capacitance of a capacitor. (3)

**[10]**

## QUESTION 10

10.1 With the aid of a block diagram, explain the operation of an oscillator. (5)

10.2 Draw a fully labelled circuit diagram of a full-wave power supply.

The drawing must include a centre-tap transformer, two diodes, a capacitor filter and a load resistor. (5)

**[10]**

**TOTAL: 100**

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**RADIO THEORY N1**

**FORMULA SHEET**

1. $$I = \frac{V}{R}$$

2. $R_T = R_1 + R_2 + R_{3...}$

3. $$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$$

4. $$Rp = \frac{Im \, x Rm}{It - Im}$$

5. $$Rs = \frac{V}{Im} \; - R_m$$

6. $$R = \frac{\rho.\ell}{A}$$

7. $$A = \frac{\pi.D^2}{4}$$

8. $$F = \frac{1}{t}$$

9. $$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + ...$$

10. $L_T = L_1 + L_2 + L_{3...}$

11. $C_T = C_1 + C_2 + C_{3...}$

12. $$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + ...$$

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