



Wynberg Boys High School

Physical Sciences

Grade 10 Test

Electricity and Magnetism

28 October 2016

Total marks: 30

Time: 30 minutes

Instructions:

1. All working must be clearly shown.
2. Standard scientific calculators may be used.
3. Give all answers to 2 decimal places, unless otherwise stated.
4. Relevant formulae and data are provided on the back of this cover sheet. In some cases, data booklets may be provided.
5. Once you have finished the test, write in your estimated mark at the top right corner of your answers script. Accurate estimations may result in rewards.

ELECTROSTATICS

| | |
|---------------------------|----------------------|
| $F = \frac{kQ_1Q_2}{r^2}$ | $E = \frac{kQ}{r^2}$ |
| $E = \frac{F}{q}$ | $V = \frac{W}{q}$ |
| $n = \frac{Q}{q_e}$ | |

ELECTRIC CIRCUITS

| | |
|--|--|
| $R = \frac{V}{I}$ | $\text{emf } (\varepsilon) = I(R + r)$ |
| $R_s = R_1 + R_2 + \dots$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$ | $q = I \Delta t$ |

PHYSICAL CONSTANTS

| NAME/NAAM | SYMBOL/SIMBOOL | VALUE/WAARDE |
|--------------------|----------------|-----------------------------------|
| Charge on electron | q_e/e | $-1,6 \times 10^{-19} \text{ C}$ |
| Electron mass | m_e | $9,11 \times 10^{-31} \text{ kg}$ |

Question 1 Multiple Choice (5 marks)

1.1 Which ONE of the following metals is NOT ferromagnetic?

- A Cobalt
- B Iron
- C Nickel
- D Copper

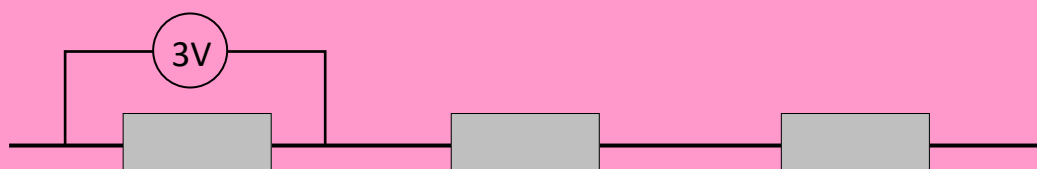
(1)

1.2 For which ONE of the quantities below is the CORRECT unit of measurement given?

| | Quantity | Unit |
|---|----------------------|------------------|
| A | Current | $C \cdot s^{-1}$ |
| B | Energy | $V \cdot C^{-1}$ |
| C | Potential difference | $A \cdot \Omega$ |
| D | Resistance | $V \cdot s$ |

(1)

1.3 Three identical resistors are connected in series. The total voltage is ...

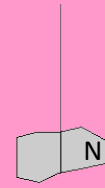


- A 3V
- B $\frac{1}{3}V$
- C 9V
- D $\frac{1}{9}V$

(1)

Question 2 Magnetism (6 marks)

The compass is one of our oldest inventions, after fire and the wheel. The first compass, called a lodestone, was a piece of magnetite. Magnetite is magnetised iron oxide.



- 2.1 Use domain theory to explain why the lodestone is permanently magnetised. (2)
- 2.2 In the diagram, the lodestone is suspended from a string. Copy the diagram and show the direction of the Earth's magnetic field lines in the space around the lodestone (2)
- 2.3 The lodestone is cut into two equal sized pieces. Which poles will be present in the piece that is on the right in the drawings above? Explain your answer. (2)
- [6]**

Question 3 Electrostatics (8 marks)

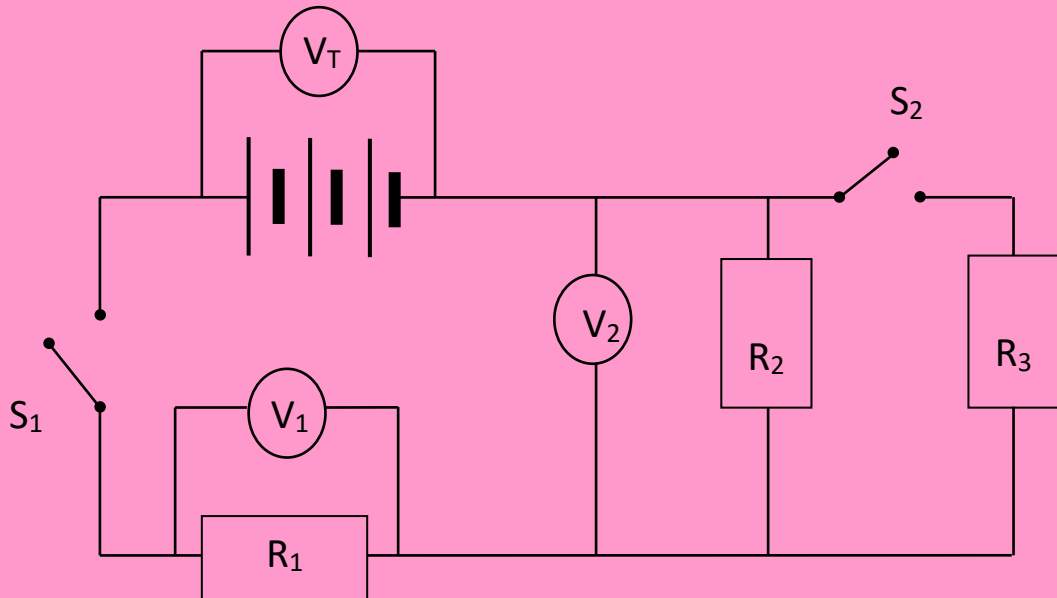
Older television sets have an electron gun that fires electrons at the screen to create the picture we see. Immediately after the television has been switched off, a charge is left on the glass screen.

- 3.1 What type of charge is left on the screen? Answer POSITIVE or NEGATIVE. (3)
- 3.2 A glass rod carrying a charge of $+6,45 \times 10^{-16}$ C touches the screen.
- 3.2.1 How has this glass rod been charged initially? Explain by referring to the movement of charges either to or from the rod. (1)
- 3.2.2 If 4200 electrons transfer onto the glass rod from the T.V. screen, calculate the new charge on the rod. (5)

[9]

Question 4 Electric circuits (10 marks)

Electricity may be the greatest human invention ever. It is so easy and safe to use. To show your understanding of electricity, study this circuit diagram and then answer the questions that follow. S_1 is closed and S_2 is open. V_T reads 4,5.



- 4.1 What is the potential difference of one of the cells in the circuit? (1)
- 4.2 V_1 reads 2,7 V and R_1 is a 4,5 Ω resistor. What is the current strength in the circuit? (3)
- 4.3 What is the reading on V_2 ? (2)
- 4.4 Hence determine the resistance of R_2 . (2)
- 4.5 S_2 is now closed. What effect will this have on:
- 4.5.1 The reading on V_2 ? Answer INCREASE, DECREASE or STAY THE SAME. (1)
- 4.5.2 R_{TOTAL} ? Answer INCREASE, DECREASE or STAY THE SAME. (1)

[10]

Total: 30 marks

